

WGGF2026



WORLD GREEN GROWTH FORUM 2026

2026 세계녹색성장포럼

2026. 7. 8.(Wed) – 7. 10.(Fri)

Lahan Hotel Pohang

Program Book

주최 | pohang
포항시

주관 | poex

후원 |



경상북도
GYEONGSANGBUK-DO

한국관광공사
Korea National Tourism Organization

GGGI

EcoPro

posco

기후변화센터
Korea Climate Change Center

ICLEI
Local Governments
for Sustainability

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WORLD GREEN GROWTH FORUM 2026

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경계를 넘어, 새로운 녹색 미래로

「세계녹색성장포럼」에 여러분을 초대합니다!

존경하는 세계 각국의 리더와 귀빈 여러분, 오늘날 전 세계의 산업도시는 기후위기 대응과 산업 경쟁력 유지라는 이중 과제에 직면해 있습니다. 포항은 철강을 중심으로 성장해 온 대표적인 산업도시로서 이러한 전환의 최전선에서 있습니다. 이러한 노력의 일환으로 제2회 세계녹색성장포럼(World Green Growth Forum, WGGF)을 개최하고 여러분을 초대하게 된 것을 매우 기쁘게 생각합니다.

올해 2회째를 맞이하는 세계녹색성장포럼은 “경계를 넘어, 새로운 녹색 미래로 (Beyond Boundaries, A New Green Future)”라는 주제 아래, 산업과 에너지, 환경과 도시, 그리고 국가 간 협력의 경계를 넘어서는 새로운 녹색 전환의 방향을 모색하고자 합니다.

이번 포럼에서는 산업도시의 저탄소 전환 전략, 녹색기술과 공급망의 재편, 기후금융과 정책 협력, 그리고 글로벌 거버넌스를 통한 공동 대응 방안 등 다양한 분야를 아우르며, 지속가능한 미래를 위한 통합적 해법을 심도 있게 논의할 예정입니다.

포항은 그동안 그린웨이 프로젝트, 도시숲 조성, 미래 신산업 육성 등을 통해 산업과 환경이 조화를 이루는 도시로 변화해 왔습니다. 이러한 경험을 바탕으로 산업과 자연이 공존하는 지속 가능한 도시 모델을 세계와 공유하고자 합니다.

이번 포럼이 산업도시 포항이 기후위기라는 시대적 과제를 직시하고, 기존의 경계를 넘어 산업과 환경, 지역과 세계를 연결하는 해법을 모색하는 계기가 되기를 바랍니다. 나아가 이러한 논의가 시민의 실천으로 이어지는 전환의 여정으로 확장되어 글로벌 녹색 전환을 이끄는 협력 플랫폼으로 자리매김하기를 기대합니다.

여러분의 적극적인 참여와 깊은 통찰은 우리 모두가 직면한 도전 과제에 대한 해법을 찾는 데 큰 힘이 될 것입니다. 포항에서 열리는 뜻깊은 여정에 함께해 주시기를 진심으로 바랍니다.

감사합니다.

Beyond Boundaries, A New Green Future

Welcome to the World Green Growth Forum!

Distinguished global leaders and honoured guests, Today, industrial cities around the world are facing a dual challenge: addressing the climate crisis while maintaining their industrial competitiveness. Pohang, an industrial city that has grown alongside the steel industry, is at the forefront of this transition. It is therefore my great pleasure to invite you to the 2026 World Green Growth Forum(WGGF 2026), which is being held as part of these ongoing efforts.

This year's forum, under the theme 'Beyond Boundaries, A New Green Future', seeks to explore new directions for a green transition that transcend the boundaries of industry and energy, environment and cities, and international cooperation.

The forum will feature in-depth discussions on integrated solutions for a sustainable future, covering topics such as low-carbon transition strategies for industrial cities, restructuring green technologies and supply chains, climate finance, policy cooperation and joint response measures through global governance.

Pohang has been transforming into a city where industry and the environment are in harmony through initiatives such as the Green Way Project, the creation of urban forests and the development of forward-looking industries. Building upon these experiences, our aim is to share with the world a sustainable city model in which industry and nature coexist seamlessly. I hope that this forum will provide a pivotal opportunity for Pohang, a city driven by industry, to address the defining challenge of our time-the climate crisis-and seek solutions that connect industry with the environment and local communities with the global stage, moving beyond existing boundaries.

Furthermore, I anticipate that these discussions will evolve into a transition driven by civic action, establishing this forum as a collaborative platform leading the global green transition.

Thank you.

프로그램

	7. 8.(수) Day 1	7. 9.(목) Day 2			7. 10.(금) Day 3		
	그랜드홀(5F)	그랜드홀(5F)	에메랄드(4F)	사파이어(4F)	그랜드홀(5F)	에메랄드(4F)	
09:30-10:00		참가자 등록			참가자 등록		
10:00-10:30		기조 강연		제2회 녹색성장 아이디어 해커톤	세션 5. 기후변화센터 세션	포항 타운홀 COP	
10:30-11:00		세션 1. 녹색산업			휴식		
11:00-11:30					세션 6. 이클레이 세션		
11:30-12:00							
12:00-12:30							
12:30-13:00		VIP 오찬 by GGGI			기후위기 시대, 지속가능한 미식문화와 UCCN		
13:00-13:30		세션 2. 저탄소 해양교통 (GGGI 세션)					
13:30-14:00		청소년 기후실험실	세션 7. 시민참여 토크 콘서트		폐회식		
14:00-14:30							
14:30-15:00							
15:00-15:30	참가자 등록	휴식				산업시찰 및 관광	
15:30-16:00							
16:00-16:30	프레스 컨퍼런스 (루비 4F)	세션 4. 해양생태	GGGI × 포항기업 워크숍				
16:30-17:00							
17:00-17:30	개회식						
17:30-18:00							
18:00-20:00	환영만찬	네트워킹 리셉션					

Program at a Glance

	8 July(Wed) Day 1	9 July(Thu) Day 2			10 July(Fri) Day 3			
	Grand Hall(5F)	Grand Hall(5F)	Emerald(4F)	Sapphire(4F)	Grand Hall(5F)	Emerald(4F)		
09:30-10:00		Registration			Registration			
10:00-10:30		Keynote Speech		2 nd Green Growth Idea Hackathon	Session 5. Climate Change Center Session	Pohang Townhall COP		
10:30-11:00		Session 1. Greening Industry			Break			
11:00-11:30					Session 6. ICLEI Session			
11:30-12:00								Climate Crisis Era: Sustainable Gastronomy Culture and UCCN
12:00-12:30								
12:30-13:00		VIP Luncheon by GGGI						
13:00-13:30		Session 2. Zero-Carbon Maritime Transport (GGGI Session)			Youth Climte Lab	Session 7. Citizen Talk Concert	Closing Ceremony	
13:30-14:00								
14:00-14:30								
14:30-15:00								
15:00-15:30	Registration	Break						
15:30-16:00								
16:00-16:30	Press Conference (Ruby 4F)	Session 4. Blue Carbon	GGGI × Pohang Corporate Workshop					
16:30-17:00								
17:00-17:30	Opening Speech							
17:30-18:00								
18:00-20:00	Welcome Dinner	Networking Reception						

일자별 프로그램

7. 8.(수) - 9.(목) | 1일차 & 2일차

일자	시간	구분	내용	장소	
7. 8. (수)	17:00-18:00	개회식 및 오프닝 스피치	글로벌 기후목표와 녹색도시로의 전환 이회성 CF 연합 회장 기후위기 시대, 글로벌 목표를 위한 연대 짐 스키 IPCC 의장 *영상	5층 그랜드 홀	
	18:00-20:00		환영만찬		
7. 9. (목)	10:00-10:30	기조 강연	지속가능성을 경쟁 우위로: 왜 녹색 전환이 이제 비즈니스 및 지정학적 필수 과제인가 후안 베르데 Alamo Holding Group 회장	5층 그랜드 홀	
	10:30-12:00	세션 1. 녹색산업	산업 도시에서 시작되는 녹색전환		
			글로벌 공급망 재편 아비아야 칼하이 크누센 북극경제이사회(AEC) 의장		
			지속가능한 미래를 위한 AI와 디지털 인프라 웬 용강 난양기술대학교 교수		
			철강 탄소중립을 위한 수소 기반 기술 전략과 전환 경로 윤창원 포항공과대학교 화학공학과 교수		
			탄소중립을 위한 기술적 전략 박상준 에코프로HN 상무		
	그린 암모니아 기반 청정 발전 솔루션 김기태 GS건설 분산에너지 책임연구원				
	12:00-13:30	VIP 오찬 by GGGI			
	13:30-14:30	세션 2. 저탄소 해양 교통 (GGGI 세션)	저탄소 해양 교통의 미래: 확장 가능한 탄소 중립 달성 경로로서의 그린 암모니아 [환영사] 제라드 오도노휴 글로벌녹색성장기구 사무차장	5층 그랜드 홀	
			[특별연설] 글로벌 트렌드: 저탄소 해운 전환 *영상 장 르미르 캐나다 퀘벡주 국제관계부 기후변화 및 북극권 특사대사		
[좌장] 장창선 글로벌녹색성장기구 부국장 [패널] 지노 반 베긴 ICLEI 사무총장 [패널] 자크 플리스 주한 룩셈부르크 대사 [패널] 버나뎃 테레스 페르난데즈 주한 필리핀 대사 [패널] 로저 로요 주한 스페인 상공회의소 회장 [패널] 다미앙 페레이라 주한 퀘벡 정부 대표					
14:30-15:30	세션 3. 녹색금융	전환의 동력: 난감축 산업 전환을 위한 녹색 자본 [좌장] 김종대 인하대학교 녹색금융대학원 명예교수 [패널] 애런 드레이어 글로벌녹색성장기구 탄소금융부 부국장 [패널] 정영두 한국해양진흥공사 북극항로지원센터장 [패널] 정우송 위터라인 파트너스 대표 [패널] 김형주 국가녹색기술연구소 책임연구원 [패널] 최영주 한국은행 지속가능성장실 실장			
15:30-16:00	휴식				
16:00-17:00	세션 4. 해양생태	블루카본: 해양 생태계 중심의 탄소 네거티브 전략	5층 그랜드 홀		
		[좌장] 김승도 한림대학교 환경생명공학과 명예교수			
		바다와 육지가 만나는 해안 지역을 돌보다 다니엘 머디아쏘 국제임업연구센터-세계농림어업센터 선임연구원			
탄소중립을 위한 수산자원 기반의 블루카본 활용 최임호 한국수산자원공단 전략사업본부 본부장					
[패널] 정성우 (재)포항산업과학연구원 수석 연구원 [패널] 김주형 군산대학교 해양생명과학과 교수					
18:00-20:00	네트워킹 리셉션			동빈 문화창고 1969	

Daily Program

8(Wed) - 9(Thu) July | Day 1 & Day 2

Day	Time	Content	Details	Location
8 July (Wed)	17:00-18:00	Opening Speech	Global Climate Goal and Green City Transition Hoesung Lee President, Carbon Free Alliance Solidarity for Global Goals in an Era of Climate Crisis Jim Skea Chair, IPCC *Video	5F Grand Hall
	18:00-20:00		Welcome Dinner	
9 July (Thu)	10:00-10:30	Keynote Speech	Sustainability as a Competitive Advantage: Why the Green Transition is now a Business and Geopolitical Imperative Juan Verde Founder & President, Alamo Holding Group	5F Grand Hall
	10:30-12:00	Session 1. Greening Industry	Green Transition Begins in Industrial Cities	
			Global Supply Chain Restructuring Aviaaja Karlshøj Knudsen Chair, Arctic Economic Council(AEC)	
			AI and Digital Infrastructure for a Sustainable Future: A Tale of Twin Transition Yonggang Wen Professor, Nanyang Technological University	
			Hydrogen-Based Steel Decarbonization: Strategy and Technology Pathways Chang Won Yoon Professor, Chemical Engineering, Pohang University of Science and Technology	
			Technical Strategies for Achieving Carbon Neutrality Sangjun Park Vice President, ECOPRO HN. CO., LTD.	
			Green Ammonia to Power Solution Kitae Kim Leader, GS Engineering & Construction Corp.	
	12:00-13:30	VIP Luncheon by GGGI		
	13:30-14:30	Session 2. Zero-Carbon Maritime Transport (GGGI Session)	The Future of Zero-Carbon Maritime Transport: Green Ammonia as a Scalable Pathway to Net Zero [Welcome Remarks] Gerard O'Donoghue Deputy Executive Director, Global Green Growth Institute	5F Grand Hall
			[Special Remarks] Global Trends: Low-Carbon Maritime Transition *Video Jean Lemire Special Envoy for Climate Change, Quebec	
			[Moderator] Chang Sun Jang Deputy Director, Global Green Growth Institute [Panel] Gino Van Begin Secretary General, ICLEI [Panel] Jacques Flies Ambassador, Embassy of Luxembourg in Seoul [Panel] Bernadette Therese C. Fernandez Ambassador, Embassy of the Republic of the Philippines in Seoul	
	14:30-15:30	Session 3. Green Finance	[Panel] Roger Royo President, ESCCK(Spanish Chamber of Commerce in Korea) [Panel] Damien Pereira Chief Representative, The Quebec Government Office in Seoul	
			Driving the Transition: Green Capital for Hard-to-Abate Industries [Moderator] Jong Dae Kim Emeritus Professor, College of Business Administration, Inha University [Panel] Aaron Drayer Deputy Head, Carbon finance department, Global Green Growth Institute [Panel] Jung, Young Doo General Manager of K-Arctic Route Development & Support Center, Korea Ocean Business Corporation [Panel] JUNG, WOO-SONG CEO, Waterline Partners [Panel] Hyung Ju KIM Principal Researcher, National Institute of Green Technology(NIGT) [Panel] CHOI, Youngjoo Director General, Office of Sustainable Growth, Bank of Korea	
	15:30-16:00	Break		
	16:00-17:00	Session 4. Blue Carbon	Blue Carbon: Marine Ecosystem-Based Carbon-Negative Strategies [Moderator] KIM, Seungdo Emeritus Professor, Department of Environmental Sciences & Biotechnology, Hallym University	5F Grand Hall
			Caring for Coastal Zones, Where Oceans and Lands Meet Daniel Murdiyarso Senior Associate, Center for International Forestry Research- World Agroforestry(CIFOR-ICRAF)	
			Fisheries Resources-Based Blue Carbon Utilization Policy for Carbon Neutrality IM HO, CHOI Senior Director, Strategic Business Department, Korea Fisheries Resources Agency [Panel] Sung-Woo Jeong Senior Researcher, Research Institute of Industrial and Science [Panel] Ju-Hyoung Kim Professor, Department of Aquaculture and Aquatic Science, Kunsan National University	
	18:00-20:00	Networking Reception		Dongbin cultural warehouse 1969

일자별 프로그램
7. 10.(금) I 3일차

일자	시간	구분	내용	장소
7. 10. (금)	10:00-11:00	세션 5. 기후변화센터 세션	데이터와 실천으로 만드는 기후 안심 도시 [좌장] 최지원 기후변화센터 사무국장	5층 그랜드 홀
			기후위기 대응을 위한 스마트 수해 예방 체계 이상훈 포항 철강산단 통합관제센터 센터장	
			참여에서 정밀 실증으로: 탄소중립을 위한 AI기반 리빙랩 황철원 포항 탄소중립지원센터 센터장	
			철강슬래그 활용 바다숲 조성을 통한 지역 상생협력 진영주 포스코 환경에너지기획실 실장	
			[패널] 권태중 포항시 기후대기과 과장 [패널] 김수정 포항 YWCA 사무총장 [패널] 김옥경 포항 시민 대표	
	11:00-11:30	휴식		5층 그랜드 홀
	11:30-12:30	세션 6. 이클레이 세션	자연기반해법을 활용한 산업도시의 녹색전환 [좌장] 손봉희 이클레이 한국사무소 부소장	
			벨기에 루벤시의 기후거리 *영상	
			도시 산업 유산의 탈탄소화: 선전 산업 단지 재생을 위한 친환경 해법 레이산 꾸오 선전 도시계획설계연구소 기획국장	
			숲길과 물길이 연결된 정원도시 포항 정성진 포항시 그린웨이 운영팀장	
	13:30-14:30	세션 7. 시민참여 토론회	지구를 구하는 일상 속 실천 최재천 이화여대 에코과학부 명예교수 홍다경 지구를 지키는 배움터 대표	5층 그랜드 홀
	14:30-15:30	폐회식	[좌장] 최재철 기후변화센터 이사장	

부대 행사
7. 9.(목) - 10.(금) I 2일차 & 3일차

일자	시간	구분	장소
7. 9. (목)	10:00-18:00	제2회 녹색성장 아이디어 해커톤	4층 사파이어
	13:30-15:00	청소년 기후 실험실	4층 에메랄드
	15:30-17:30	GGGI × 포항기업 워크숍	
7. 10. (금)	10:00-11:00	포항 타운홀 COP	4층 에메랄드
	13:00-14:30	기후위기 시대, 지속가능한 미식문화와 UCCN	

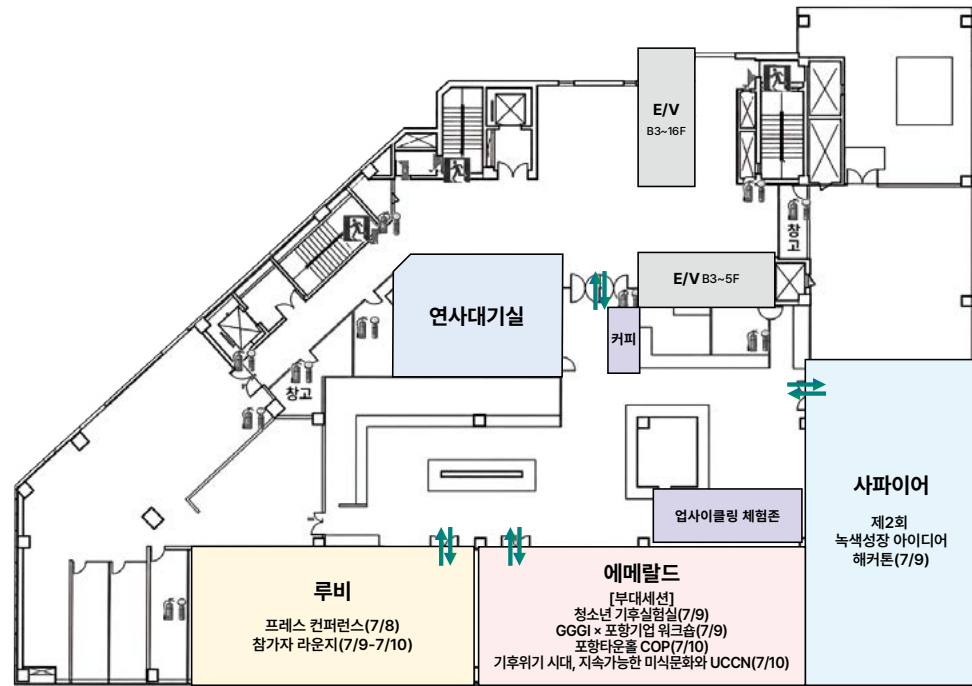
Daily Program
10(Fri) July I Day 3

Day	Time	Content	Details	Location
10 July (Fri)	10:00-11:00	Session 5. Climate Change Center Session	Building Climate-Resilient Cities through Data and Action [Moderator] Jiwon Choi Director General, Climate Change Center	5F Grand Hall
			Smart Flood Prevention System for Climate Crisis Response LEE, SANG HOON Center Director, Integrated Control Center of Pohang Steel Industrial Complex	
			From Participation to Precision: AI-Based Living Lab for Carbon Neutrality Cherwon Hwang Director, Pohang Carbon Neutrality Support Center	
			Regional Cooperation through Steel Slag-Based Marine Forest Restoration Young-Ju Jin Head, POSCO Environmental & Energy Planning Office	
			[Panel] TAE JUNG KWON Deputy Director, Climate & Air Quality Division, Pohang City [Panel] Sujung Kim Secretary General, Pohang Young Women Christian Association [Panel] Ok Kyung Kim Citizen	
	11:00-11:30	Break		5F Grand Hall
	11:30-12:30	Session 6. ICLEI Session	Green Transition of Industrial Cities through Nature-based Solutions [Moderator] Bonghee Son Deputy Director, ICLEI Korea Office	
			Leuven's Climate Street *Video	
			Decarbonizing Urban Industrial Heritage: Green Interventions to Renew the Industrial Zones in Shenzhen Leixian Guo Chief Planning Director, Urban Planning & Design Institute of Shenzhen (UPDIS), China	
			Garden City Pohang, Connected by a Green Network Seong-jin Jeong Greenway Project Operations Manager, Pohang City	
	13:30-14:30	Session 7. Citizen Talk Concert	Daily Actions to Save the Planet JAE CHUN CHOE Professor Emeritus, Division of EcoScience, Ewha Womans University Da Gyeong Hong CEO, Learning Center for the Earth	5F Grand Hall
	14:30-15:30	Closing Ceremony	[Moderator] Jai-chul Choi Chairman, Climate Change Center	

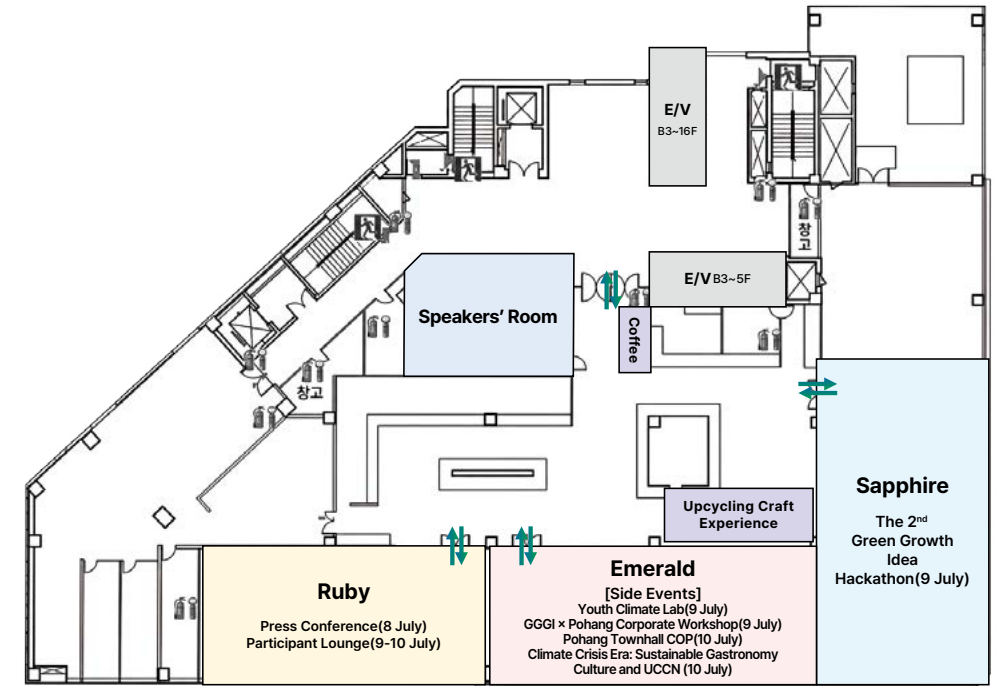
Side Events
9(Thu) - 10(Fri) July I Day 2 & Day 3

Day	Time	Content	Location
9 July (Thu)	10:00-18:00	2 nd Green Growth Idea Hackathon	4F Sapphire
	13:30-15:00	Youth Climate Lab	4F Emerald
	15:30-17:30	GGGI × Pohang Corporate Workshop	
10 July (Fri)	10:00-11:00	Pohang Townhall COP	4F Emerald
	13:00-14:30	Climate Crisis Era: Sustainable Gastronomy Culture and UCCN	

라한호텔 포항 4F



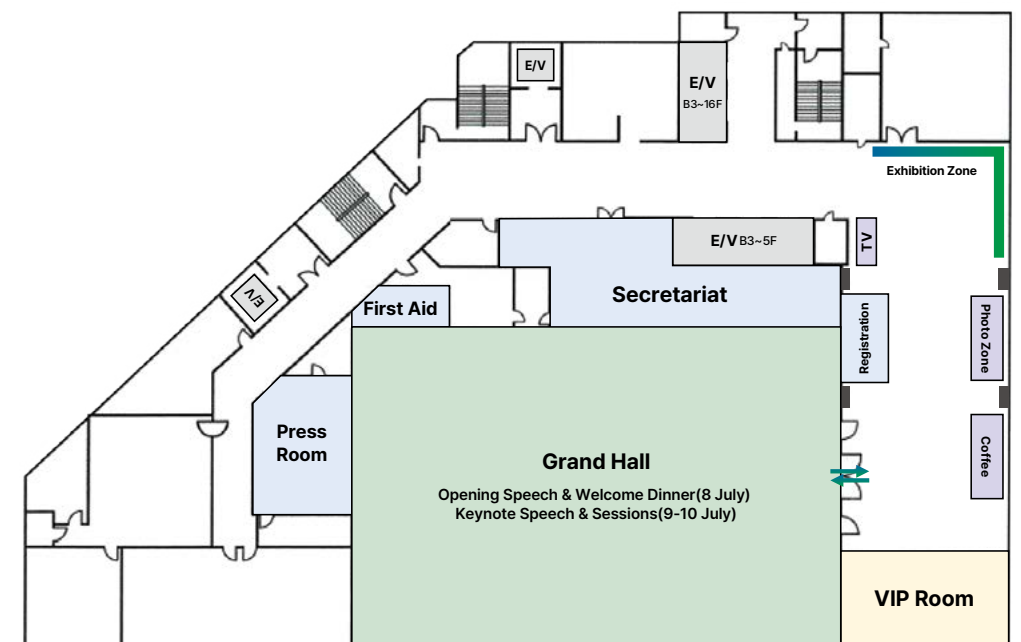
LAHAN Hotel Pohang 4F



라한호텔 포항 5F



LAHAN Hotel Pohang 5F



오프닝 스피치

Opening Speech

글로벌 기후목표와 녹색도시로의 전환

Global Climate Goal and Green City Transition

이회성 Hoesung Lee

CF 연합 회장 (IPCC 6대 의장)

President, Carbon Free Alliance, IPCC Former Chair

기후위기 시대, 글로벌 목표를 위한 연대

Solidarity for Global Goals in an Era of Climate Crisis

짐 스키 Jim Skea

IPCC 의장

Chair, IPCC (Intergovernmental Panel on Climate Change)



글로벌 기후목표와 녹색도시로의 전환
Global Climate Goal and Green City Transition

이회성 Hoesung Lee

CF 연합 회장(IPCC 6대 의장)
President, Carbon Free Alliance, IPCC Former Chair

주요경력

- 2015-2023 IPCC(Intergovernmental Panel on Climate Change) 의장
- 2019 타임(TIME) 영향력 있는 인물 100인 선정
- 2020 세계에너지경제학회(IAEE) "Outstanding Contributions to the Profession Award" 수상
- 2021 블룸버그(Bloomberg) 올해의 인물 50인
- 2024 에너지 인텔리전스(Energy Intelligence) "2024 Energy Economist of the Year" 수상

Biography

- 2015-2023 Chair, Intergovernmental Panel on Climate Change
- 2019 TIME's 100 Most Influential People
- 2020 IAEE "Outstanding Contributions to the Profession Award"
- 2021 Bloomberg's 50 global leaders
- 2024 Energy Economist of the Year from Energy Intelligence



기후위기 시대, 글로벌 목표를 위한 연대 *영상
Solidarity for Global Goals in an Era of Climate Crisis *Video

짐 스키 Jim Skea

IPCC 의장
Chair, IPCC(Intergovernmental Panel on Climate Change)

주요경력

- 1981-1983 카네기멜런대학교 정책연구원
- 1983-1998 서식스대학교 과학정책연구단위(SPRU) 연구원/교수급 연구위원(1994~1998)
- 1998-2004 서식스대학교 정책연구소 소장
- 2004-2012 영국에너지연구센터(UKERC) 연구총괄책임자
- 2012-2017 영국연구위원회(RCUK) 에너지전략 연구위원
- 2015-2017 에너지연구소(EI) 회장
- 2009-2023 임페리얼 칼리지 런던 지속가능에너지 교수
- 2015-2023 IPCC 제3실무그룹(기후변화 완화) 공동의장
- 2018-2023 스코틀랜드 공정전환위원회 의장
- 2023-현재 IPCC(기후변화에 관한 정부간 협의체) 의장

Biography

- 1981-1983 Carnegie-Mellon University, Policy Researcher
- 1983-1998 Sussex University Science Policy Research Unit, Researcher / Professorial Fellow (1994-1998)
- 1998-2004 Sussex University, Policy Studies Institute, Director
- 2004-2012 UK Energy Research Centre, Research Director
- 2012-2017 Research Councils UK, Energy Strategy Fellow
- 2015-2017 Energy Institute, President
- 2009-2023 Imperial College London, Professor of Sustainable Energy
- 2015-2023 IPCC Working Group III (Mitigation), Co-Chair
- 2018-2023 Scotland's Just Transition Commission, Chair
- 2023-Present IPCC (Intergovernmental Panel on Climate Change), Chair

기조 강연

Keynote Speech

지속가능성을 경쟁 우위로: 왜 녹색 전환이
이제 비즈니스 및 지정학적 필수 과제인가

Sustainability as a Competitive Advantage: Why the Green
Transition Is now a Business and Geopolitical Imperative

후안 베르데 Juan Verde
Alamo Holding Group 회장
Founder & President, Alamo Holding Group



지속가능성을 경쟁우위로: 왜 녹색 전환이 이제 비즈니스 및 지정학적 필수 과제인가

Sustainability as a Competitive Advantage: Why the Green Transition Is now a Business and Geopolitical Imperative

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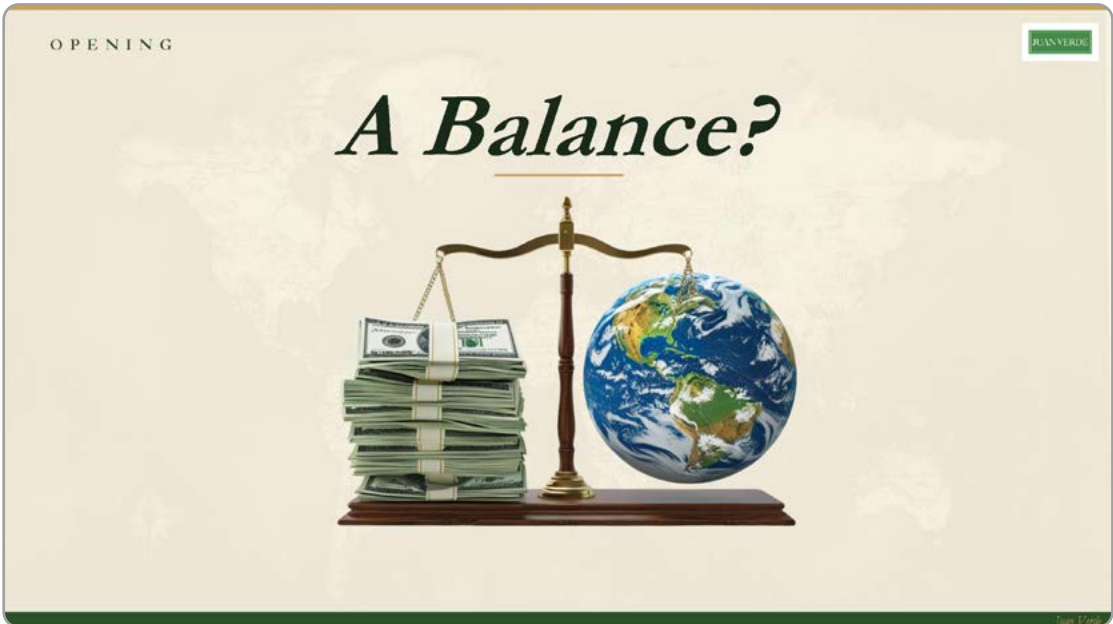
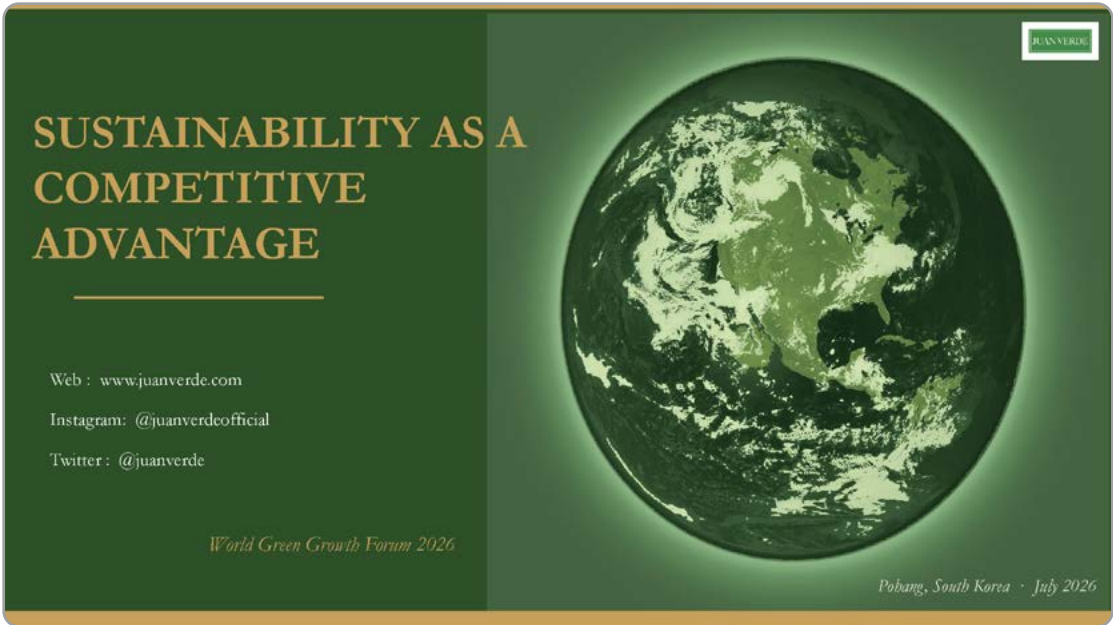
Alamo Holding Group 회장
Founder & President, Alamo Holding Group

주요경력

- 2009-2012 미국 상무부 유럽·유라시아 담당 부차관보
- 2012-2014 백악관(오바마 행정부) 국제무역 및 경제정책 대외자문위원
- 2021-2023 백악관(바이든 행정부) 지속가능성 및 경제 분야 자문위원
- 2013-현재 어드밴스드 리더십 재단(Advanced Leadership Foundation) 창립자 겸 회장
- 2004-현재 알라모 솔루션스(Alamo Solutions) 창립자 겸 회장
- 2024-현재 볼칸 컴파니아 미네라(Volcan Compañía Minera) 부회장

Biography

- 2009-2012 U.S. Department of Commerce, Deputy Assistant Secretary for Europe and Eurasia
- 2012-2014 The White House(Obama Administration), External Advisor on International Trade and Economic Policy
- 2021-2023 The White House(Biden Administration), Advisor on Sustainability and Economic Affairs
- 2013-Present Advanced Leadership Foundation, Founder and President
- 2004-Present Alamo Solutions, Founder and President
- 2024-Present Volcan Compañía Minera, Vice Chairman



Three Ideas. One Conviction.

01

Climate Change
Is one of the biggest
risks and
opportunities.

And it is already on your
P&L.

NOW PRESENTING

02

Follow the
Money

The world is in a deep
transition toward a low-
emissions economic model,
opening extraordinary
business opportunities.

03

Geopolitics
Accelerates
Sustainability

The current geopolitical
context is creating a unique
window to accelerate this
transformation.

IDEA 01 — CLIMATE CHANGE IS ON YOUR P&L

Climate Is Now a Business Risk.

World Economic Forum · Global Risks Report 2026 · 1,300+ experts

1*	Extreme weather events	Environmental
2*	Biodiversity loss and ecosystem collapse	Environmental
3*	Critical change to Earth systems	Environmental
4*	Misinformation and disinformation	Technological
5*	Adverse outcomes of AI technologies	Technological
6*	Natural resource shortages	Environmental
7*	Inequality	Societal
8*	Involuntary migration or displacement	Societal
9*	Societal polarization	Societal
10*	Pollution	Environmental

UNINSURED LOSSES

\$113B+

\$220B in total economic losses from natural catastrophes in 2025. The L.A wildfires alone generated a record \$40B in insured losses (Swiss Re sigma 1/2026).

Pohang felt it firsthand: in 2022, Typhoon Hinnamnor flooded its steelmaker POSCO and halved its annual profit.

IDEA 01 — CLIMATE CHANGE IS ON YOUR P&L

Economist.com

Kal

IDEA 02 — FOLLOW THE MONEY

What does a bee have to do with a bank?

Three Ideas. One Conviction.

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IDEA 02 — FOLLOW THE MONEY

Investment in Green Energy vs. Fossil Energy.

The year everyone said the transition was dead: \$2.3T in clean energy — +8% YoY — vs \$1.1T in fossil fuels.

Global energy transition investment exceeded \$2 trillion for the first time

Global investment in energy transition, by sector

Sector	Investment (\$ billion)
Power grids	1,881
Industry	1,517
Buildings	1,177
Transport	926
Clean energy	576

2025 RECORD

\$2.3T

Global investment in clean energy.

\$1.1T

In fossil fuels — half of clean.

2:1

The ratio in favour of clean.

IDEA 02 — FOLLOW THE MONEY

The Headlines vs. The Signal.

Separate the noise from the signal. Always — follow the money.

THE HEADLINES

What the press describes.

- US withdrew from Paris — again.
- IRA has been renegotiated.
- EU ESG regulations are being simplified.
- BlackRock left Net Zero Asset Managers.
- ‘Sustainable finance had its moment.’

THE SIGNAL

What the balance sheets show.

- USD 137B in multilateral climate finance in 2025
- USD 7 trillion green economy by 2030 — the world's second fastest-growing sector, after tech.
- Green companies grow 2x faster and trade at 12–15% valuation premiums

IDEA 02 — FOLLOW THE MONEY

Storage. The Missing Piece Just Arrived.

Batteries make renewables firm and dispatchable. And the price of storage has collapsed — 84% in a decade.

Battery pack price (USD/kWh)

Year	Price (USD/kWh)
2013	732
2015	575
2017	273
2019	156
2022	132
2024	115
2030F	60

−84% price drop 2013→2024 ~\$60 projected 2030 (BNEF)

GW's added per year

Year	GW's added
2023	155
2024	208
2025	307
2026F	459

+48% storage growth 2024→2025 \$78/MWh 4-hour battery (vs \$102 gas)

IDEA 02 — FOLLOW THE MONEY

JUAN VERDE

Global Electric Vehicle Sales.

2017 → 2025. Nineteen times more in eight years.

Year	Sales (Million)
2017	1.1
2018	2.0
2019	2.2
2020	3.2
2021	6.8
2022	10.5
2023	14.1
2024	17.3
2025	20.7

Source: IEA Global EV Outlook 2026 · 1.1M units in 2017 → 20.7M in 2025.

1 in 4
cars sold globally in 2025 was electric.

3 of 5
world's top EV-battery makers are Korean

2.3M
India's record EV sales in 2025.

~55%
China — majority electric.

By **2035** → **65%** of new vehicles

JUAN VERDE

Team Verde

IDEA 02 — FOLLOW THE MONEY

JUAN VERDE

The Next Generation of Employees: Millennials.

70% (millennials and centennials) of under-35 professionals say a company's environmental credentials matter on their choice of employer

Two out of three millennials would quit their jobs if they felt their company focused solely on profit and neglected the planet (Deloitte, 2025).

Millennials will account for **two-thirds** of the global workforce within three years (by 2029)

JUAN VERDE

Team Verde

IDEA 02 — FOLLOW THE MONEY

JUAN VERDE

What Customers Want:

A second consumer shift — pointing in exactly the same direction.

SHIFT 01 — SUSTAINABILITY IS MAINSTREAM

78%
of consumers say sustainability matters when choosing a brand. (IBM IBV, 19,000 respondents)

53%
of consumers would pay up to 10% more for sustainable products.

\$254B → \$594B
Global organic food market, today vs. 2033 forecast—+134% growth.

Source: IBM IBV Consumer Sustainability Study 2024 · PwC, Value of the Consumer 2024 · Research and Markets, Organic Food 2025.

JUAN VERDE

Team Verde

IDEA 02 — FOLLOW THE MONEY

JUAN VERDE

Three Ideas. One Conviction.

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Climate Change Is one of the biggest risks and opportunities.

it is already on your P&L.

02

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The world is in a deep transition toward a low-emissions economic model, opening extraordinary business opportunities.

03

Geopolitics Accelerates Sustainability

The current geopolitical context is creating a unique window to accelerate this transformation.

NOW PRESENTING

JUAN VERDE

Team Verde

IDEA 03 — GEOPOLITICS ACCELERATES IT

JUAN VERDE

Energy Security Is National Security.

GERMANY · RUSSIAN GAS DEPENDENCE

45% → 12%

Four years ago vs. today. Full phase-out by 2027.



STRAIT OF HORMUZ · 2026

20%

of global oil. Functionally closed since February.



Brent Crude: \$72 → \$120 in weeks.
The ongoing war between Russia and Ukraine and the war in the middle East are accelerating the energy transition by exposing our vulnerability to energy dependence.

Source: Economist 2021 · U.S. EIA World Oil Trends Report 2021 · Reuters (Brent Crude, 2023)

Europe learned this with Russia. Korea imports ~98% of its fuel — for Asia, this is survival.

IDEA 03 — GEOPOLITICS ACCELERATES IT

JUAN VERDE

During the Trump administration, the transition may slow — *but it will not reverse.*

ECONOMIC FACTORS

\$115B

Private investment in U.S. clean-energy manufacturing since 2022.

2×

Per-capita clean-energy subsidies in Republican vs. Democratic states.

71%

Of U.S. GDP generated in Democratic states — the economic base.

POLITICAL FACTORS

68%

Of Americans believe the U.S. should prioritize renewable energy.

72%

Believe government should do more to protect the environment.

69%

Probability Democrats take House majority (Silver Bulletin, Apr 2026).

The political noise is temporary. The capital direction and social demand are not.

IDEA 03 — GEOPOLITICS ACCELERATES IT

JUAN VERDE

Geopolitics Is Accelerating the Sustainability Agenda.

It is making it irreversible — embedded in the architecture of strategic power.
What was an ESG priority in 2019 is now a strategic necessity in 2026.

FIVE FORCES REFRAME THE AGENDA

01

Energy Security

Energy independence = National Security.
Every solar panel installed in Europe is now an act of foreign policy.

02

Food Security

Food security = National Security.
Every regenerative practice adopted today is tomorrow's strategic reserve.

03

Artificial Intelligence

Clean power = safe data centers
The AI race is a race for clean power. Data centers will consume 945 TWh by 2030 (IEA) — equal to Japan's entire electricity

04

Supply Chains

Circular = resilient.
The race for critical minerals — lithium, nickel, rare earths — pushes Korea, Japan and the US to build shorter, cleaner, diversified chains.

05

Defense

Autonomy = survival.
The most advanced armies are decarbonizing — not by ideology, but by necessity.

Source: IEA World Energy Outlook 2023 · FAO State of Food Security 2023 · IEA Electricity 2024 · Ellen MacArthur Foundation 2023 · NATO Climate Change & Security Action Plan 2024

IDEA 03 — GEOPOLITICS ACCELERATES IT

JUAN VERDE

Three Scenarios for the Next Decade.

What every board in this sector is asking right now.

01

Sustainability Collapses

Not credible

- Requires reversing physics, markets, and consumer demand.
- Capital does not go backwards when clean power is already cheaper.
- The shift is now structural, not political.

02

Sustainability stays the same

Very low probability

- Sustainability returns to marketing and ESG.
- \$2.3T/year in clean energy and \$6.8T in green bonds are not a trend.
- Now it is an economic structural force.

03

Sustainability = Competitiveness and resilience

Almost all my probability
More efficiency. More strategic autonomy. More security. More Sovereignty

JUAN VERDE

KAIROS

VS. KRONOS

The money has already begun to move. History doesn't wait for mandates to catch up.

"Disruption isn't the exception anymore — it's the baseline. The real advantage is staying flexible, but ready to act with conviction."

Thank you.

CONNECT WITH JUAN VERDE

Web www.juanverde.com

Instagram [@juanverdeofficial](https://www.instagram.com/juanverdeofficial)

Twitter [@juanverde](https://twitter.com/juanverde)

WORLD
GREEN GROWTH
FORUM 2026
2026 세계녹색성장포럼

세션 1. 녹색산업

Session 1. Greening Industry

산업 도시에서 시작되는 녹색 전환
Green Transition Begins in Industrial Cities

글로벌 공급망 재편

Global Supply Chain Restructuring

아비아야 칼회이 크누센 Aviaaja Karlshøj Knudsen

북극경제이사회(AEC) 의장

Chair, Arctic Economic Council(AEC)

지속가능한 미래를 위한 AI와 디지털 인프라

AI and Digital Infrastructure for a Sustainable Future: A Tale of Twin Transition

웬 용강 Yonggang Wen

난양기술대학교 교수

Professor, Nanyang Technological University

철강 탄소중립을 위한 수소 기반 기술 전략과 전환 경로

Hydrogen-Based Steel Decarbonization: Strategy and Technology Pathways

윤창원 Chang Won Yoon

포항공과대학교 화학공학과 교수

Professor, Chemical Engineering, Pohang University of Science and Technology

탄소중립을 위한 기술적 전략

Technical Strategies for Achieving Carbon Neutrality

박상준 Sangjun Park

에코프로 HN 상무

Vice President, ECOPRO HN. CO., LTD.

그린 암모니아 기반 청정 발전 솔루션

Green Ammonia to power solution

김기태 Kitae Kim

GS 건설 분산에너지 책임연구원

Leader, GS Engineering & Construction Corp.



글로벌 공급망 재편
Global Supply Chain Restructuring

연사 Speaker
아비아아 칼회이 크누센 Aviaaja Karlshøj Knudsen
북극경제이사회(AEC) 의장
Chair, Arctic Economic Council(AEC)

주요경력	
2004-2007	그린란드 세르메르수크(Sermersooq) 자치구 계획부 도시계획가
2005-2006	그린란드 학생연합회(Kalaallit Ilinniagaqartut Kattufiat) 회장
2008-2009	살 아키텍츠(Sahl Architects) 건축가
2009-2015	TNT 누크 아키텍츠(TNT Nuuk Architects) 프로젝트 건축가
2015-2017	그린란드 정부 인프라부 선임자문관
2017-2019	칼라알리트 에어포트(Kalaallit Airports A/S) 프로젝트 매니저
2018-2021	투스스(Tusass) 이사회 이사
2019-2024	칼라알리트 에어포트 홀딩(Kalaallit Airports Holding A/S) 프로젝트 총괄
2021-현재	INI A/S 부의장
2025-현재	누나그린(NunaGreen A/S) 최고경영자
2025-현재	북극경제이사회(Arctic Economic Council) 의장

Biography	
2004-2007	Municipality of Sermersooq, Planning Department – Planner
2005-2006	Kalaallit Ilinniagaqartut Kattufiat – Chair
2008-2009	Sahl Architects – Architect
2009-2015	TNT Nuuk Architects – Project Architect
2015-2017	Ministry of Infrastructure (Government of Greenland) – Senior Advisor
2017-2019	Kalaallit Airports A/S – Project Manager
2018-2021	Tusass – Board Member
2019-2024	Kalaallit Airports Holding A/S – Project Director
2021-Present	INI A/S – Vice Chair
2025-Present	NunaGreen A/S – CEO
2025-Present	Arctic Economic Council – Chair



WHAT IS AEC

”

The Arctic Economic Council is an **independent** business membership organisation that does **policy** advocacy, facilitates **partnerships** and **promotes** sustainable economic development in the **Arctic**.

AEC



Greenland

Greenland is the world's largest island, with a **44,000 km coastline and a total population of just **56.000** people.**

The country is endowed with abundant natural resources, with fisheries remaining the backbone of the economy.

At the same time Greenland holds significant opportunities in renewable energy, critical minerals and industrial development

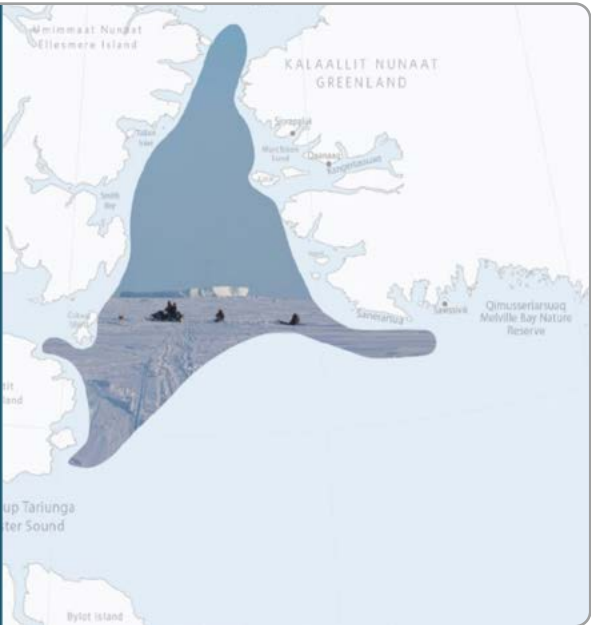




”

Pikialasorsuaq means **"The Great Upwelling"** in Greenlandic. It is a unique marine area between northern Greenland and Canada, where the ocean remains open even during winter due to a remarkable interaction of ocean currents, wind patterns, and a natural ice bridge in the Kane Basin.

The area is one of the most important ecosystems in the Arctic, supporting rich biodiversity, including seabirds, marine mammals, and fish, while also sustaining Inuit communities that have depended on its resources for generations.



ARCTIC ECONOMIC COUNCIL

KEY DRIVERS OF THE SHIPPING INDUSTRY

Increasing tensions



ARCTIC ECONOMIC COUNCIL

KEY DRIVERS OF THE SHIPPING INDUSTRY

Increasing temperatures



ARCTIC ECONOMIC COUNCIL

THE NEW SUPPLY CHAINS



ARCTIC ECONOMIC COUNCIL

SHIPPED
CENTURIES AGO
AND TODAY

Seafood



31 OUT OF 34 CRM ARE IN THE ARCTIC

Materials that all Arctic states and Arctic council observers agree on: Antimony, Cobalt, Lithium (+P), Tungsten

Materials that 9 agree on: Aluminium (Bauxite), Copper, Gallium, Germanium, Graphite, Nickel (+P), Niobium (+P), Platinum Group Metals/Elements (PGM/PGE), Tantalum (+P), Tin

Materials that 8 agree on: Copper (also as SRM), Gallium, Nickel, Silicon (metal), Tin, Titanium (+P), Vanadium (+P)

Materials that 7 agree on: Germanium (+P), Indium, Magnesium (+F), Manganese (+F), Molybdenum, Rare earth elements (REE) (+F).

Materials that 6 agree on: Bismuth, Chromite, Fluorspar (F+P), Hafnium (+P), Scandium (+P).

Materials that 5 agree on: Beryllium, Hafnium, Palladium, Strontium (F+P), Tellurium, Zirconium

Materials that 4 agree on: Dysprosium, Helium (F+P), Neodymium, Phosphorus (F+P), Zinc

Materials only mentioned by one state: Amber, Boron, Calcium, Carbon, Iron ore, Osmium, Promethium, Silver, Natural gas, Crude oil

Materials that 3 agree on: Caesium, Cerium, Feldspar (F+P), Iridium, Lanthanum, Phosphate rock (+F), Potash, Rhenium, Rhodium, Ruthenium, Selenium, Terbium, Uranium

Materials that 2 agree on: Arsenic, Barium, Cadmium, Coking Coal, Erbium, Europium, Gadolinium, Gold, Holmium, Lead, Lutetium, Praseodymium, Rubidium, Samarium, Thulium, Ytterbium, Yttrium.

As of 2024, the most extracted critical and strategic raw materials in the Arctic, according to the EU's critical raw materials list, are:

- Copper and nickel, extracted in 4 Arctic states.
- Cobalt, feldspar, graphite, PGM, silicon and titanium, extracted in 3 Arctic states.
- Aluminium/bauxite, coking coal, phosphate rock, rare earth elements and tantalum, extracted in 2 Arctic states.
- Antimony, arsenic, barite, gallium, germanium, lithium, magnesium, niobium, phosphorus, tungsten and vanadium, each extracted by one Arctic state.

This means that three quarters of the critical raw materials from EU's list are currently extracted in the Arctic. Only 9 raw materials are not produced in the Arctic: beryllium, bismuth, boron, fluorspar, hafnium, helium, manganese, scandium, strontium.

However, according to geological studies suggest strong potential for future extraction of beryllium, bismuth, fluorspar, hafnium, manganese and scandium.

This means that **31 out of 34 critical raw materials could be extracted in the Arctic in the future**. The only critical raw materials that are yet to be found for new exploitation in the Arctic states are boron, helium and strontium.

*data collected from the following states or regional organisations' own CRM lists: Canada, Russian Federation, USA, France, PRC, Poland, Republic of India, Republic of Korea, UK, EU.

AEC

ARCTIC ECONOMIC COUNCIL

SHIPPED
CENTURIES AGO
AND TODAY

Raw Materials

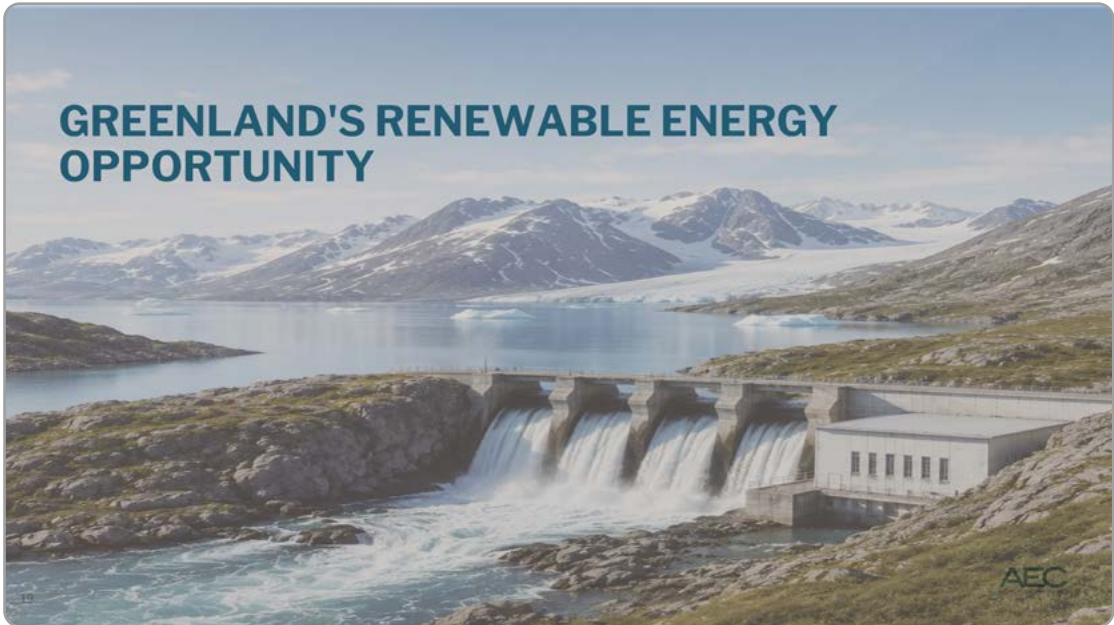


RENEWABLES ACROSS THE REGION



wind geothermal hydro solar

AEC



”

Barriers

In the Arctic, geography, weather and limited infrastructure raise the bar for project delivery. Local knowledge and community engagement are not optional — they are essential

—



”

Arctic Investment Protocol aspires to promote sustainable and equitable economic growth in the region that furthers community well-being and builds resilient societies in a fair, inclusive and environmentally sound manner.

Arctic Investment Protocol

—

Arctic Investment Protocol
Guidelines for Responsible
Investment in the Arctic

SIX BASIC PRINCIPLES FOR INVESTORS TO FOLLOW

- 1 | Build Resilient Societies Through Economic Development
- 2 | Respect and Include Local Communities and Indigenous Peoples
- 3 | Pursue Measures to Protect the Environment of the Arctic
- 4 | Practice Responsible and Transparent Business Methods
- 5 | Consult and Integrate Science and Traditional Ecological Knowledge
- 6 | Strengthen Pan-Arctic Collaboration and Sharing of Best Practices



BUSINESS HAPPENS AT THE SPEED OF TRUST





지속가능한 미래를 위한 AI와 디지털 인프라

AI and Digital Infrastructure for a Sustainable Future: A Tale of Twin Transition

연사 Speaker

웬 용강 Yonggang Wen

난양기술대학교 교수
Professor, Nanyang Technological University

주요경력

2014-2016	IEEE 통신학회 멀티미디어 통신 기술위원회 위원장
2016-2018	난양공과대학교(NTU) 컴퓨터과학·공학부 혁신 담당 부학부장
2017-2019	NTU 난양기술창업센터(NTC) 센터장 직무대행
2018-2023	NTC 공과대학 연구부학장
2023	NTC 총장실 역량개발 담당 부총장보
2023-2025	IEEE Transactions on Multimedia 편집위원장
현재	NTC 컴퓨터과학·공학 석좌교수 겸 교수
현재	NTC 총장실 부총장보(대학원 교육) 및 대학원장

학력

2008	미국 매사추세츠 공과대학교 전기공학·컴퓨터과학 박사(서양문학 부전공)
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주요 수상 이력

2013	아세안 ICT 어워드 금상(멀티스크린 클라우드 소셜 TV)
2015	데이터센터 다이내믹스 어워드 아시아-태평양 지역상(데이터센터용 인지형 디지털 트윈)
2016	아세안 ICT 어워드 금상(데이터센터용 인지형 디지털 트윈)
2016	난양 혁신·기업가정신상
2019	난양 연구상
2020	IEEE TCCPS 산업기술우수상
2021	W.Media 아시아-태평양 클라우드 및 데이터센터 기술 리더상
2022	싱가포르컴퓨터학회 디지털 기술 리더상
2023	ASPLOS 최우수 논문상

Experience & Academic Roles

2014-2016	Chair, IEEE ComSoc Multimedia Communication Technical Committee
2016-2018	Assistant Chair(Innovation), School of Computer Science and Engineering, NTU Singapore
2017-2019	Acting Director, Nanyang Technopreneurship Center(NTC), NTU Singapore
2018-2023	Associate Dean(Research), College of Engineering, NTU Singapore
2023	Associate Vice President(Capability Building), President's Office, NTU Singapore
2023-2025	Editor in Chief, IEEE Transactions on Multimedia(TMM)
Present	Professor and President's Chair in Computer Science and Engineering, NTU Singapore
Present	Vice Provost(Graduate Education) & Dean of Graduate College, NTU Singapore

Education

2008	PhD in Electrical Engineering and Computer Science (Minor in Western Literature), MIT
------	---

Major Awards & Recognitions

2013	Gold Medal, ASEAN ICT Award(Multi-Screen Cloud Social TV)
2015	Data Centre Dynamics Awards – APAC(Cognitive Digital Twin for Data Centre)
2016	Gold Medal, ASEAN ICT Awards(Cognitive Digital Twin for Data Centre)
2016	Winner, Nanyang Awards for Innovation and Entrepreneurship
2019	Winner, Nanyang Research Award
2020	IEEE TCCPS Industrial Technical Excellence Award
2021	W.Media APAC Cloud and Datacenter Technology Leader Award
2022	Singapore Computer Society Digital Achiever Tech Leader Award
2023	Best Paper Award, ASPLOS(International Conference)



AI and Digital Infrastructure for a Sustainable Future: *A Tale of Twin Transition*

WEN Yonggang, FIEEE & FSAEng
President's Chair in Data Science
Vice Provost (Graduate Education) & Dean, Graduate College
Director, NTU Centre in Computational Technologies for Finance (CCTF)
Nanyang Technological University, Singapore

6 July 2026



Twinning Sustainable and Digital Transitions via AI & Data [1]



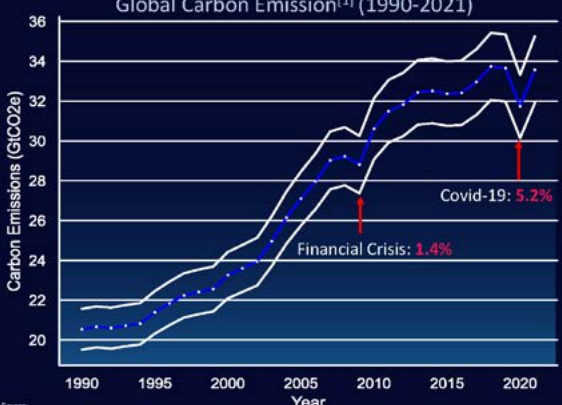
Source:
1. 2022 EU Strategic Foresight Report, (https://commission.europa.eu/strategy-and-policy/strategic-foresight/2022-strategic-foresight-report_en)

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Hidden Carbon Bill of Digitalisation: physical activity fell 60%, yet emission dropped only 5%

Global Carbon Emission^[1] (1990-2021)



Carbon Emissions (GtCO₂e)

Year

Financial Crisis: 1.4%

Covid-19: 5.2%

Land Transportation^[2]

60 %

Physical Activity Reduction

Airline Traffic^[3]

71 %

Internet Traffic^[4]

25 %

Online Activity Acceleration

Zoom DAU^[5]

300 %

Source:
1. CO₂ Emissions in 2022 IEA, (<https://www.iea.org/en/press-releases/2022/06/2022-co2-emissions-in-2022>)
2. Rahman, S. M., Khatun, N., Ahsan, K., Al-Sagheer, I., Gader, U., Raza, L., & Rashed, O. (2023). Transformation of urban mobility during COVID-19 pandemic: Lessons for transportation planning. Journal of transport & health, 23, 101257.
3. Conference for Air Travel through the COVID-19 Public Health Crisis, (<https://www.icao.int/publications/Pages/CAAT-17.aspx>)
4. The Network Impact of the Global COVID-19 Pandemic, (https://www.eurostat.ec.europa.eu/tgm/table?l=1&_lang=en)
5. Zoom Statistics 2024: How Video Conferencing Changed Our Lives, (<https://www.zoom.us/statistics>)

 NTU-Restricted 2

01

Sustainability for AI



02

AI for Sustainability



03

Twinning AI and Sustainability



 NTU-Restricted 4

01

Sustainability for AI

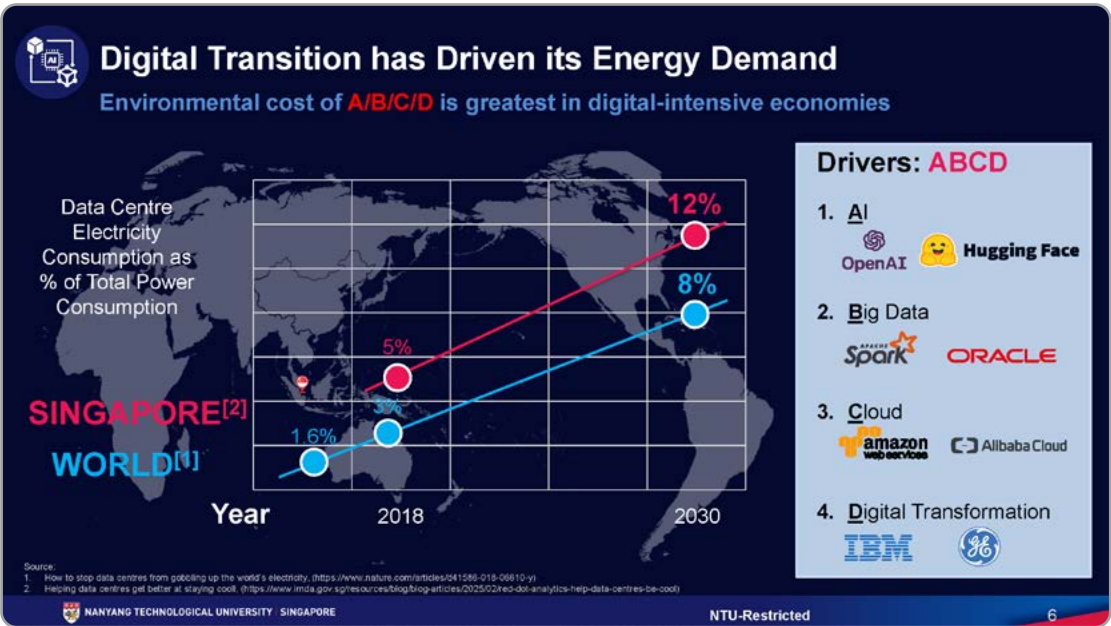
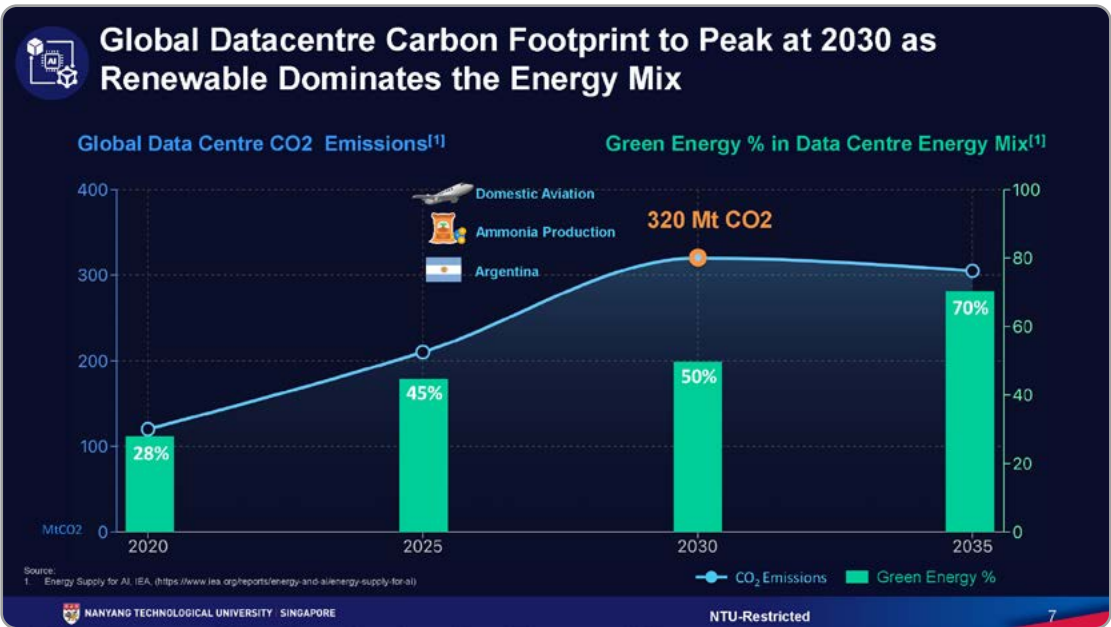
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AI for Sustainability

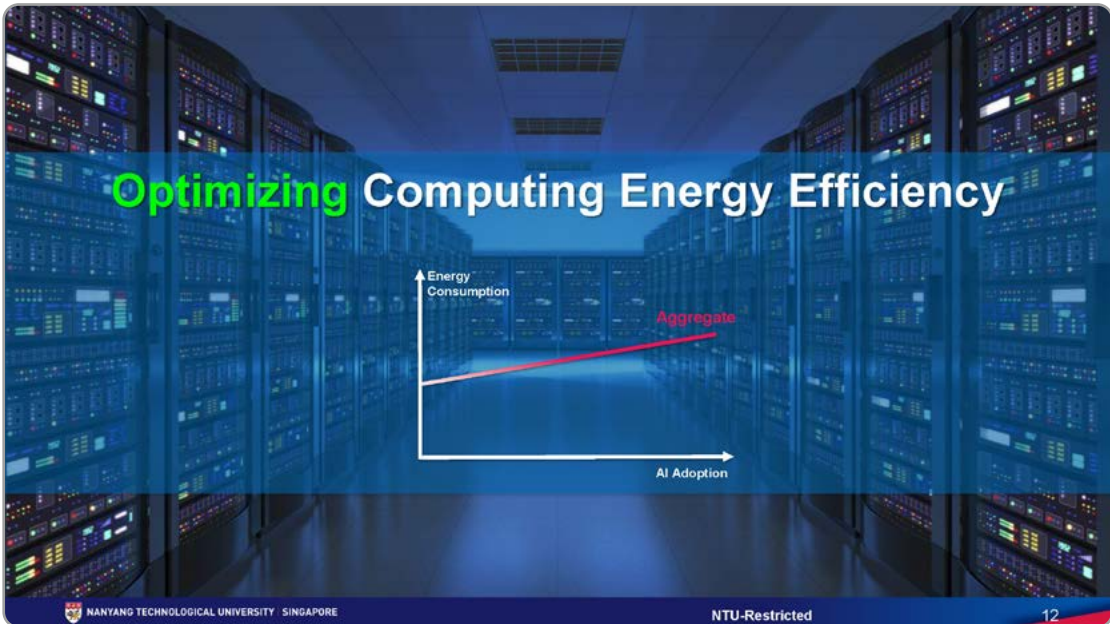
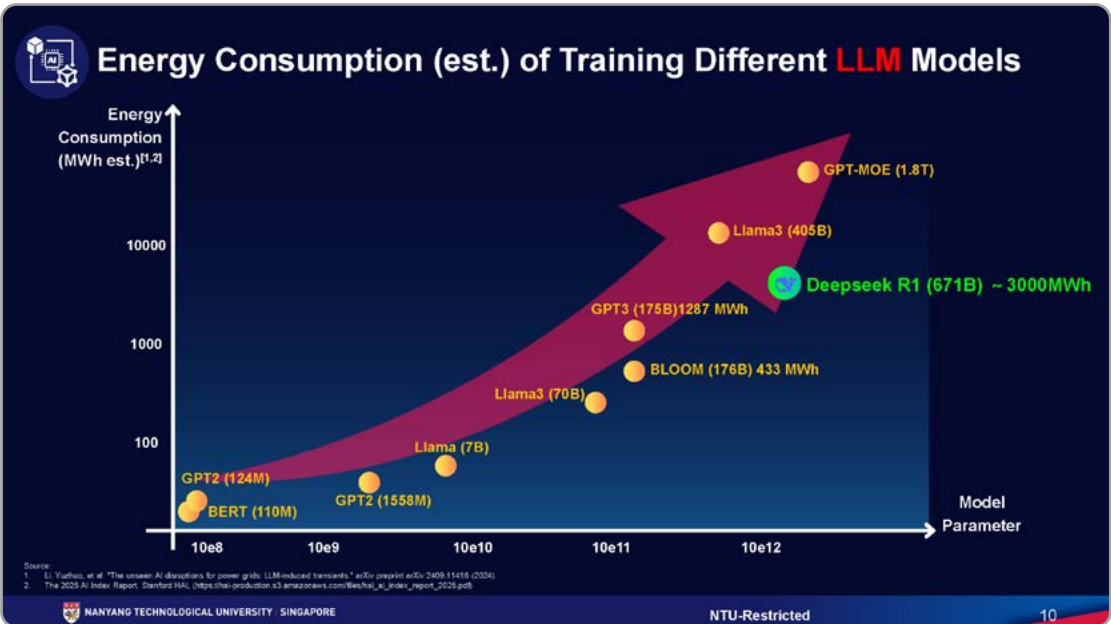
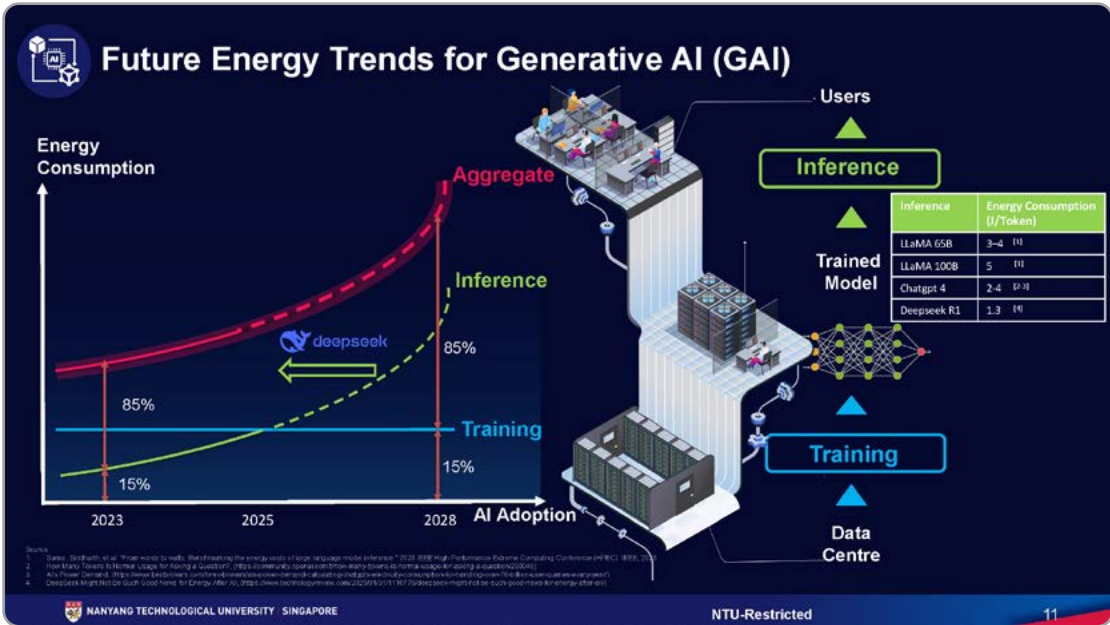
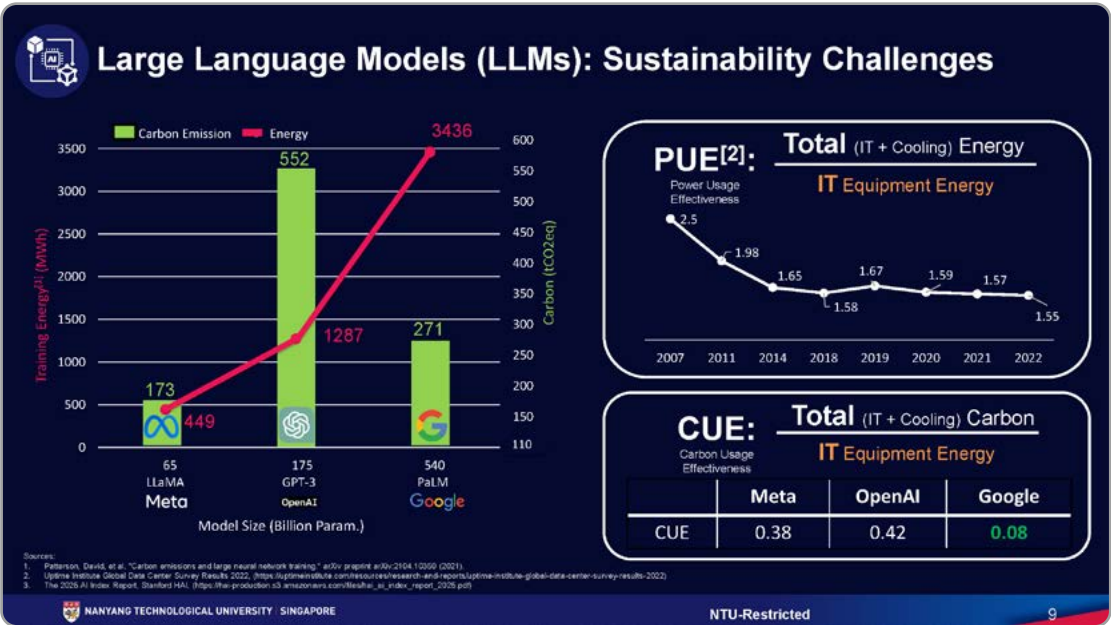
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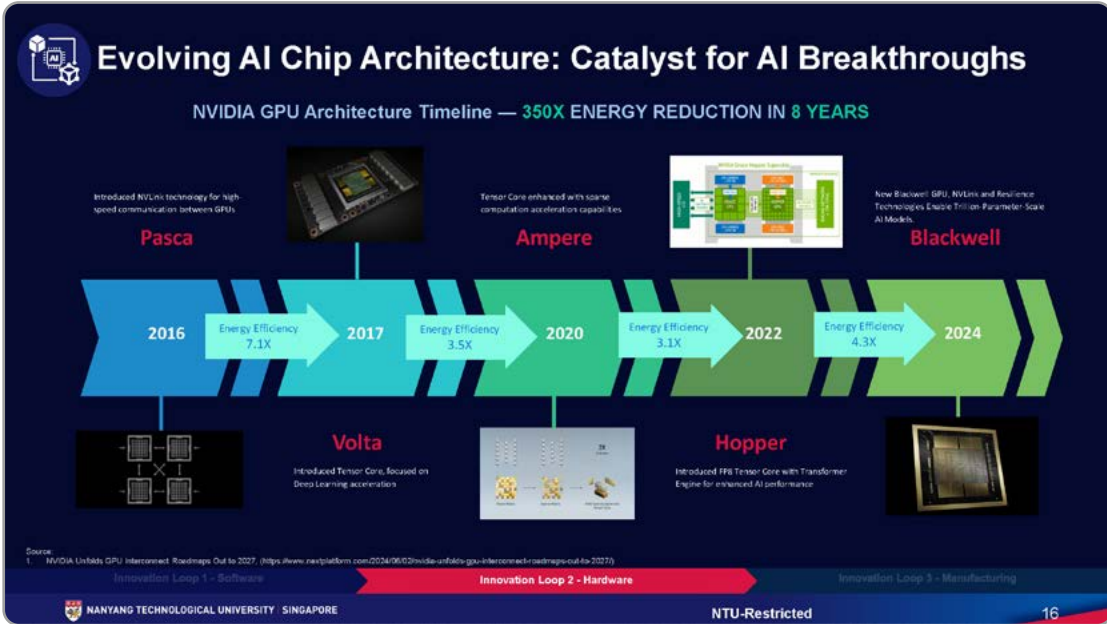
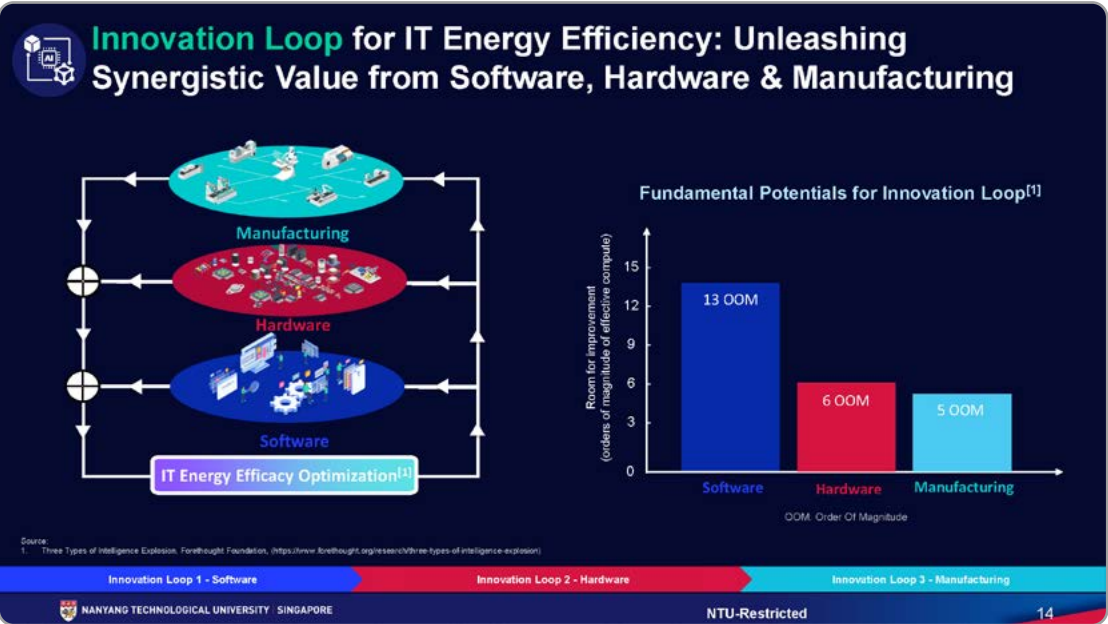
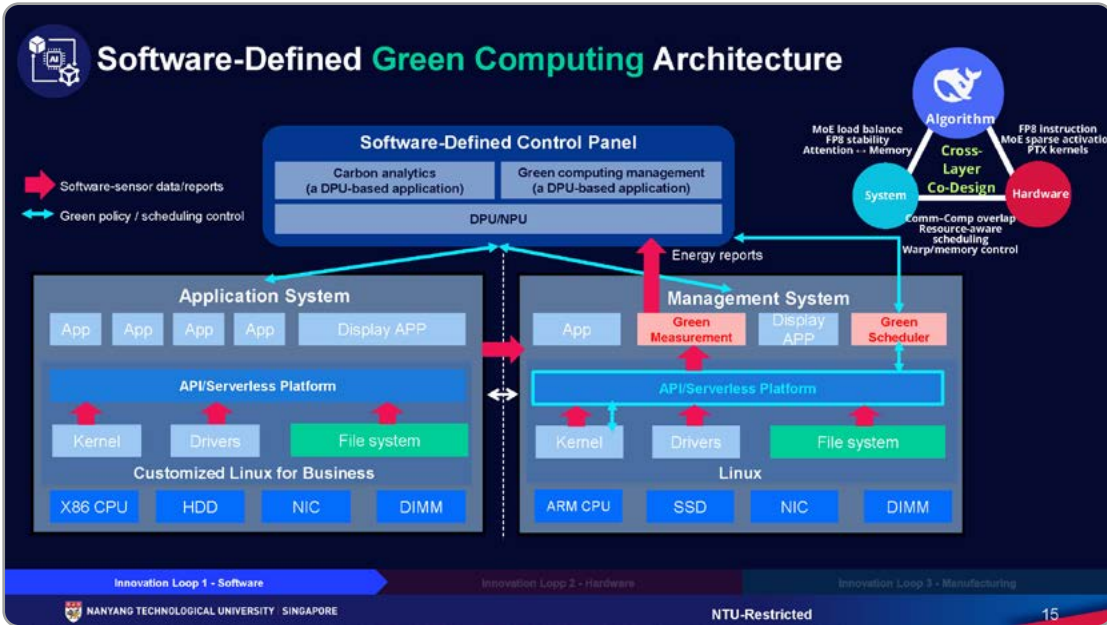
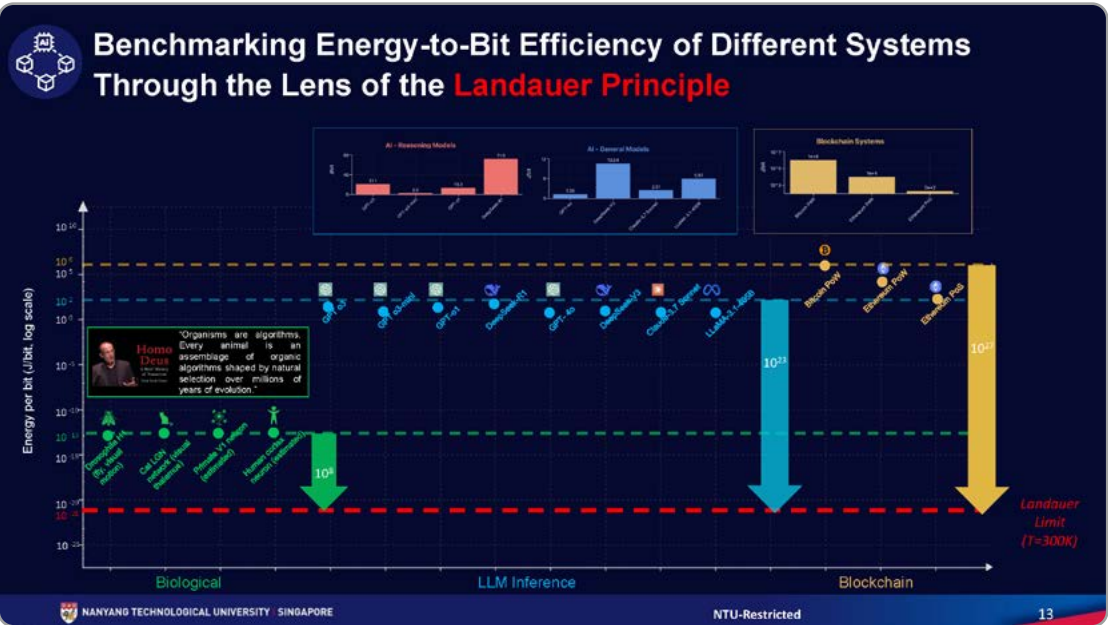
Twinning AI and Sustainability

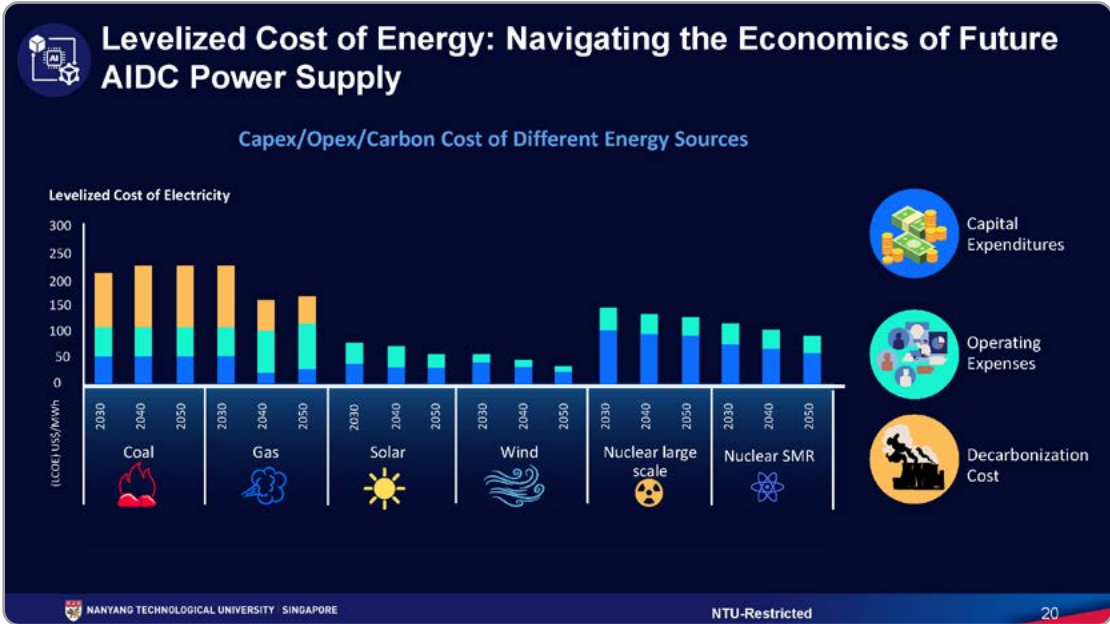
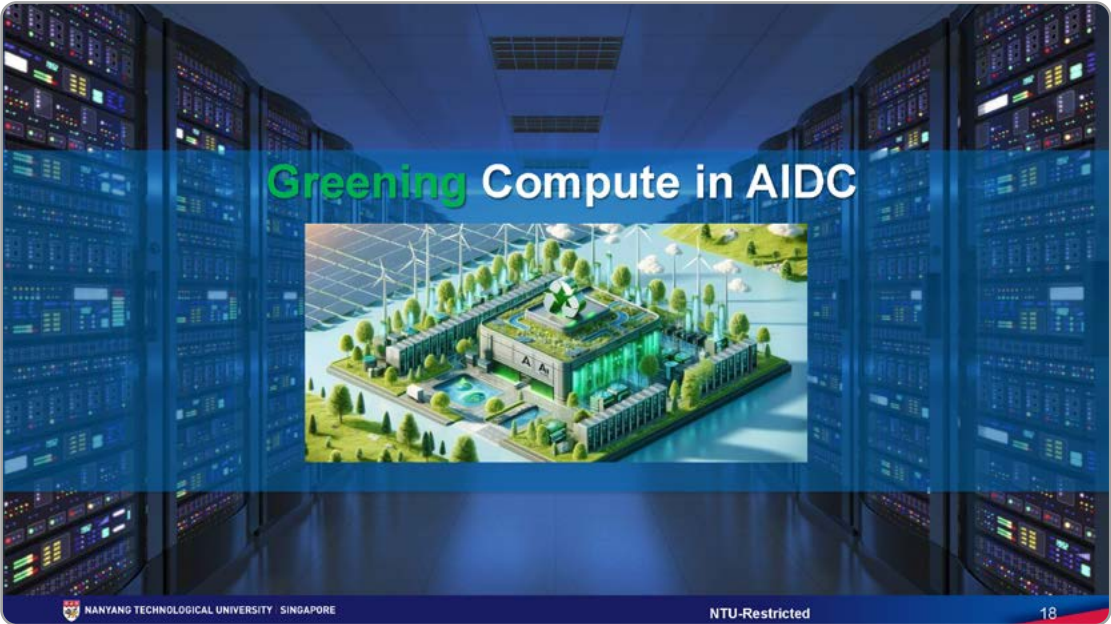
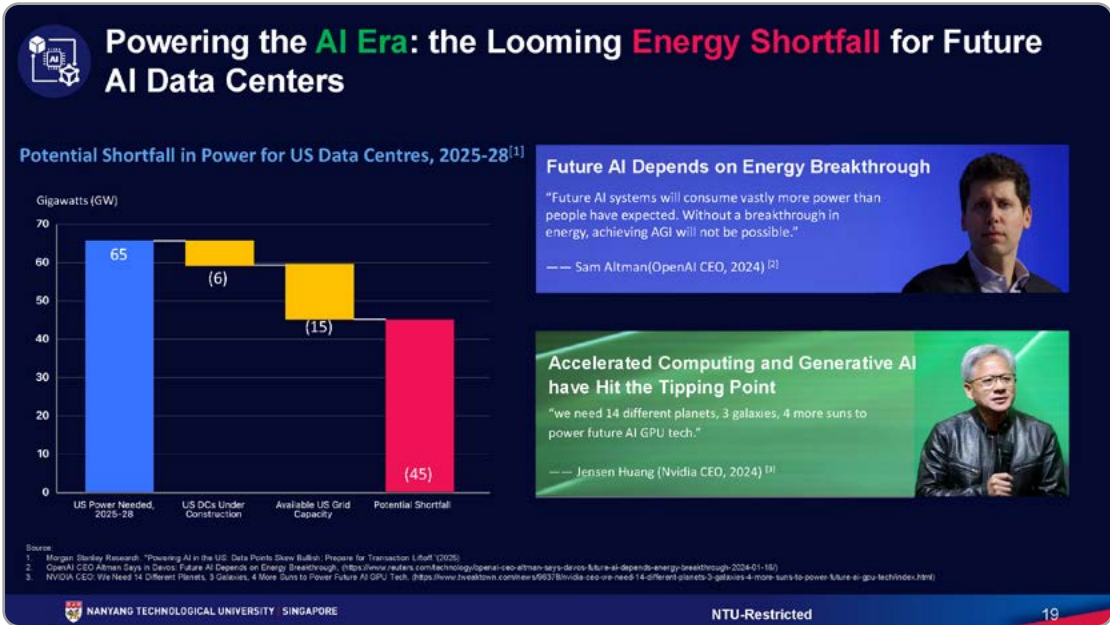
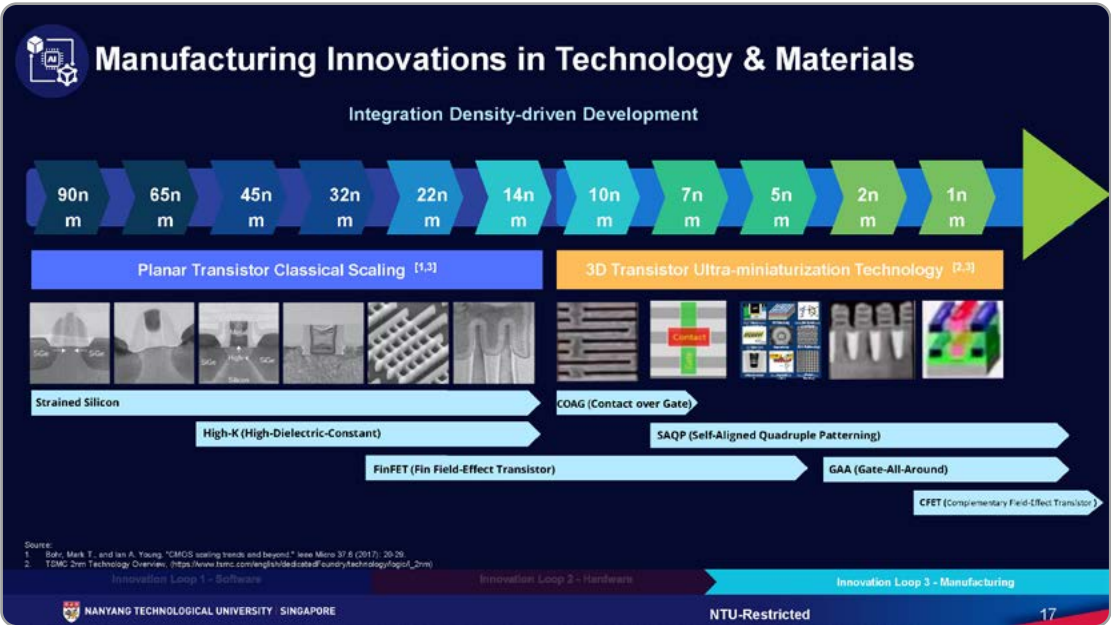
AI

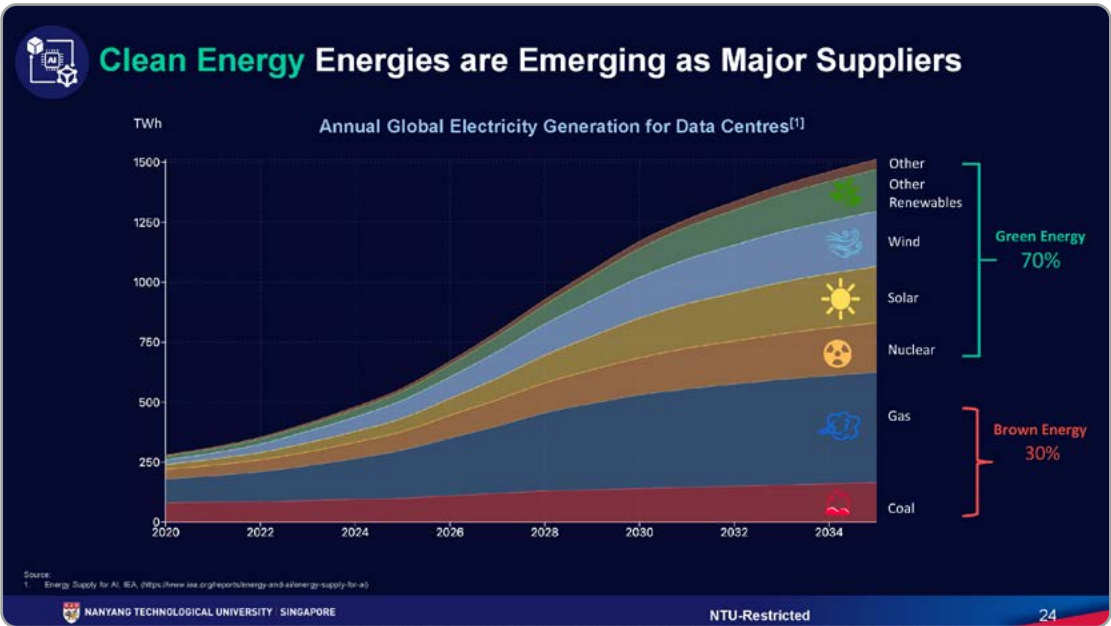
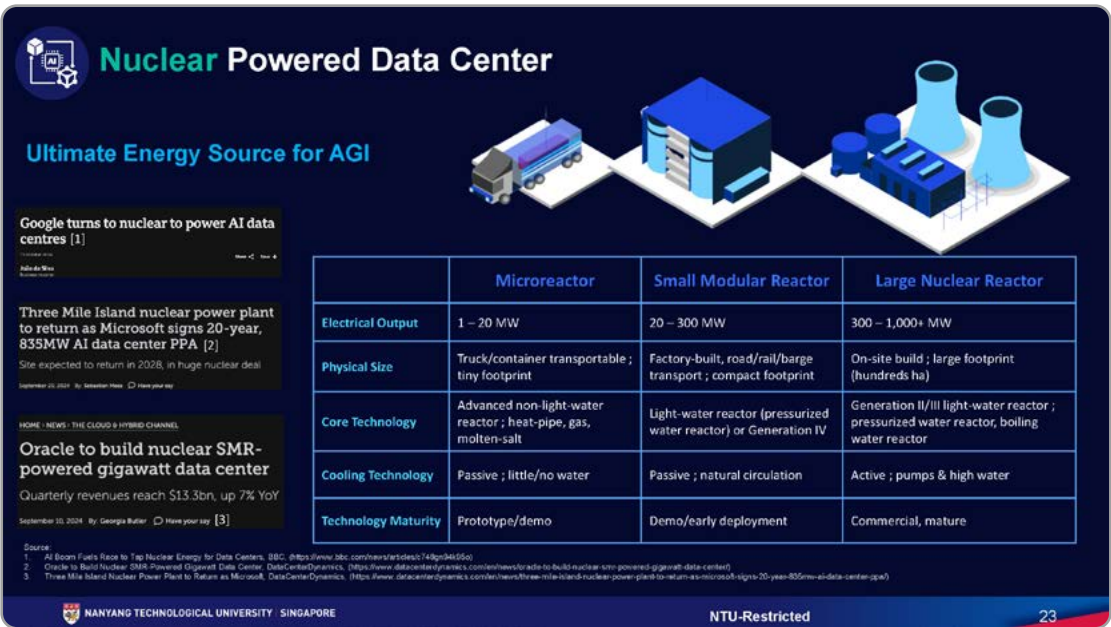
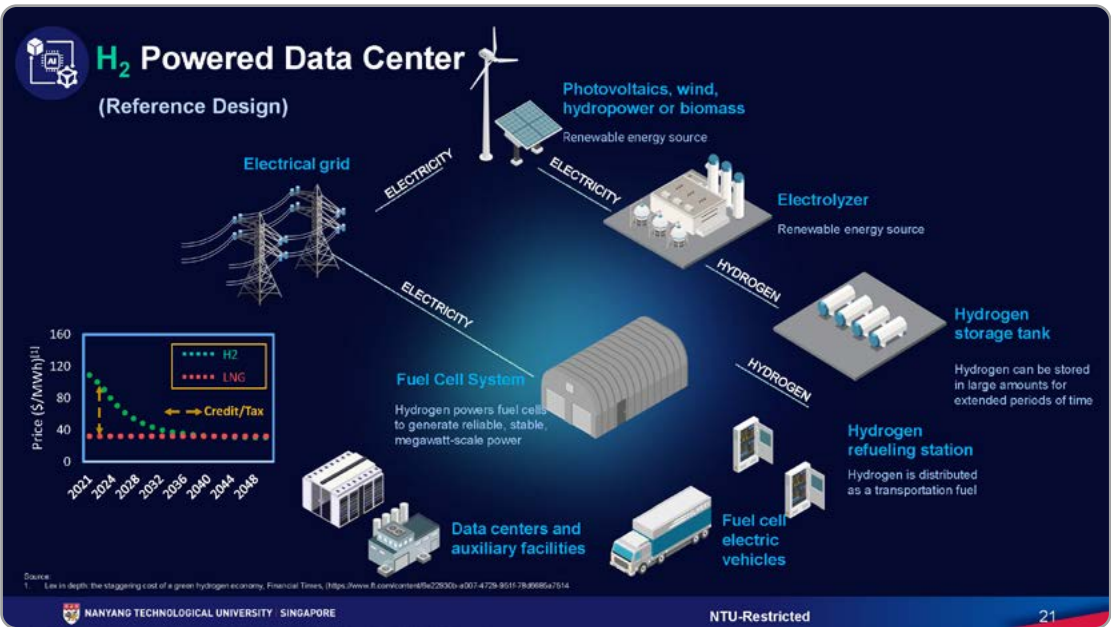


GenAI Sustainability Challenges









02

AI for Sustainability

01

Sustainability for AI

03

Twinning AI and Sustainability

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25

Industrial AI: Driving Digital Transformation in the Physical Realm

Customers

Employees

Work Scheduling

Smart Buildings

Port Automation

Datacentre Management

Factory

Field

Fleet

Facility

Business AI: AI for digital spaces

Digital/

AI

Transformation

Industrial AI: AI for physical spaces (F4)

Challenges

• CRM

• HR Management

• Financial Management

• Marketing

• Data Availability

• Data Quality

• Data Privacy

• Testing Costs & Complexity

• High Cost of Deployment

• High Cost of Failure

• Training Challenges ("black swans")

• High Regulatory Requirements

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27

AI Accelerating Decarbonization in Heavy Industries

Digital Solution 2050 Net Zero Trajectories^[1]

Mt CO₂e

60,000

50,000

40,000

30,000

20,000

10,000

0

2000

2030

2040

2050

Business-As-Usual (BAU) Scenario

20% EMISSIONS REDUCTION FROM 33 DIGITAL USECASES

IEA 2025 Net Zero Trajectories Scenario

Energy

Material

Mobility

Source:

1. World Economic Forum (2022). How Digital Solutions Can Reduce Global Emissions. Retrieved from <https://www.weforum.org/stories/2022/02/how-digital-solutions-can-reduce-global-emissions/>

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"Industrial Metaverse": Digital Transformation with Physics-Informed Machine Learning (PIML)

PHYSICAL SYSTEM

Digitalization

World Fusion Model

Simulation

Validation

AI POLICY ENGINE

Actualization

Multiphysics and Multiscale digital twin framework

PIML

REDDOT AI

Forbes Asia 100 TO WATCH 2023

ENABLING TECHNOLOGY LEADER

Frost & Sullivan's Best Practice 2024

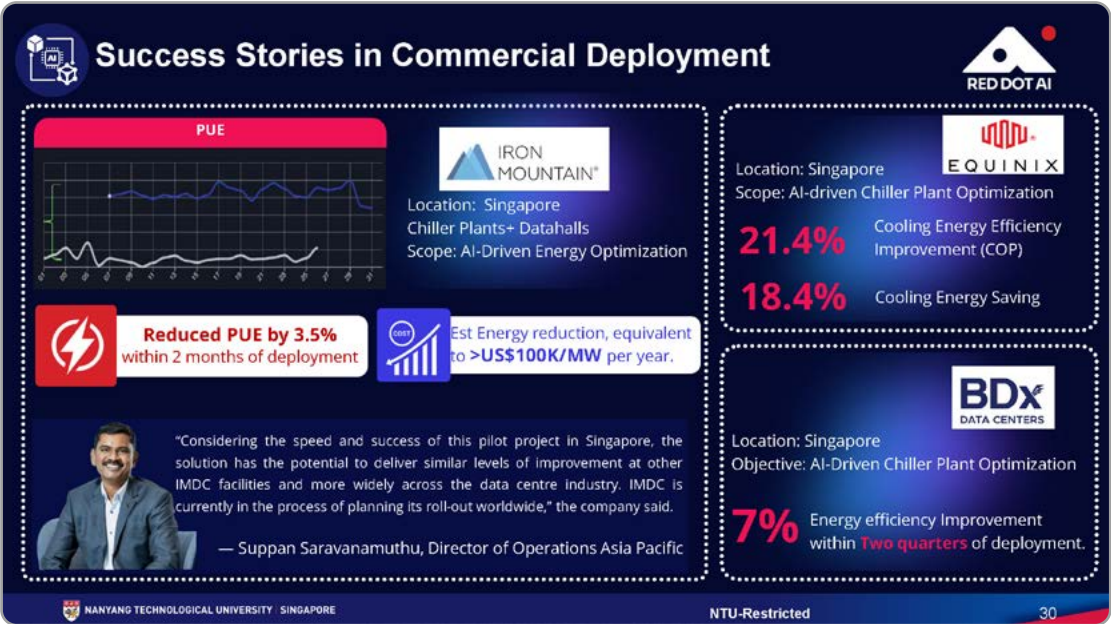
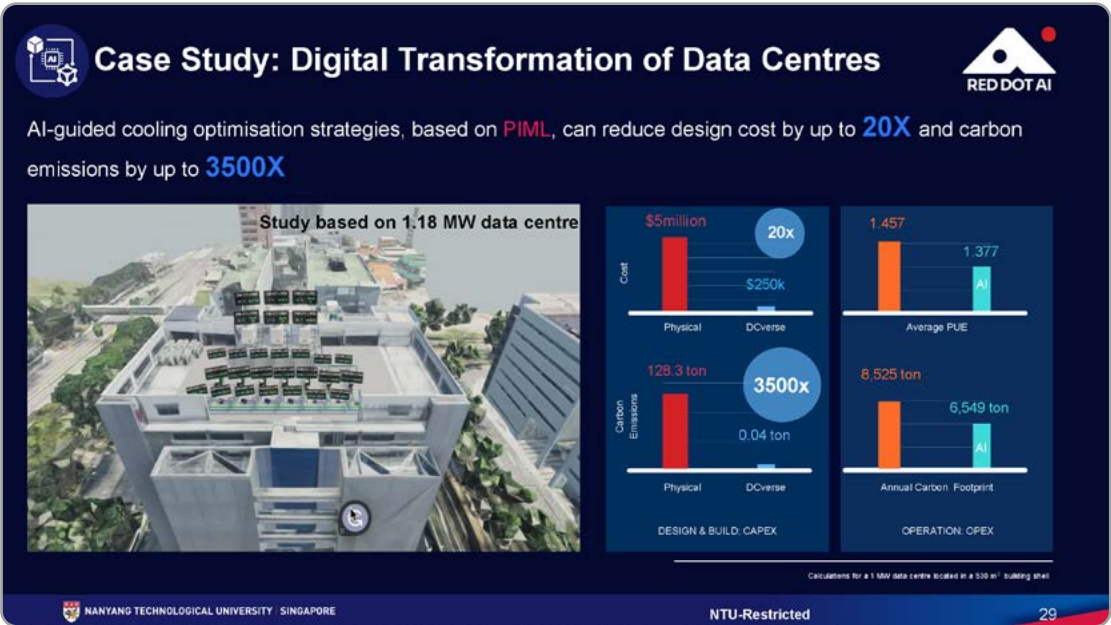
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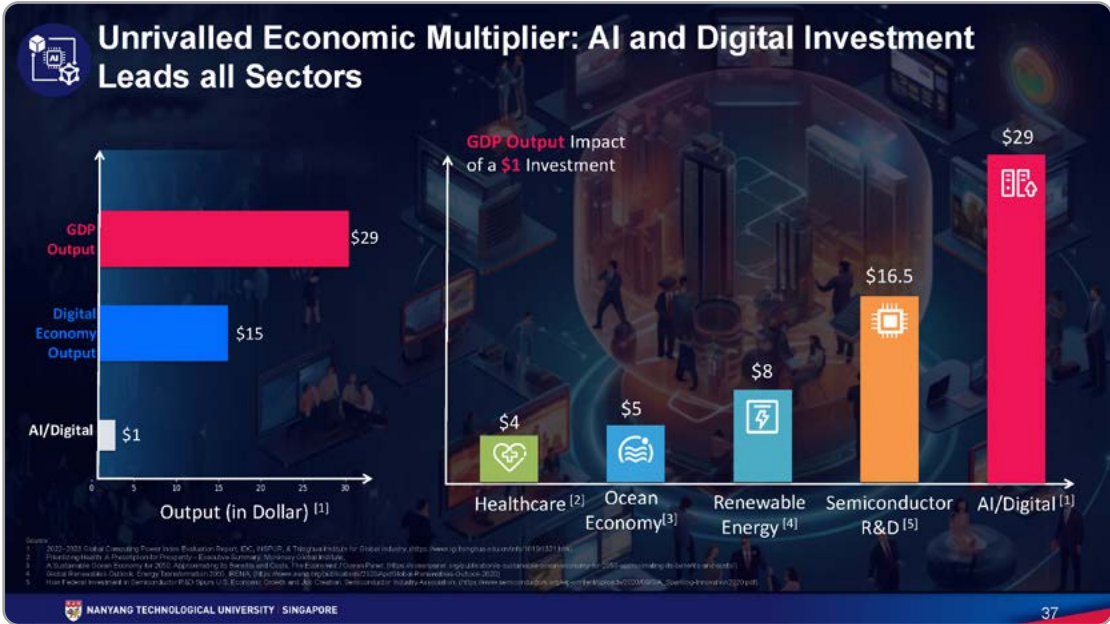
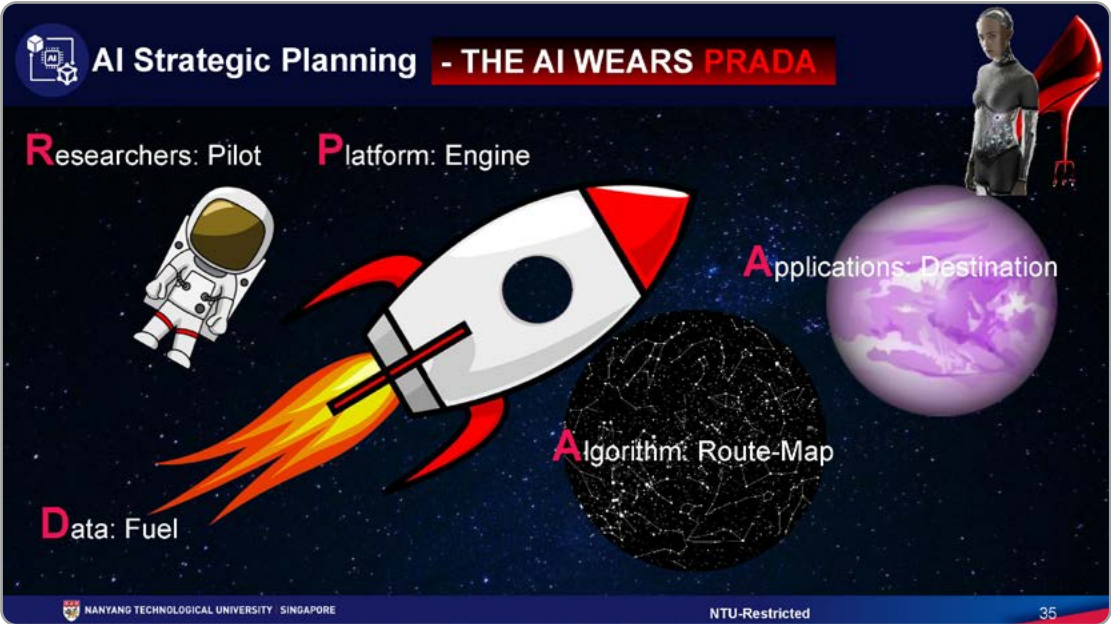
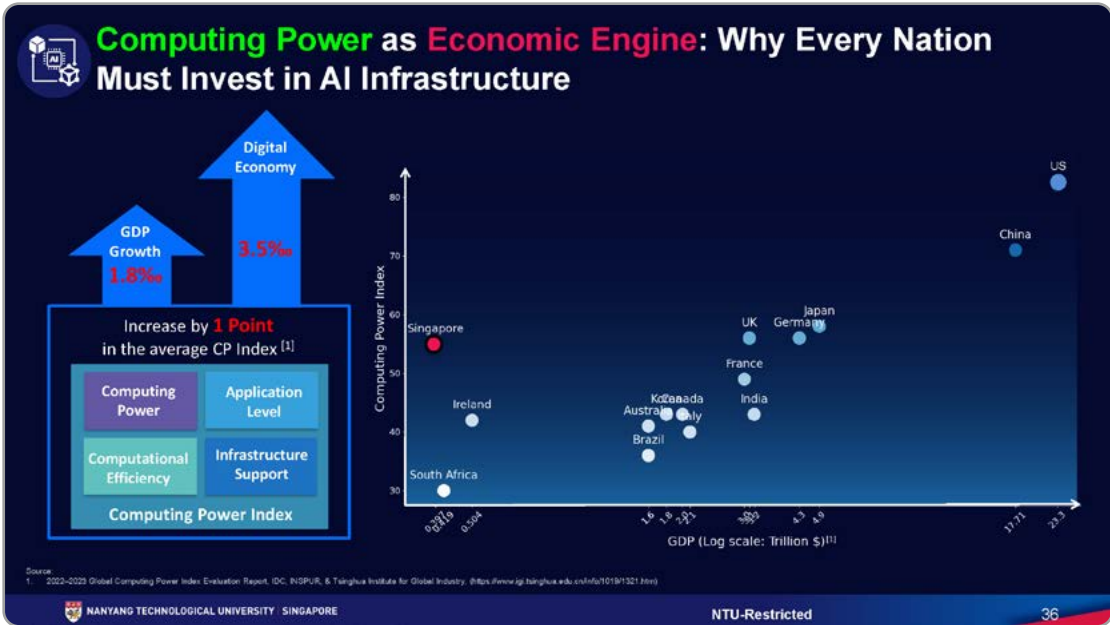
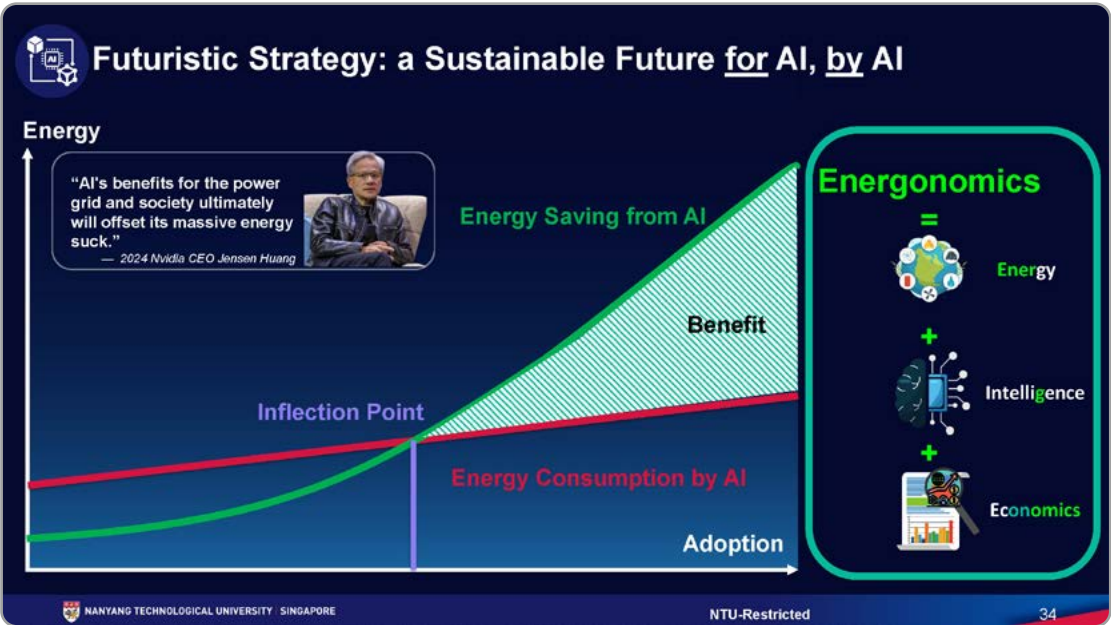
1. Wang, R., Cao, Z., Zheng, Q., Tan, R., Wen, Y., Leung, T., Kennedy, S., & Tech, J. (2022). Toward physics-informed machine learning for data center operations: A tropical case study. arXiv preprint arXiv:2205.19414.

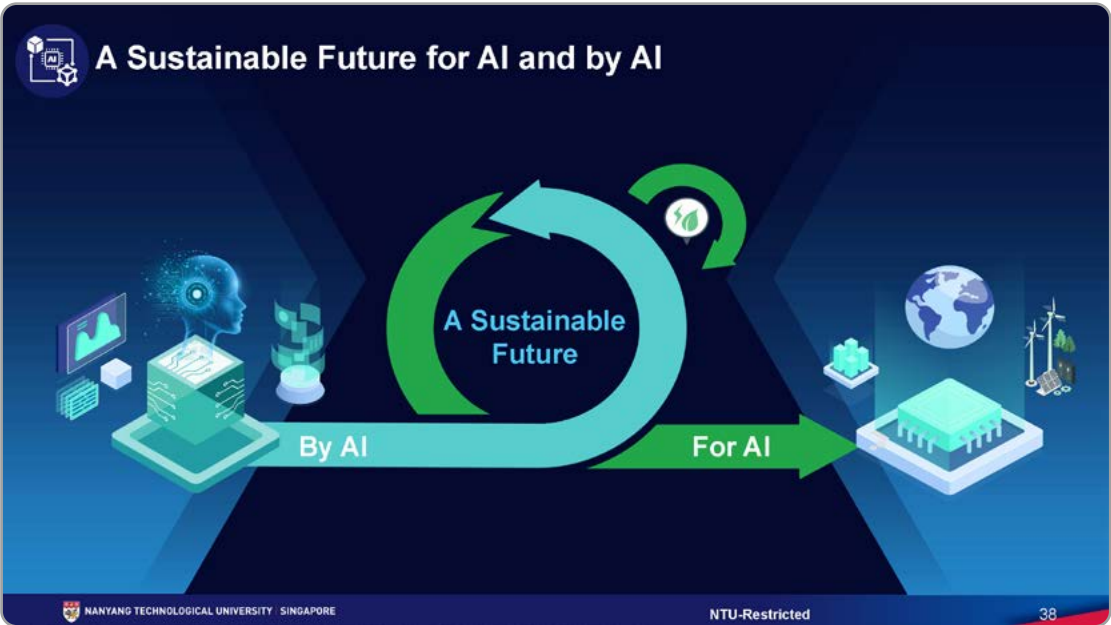
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WORLD
GREEN GROWTH
FORUM 2026
2026 세계녹색성장포럼



철강 탄소중립을 위한 수소 기반 기술 전략과 전환 경로

Hydrogen-Based Steel Decarbonization: Strategy and Technology Pathways

연사 Speaker

윤창원 Chang Won Yoon

포항공과대학교 화학공학과 교수
Professor, Chemical Engineering, Pohang University of Science and Technology

주요경력

- 2008-2010 University of California, Berkeley / 박사후연구원
- 2010-2021 한국과학기술연구원(KIST) / 선택임연구원
(2019 – 2020: KIST 수소연료전지연구단장 역임)
- 2021-현재 POSTECH 화학공학과 / 정교수
- 2021-2023 포항산업과학연구원(RIST) / 수소저탄소연구소장(겸직)
- 2022-2026 포스코홀딩스 미래기술연구원 / 수소저탄소연구소 자문교수
- 2026-현재 포항산업과학연구원(RIST) / 수소저탄소연구소장(겸직)

Biography

- 2008-2010 University of California, Berkeley Postdoctoral Researcher
- 2010-2021 Korea Institute of Science and Technology(KIST) / Senior/Principal Scientist('19-'20: KIST Center for H2 and Fuel Cell Research Center / Head)
- 2021-present POSTECH Chemical Engineering / Full Professor
- 2021-2023 Research Institute of Industrial Science & Technology(RIST), Hydrogen & Low Carbon R&D Laboratories / Director(Joint Appointment)
- 2022-2026 POSCO Holdings N.EX.T Hub, Hydrogen & Low Carbon R&D Laboratories / Advisory Professor
- 2026-present Research Institute of Industrial Science & Technology(RIST), Hydrogen & Low Carbon R&D Laboratories / Director(Joint Appointment)

WGGF 2026
Session 1: Green Transformation

2026. 07. 09

Hydrogen-Based Steel Decarbonization: Strategy and Technology Pathways

Chang Won Yoon

POSTECH
Pohang University of Science and Technology

posco
HOLDINGS

Professor | Chemical Engineering, Pohang University of Science and Technology (POSTECH)
Director | Global Hydrogen and Low Carbon Research Center
Director | POSCO Holdings-POSTECH-RIST Integrated Research Center

RIST

Hydrogen Policy in Korea: Ministry of Trade, Industry and Energy (MOTIE)

Hydrogen Economy Implementation Basic Plan* (2021.11)

Year	H ₂ demand (Mton)	Transportation (Mton)	Power generation (Mton)	CO ₂ -free H ₂ share
2020	0.22	0.02	0.20	0%
2030	3.9	0.37	3.53	75%
2050	27.9	0.8	27.1	100%

2050 Final energy consumption

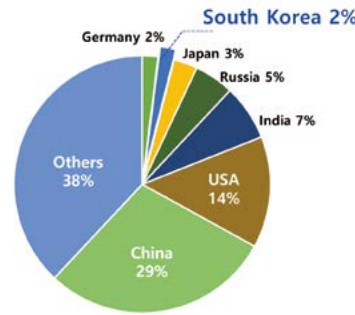
2050 Power generation

South Korea is expected to import CO₂-free H₂ from overseas in the future
→ The government is considering “establishing a H₂ Supply Chain” based on NH₃ and other carriers

Steelmaking at a Turning Point

Global Carbon Emission by Country

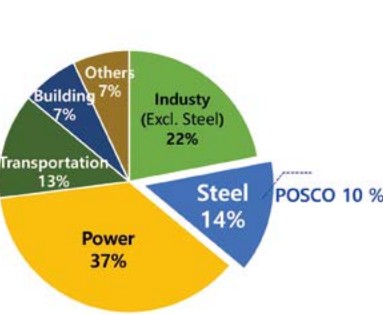
Approx. 34 Billion Tons / Year



(Ref) Visualizing All the World's Carbon Emissions by Country (2021)

South Korea's Carbon Emission Status

Approx. 730 Million Tons / Year



(Ref) [기후솔루션] 국내 철강산업 탄소중립 대응 동향과 이슈 (2021.11)

3

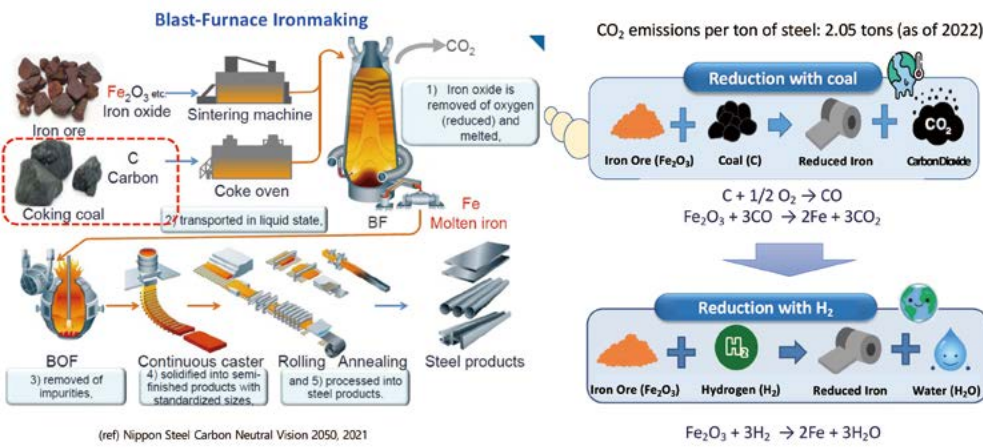
Global Race: Shaft Furnace-Based H₂-DRI Routes

Low Carbon Process	Facilities Configuration		Notes
	Shaft Furnace	EAF (Electric Arc Furnace)	
Shaft-based Routes			Intensifying Shortage of High-Grade Iron Ore for Pellet Production (Supply Gap < 133 Mta) Production Constraints for High-Grade Steel ([N] > 30-40 ppm)

- ✓ Exclusive Use of Iron Ore Pellets as Feedstock (Requires High-Grade Ore)
- ✓ Limitations of Shaft Furnace-based EAF in High-Margin Premium Markets

5

Steelmaking at a Turning Point: Hydrogen Reduction Process



Hydrogen-based Ironmaking Creates an Anchor Demand for Clean H₂

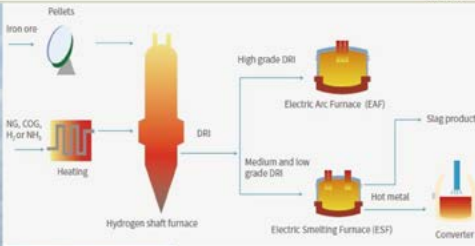
4

HYBRIT Hydrogen-based Steelmaking: Shaft Reduction Process (MIDREX®)



Photo: <https://constructionnews.co.nz/2021/10/26/the-worlds-first-fossil-free-steel-ready-for-delivery/>

HyRESP Hydrogen-based Steelmaking: Shaft Reduction Process (ENERGIRON®)



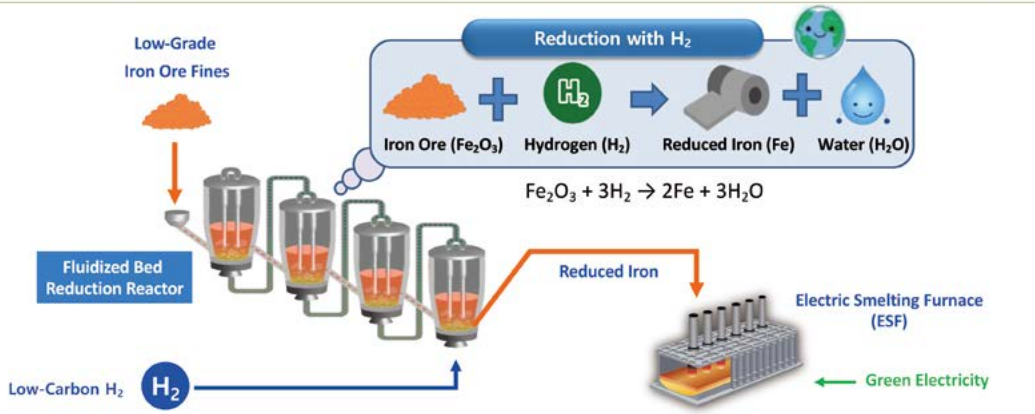


World's First 1.0 Mta-Class Hydrogen-based Shaft Furnace in Commercial Operation

Can we develop a route that is less constrained by high-grade pellet availability?

The Next Question: Where Does the Hydrogen Come From?

POSCO HyREX: Fluidized Reduction of “Fine Ores” + Electric Smelting



Low-Grade Iron Ore Fines

Reduction with H₂

Iron Ore (Fe₂O₃) + Hydrogen (H₂) → Reduced Iron (Fe) + Water (H₂O)

Fe₂O₃ + 3H₂ → 2Fe + 3H₂O

Fluidized Bed Reduction Reactor

Low-Carbon H₂

Reduced Iron

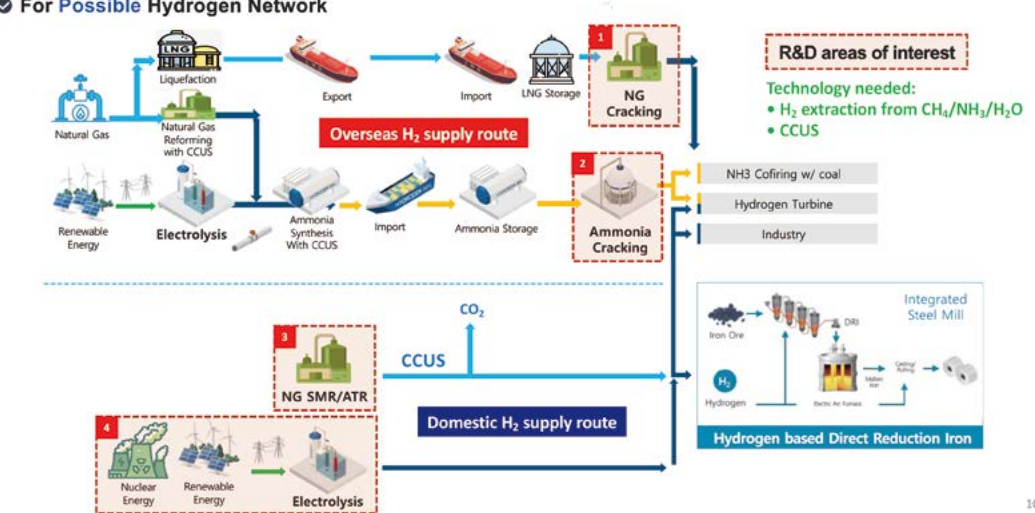
Electric Smelting Furnace (ESF)

Green Electricity

Fine ores are much more widely available, and HyREX addresses one of the major bottlenecks of H₂-based ironmaking

POSCO pursuing demonstration of HyREX-based direct reduced iron (DRI) production

Potential Hydrogen Supply Pathways (Overseas & Domestic)



For Possible Hydrogen Network

Overseas H₂ supply route

Domestic H₂ supply route

CCUS

Integrated Steel Mill

Hydrogen based Direct Reduction Iron

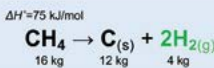
R&D areas of interest

- H₂ extraction from CH₄/NH₃/H₂O
- CCUS

01 Methane Pyrolysis: Turquoise H₂

Methane Pyrolysis as a Candidate Route for Low-Carbon H₂ (Turquoise H₂)

Core Concept:



- **Strategic Fit:** Leveraging existing LNG infrastructure with no CO₂ emission at reaction level
- **Energy Efficiency:** Lower theoretical energy requirement compared to water electrolysis
- **R&D Focus (High-level):** Reactor scale-up and optimization for continuous operation
- **Efficient separation and valorization of solid carbon by-products.**

Company	Plasma Cracking		High Temp. Cracking		Catalytic Cracking	
	(US) Monolith	(DE) Graforce	(US) ExxonMobil	(DE) BASF	(AU) Hazer	(FI) Hycamite
						

11

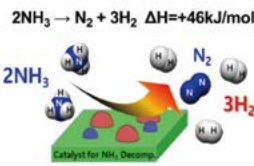
02 Ammonia Cracking

Develop core technology for high purity hydrogen from ammonia

Integrated process analysis, scale-up process design and demonstration

- POSCO Holdings secured the Basic Design Package for the integrated NH₃ cracking process (700 tons-H₂/year)

[Catalyst design for ammonia dehydrogenation]



[Process design for Ammonia Cracking]

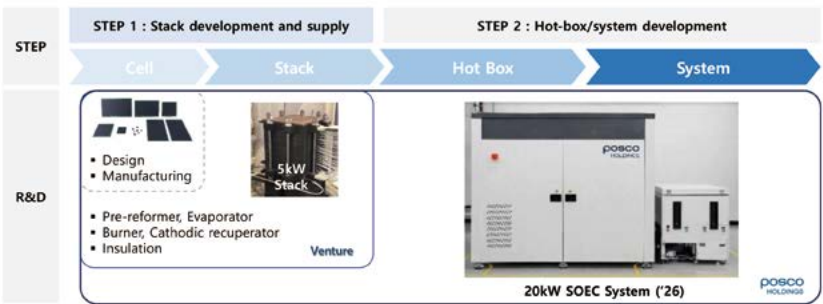


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04 High temperature water electrolysis (SOEC): Pink/Purple H₂

High-Temperature Steam Electrolysis (SOEC) Technology

- Secured world-class performance and efficiency in SOEC cell and stack

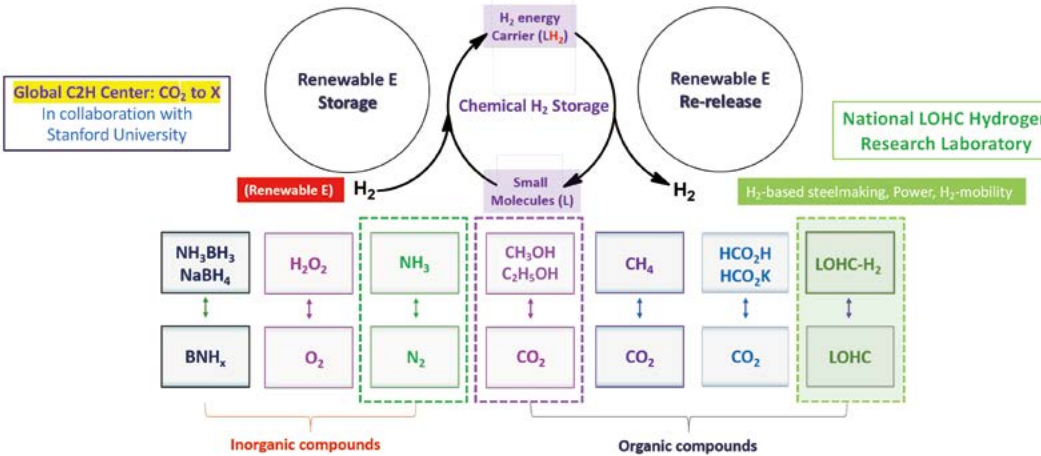


Enforus, a venture specializing in SOEC cell & stack development, was spun off in 2025

13

POSTECH Strategies for Chemical Hydrogen Storage

POSTECH Global Hydrogen & Low Carbon Research Center POSCO-Holdings-POSTECH-RIST Integrated Research Center



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Summary



- Steel decarbonization requires replacing carbon with hydrogen as the reductant.
- Hydrogen-based ironmaking can become an anchor demand for clean H₂.
- Innovative technologies are being developed in collaboration with POSCO Holdings, POSTECH, and RIST
- Beyond these R&D initiatives, Pohang City plays a critical role in advancing the regional hydrogen industry.

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Thank you for your attention!

cwyoon@postech.ac.kr

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2026 세계녹색성장포럼



탄소중립을 위한 기술적 전략

Technical Strategies for Achieving Carbon Neutrality

연사 Speaker

박상준 Sangjun Park

에코프로HN 상무
Vice President, ECOPRO HN. CO., LTD.

주요경력

- 2012. 9.-2021. 4. ㈜에코프로 이사 MW사업담당 총괄
- 2021. 5.-2023. 12. ㈜에코프로HN 상무 MW사업담당 총괄
- 2024. 1.-2025. 12. ㈜에코프로HN 상무 환경기술개발담당 총괄
- 2026. 1.-현재 ㈜에코프로HN 상무 개발담당 총괄

Biography

- 2012. 9.-2021. 4. ECOPRO. CO., LTD. Director Head of MW Business
- 2021. 5.-2023. 12. ECOPRO HN. CO., LTD. Vice President Head of MW Business
- 2024. 1.-2025. 12. ECOPRO HN. CO., LTD. Vice President Environment Technology Development Team
- 2026. 1.-Present ECOPRO HN. CO., LTD. Vice President R&D Department

Everyday Everywhere

EcoPro^{HN}

Think Tomorrow Technology for Future >

탄소중립을 위한 기술적 전략

Technical Strategies for Achieving Carbon Neutrality

2026. 7. 9. 박상준

Green Growth Technology Business & Development

Securing sustainable growth as a specialized company for eco-friendly integrated solutions

Air Environment

PFC Reduction Technology

- Commercialization experience with large-scale PFC treatment facilities
- World-class PFC removal efficiency
- Securing next-generation large-scale technology

CO₂ Capture Technology

- Representative greenhouse gas causing global warming
- Carbon capture, storage, and utilization technologies (CCUS)
- Plans to expand Smart Environmental Solutions

Next-Generation Energy

Ammonia Decomposition Technology

$NH_3 \rightarrow N_2 + H_2$

- Hydrogen production via NH_3 decomposition
- Application of microwave-based technology & Non-Precious Metal Catalysts
- Planned demonstration of pilot-scale facilities

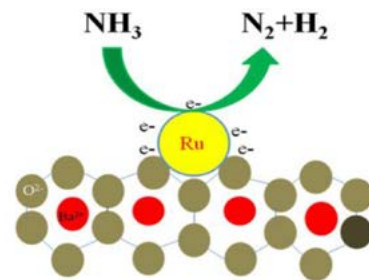
Resource Recovery

Wastewater Recovery Technology (Redox-BPED)

- Low-cost Desalination Process
- Development of electrolysis technology
- Production of high-value resources

Ammonia Decomposition Technology

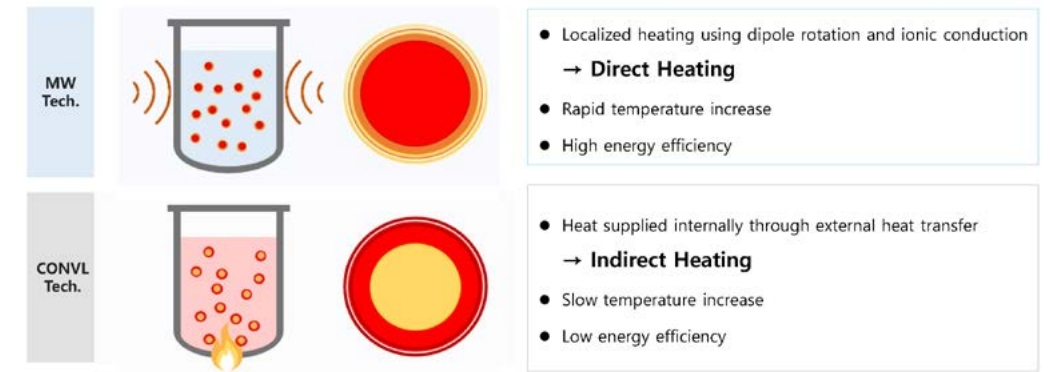
NH₃ to H₂ Extraction Demonstration Project



3

What is Microwave (MW)?

Approximately **30% higher energy efficiency** compared to conventional electric heating

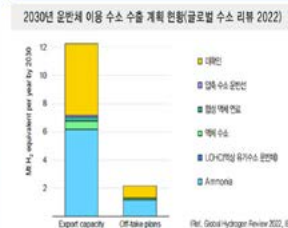


Future Key Energy: Hydrogen (H₂)

Development of ammonia Decomposition catalysts and system for hydrogen production



- Hydrogen demand has been growing at approximately 6% annually since 2017
- Expected to reach KRW 300 trillion market size by 2050



- **High Density of H_2 Storage**
 - 17.8 wt% H_2
- **Liquefaction easier than hydrogen**
 - Room Temp, 8.5bar or $-33^\circ C$, 1atm
- **Leverages existing Infrastructure**
 - Economically viable H_2 storage
- **Carbon-free fuel**
 - No CO_2 emissions during decomposition

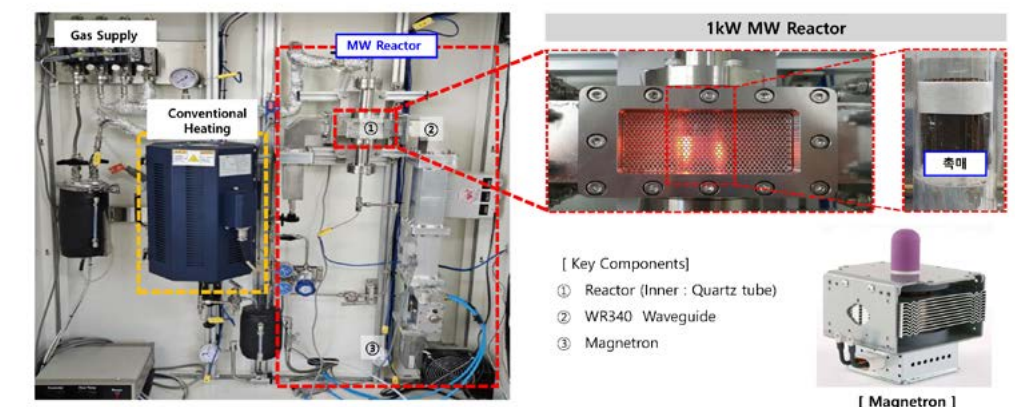
How to decompose ammonia (NH_3)?

Utilizing Non-Precious Metal Catalysts & Microwave (MW) Heating

4

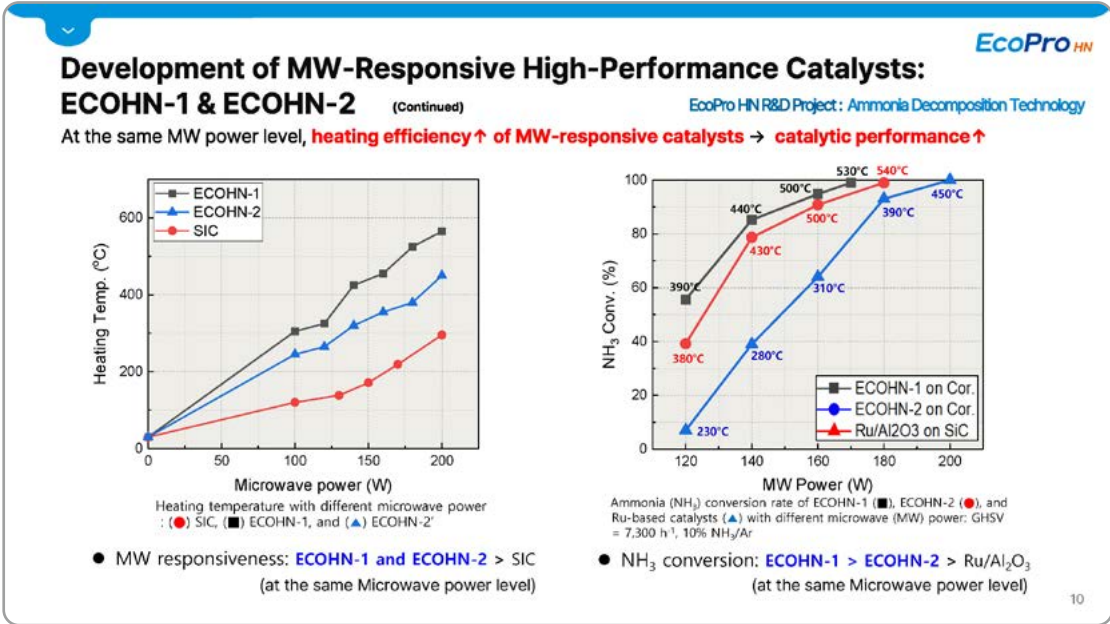
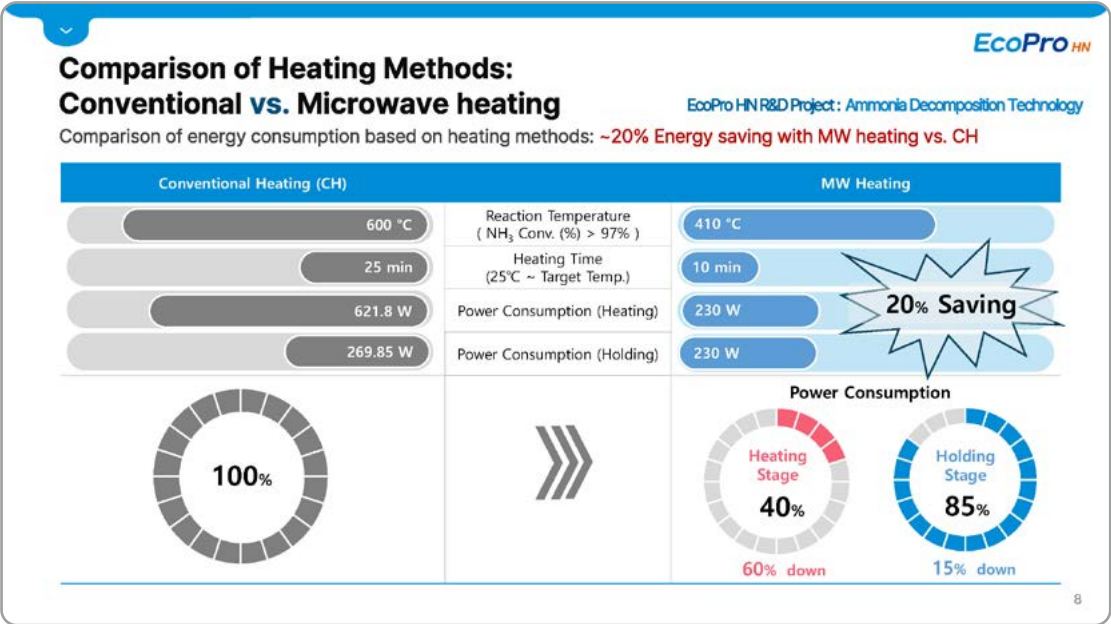
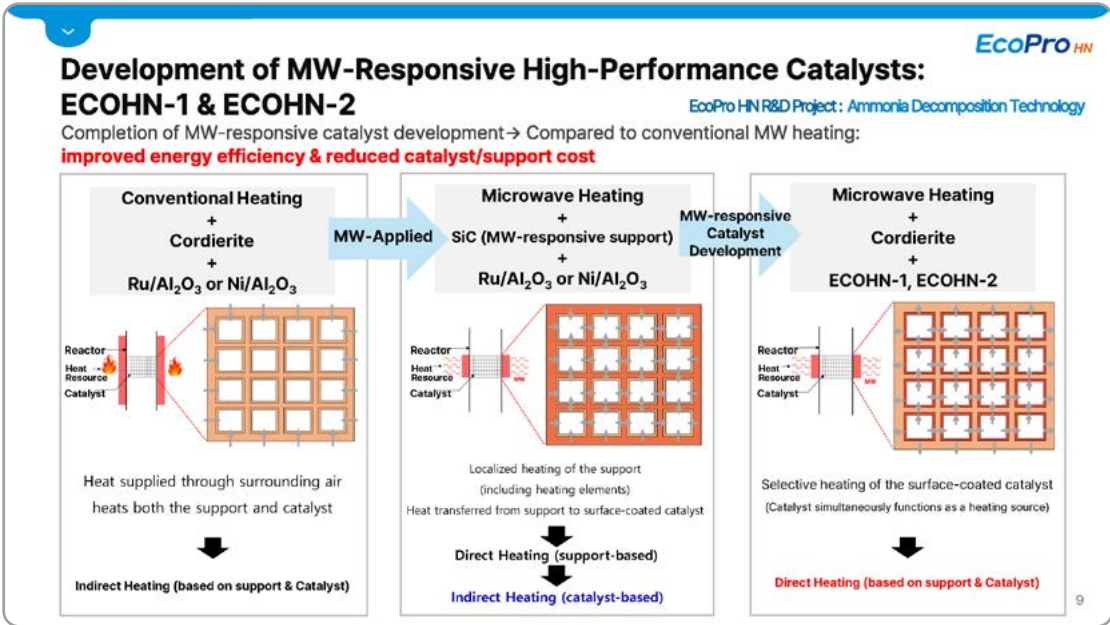
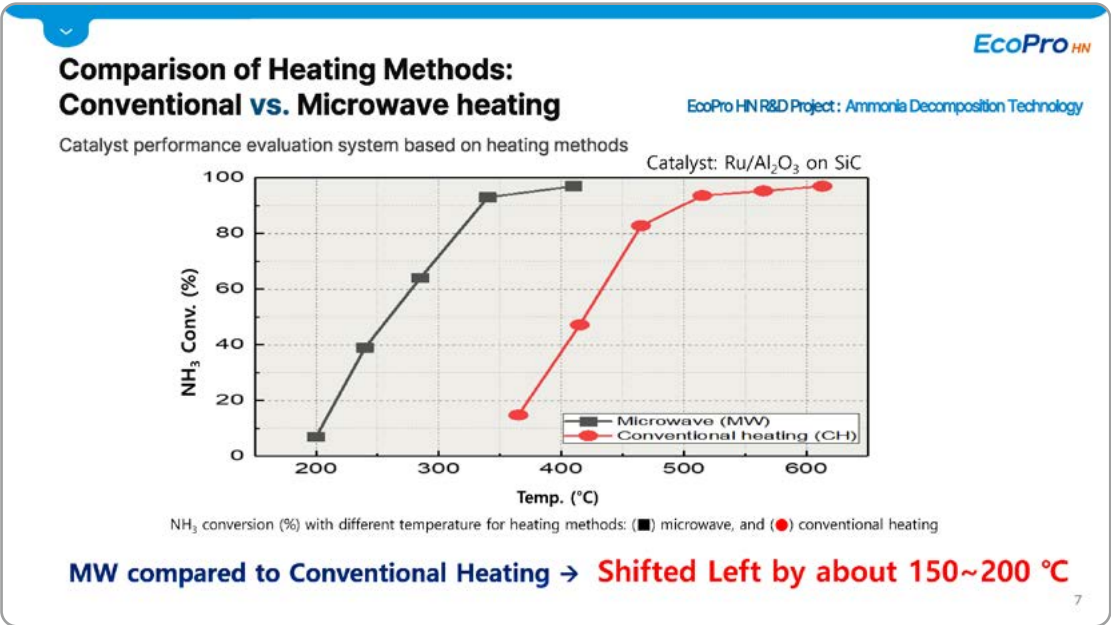
Comparison of Heating Methods: Conventional vs. Microwave heating

Catalyst performance evaluation system based on heating methods



- ① Reactor (Inner : Quartz tube)
- ② WR340 Waveguide
- ③ Magnetron

[Magnetron]



Demonstration & Evaluation of MW-Ammonia Decomposition System

EcoPro HN R&D Project : Ammonia Decomposition Technology

Preparing for the demonstration evaluation of MW-based ammonia decomposition unit linked with an NH₃-H₂ co-firing engine



KIMM (Korea Institute of Machinery & Materials)

- 156 Gajeongbuk-ro, Yuseong-gu, Daejeon
- Equipped with a liquefied ammonia storage tank
- Equipped with an NH₃-H₂ co-firing and combustion engine



MGO (바이오)
Pilot 연료
암모니아 / 개질 H₂ 혼소
NH₃
H₂
NH₃ → H₂
<개질 혼소 시스템 구성도>

- **Approved** for Regulatory Sandbox demonstration exemption
- Safety committee review **in progress**
- Installation and permitting expected by: **October 2025**

11

Scientific Challenges in the Battery Value Chain

EcoPro HN R&D Project : Wastewater Recovery Technology

Discharge of large amounts of Sodium Sulfate (Na₂SO₄) wastewater



Black Mass
STEP 01
방전 및 파/분쇄

Precipitation
STEP 02
침출

Extraction
STEP 03
추출

Precipitation & Drying
STEP 04
침전 및 건조

- High risk (thermal runaway)
- Low efficiency (long discharge time)
- High cost (large footprint required)
- High environmental impact (hazardous gas emissions)

- High complexity (NCM vs. LFP)
- Low efficiency (long processing time)
- High environmental burden (extensive use of alkali chemicals)

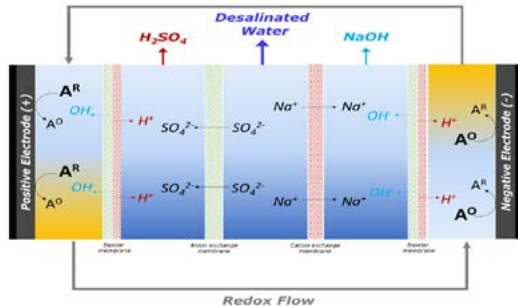
- High cost (expensive organic solvents)
- Low efficiency (low yield)
- Slow processing (long operation time)
- Safety risks (flammable organic solvents)
- High scalability limitations
- High environmental burden (extensive use of alkali chemicals)

- High environmental burden (large water consumption)
- Low efficiency (long processing time)
- Low energy efficiency (high energy consumption for post-treatment)

13

Wastewater Recovery Technology

Redox – BPED Wastewater Treatment



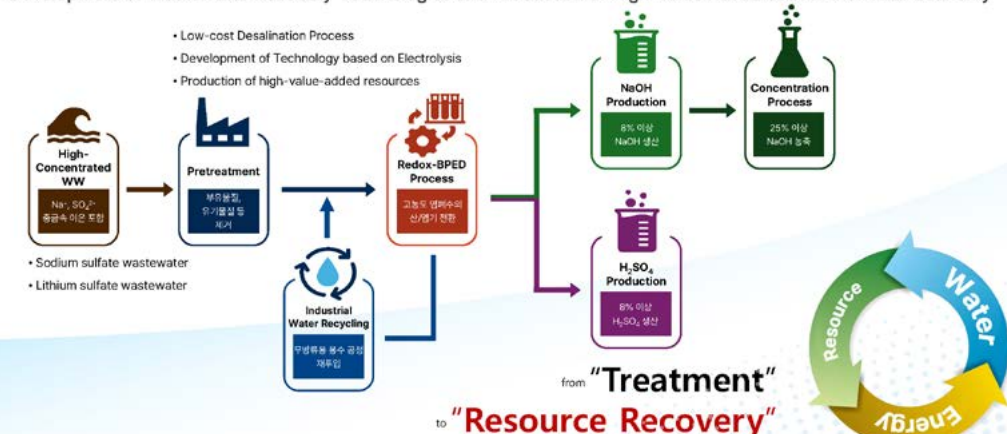
Positive Electrode (+)
Negative Electrode (-)
Desalinated Water
H₂SO₄
NaOH
Redox Flow

12

Battery Wastewater Recovery Technology

EcoPro HN R&D Project : Wastewater Recovery Technology

Development of Wastewater Recovery Technologies and Production of High-value Resources for a Circular Economy



High-Concentrated WW
Pretreatment
Redox-BPED Process
Industrial Water Recycling
NaOH Production
Concentration Process
H₂SO₄ Production

from "Treatment" to "Resource Recovery"

Resource
Water
Energy

14



그린 암모니아 기반 청정 발전 솔루션

Green Ammonia to power solution

연사 Speaker

김기태 Kitae Kim

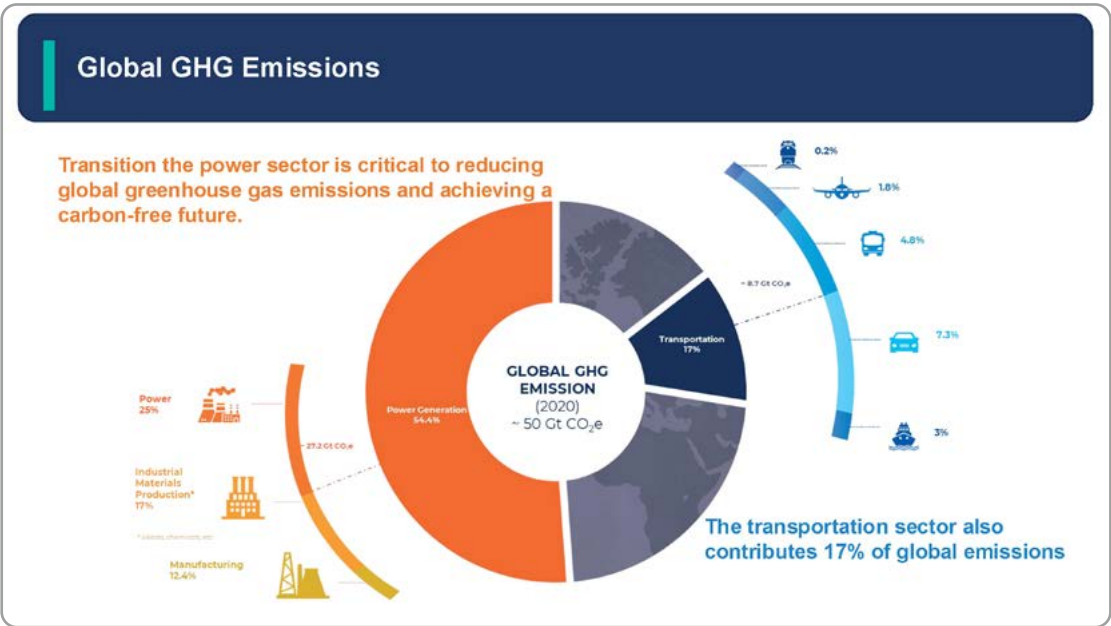
GS 건설 분산에너지 책임연구원
Leader, GS Engineering & Construction Corp.

주요경력

1989-1999	GS 건설 공정팀 Process Engineer
2000-2010	GS 건설 신사업 기획 & 리스크 관리 Manager
2011-2014	GS 건설 신사업팀 Team Leader
2015-2019	GS 건설 CFP Project 팀 Engineering & Planning Manager
2020-2022	GS 건설 기획팀 책임
2023-2025	GS 건설 연구소-H2 & CCUS 책임연구원
2025-현재	GS 건설 신사업추진팀

Biography

1989-1999	GS E&C Process Team Process Engineer
2000-2010	GS E&C New Business Planning & Risk Management Team Manager
2011-2014	GS E&C New Business Team Team Leader
2015-2019	GS E&C CFP Project Team Engineering & Planning Manager
2020-2022	GS E&C Planning Team Leader
2023-2025	GS E&C R&D Center-H2 & CCUS Leader
2025-Present	GS E&C New Business Development Team Leader

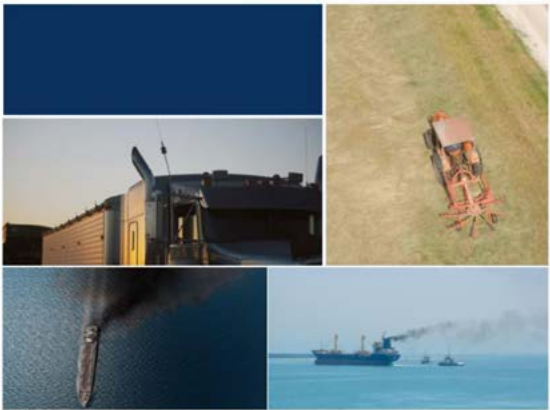


Hydrogen: the Missing Piece in Energy Transition

Will hydrogen be the best solution to decarbonize heavy industries?

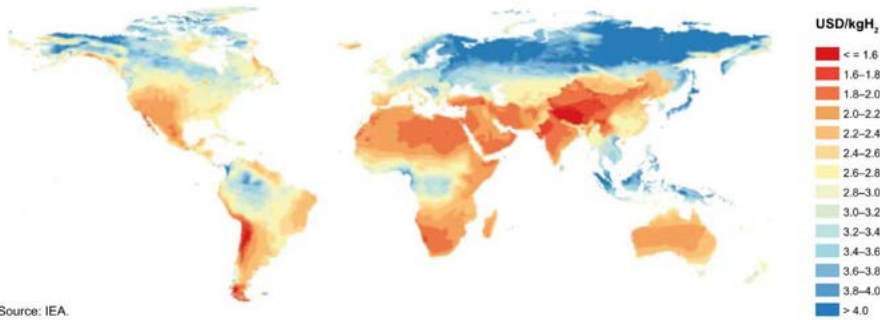
Hydrogen (H₂)
for hard-to-decarbonize industries

- Abundant material
- Technology ready
- Regulation & government support



Hydrogen Problem:

Renewable hydrogen source is far from where it's mostly needed!



Source: IEA.

Energy Transportation / Storage

Securing a Stable and Resilient Energy Supply through Renewable Energy



How to Transport ?

- Subsea Cable ?
- Battery ?
- Liquid H₂ ?
- Liquid NH₃ ?

Energy Carrier

CATEGORY	LIQUID NH ₃	LIQUID H ₂	BATTERY	SUBSEA CABLE
Storage density (LHV, J/L × 10 ⁹)	12.7	8.5	1.8	—
Transport efficiency	Optimized for long-distance bulk transport (−33 °C)	Requires cryogenic temperature (−253 °C)	Suitable for short distances	Distance constraints and losses
Infrastructure	Utilizes existing global chemical / fertilizer logistics	Requires brand-new dedicated infrastructure	Limited to local grid scaling	Immense initial capital required

Ammonia Infrastructure Today



190 MTA of production



200 ports store ammonia



4,000 km+ of pipelines in U.S.



20 MTA of waterborne trading



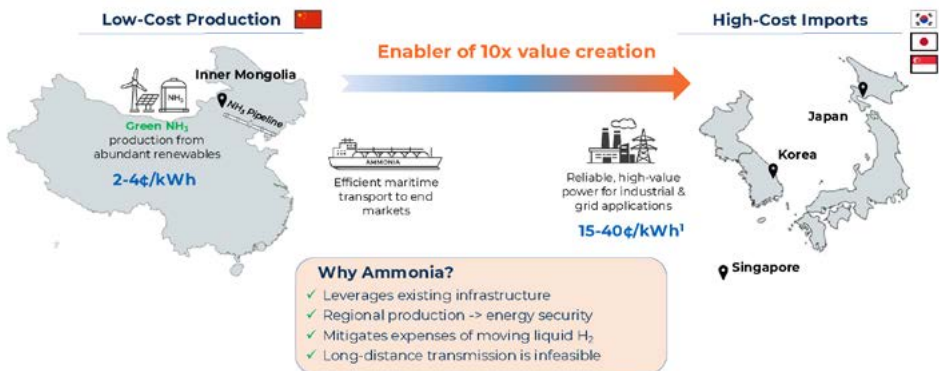
500 vessels capable of carrying ammonia

- 100+ years of scaled industrial use of ammonia
- No **ammonia-to-power** technology available to date

MTA: million metric tons per annum
Sources: DNV, IRENA

Ammonia Market Outlook

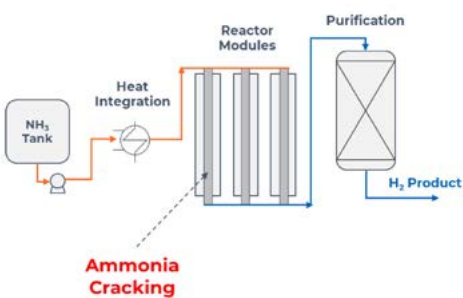
Ammonia is the lowest-cost vector for arbitraging clean power.



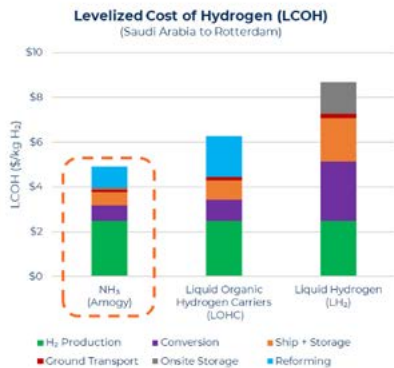
Note: price ranges in represented key markets are indicative of wholesale electricity prices. L: Price range low end is the industrial price in Singapore; high end is the price for ammonia-fired power generation under the Korean CHPS and the Japanese CH.

Ammonia as a Hydrogen Carrier

NH₃ Cracking Process Overview



NH₃ vs. Alternative Carriers



Ammonia Market Outlook

Growing Clean Ammonia Demand



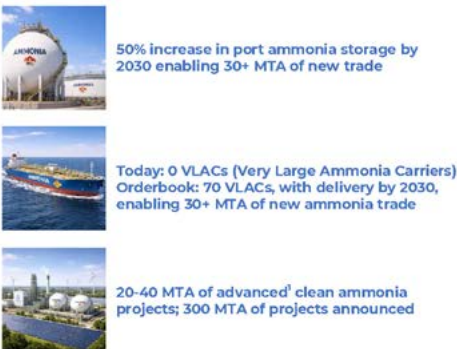
Ammonia Market Outlook

Rapidly evolving clean ammonia production and infrastructure driven by ammonia as a fuel

Clean Ammonia Market to Reach 100 MTA by 2040



Growing Ammonia Infrastructure



Ammonia Market Outlook

Sourcing Green Ammonia from China



Export Port	Tank Storage	Usage	Status
Dalian	Refr. tank for gray NH ₃	In-house	In operation
Dalian	Refr. tank for green NH ₃	In-house	2027
Panjin	Refr. tank for green NH ₃	In-house	2027
Jinzhou	Refr. tank for green NH ₃	In-house	2027
Lianyungang	Refr. tank (1) for gray NH ₃	Unknown	In operation
Dafeng	Pressurized tanks (6) for gray NH ₃	For lease (-33°C to customer)	In operation
Nanjing	Refr. tank for green NH ₃	In-house & lease	2026

Ammonia Market Outlook

Ammonia Production Costs Falling Rapidly



Drivers of low-cost Green Ammonia

Green ammonia production costs in China and India are **>\$150/ton lower vs 2024 expectations**

Clean ammonia dominated by exports; export market will be set by low-cost production:

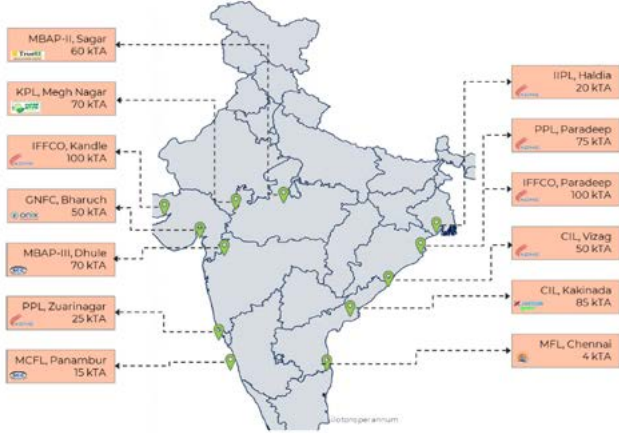
Shift in ammonia market dynamics:

- Conventional: short-term, low volume
- Clean fuel: long-term, high volume

New SPA pricing model → market prices converging towards production cost

Ammonia Market Outlook

Sourcing Green Ammonia from India



- Avg. price ~\$608/ton
- Avg. auction lot size ~56 kTA
- Fixed price of green NH₃ for 10 years
- Payment security guaranteed by Indian government with subsidy:
 - Year 1: \$104/ton
 - Year 2: \$83/ton
 - Year 3: \$62/ton
- Carbon intensity ≤ 2 kg CO₂e/kg H₂
 - Well-to-gate 12-month average

Introduction of AMUN Energy



GS E&C
Eco-friendly Energy Developer

Revenue KRW 12.45 trillion ('25)
Capability EPC Turn-Key / H₂, NH₃ Value Chain

Business Area

- Plant
- Green
- Arch. / Housing
- Infra
- New Business



JOINT VENTURE



AMUN ENERGY

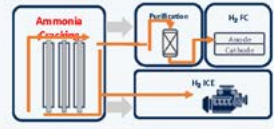
The world's first modularized Green ammonia-to-power solution pursuing Net Zero

Operation · Power Sales
Solution Provider
Project Developer



AMOGY
Global Core Technology Company

Founded Nov. 2020
Funding \$320M cumulative
Technology World-leading NH₃ cracking tech



2021 2022 2023 2024 2025



Products : Modular Power

1MW Solution



10MW ~40 MW Solution



Remote Area Solution 3~5MW



Carbon-Free Energy Solution

AMUN's Solution



Green Ammonia

- 40ft Container (1MW)
- Unlimited Expansion (Stacking)
- Space & Cost Competitive

Carbon-Free Electricity

Social Contribution



Carbon-Free Electricity

Global Net Zero

Carbon-Price Risk Mitigation

* Additional Costs or Prices incurred or to-be incurred by emission of carbon (ex. carbon tax, cross-border adjustment mechanism(CBAM))

Target Sectors



Data Center

Zero-energy Building

Industrial Area

Zero-energy Port

Products : Modular Power

 1MW Industrial · Buildings APPLICATIONS Battery plants Small-mid complexes DEPLOYMENT 2026~27 Pohang	 3~5MW Remote · Mining APPLICATIONS Aramco, etc. Remote mines, plants DEPLOYMENT Global Sales	 10MW Data Center class APPLICATIONS Data centers Mid-size complexes DEPLOYMENT 2028 Pohang Expansion	 40MW Large Industrial APPLICATIONS Yeongilman Complex Export manufacturers DEPLOYMENT 2030 Pohang Rollout	 50MW+ EPC Power Plant APPLICATIONS GS E&C EPC Reformer + CCGT DEPLOYMENT Global EPC
---	---	---	--	--

Modularized & Stackable Stack identical 1 MW modules for unlimited scale — winning on footprint, cost, and lead time

Pilot Project in Pohang, South Korea

❖ 1st large-scale deployment under Korea's Distributed Energy Act (DEA)

❖ Pilot Scope : 1MW FOAK Pilot in 2026-2027 supplying electricity to Secondary Battery Company

❖ Path to Scale : Scaling to 10MW (Commercial phase) and 40MW in 2030

1MW
FOAK
(2026-27)


AD200
(2026)

Multiplying 200 kW

10-40MW
(2030)


Multiplying 1 MW

GS E&C x AMOGY

AMUN ENERGY

Pohang Project



EPC

Gen-set

Off-taker

Fuel-supply

Licensing Government







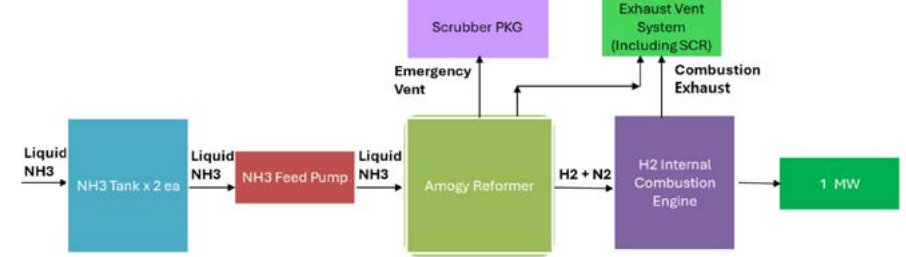






Pilot Project in Pohang, South Korea

Power Package – AMMDrive 1MW by AMOGY

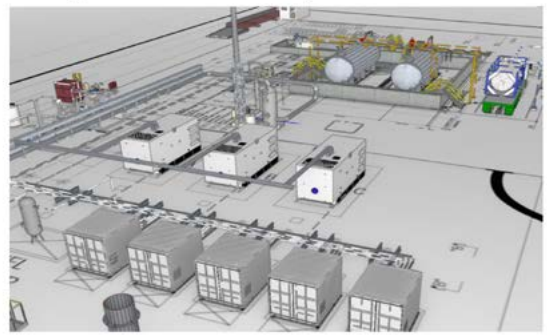
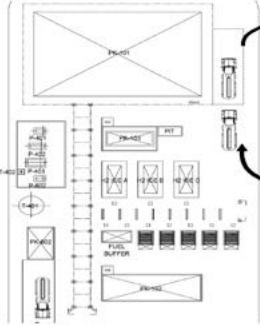


Auxiliaries

- Ammonia Feeding system : NH3 Tank x 2 ea, Pump
- Exhaust Gas Venting system with SCR
- Ammonia Release Mitigation System(ARMS) : Scrubber Package

Pilot Project in Pohang, South Korea

❖ Basic Design completion; Construction starting mid-2026 for 2Q 2027 operation.



Dec. 2025

Apr. 2026

July 2026

Aug 2026

Jun. 2027

2028 ~2030

Approved for DEA by Gov.

Basic Design

PO for LLI Pkg.

Groundbreaking

Start Operation of 1MW

Scaling to 10 MW ~40MW

CHPS vs. Green Ammonia Distributed Power Generation

	Clean Hydrogen Power	+ Distributed Power (Renewables / LNG)	= Clean Distributed Power (Green H2 / Ammonia)
Purpose & Contribution	Reduction of greenhouse gas emissions	Development of domestic distributed energy systems	GHG reduction + Distributed Power
Participants	Pure hydrogen and hydrogen co-firing power generation	Selected operators within distributed energy-specialized zones	Selected operators within distributed energy-specialized zones
Energy / Fuel Used	Clean hydrogen, Clean ammonia	Renewable energy, LNG	Green H2 / Green NH3
LCOE	KRW 400-700/kW * Exchange-rate risk compensation	KRW 150-250/kW	KRW 400-700/kW
Government Support	Competitive bidding-based operator selection with guaranteed power generation cost compensation (15-20 years)	No stable long-term support Only CAPEX support for selected operators	No stable long-term support Only CAPEX support for selected operators

Request to Government:

To accelerate the early adoption of clean distributed power generation, policy support similar to CHPS should also be extended to green H2/ammonia distributed power projects.



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2026 세계녹색성장포럼

세션 2. 저탄소 해양교통 (GGGI세션)

Session 2. Zero-Carbon Maritime Transport (GGGI Session)

저탄소 해양 교통의 미래:
확장 가능한 탄소 중립 달성 경로로서의 그린 암모니아
The Future of Zero-Carbon Maritime Transport:
Green Ammonia as a Scalable Pathway to Net Zero

환영사 Welcome Remarks

제라드 오도노휴 Gerard O'Donoghue
글로벌녹색성장기구 사무차장
Deputy Executive Director, Global Green Growth Institute

특별연설 Special Remarks

글로벌 트렌드: 저탄소 해운 전환
Global Trends: Low-Carbon Maritime Transition
장 르미르 Jean Lemire
캐나다 퀘벡주 국제관계부 기후변화 및 북극권 특사대사
Special Envoy for Climate Change, Quebec

좌장 Moderator

장창선 Chang Sun Jang
글로벌녹색성장기구 부국장
Deputy Director, Global Green Growth Institute

패널 Panel

지노 반 베긴 Gino Van Begin
ICLEI 사무총장
Secretary General, ICLEI

자크 플리스 Jacques Flies
주한 룩셈부르크 대사관 대사
Ambassador, Embassy of Luxembourg in Seoul

버나뎃 테레스 페르난데즈 Bernadette Therese C. Fernandez
주한 필리핀 대사관 대사
Ambassador, Embassy of the Republic of the Philippines in Seoul

로저 로요 Roger Royo
주한 스페인 상공회의소 회장
President, ESCCK(Spanish Chamber of Commerce in Korea)

다미앙 페레이라 Damien Pereira
주한 퀘벡 정부 대표
Chief Representative, The Quebec Government Office in Seoul



환영사 Welcome Remarks

제라드 오도노휴 Gerard O'Donoghue

글로벌녹색성장기구 사무차장
Deputy Executive Director, Global Green Growth Institute

주요경력

제라드 오도노휴 글로벌녹색성장기구(GGGI) 사무차장은 녹색기후기금(GCF)에서 최고재무책임자(CFO) 겸 지원서비스국장을 거쳐 2018년 10월 GGGI에 합류하였다. 2014년 4월 GCF에 합류하기 전까지 약 20년간 국제농업연구협의그룹(CGIAR)에서 재무 분야의 고위직을 역임하며, 미국 워싱턴 D.C.(세계은행), 이탈리아 로마, 케냐, 에티오피아, 스리랑카 등에서 근무하였다. 그는 아일랜드 국적으로 재무, 경영 및 전문 리더십 분야에서 풍부한 경험을 보유하고 있다. 또한 시티오브런던 소재 프라이스 워터하우스에서 선임 관리자로 재직하며 감사와 기업 재무를 비롯한 다양한 업무를 수행했으며, 폭넓은 주요 고객층을 대상으로 자문을 제공하였다. 오도노휴 사무차장은 아일랜드국립대학교에서 수학 및 수리물리학을 전공하였으며, 잉글랜드-웨일스 공인회계사협회(ICAEW) 펠로우이다. 또한 영국 요크대학교에서 전문경영을 수학하였다.

Biography

Gerard joined GGGI in October 2018 from the Green Climate Fund (GCF) where he had been the Chief Financial Officer (CFO) & Director Support Services. Prior to joining GCF in April 2014 he served in various senior finance capacities for a period of 20 years at the CGIAR living and working in Washinton DC (WB), Rome, Kenya, Ethiopia and Sri Lanka. An Irish national, Gerard has a wealth of finance, management and professional leadership experience. He was formerly a Senior Manager with Price Waterhouse, based in the City of London, where his work ranged from auditing to corporate finance, with a broad spectrum of high profile clients. Gerard's primary degree is in mathematics and mathematical physics from the National University of Ireland. He is a Fellow of the Institute of Chartered Accountants of England & Wales and also studied Professional Management at the University of York, England.



글로벌 트렌드: 저탄소 해운 전환 *영상

Global Trends: Low-Carbon Maritime Transition *Video

특별 연설 Special Remarks

장 르미르 Jean Lemire

캐나다 퀘벡주 국제관계부 기후변화 및 북극권 특사대사
Special Envoy for Climate Change, Quebec

주요경력

장 르미르는 생물학을 전공한 환경 전문가이자 저명한 과학 해설자이다. 르미르는 2017년 9월 퀘벡주 정부의 기후변화·북유럽 및 북극 담당 특사로 임명되어, 퀘벡 외교 역사상 최초의 특사가 되었다. 그는 국제 협력 파트너십을 구축하고 유엔기후변화협약, 생물다양성협약, 북극이사회, 석유·가스 탈피 연합, 유엔환경계획 산하 플라스틱 오염 정부간협상위원회 등 다양한 다자 협약 및 국제회의에서 퀘벡주 정부를 대표하고 있다.

르미르의 주요 역할은 다음과 같다.

- 생물다양성협약에서 지방정부를 대표하는 대표자 및 대변인
- 유엔식량농업기구(FAO)의 SAGA 식량안보 및 기후변화 프로젝트 홍보대사
- 유엔 글로벌 기후행동상을 수상한 국제기후협력프로그램(ICCP) 자문위원회 의장
- 퀘벡주 정부 국제환경팀 총괄 조정자

그는 기후변화와 생물다양성 분야에서의 활동을 통해 다수의 국제 과학탐사 임무를 수행했으며, 그가 제작한 영화와 저서, 웹 콘텐츠는 다양한 국제상을 수상하였다. 르미르는 캐나다 훈장 2등급을 수훈하였으며, 퀘벡 리무스키대학교에서 해양학 명예박사, 퀘벡 몬트리올대학교에서 지리학 명예박사 학위를 받았다. 또한 서브룩대학교 명예대사로 위촉되었다. 2010년에는 반기문 당시 유엔 사무총장이 그를 생물다양성 분야의 유엔 그린웨이브 홍보대사로 임명하였다. 또한 그는 국제적인 환경상인 미도리 생물다양성상의 첫 수상자이기도 하다.

Biography

A biologist by training, Jean Lemire is an environmental specialist and renowned science communicator. He was appointed Special Envoy for Climate Change, Nordic and Arctic Affairs by the Government of Québec in September 2017, thus becoming the first envoy in the history of Québec diplomacy. In this capacity, he develops international partnerships and represents the Government of Québec at various multilateral conventions and forums, including the United Nations Framework Convention on Climate Change, the Convention on Biological Diversity, the Arctic Council, the Beyond Oil and Gas Alliance and the United Nations Environment Programme’s Intergovernmental Negotiating Committee on Plastic Pollution. As part of his responsibilities, Jean Lemire acts as:

- Representative and spokesperson for subnational governments at the Convention on Biological Diversity;
- Ambassador for the SAGA project on food security and climate change of the United Nations Food and Agriculture Organization (FAO);
- President of the Advisory Board of the International Climate Cooperation Program (ICCP), winner of the United Nations Global Climate Action Award;
- Coordinator of the Government of Québec’s International Environmental Team.

His work on climate change and biodiversity has led to major international scientific missions. His films, books and web creations have garnered numerous awards. Among his distinctions, he was named an Officer of the Order of Canada, has received two honorary doctorates (oceanography-UQAR and geography-UQAM) and holds the title of Grand Ambassador of the Université de Sherbrooke. In 2010, UN Secretary-General Ban Ki Moon appointed him UN Green Wave Ambassador for biodiversity. He is also the first recipient of the prestigious Midori Prize for Biodiversity.



좌장 Moderator

장창선 Chang Sun Jang

글로벌녹색성장기구 부국장
Deputy Director, Global Green Growth Institute

주요경력

- | | |
|-----------|------------------------|
| 2014-2020 | 국가녹색기술연구소(NIGT), 선임연구원 |
| 2023-현재 | 국토교통 국제감축협의회 위원 |
| 2020-현재 | 글로벌녹색성장기구(GGGI), 부국장 |

Biography

- | | |
|--------------|---|
| 2014-2020 | National Institute of Green Technology(NIGT), Senior Researcher |
| 2023-Present | International Carbon Reduction Consultative Committee, Ministry of Land, Infrastructure and Transport(MOLIT), Republic of Korea, Committee Member |
| 2020-Present | Green Growth Institute(GGGI), Deputy Director |



패널 Panel

지노 반 베긴 Gino Van Begin

ICLEI 사무총장
Secretary General, ICLEI

- 주요경력**
- 2000-2002 이클레이 유럽본부 부소장
 - 2002-2012 이클레이 유럽본부 소장
 - 2007-2012 이클레이 세계 부사무총장
 - 2013-현재 이클레이 세계 사무총장

- Biography**
- 2000-2002 Deputy Regional Director, ICLEI Europe
 - 2002-2012 Regional Director, ICLEI Europe
 - 2007-2012 Deputy Secretary General, ICLEI - Local Governments for Sustainability
 - 2013-Present Secretary General, ICLEI - Local Governments for Sustainability



패널 Panel

자크 플리스 Jacques Flies

주한 룩셈부르크 대사관 대사
Ambassador, Embassy of Luxembourg in Seoul

- 주요경력**
- 2001-2008 룩셈부르크 외교부 개발협력총국 내 시민사회협력, 다자업무 및 운영총괄 등 담당
 - 2008-2012 주세네갈 룩셈부르크대사관 대리대사 및 세네갈·말리 개발협력사무소장
 - 2012-2017 주유엔 룩셈부르크 상주대표부 정치조정관
 - 2017-2018 룩셈부르크 외교유럽부 국방국 부국장
 - 2020-2023 룩셈부르크 국무부 산하 총리실 정부 사무총장
 - 2023-현재 주대한민국 룩셈부르크 대사

- Biography**
- 2001-2008 Ministry of Foreign Affairs, Development Cooperation Directorate, Luxembourg-different positions: civil society relations, multilateral affairs, head of operations;
 - 2008-2012 Embassy of Luxembourg in Dakar, Senegal: Chargé d'affaires a.i. and Head of the Development Cooperation Office, Senegal and Mali;
 - 2012-2017 Permanent Mission of Luxembourg to the United Nations, New York: Political coordinator;
 - 2017-2018 Ministry of Foreign and European Affairs, Defence Directorate, Luxembourg: Deputy Director;
 - 2020-2023 Prime Minister's Office-Ministry of State, Luxembourg: Secretary General of the Government.
 - 2023-Present Ambassador of Luxembourg to the Republic of Korea



패널 Panel

버나뎃 테레스 페르난데즈 Bernadette Therese C. Fernandez

주한 필리핀 대사관 대사
Ambassador, Embassy of the Republic of the Philippines in Seoul

주요경력

외교부

- 1995. 11.-1996. 12. APEC 국가조직위원회 국장 지원 협력관, 이후 특별 보좌관
- 1997. 1.-1997. 10. 아시아태평양국 제 1 과(북아시아) 사무관 이후 과장대행
- 2003. 10.-2006. 10. 인사행정서비스국 인사관리과 과장 대행 이후 과장
- 2013. 2.-2014. 5. 유럽국 제2과(남유럽) 과장
- 2014. 5.-2016. 7. UN 및 국제기구국 부국장(Executive Director), 이후 차관보 대행
- 2022. 10.-2025. 6. 외교부 장관실 수석조정관

재외 공관

- 1997. 10.-2003. 10. 주중 베이징 필리핀대사관 3등서기관 겸 부영사, 이후 2등서기관 겸 영사
- 2006. 12.-2012. 12. 주영 런던 필리핀대사관 1등서기관 겸 영사 파견후, 공사겸 영사로, 다시 공사겸 총영사로 승진
- 2016. 10.-2020. 1. 주캐나다 토론토 필리핀 총영사관 부총영사
- 2020. 1.-2022. 10. 주이탈리아 밀라노 필리핀총영사관 총영사
- 2025. 9.-현재 주한필리핀 특명전권대사

Biography

In the Department of Foreign Affairs

- 1995. 11.-1996. 12. Coordinating Officer, then Special Assistant to the Director General, APEC National Organizing Commission
- 1997. 1.-1997. 10. Assistant Director, then Acting Director, Division I(North Asia), Office of Asian and Pacific Affairs
- 2003. 10.-2006. 10. Acting Director, then Director, Personnel Management Division, Office of Personnel and Administrative Services
- 2013. 2.-2014. 5. Director, Division II(Southern Europe), Office of European Affairs
- 2014. 5.-2016. 7. Executive Director, then Acting Assistant Secretary, Office of United Nations and International Organizations
- 2022. 10.-2025. 6. Chief Coordinator, Office of the Secretary of Foreign Affairs

At Foreign Service Posts

- 1997. 10.-2003. 10. Third Secretary and Vice Consul then Second Secretary and Consul, Embassy of the Philippines, Beijing, People's Republic of China
- 2006. 12.-2012. 12. First Secretary and Consul, then Minister and Consul, then Minister and Consul General, Embassy of the Philippines, London, United Kingdom
- 2016. 10.-2020. 1. Deputy Consul General, Philippine Consulate General, Toronto, Canada
- 2020. 1.-2022. 10. Consul General, Philippine Consulate General, Milan, Italy
- 2025. 9.-Present Ambassador Extraordinary and Plenipotentiary, Seoul, Republic of Korea



패널 Panel

로저 로요 Roger Royo

주한 스페인 상공회의소 회장
President, ESCCK(Spanish Chamber of Commerce in Korea)

주요경력

2008-2015	악티바 감사법인(Activa, Sociedad de Auditoria), 셀리아 이 셀리아크스(Celia & Celiacs) 외부감사인
2016-2020	주한스페인상공회의소(ESCCK) 사무총장
2019-2025	솔브릿지 국제경영대학(SolBridge International School of Business) 조교수 및 글로벌 스타트업 센터장
2020-2023	한국과학기술원(KAIST) IT경영학 박사(ESG 및 벤처캐피탈)
2020-2024	KAIST 연구원
2022	글로벌디지털혁신네트워크(Global Digital Innovation Network) 연구원
2022-2025	사우스 서밋 아시아(South Summit Asia) 지역총괄책임자
2023-현재	아시아 혁신정책학회(ASIP) 기후위원회 위원
2024-현재	ESCCK 회장
2026.6.-12. 2025	아시아개발은행 한국허브(ADB K-Hub) 정책 전문컨설턴트
2025	DPA (EU Digital Partnerships) 파트너십 전문위원 및 조정관
2025-현재	알타바 그룹(ALTAVA Group) CBO

Biography

2008-2015	Activa, Sociedad de Auditoria, Celia & Celiacs, External Auditor
2016-2020	Spanish Chamber of Commerce Korea(ESCCK), Secretary General
2019-2025	SolBridge International School of Business, Assistant Professor & Head, Global Startup Center
2020-2023	KAIST(Korea Advanced Institute of Science and Technology), Ph.D. in IT Management (ESG & Venture Capital)
2020-2024	KAIST(Korea Advanced Institute of Science and Technology), Researcher
2022	Global Digital Innovation Network, Researcher
2022-2025	South Summit Asia, Regional Director
2023-Present	ASIP(Asian Society for Innovation & Policy), Climate Committee Member
2024-Present	Spanish Chamber of Commerce Korea(ESCCK), President
2026.6.-12. 2025	ADB K-Hub(Asian Development Bank), Policy Specialist Consultant
2025	DPA(EU Digital Partnerships), Partnerships Specialist & Coordinator
2025-Present	ALTAVA Group, Chief Business Officer(CBO)



패널 Panel

다미앙 페레이라 Damien Pereira

주한 퀘벡 정부 대표
Chief Representative, The Quebec Government Office in Seoul

주요경력

	프랑스, 호주, 밴쿠버 소재 민간 기업, 플라스틱·컴퓨터 공학·운송 분야 실무자
	인도 총영사관(밴쿠버) 및 인도 고등판무관 사무소(오타와), 캐나다 서부 영사 센터 설립 컨설턴트
2011-2021	주프랑스 퀘벡정부 대표부(파리) & 캐나다 서부 퀘벡정부 사무소(밴쿠버), 경제담당 상무관 / 혁신담당 상무관 / 상무부 대표 직무대행 / 퀘벡 경제·혁신·에너지부 (국내외 파트너십 부서), 국제 분야담당 자문관
2024	퀘벡-한국 비즈니스 협회, 창립 멤버 및 혁신 부회장
2024	글로벌 항공우주 클러스터 파트너십 (GACP), 이사회 멤버
2024	에어로 몬트리올 (퀘벡 항공우주 클러스터), 성장 및 국제 업무 이사
Present	주한 퀘벡정부 대표부, 대표

Biography

	Private Sector (France, Australia, Vancouver), Various Positions in Plastics, IT Engineering, and Transportation
	Consulate General of India (Vancouver) & High Commission of India (Ottawa), Operational Consultant for Consular Centers in Western Canada
2011-2021	Québec Government Office in Paris & Québec Office in Vancouver, Economic Affairs Attaché / Innovation Attaché / Interim Director of Economic Affairs / Québec's Ministry of Economy, Innovation, and Energy, International Affairs Advisor (Division of Canadian and International Innovation Partnerships)
2024	Québec-Korea Business Association, Founding Member & Vice President of Innovation
2024	Global Aerospace Cluster Partnership (GACP), Member of the Board of Directors
2024	Aéro Montréal (Québec's aerospace cluster), Director Growth and International Affairs
Present	Québec Government Office in Seoul, Chief Representative

세션 3. 녹색금융

Session 3. Green Finance

전환의 동력: 난감축 산업 전환을 위한 녹색 자본
Driving the Transition: Green Capital for Hard-to-Abate Industries

좌장 Moderator

김종대 Jong Dae Kim
인하대학교 녹색금융대학원 명예교수
Emeritus Professor, College of Business Administration, Inha University

패널 Panel

애런 드레이어 Aaron Drayer
글로벌녹색성장기구 탄소금융부 부국장
Deputy Head, Carbon finance department, Global Green Growth Institute

정영두 Jung, Young Doo
한국해양진흥공사 북극항로지원센터장
General Manager of K-Arctic Route Development & Support Center,
Korea Ocean Business Corporation

정우송 JUNG, WOO-SONG
워터라인 파트너스 대표
CEO, Waterline Partners

김형주 Hyung Ju KIM
국가녹색기술연구소 책임연구원
Principal Researcher, National Institute of Green Technology(NIGT)

최영주 CHOI, Youngjoo
한국은행 지속가능성장실 실장
Director General, Office of Sustainable Growth, Bank of Korea



좌장 Moderator

김종대 Jong Dae Kim

인하대학교 녹색금융대학원 명예교수
Emeritus Professor, College of Business Administration, Inha University

주요경력

- 인하대학교 경영대학장
- 지속가능경영연구소 소장
- 인하대학교 녹색금융대학원 원장
- 인천시 녹색성장위원회 위원장
- 한국환경경영학회 회장
- 금융위원회 ESG 금융 태스크포스 위원
- 금융위원회 녹색금융위원회 위원
- 국민연금기금 책임투자자문위원회 위원
- 한국회계기준원 자문위원
- 아모레퍼시픽 사외이사
- 포스코 기업시민자문위원회 위원
- 인하대학교 경영대학 명예교수
- 인하대학교 ESG 센터장
- SDG연구소장
- AJSSR, 편집위원장

학력

- 서울대학교 경제학학사
- 서울대학교 경영학석사
- 조지워싱턴대학교 회계학박사

Biography

Dean of College of Business Administration, Inha University
Executive Director, Sustainability Management Research Institute
Program Director of Green Finance Graduate Program at Inha University
Chair of Green Growth Committee, The City of Incheon, Korea
President of Korea Environmental Management Association
Member of ESG Finance Taskforce, Financial Services Commission, Korea
Member of Green Finance Committee, Financial Services Commission, Korea
Member of Responsible Investment Advisory Board, National Pension Services
Advisory Member of Korea Accounting Standards Boards
Independent Director and Chair of ESG Committee of AmorePacific Corp.
Member of Strategy Advisory Board, POSCO
Emeritus Professor, College of Business Administration, Inha University,
Director of ESG Center, Inha University
Executive Director of SDG Institute
Editor-in-Chief, Asian Journal of Sustainability and Social Responsibility (Springer)

EDUCATION

BA in Economics, Seoul National University
MBA, Business School, Seoul National University
Ph. D. in Accounting at George Washington University



패널 Panel

애런 드레이어 Aaron Drayer

글로벌녹색성장기구 탄소금융부 부국장
Deputy Head, Carbon finance department, Global Green Growth Institute

주요경력

- 2003-2011 케모닉스 인터내셔널(Chemonics International), 페루 대안개발사업
- 2003. 1.-2004. 12. 인프라 프로그램 총괄 및 운영 관리자
- 2005. 1.-2005. 12. 토지 소유권 등록 프로그램 총괄
- 2006. 1.-2009. 12. 기술지원팀 총괄
- 2011-2013 경제개발 총괄
- 케모닉스 인터내셔널 / 미국국제개발처(USAID), 페루 리마 페루 보스케스 프로젝트(Perú Bosques Project)(환경관리 및 산림 거버넌스 지원 사업) 경제개발 활동 관리자
- 2013. 4.-2016. 6. 글로벌녹색성장기구(GGGI) 대한민국 서울, 페루 리마 페루 프로그램 관리자
- 2016. 6.-2021. 4. 페루 대표
- 2021. 4.-2024. 4. 파트너십 부장
- 2024. 4.-현재 탄소가격책정유닛 부국장

Biography

- 2003-2011 CHEMONICS INTERNATIONAL, Peru, Alternative Development Project
- 2003. 1.-2004. 12. Director of Infrastructure Program and Operations Manager
- 2005. 1.-2005. 12. Director of Land Titling Program
- 2006. 1.-2009. 12. Technical Support Team Director
- 2010. 1.-2011. 7. Director of Economic Development
- 2011-2013 Lima, Peru Perú Bosques Project(Environmental Management and Forest Governance Support Activity) Manager of Economic Development Activities
- 2013. 4.-2016. 6. GLOBAL GREEN GROWTH INSTITUTE(GGGI) Seoul, Republic of Korea and Lima, Peru Peru Program Manager
- 2016. 6.-2021. 4. Peru Country Representative
- 2021. 4.-2024. 4. Head of Partnerships
- 2024. 4.-Present Deputy Head of Carbon Pricing Unit



패널 Panel

정영두 Jung, Young Doo

한국해양진흥공사 북극항로지원센터장
General Manager of K-Arctic Route Development & Support Center, Korea Ocean Business Corporation

주요경력

- 1996-2009 팬오션 등 국적선사 용대선 및 해운시황 리서치
- 2009-2018 한국자산관리공사·캠코선박운용 해운시황 리서치 및 선박펀드관리
- 2018-2022 한국해양진흥공사 스마트해운정보센터장
- 2022-2025 한국해양진흥공사 ESG경영실장
- 2025-2026 한국해양진흥공사 해상공급망기획단장
- 2026-현재 한국해양진흥공사 북극항로종합지원센터장

Biography

- 1996-2009 Chartering & Shipping Market Research at Pan Ocean and Other Korean Shipping Companies
- 2009-2018 Shipping Market Research & Ship Fund Management at KAMCO & KAMCOSIMC
- 2018-2022 General Manager of Smart Shipping Information Center, KOBC
- 2022-2025 General Manager of ESG Management Dept, KOBC
- 2025-2026 General Manager of Maritime Supply Chain Planning Dept, KOBC
- 2026-Present General Manager of K-Arctic Route Development & Support Center, KOBC



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정우송 JUNG, WOO-SONG

워터라인 파트너스 대표
CEO, Waterline Partners

주요경력

- 2004-2008 흥아해운 기획팀
- 2009-2016 SMBC(Sumitomo Mitsui Banking Corp.) Seoul 구조화금융그룹
- 2016-2025 다올자산운용 투자금융본부 본부장
- 2025-현재 워터라인 파트너스 대표이사

Biography

- 2004-2008 Heung-A Shipping Co., Ltd. Planning Team
- 2009-2016 Sumitomo Mitsui Banking Corporation(SMBC) Seoul Structured Finance Group
- 2016-2025 DAOL Asset Management, Managing Director & Head of Global IB Division
- 2025-Present Waterline Partners, Chief Executive Officer



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김형주 Hyung Ju KIM

국가녹색기술연구소 책임연구원
Principal Researcher, National Institute of Green Technology(NIGT)

주요경력

- 1997-1998 한국과학기술연구원(KIST) 휴먼로봇센터, 위촉연구원
- 1999-2004 독일 베를린공과대학교(TU Berlin) 기계 및 생산공학부, 박사과정(독일DAAD장학생)
- 2004-2006 한국과학기술연구원(KIST) 유럽연구소 환경연구부, 선임연구원
- 2006-2008 독일 베를린공과대학교(TU Berlin) 생산공학 및 공작기계연구소(IWF), 박사후연구원
- 2008-2014 미국 미시간대학교(University of Michigan) 지속가능시스템센터(CSS), 연구위원
- 2014-현재 국가녹색기술연구소(NIGT), 책임연구원
- 2015-2016 국가녹색기술연구소, 국제전략부장 및 기후기술협력센터장
- 2017-2018 국가녹색기술연구소, 정책연구부장
- 2020-2023 국가녹색기술연구소, 선임부장(부기관장)
- 2023-2024 대통령직속 탄소중립녹색성장위원회, 해외감축전문위원회 위원
- 2025-현재 세종대학교 기후변화특성화대학원, 겸임교수

Biography

- 1997-1998 Visiting Researcher, Center for Human-compatible Robotics, KIST
- 1999-2004 Ph.D. Candidate, Faculty of Mechanical and Process Engineering, TU Berlin, Germany (DAAD Scholar)
- 2004-2006 Senior Researcher, Environmental Research Dept., KIST Europe, Germany
- 2006-2008 Postdoctoral Researcher, Institute for Machine Tools and Factory Management(IWF), Technical University Berlin, Germany
- 2008-2014 Research Fellow, Center for Sustainable Systems(CSS), University of Michigan, USA
- 2014-Present Principal Researcher, National Institute of Green Technology(NIGT)
- 2015-2016 Director, International Strategy Dept. & Climate Technology Cooperation Center, NIGT
- 2017-2018 Director, Policy Research Dept., NIGT
- 2020-2023 Executive Director(Acting Vice President), NIGT
- 2023-2024 Member, International Mitigation Committee, Presidential Commission on 2050 Carbon Neutrality and Green Growth
- 2025-Present Adjunct Professor, Graduate School of Climate Change, Sejong University



패널 Panel

최영주 CHOI, Youngjoo

한국은행 지속가능성장실 실장
Director General, Office of Sustainable Growth, Bank of Korea

주요경력	
1997-현재	한국은행
2019-2020	금융시장국 금융시장연구팀장
2021	시장운영팀장
2022	대전시청 경제정책협력관(파견)
2023	금융시장국 시장총괄팀장
2023-2025	통화금융부장
2026-현재	지속가능성장실 실장

Biography	
1997-Present	Bank of Korea
2019-2020	Head, Financial Markets Research Team
2021	Head, Market Operations Team
2022	Economic Policy Advisor, Daejeon City
2023	Head, Financial Markets Affairs Team
2023-2025	Director, Money and Financial Markets Division
2026-Present	Director General, Office of Sustainable Growth

WORLD
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FORUM 2026
2026 세계녹색성장포럼

세션 4. 해양생태

Session 4. Blue Carbon

블루카본: 해양 생태계 중심의 탄소 네거티브 전략

Blue Carbon: Marine Ecosystem-Based Carbon-Negative Strategies

좌장 Moderator

김승도 KIM, Seungdo

한림대학교 환경생명공학과 명예교수

Emeritus Professor, Department of Environmental Science & Biotechnology, Hallym University

바다와 육지가 만나는 해안 지역을 돌보다

Caring for Coastal Zones, Where Oceans and Lands Meet

다니엘 머디아소 Daniel Murdiyarso

국제임업연구센터-세계농림어업센터 선임연구원

Senior Associate,

Center for International Forestry Research-World Agroforestry (CIFOR-ICRAF)

탄소중립을 위한 수산자원 기반의 블루카본 활용

Fisheries Resources-Based Blue Carbon Utilization Policy for Carbon Neutrality

최임호 IM HO, CHOI

한국수산자원공단 전략사업본부 본부장

Senior Director, Strategic Business Department, Korea Fisheries Resources Agency

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정성우 Sungwoo Jeong

(재)포항산업과학연구원 수석 연구원

Senior Researcher, Research Institute of Industrial and Science

김주형 JuHyoung Kim

군산대학교 해양생명과학과 교수

Professor, Department of Aquaculture and Aquatic Science,
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좌장 Moderator

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한림대학교 환경생명공학과 명예교수
Emeritus Professor, Department of Environmental Sciences & Biotechnology,
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주요경력

1988-1990	Oak Ridge National Laboratory, USA, 연구원
1995-1997	한국환경연구원(KEI) 책임연구원
1997-2022	한림대학교 환경생명공학과 교수
2022-현재	한림대학교 환경생명공학과 명예교수
2024-현재	UNFCCC, 선진국 국가 온실가스 인벤토리 보고서 전문가 검토팀, 검토팀장 2009~2011 청와대 사회정책수석실 환경부문 자문위원
2009-2013	IPCC, 2019 IPCC 온실가스 배출계수 데이터베이스 편집위원회, 편집위원
2010-2019	현대제철 사외이사
2015-2018	유엔기후변화협약(UNFCCC) 정부협상 대표단 투명성 의제 담당 협상대표
2016-현재	한국환경한림원 정회원
2017-2019	IPCC, 2019 IPCC 국가 온실가스 인벤토리 작성 지침서, 소각 분야 주저자
2018-2021	국가기후환경회의 국가협력분과 위원
2020-2021	녹색성장위원회 총괄기획분과 민간위원
2021-현재	온실가스 배출량 인증위원회 민간위원
2026-2027	IPCC, 2027 IPCC CDR/CCUS 방법론 지침서, CDR 분야 주저자

Biography

1988-1990	Oak Ridge National Laboratory, USA, Researcher
1995-1997	Korea Environmental Institute, Research Associate
1997-2022	Hallym University, Dept. of Environ. Sciences & Biotechnology, Professor
2022-Present	Hallym University, Dept. of Environ. Sciences & Biotechnology, Emeritus Professor UNFCCC, Expert Review Team for National Inventory Report, Lead Reviewer
2024-Present	Chief Secretary Office to the President for Social Policy, Consulting Committee Member for Environment Field
2009-2013	IPCC Emission Factor Database(EFDB) Board, Board Member
2010-2019	Hyundai Steel, Co., Independent Director
2015-2018	Delegate of Korean Government to UNFCCC, Negotiator on Transparency Agenda
2016-Present	Korea Academy of Environmental Science, Registered Member
2017-2019	IPCC, 2019 Refinement to the 2006 IPCC Guidelines for National GHG Inventories, Lead Author of Incineration & Open Burning in the Waste Sector
2018-2021	National Council on Climate and Air Quality, Civilian Committee Member
2020-2021	Korea Prime Minister's Committee for Green Growth, Civilian Committee Member
2021-Present	Certification Committee for GHG Emission, Civilian Committee Member
2026-2027	IPCC, 2027 Methodology Report on CDR/CCUS for National GHG Inventories, Lead Author of Tidal Flat



바다와 육지가 만나는 해안 지역을 돌보다
Caring for Coastal Zones, Where Oceans and Lands Meet

연사 Speaker

다니엘 머디아소 Daniel Murdiyarso

국제임업연구센터-세계농림어업센터 선임연구원
Senior Associate, Center for International Forestry Research-World Agroforestry(CIFOR-ICRAF)

주요경력

- 1988-2000 기후변화에 관한 정부간 협의체(IPCC) 제3차 평가보고서 총괄주저자
- 1999-2025 인도네시아 IPB대학교(IPB University) 대기과학 교수
- 1999-2001 IPCC 「토지이용·토지이용변화 및 산림 특별보고서」 총괄주저자
- 2000-2002 인도네시아 환경부 차관
- 2000-2002 유엔기후변화협약(UNFCCC) 및 생물다양성협약(CBD) 인도네시아 국가대표 연락관
- 2003-2006 국제산림연구센터(CIFOR) 연구원
- 2005-2007 IPCC 제4차 평가보고서 검토편집자
- 2006-2016 CIFOR 선임연구원
- 2011-2013 「국가 온실가스 인벤토리 작성을 위한 2006 IPCC 가이드라인 2013년 보완판」 주저자
- 2016-2025 CIFOR 수석연구원
- 2023-2028 인도네시아 과학원 원장
- 2026-2028 국제산림연구센터-세계농림어업센터(CIFOR-ICRAF) 선임연구위원

Biography

- 1988-2000 Coordinating Lead Author, Climate Change - Third Assessment Report, IPCC
- 1999-2025 Professor, Atmospheric Sciences IPB University, Indonesia
- 1999-2001 Coordinating Lead Author, Special Report on Land-use, Land-use Change and Forestry, IPCC
- 2000-2002 Deputy Minister of Environment Republic of Indones
- 2000-2002 National Focal Point, UNFCCC and UN CBD for the Republic of Indonesia
- 2003-2006 Scientist, Center for International Forestry Research(CIFOR)
- 2005-2007 Review Editor, Climate Change - Fourth Assessment Report, Intergovernmental Panel on Climate Change(IPCC)
- 2006-2016 Senior Scientist, Center for International Forestry Research(CIFOR)
- 2011-2013 Lead Author, 2013 Supplement to the 2006 IPCC Guidelines for National GHG Inventory
- 2016-2025 Principal Scientist, Center for International Forestry Research(CIFOR)
- 2023-2028 President, Indonesian Academy of Sciences
- 2026-2028 Senior Associate Center for International Forestry Research - World Agroforestry (CIFOR-ICRAF)

Caring for Coastal Zones, Where Oceans and Lands Meet

Daniel Murdiyarso, Milkah Royna, Sigit D. Sasmito, Triaklaksita SP. Ardhanj,
Phidju Marin Sagala, Nining Liswanti, and Kania Dewi Rahayu



Mangrove capacity in trapping sediment



Photo by: Aulia Erlangga/CIFOR-ICRAF



Research questions

To what extent mangrove presence promote mudflat development?

- Mudflat and land building
- Mudflat and carbon
- Mudflat and migratory birds

Why mangrove is needed in aquaculture?

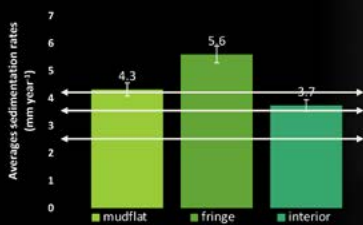
- Mangrove and fish production
- Mangrove and shellfish production
- Mangrove and offshore fishery



Photo by: Aulia Erlangga/CIFOR-ICRAF

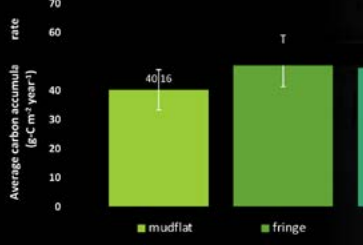


Adaptation benefits



Zone	Average sedimentation rates (mm year ⁻¹)
mudflat	4.3
fringe	5.6
interior	3.7

Local accretion average
Regional average sea level rise
Global average sea level rise

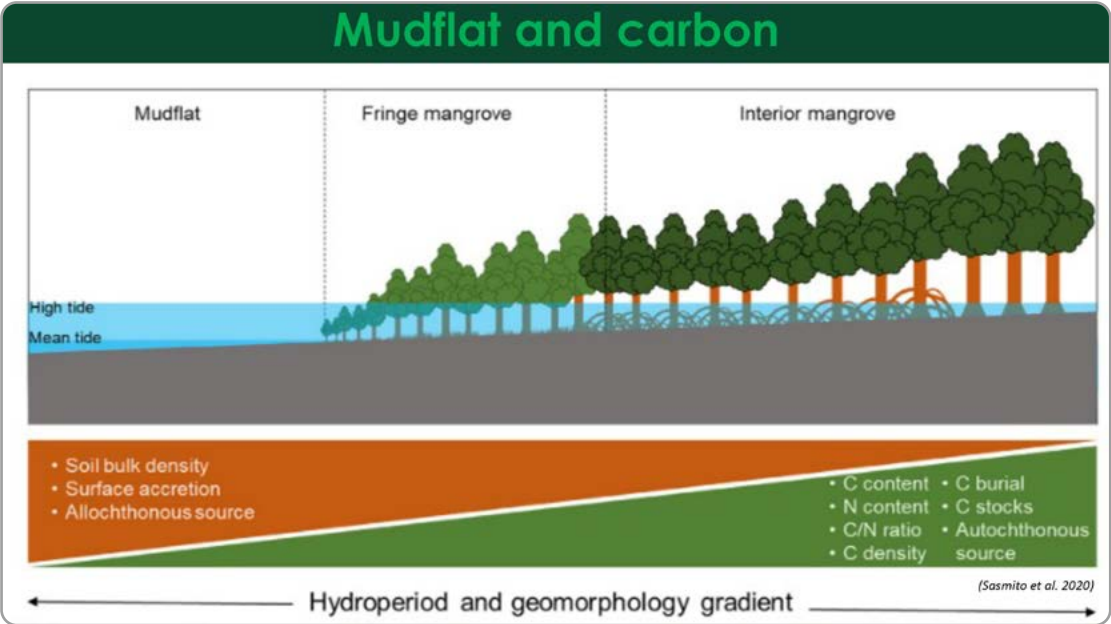
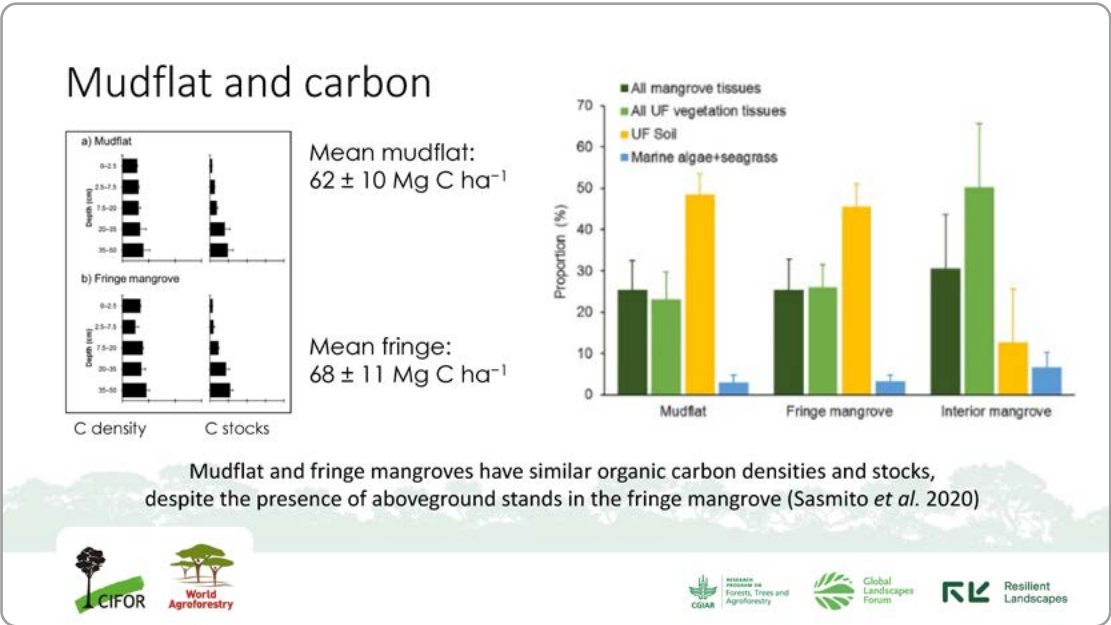


Zone	Average carbon accumulation rate (g C m ⁻² year ⁻¹)
mudflat	40.16
fringe	47.72
interior	47.72



Hanggara et al. 2021. Est Coast Shelf Sci





Biodiversity benefits

Asian Migratory Bird Flyways

Central Asian-Indian Flyway
East Asian-Australian Flyway
West Pacific Flyway

Yong et al. 2015

Aquaculture: fish production and mangrove

Dense silvofishery: 113 kg ha⁻¹

Sparse silvofishery: 85 kg ha⁻¹

Non-silvofishery: 75 kg ha⁻¹

Carbon stocks (Mg C ha⁻¹)

Legend: AGC (green), BGC (yellow), Necromass C (orange), Soil C (brown)

FM, IM, DSP, SSP, NSP

Rayna et al. (2024)

Mangrove > silvofishery pond > non silvofishery pond

Total ecosystem carbon stock (Mg C ha⁻¹)

500, 250, 0, -250, -500, -750, -1000, -1250, -1500

Mangrove forests, Working ponds, Abandoned ponds (Wedung)

Mangrove forests, Working ponds, Abandoned ponds (Sayung)

(Ardhani et al. (2025))

Aquaculture and C stocks

Mangrove
↓
Working pond
↓
Abandoned pond

Near-shore fishery

- Shell clams: 3-5 kg/harvest (IDR 10,000/kg)
- Oyster: 12 kg/harvest (IDR 5,000/kg)

Photo by Rijky/CIFOR-ICRAF

Offshore fishery

- Cutlassfish: 600 kg/harvest (IDR 45,000/kg)
- Seasonally harvested (December to March)



Photo by: Danar Mulyadisa/CIFOR-ICRAF

Photo by R/fky/CIFOR-ICRAF



Thank you

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The Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF) harnesses the power of trees, forests and agroforestry landscapes to address the most pressing global challenges of our time – biodiversity loss, climate change, food security, livelihoods and inequity. CIFOR and ICRAF are CGIAR Research Centers.



Conclusions

Mudflat and Mangroves

- Mudflat indicates mangrove capacity in building land to cope with SLR
- Mudflat may not

Mudflat and Carbon

- Mudflat has the potential to store carbon ($62 \pm 10 \text{ Mg C ha}^{-1}$)
- Mudflat is rich in allochthonous carbon (48.72%)

Mudflat and Biodiversity

- Mudflat is an important habitat for migratory birds
- Diverse offshore fish catch and near-shore fishery found in healthy mangrove

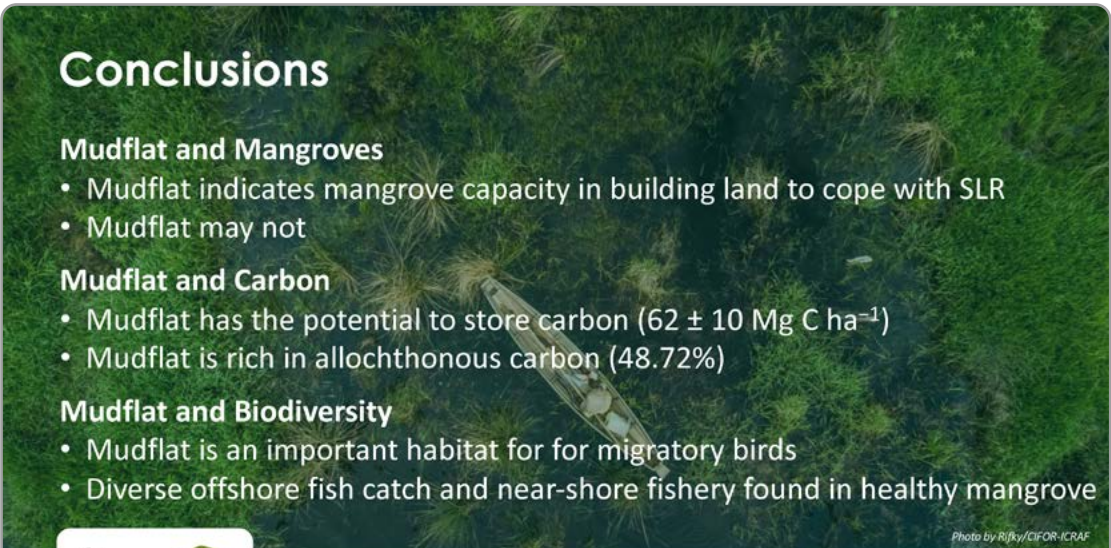


Photo by R/fky/CIFOR-ICRAF





탄소중립을 위한 수산자원 기반의 블루카본 활용

Fisheries Resources-Based Blue Carbon Utilization Policy for Carbon Neutrality

연사 Speaker

최임호 IM HO, CHOI

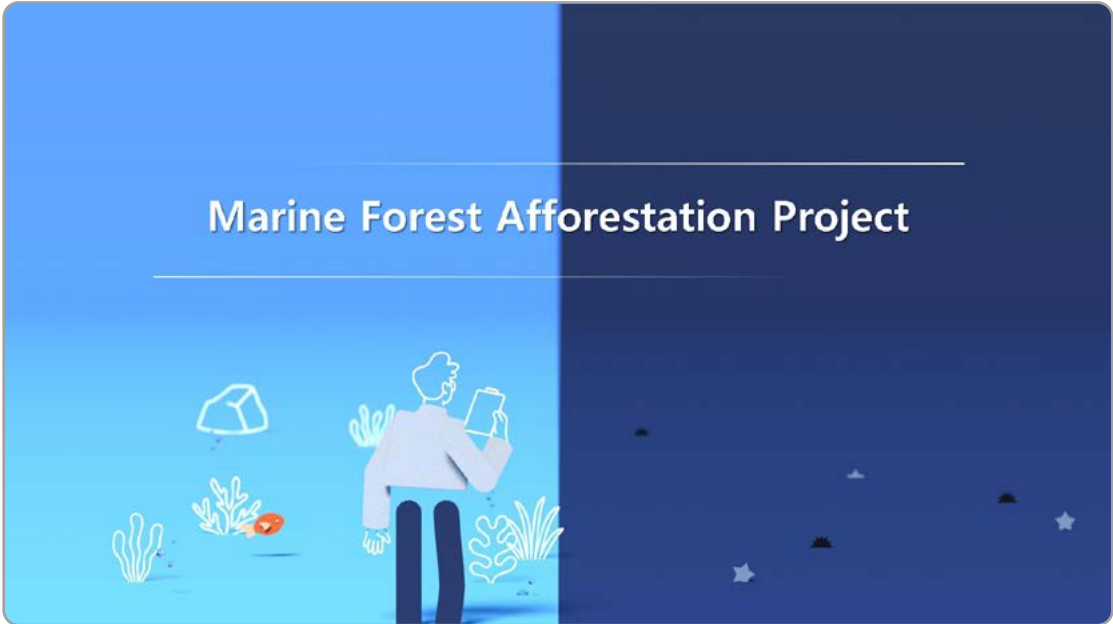
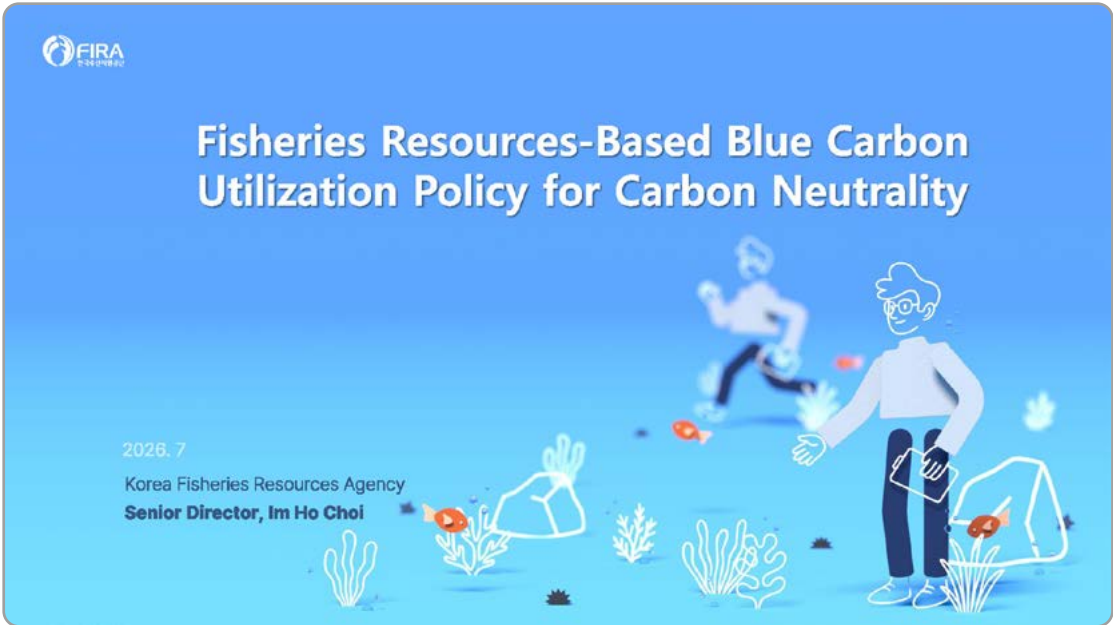
한국수산자원공단 전략사업본부 본부장
Senior Director, Strategic Business Department, Korea Fisheries Resources Agency

주요경력

- 2002-2021 전남대학교 환경해양학 박사
- 2002-2010 국립수산물과학원 자원조성 및 바다목장 연구원
- 2010-2025 한국수산자원공단 블루카본전략실장
- 2026-현재 현재 한국수산자원공단 전략사업본부장
- 2025-2026 2050 탄소중립녹색성장위원회 기후변화정책분과 농축수산/흡수원 분과 전문위원
- 2026-현재 국가기후대응위원회 탄소중립 이행점검 실무점검위원장

Biography

- 2002-2021 Chonnam National University. Doctor of Environmental Oceanography
- 2002-2010 National Institute of Fisheries Science Researcher of Fisheries Resources
- 2010-2025 Korea Fisheries Resources Agency. Blue Carbon implementation. Division Director
- 2025-2026 Korea Fisheries Resources Agency. Strategic Business Department. Senior Director
- 2026-Present Presidential Commission on Climate Crisis Response. Commissioner for Climate Change policy and Member of the Inspection Committee



Marine Forest Afforestation Project

Project Background: Climate Crisis

Adverse Impacts on Marine Ecosystem

Coral Bleaching

Rising sea Temperature cause corals to lose their symbiotic algae, turning white. Prolonged bleaching can lead to the collapse of entire coral reef communities.



Barren Grounds

Rising sea Temperature and environmental changes are causing seaweed forests to disappear, turning marine habitats into barren areas where marine life can no longer survive.



Climate Change is severely impacting marine ecosystems through coral bleaching, biodiversity loss, barren grounds, and food chain collapse.

Marine Forest Afforestation Project

Project Outline

What is a Marine Forest?

Land



Big Fire

Afforestation



Marine



Barren Ground

Marine Forest Afforestation



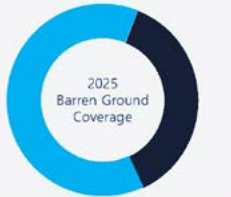
A Macroalgal habitat that provides shelter for marine life and offers resources and nursery grounds for many marine organisms, supporting a healthy marine ecosystem.

Marine Forest Afforestation Project

Project Background: Climate Crisis

What is Barren Grounds?

2025 Barren Grounds Coverage



Survey Site	100%	425.8km²
Healthy Reef	65.9%	280.7km²
Barren Ground Reef	34.1%	145.1km²

Global Barren Grounds Distribution

Barren Ground Status by Coralline Algae Coverage

← Healthy 40% Progressing 80% Severe →

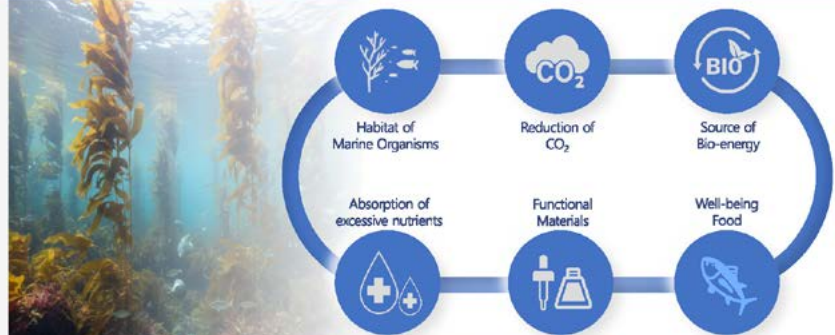


Barren grounds result from climate change, coastal pollution, excessive coastal development, and increased grazing pressure by marine herbivores.

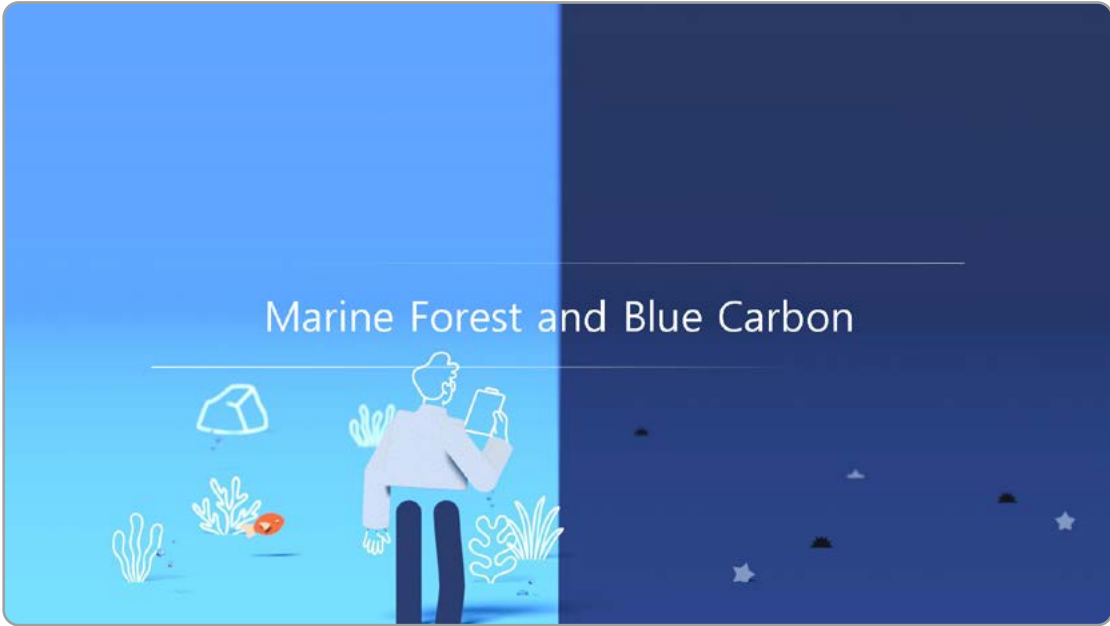
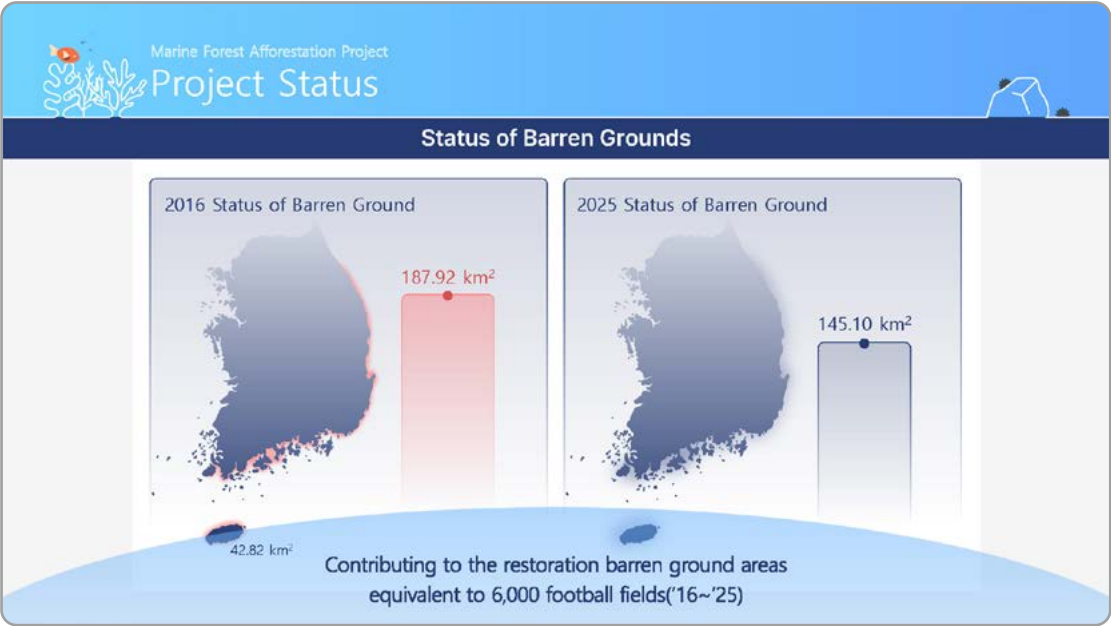
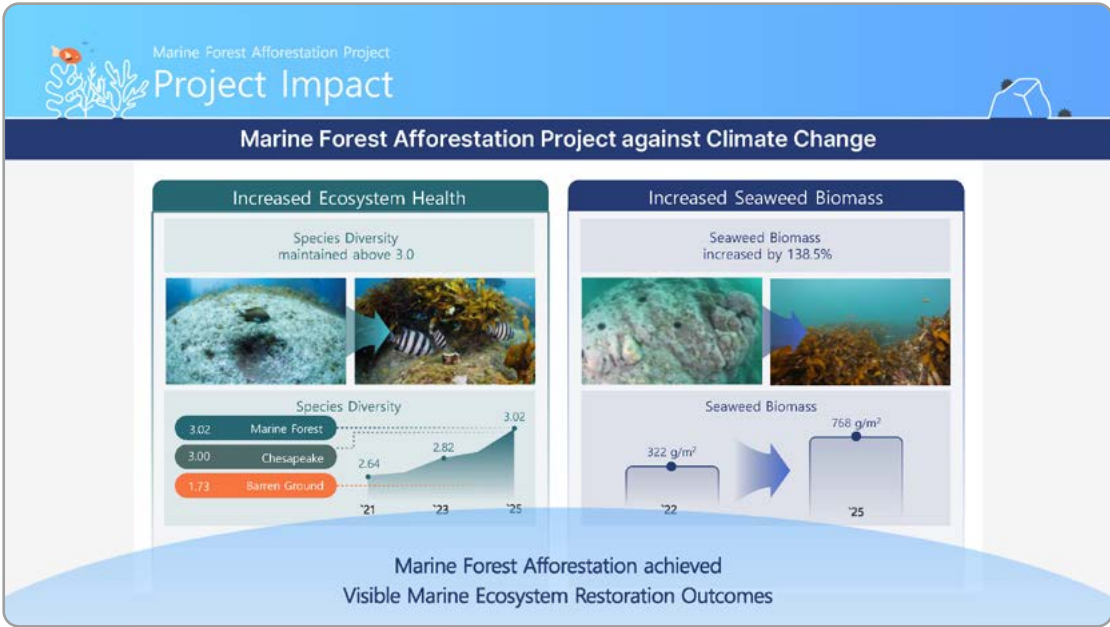
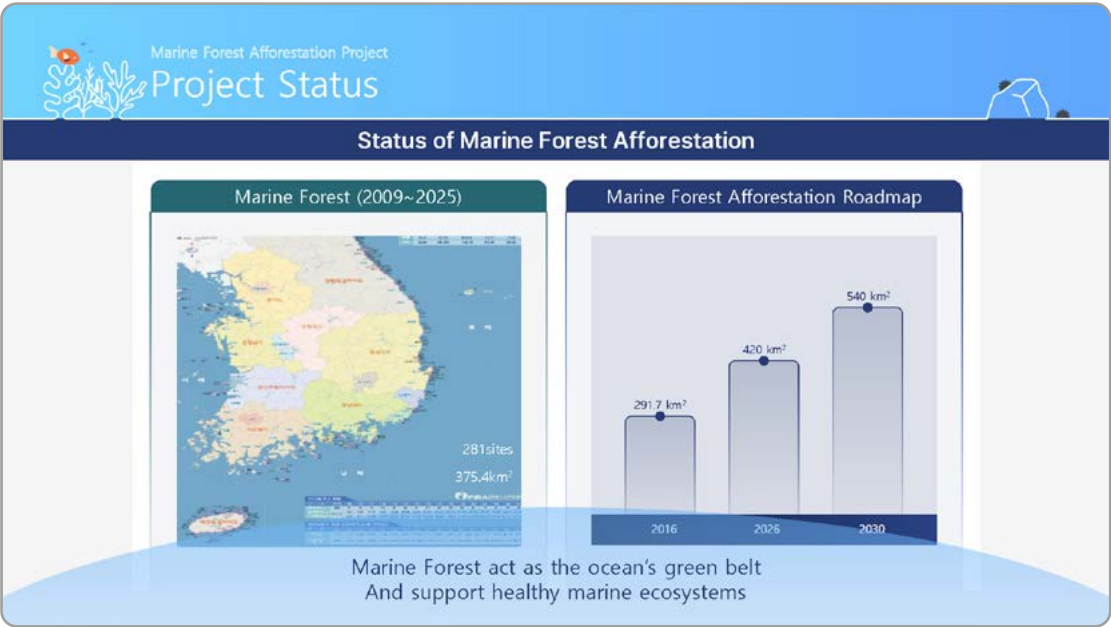
Marine Forest Afforestation Project

Project Outline

Function of Marine Forest



Marine Forest Afforestation creating a virtuous cycle of ecology and economy



Marine Forest and Blue Carbon

Blue Carbon

What is a Blue Carbon?

Black Carbon



The sooty black material emitted from gas and diesel engines, and other sources that burn fossil fuel

Green Carbon



The Carbon stored in the plants and soil of natural ecosystem

Blue Carbon



The Carbon stored by the Ocean (Salt marsh, Mangrove, Seagrass)

Carbon absorption capacity

Blue Carbon = X 50 Green Carbon
(Area – to – Area Comparison)

Marine Forest and Blue Carbon

Blue Carbon R&D

A comparative study of NEP^{Chem.} & NEP^{Biol.}

Unit : ton CO₂ ha⁻¹yr⁻¹

NEP^{Chem.}

Air-sea CO₂ flux = 0.46 tons CO₂ ha⁻¹ yr⁻¹
C_r uptake > 2.54 tons CO₂ ha⁻¹ yr⁻¹

Continuous pCO₂ measurements

Sampling & Analysis

NEP^{Biol.}

NEP^{Biol.} > 3.69 tons CO₂ ha⁻¹ yr⁻¹

Tent incubation system

NPP



1km² of Marine Forest absorbs 369 tons km⁻² yr⁻¹

Marine Forest and Blue Carbon

Blue Carbon R&D

Study Result of CO₂ absorption capacity

Unit : g C m⁻²yr⁻¹

C influx
77 g

DIC
19 g

1M

1M

DOC
4 g

77g

77 + 19 - 4
= 92

Absorbed C
92 g

Equivalent

CO₂
337.6 g

Carbon Neutrality Contribution through Marine Forest Afforestation

Marine Forest and Blue Carbon

Blue Carbon R&D

Scientific verification of CO₂ absorption

< Based on ocean chemistry system >

< Based on seaweed community >

< Study of CO₂ absorption capacity >

< Study of CO₂ absorption capacity >

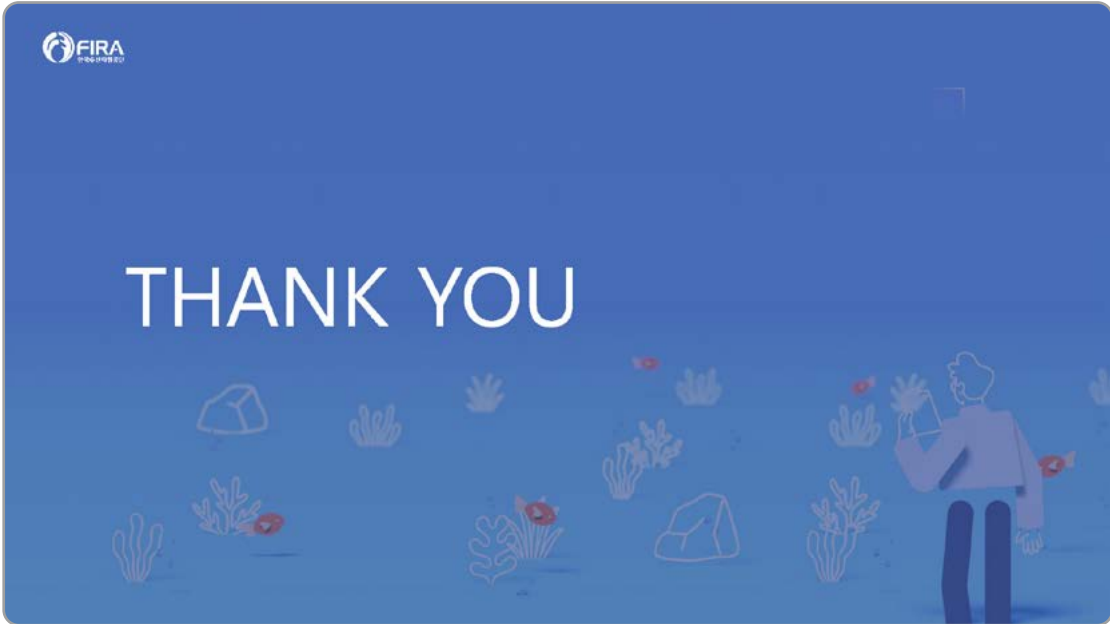
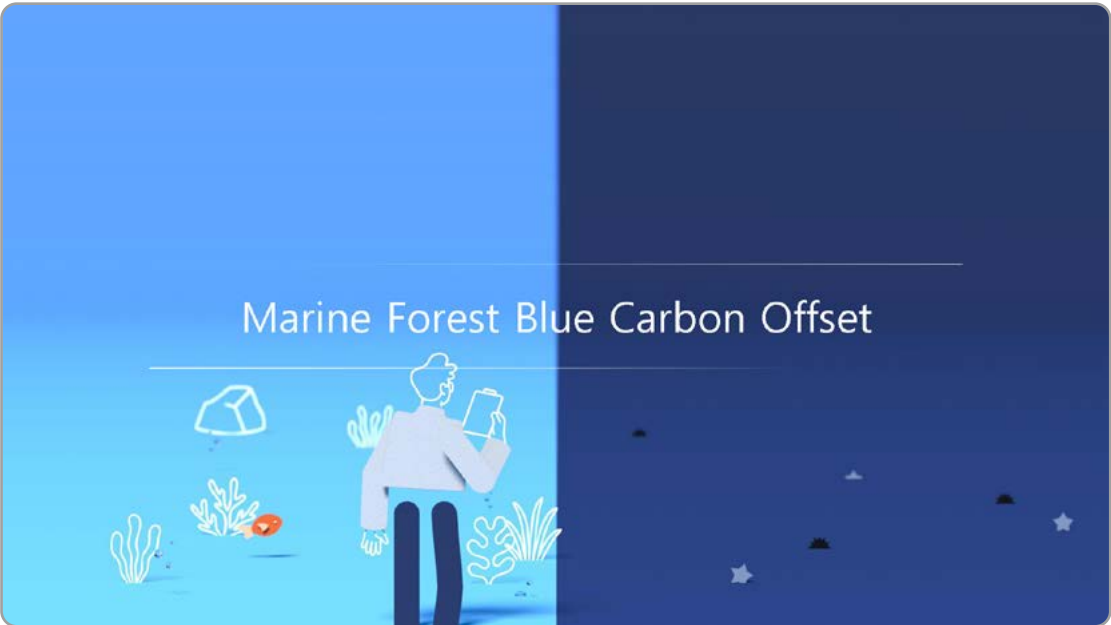
< Lee et al. 2025 >

< Kim et al. 2025 >

< Kim et al. 2023 >

< Kim et al. 2022 >

Carbon sequestration assessment methodologies for marine forests have been scientifically validated through publication in international journals.





패널 Panel

정성우 Sung-Woo Jeong

(재)포항산업과학연구원 수석 연구원
Senior Researcher, Research Institute of Industrial and Science

주요경력

- 2009-2010 네덜란드 와게닝겐대학교 연구원
- 2011-2013 경상국립대학교 강사
- 2014-2026 포항산업과학연구원 수석연구원

Biography

- 2009-2010 Wageningen UR, the Netherlands Researcher
- 2011-2013 Gyeongsang National University Lecturer
- 2014-2026 RIST Senior Researcher



패널 Panel

김주형 Ju-Hyoung Kim

군산대학교 해양생명과학과 교수
Professor, Department of Aquaculture and Aquatic Science, Kunsan National University

주요경력

- 2000-2006 전남대학교 지구환경과학부(해양환경전공) 이학사
- 2006-2008 전남대학교 해양학과 이학석사
- 2008-2014 전남대학교 해양학과 이학박사
- 2014-2015 전남대학교 BK21+ 신진연구인력
- 2015-2019 국립군산대학교 해양생명응용과학부 조교수
- 2019-2023 국립군산대학교 해양생명과학과 부교수
- 2024-현재 국립군산대학교 해양생명과학과 교수
- 2018-2020, 2022-2026 국립군산대학교 수산과학연구소 소장

Biography

- 2000-2006 B.S.,(Faculty of Earth and Environmental Sciences, Chonnam National University, Gwangju)
- 2006-2008 M.S.,(Department of Oceanography, Chonnam National University, Gwangju)
- 2008-2014 Ph. D.,(Department of Oceanography, Chonnam National University, Gwangju)
- 2014-2015 Post-Doctoral Fellow, Climate Change and Ecosystem Prediction Research Team (BK21 Plus Research Group), Chonnam National University
- 2015-2019 Assistant Professor, Faculty of Marine Applied Biosciences, Kunsan National University
- 2019-2023 Associate Professor, Department of Aquaculture and Aquatic Science, Kunsan National University
- 2024-Present Full Professor, Department of Aquaculture and Aquatic Science, Kunsan National University
- 2018-2020, 2022-2026 Director of Fisheries Science Institute, Kunsan National University

세션 5. 기후변화센터 세션

Session 5. Climate Change Center Session

데이터와 실천으로 만드는 기후 안심 도시

Building Climate-Resilient Cities through Data and Action

좌장 Moderator

최지원 Jiwon Choi

기후변화센터 사무국장

Director General, Climate Change Center

기후위기 대응을 위한 스마트 수해 예방 체계

Smart Flood Prevention System for Climate Crisis Response

이상훈 LEE, SANG HOON

포항 철강산단 통합관제센터 센터장

Center Director, Integrated Control Center of Pohang Steel Industrial Complex

참여에서 정밀 실증으로: 탄소중립을 위한 AI기반 리빙랩

From Participation to Precision: AI-Based Living Lab for Carbon Neutrality

황철원 Cherwon Hwang

포항 탄소중립지원센터 센터장

Director, Pohang Carbon Neutrality Support Center

철강슬래그 활용 바다숲 조성을 통한 지역 상생협력

Regional Cooperation through Steel Slag-Based Marine Forest Restoration

진영주 Young-Ju Jin

포스코 환경에너지기획실 실장

Head, POSCO Environmental & Energy Planning Office

패널 Panel

권태중 TAE JUNG KWON

포항시 기후대기과 과장

Deputy Director, Climate & Air Quality Division, Pohang City,

김수정 Sujung Kim

포항 YWCA 사무총장

Secretary General, Pohang Young Women Christian Association

김옥경 Ok Kyung Kim

포항 시민 대표

Citizen



좌장 Moderator

최지원 Jiwon Choi

기후변화센터 사무국장
Director General, Climate Change Center

주요경력

- 2020-2024 기후변화센터 지식네트워크팀 팀장
- 2022-현재 기후위기대응·에너지전환·지방정부협의회 사무국장
- 2025-현재 기후변화센터 사무국장

주요활동

- 2024-2025 탄소중립·녹색성장위원회 공정전환·기후적응분과 지역 전문위원
- 2024-현재 양평군 지속가능발전위원회 환경분야 위원
- 2025-현재 서울형 탄소시장 운영위원회 위원
- 2025-현재 기후에너지환경부 에너지위원회 위원
- 2026-현재 포항시 기후위기대응위원회 위원

Biography

- 2020-2024 Head of Knowledge Network Team, Climate Change Center
- 2022-Present Director General, Local Government Association for Climate Crisis Response and Energy Transition
- 2025-Present Director General, Climate Change Center

Recent Key Activities

- 2024-2025 Regional Expert Member of the Just Transition & Climate Adaptation Subcommittee, Presidential Commission on Carbon Neutrality and Green Growth
- 2024-Present Member of the Environment Subcommittee, Yangpyeong-gun Sustainable Development Committee
- 2025-Present Member of the Seoul-style Carbon Market Steering Committee, Seoul Metropolitan Government
- 2025-Present Member of the Energy Committee, Ministry of Climate, Energy and Environment
- 2026-Present Member of the Pohang City Committee on Climate Crisis Response



기후위기 대응을 위한 스마트 수해 예방 체계

Smart Flood Prevention System for Climate Crisis Response

연사 Speaker

이상훈 LEE, SANG HOON

포항 철강산업 통합관제센터 센터장
Center Director, Integrated Control Center of Pohang Steel Industrial Complex

주요경력

- 2019-2021 한국산업단지공단 울산지역본부
- 2023-2025 한국산업단지공단 포항지사
- 2025-2026 포항철강산업 통합관제센터 센터장

Biography

- 2019-2021 Ulsan Branch of Korea Industrial Complex Corporation
- 2023-2025 Pohang Branch of Korea Industrial Complex Corporation
- 2025-2026 Integrated Control Center

WGGF 2026 (Green Growth Forum) Official Session Presentation Material

Smart Flood Prevention System for Climate Crisis Response

Operation Case of AI-based Flood Prediction Modeling at Pohang Steel Industrial Complex Integrated Control Center

영진기술(주)

01. The Routine of Extreme Weather due to Climate Change: The Need for Proactive Response

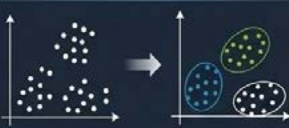
Securing the Safety of National Core Industrial Complexes by Integrated Analysis of Past Flood History and Real-time Threats.

The Physical Threat



Typhoon Khanun, Hyeongsan Bridge Flood Sign Monitoring Site

The Analytical Approach



- Evolution of Threat**
Increasing flood risk for Pohang Steel Industrial Complex due to more intense localized heavy rain and strong typhoons.
- Derivation of Vulnerable Areas**
Primary classification of precise flood-vulnerable points within the complex by combining past flood history data and K-Means clustering.
- Paradigm Shift in Response**
Moving from a 'post-recovery' system to data-driven real-time 'proactive prediction and prevention' for disaster response.

WGGF 2026 (녹색성장포럼) 공식 세션 발표 자료

기후위기 대응을 위한 스마트 수해 예방 체계

포항철강산업 통합관제센터 AI 기반 수해예측모델링 운영 사례

포항시 포항 한국산업단지공단 Korea Industrial Complex Corporation

01. 기후변화로 인한 극한 기상의 일상화: 선제적 대응의 필요성

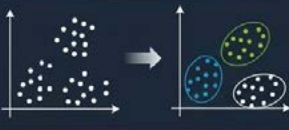
과거의 수해 이력과 실시간 위협을 융합 분석하여 국가 핵심 산업단지의 안전을 확보합니다.

The Physical Threat



태풍 카눈 당시 형산교 홍수 징후 감시 현장

The Analytical Approach



- 위험의 진화**
국지성 집중호우 및 태풍 발생 강도 증가로 인해 포항철강산업단지의 침수 피해 리스크가 고조되고 있습니다.
- 취약 지구 도출**
과거 수해 이력 데이터와 K-Means 클러스터링 기법을 결합하여 산업 내 정밀 수해 취약 지점을 1차적으로 분류해 냈습니다.
- 대응 패러다임의 전환**
기존의 '사후 복구' 중심 체계에서 벗어나, 데이터 기반의 실시간 '사전 예측 및 원천 차단'으로 재난 대응의 축을 이동해야 합니다.

02. AI-Based Flood Prediction Modeling and Real-Time IoT Control Solution

Realizing a perfect Digital Twin through the convergence of precise field IoT data and global standard prediction models.

Real-Time Water Level Monitoring CCTV
(Resolution 1920x1080)

Rain Gauge
(Precision 0.1mm)

Smart Manhole
(Sewage Inflow Prediction)

US EPA SWMM-Based Flood Prediction Modeling
3D Visualization of Damage Scale and Prediction Scope via Distributed Rainfall-Runoff Model

Optimal Flood Evacuation Route Guidance Service
Real-time derivation of optimal routes bypassing flood-risk areas using AI algorithms

03. Intelligent SOP-based Real-time Situation Dissemination Scenario

The Predictive Twin Smart Command Center

Automating the 4-stage Standard Operating Procedure (SOP) based on water level changes completely prevents loss of life and property damage.

Escalation Staircase

- Stage 1 - Attention**
Trigger : Water level reaches 1.56m
Action : Sign monitoring & initial response preparation
- Stage 2 - Caution**
Trigger : Water level reaches 2.50m
Action : Constant rainfall/flow monitoring, activation of cooperation system
- Stage 3 - Alert**
Trigger : Water level reaches 3.00m
Action : Issue flood advisory, staff standby & access control
- Stage 4 - Critical**
Trigger : Water level reaches 4.47m
Action : Issue flood warning, provide evacuation route outside the industrial complex & start evacuation

Intelligent Situation Dissemination System Execution Screen

(Automatic SMS, SNS Push sent to relevant agencies and field staff according to SOP)

02. AI 기반 수해예측모델링 및 실시간 IoT 관제 솔루션

현장의 정밀 IoT 데이터와 글로벌 표준 예측 모델의 융합으로 완벽한 디지털 트윈을 구현합니다.

실시간 수위 감시 CCTV
(해상도 1920x1080)

강우량계
(정밀도 0.1mm)

스마트 맨홀
(하수 유입량 예측)

미국 환경청(EPA) SWMM 기반 수해 예측 모델링
분포형 강우-유출 모형을 통한 피해 규모 및 예측 범위 3D 시각화

최적 수해 대피 경로 안내 서비스
AI 알고리즘 활용 침수 위험지역 우회 및 최단 경로 실시간 도출

03. 지능형 SOP 기반 실시간 상황 전파 시나리오

The Predictive Twin Smart Command Center

수위 변화에 따른 4단계 표준 운영 절차(SOP)의 자동화로 인명과 재산 피해를 완벽히 차단합니다.

Escalation Staircase

- Stage 1 - 관심**
Trigger : 수위 1.56m 도달
Action : 정후 감시 및 초기 대응 준비
- Stage 2 - 주의**
Trigger : 수위 2.50m 도달
Action : 강우-유량 상시 모니터링, 협조체계 가동
- Stage 3 - 경계**
Trigger : 수위 3.00m 도달
Action : 홍수주의보 발령, 근무자 대기 및 출입 통제
- Stage 4 - 심각**
Trigger : 수위 4.47m 도달
Action : 홍수경보 발령, 산단 밖 대피로 제공 및 대피 개시

지능형 상황 전파 체계 시스템 실행 화면

“ 실제 상황입니다. A구역에서 침수가 예상됩니다. 즉시 대피소로 이동 바랍니다. ”
(SOP에 따른 유관기관 및 현장 근무자 SMS, SNS Push 자동 발송)



참여에서 정밀 실증으로: 탄소중립을 위한 AI 기반 리빙랩

From Participation to Precision: AI-Based Living Lab for Carbon Neutrality

연사 Speaker

황철원 Cherwon Hwang

포항 탄소중립지원센터 센터장
Director, Pohang Carbon Neutrality Support Center

주요경력

1991-1992	일본 식물형태학회 연구원
1992-1995	농림부 농업과학원 연구사
1995-현재	한동대학교 교수
2008-2009	Utah State University 환경생태학부 방문교수
2012-2015	한동대학교 글로벌리더십학부 학부장
2012-현재	경상북도 조정협의회 부회장
2013-2014	한국생명과학회 이사
2013-현재	한국대학교양교육협의회 대외협력이사 포항북부경찰서 집회 및 자문위원 위원 낙동강수계유역관리연구위원회 위원
2014-현재	대한민국 경상북도 실�크로드 프로젝트 추진위원회 위원 포항시 농업산학협동심의위원회 위원
2015-2016	Griffith University 방문교수
2017-현재	한동대학교 글로벌 미래 평생교육원 원장
2017-현재	한동대학교 국제경영대학원 최고경영자과정 주임교수
2019-2021	대한민국 경상북도 평생교육협의회 위원
2019-현재	포항시 지속가능발전위원회 위원
2019-현재	포항시 지속발전협의회 환경교육분과장
2023-현재	포항시 탄소중립지원센터 센터장

Biography

1991-1992	Japan Society for Plant Morphology Postdoctoral Researcher
1992-1995	National Institute of Agricultural Sciences, Ministry of Agriculture and Forestry Research Scientist
1995-Present	Handong Global University Professor
2008-2009	Utah State University, Visiting Professor, Department of Environmental Ecology
2012-2015	Handong Global University, Dean, School of Global Leadership
2012-Present	Gyeongsangbuk-do Coordination Council, Vice Chair
2013-2014	Korean Society of Life Science Board Director
2013-Present	Korean Council for University General Education Executive Director for External Cooperation Pohang Northern Police Station, Advisory Committee Member for Public Assemblies and Demonstrations Nakdong River Basin Management Research Committee Committee Member
2014-Present	Gyeongsangbuk-do Silk Road Project Promotion Committee Committee Member Pohang City Agricultural-Industrial-Academic Cooperation Review Committee Committee Member
2015-2016	Griffith University Visiting Professor
2017-Present	Handong Global University Global Future Lifelong Education Institute, Director
2017-Present	Handong Global University Graduate School of International Management Director of the CEO Program
2019-2021	Gyeongsangbuk-do Lifelong Education Council Committee Member
2019-Present	Pohang City Sustainable Development Committee Committee Member
2019-Present	Pohang City Sustainable Development Council Chair of the Environmental Education Division
2023-Present	Pohang Carbon Neutrality Support Center Director

Pohang City Carbon Neutrality Living Lab Demonstration Project

From Participation to Precision

| AI-Based Living Lab for Carbon Neutrality

Pohang Carbon Neutrality Support Center
Director Hwang Cher-won (Emeritus Professor, Handong Global University)

pcnc

포항시 탄소중립지원센터
Pohang Carbon Neutrality Support Center

| What is a Living Lab?

Definition

- What is a Living Lab?

A "living lab" is a real-world testing space where citizens and stakeholders co-create, test, and improve solutions to local problems.

Key Elements

- Real-world setting
- Citizen participation
- Co-creation
- Field-based feedback

Introduction

Pohang Carbon Neutrality Support Center

Establishment Purpose

To support Pohang City's carbon neutrality policy, promote a carbon-neutral lifestyle and culture, and provide systematic responses to the transition toward a carbon-neutral society.

Legal Basis

Framework Act on Carbon Neutrality and Green Growth — Article 68

- Support for developing carbon neutrality master plans and climate crisis response measures
- Development of sector-specific carbon neutrality implementation models (energy, industry, transport, etc.)
- Research, education, and public outreach related to carbon neutrality
- Calculation and analysis of greenhouse gas statistics

Location

Handong Global University, Bldg. 501, Room 102 (Industry-Academia Cooperation Hall), Heunghae-eup, Buk-gu, Pohang City



Handong Global University
Pohang, North Gyeongsang
Building 501, Room 102
Industry-Academia Cooperation Hall

| Why Living Lab?

 Carbon neutrality is a field problem, not a policy slogan.

Resident Participation

Local residents understand context and can identify real problems.

On-site Experimentation

Solutions are tested in real-world conditions, not labs.

Evidence-Based Policy

Data from the field feeds directly into policy design.

Previous Living Lab (2024)

Overview

- Target: 5 villages & commercial areas
- Activities: Education, discussion, action plans
- Goal: Carbon neutrality awareness
- Governance: Community-based governance

Action Plans Developed

- Food Waste Composting
- Community Cleanup
- Energy Conservation
- Recycling Improvement

Significance & Limitations

Significance

- Raised awareness
- Bottom-up problem finding
- Community governance
- Real practice proposals

Limitations

- No quantitative monitoring
- Hard to verify impact
- Limited scalability
- Monitoring gap noted by report

Carbon Neutrality & Ocean — Education Activity Record

Session 1

July 22, 2025 (2025.07.22)

- Saeroksaero Merchants' Assoc., Haedo-dong, Nam-gu, Pohang
- 15-20 persons incl. Chair Ju Si-yeong
- Do Hyeong-gi, Ph.D. (Biology) — Former Prof., Handong Global Univ.

Topics Covered

- Carbon Neutrality & the Ocean
- Carbon Neutrality & Global Ecosystem
- Ocean & Climate



Session 2

August 5, 2025 (2025.08.05)

- Saeroksaero Merchants' Assoc., Haedo-dong, Nam-gu, Pohang
- 15-20 persons incl. Chair Ju Si-yeong
- Park Yeong-ja, CEO — Social EduTech Korea Co., Ltd.

Topics Covered

- Carbon Neutrality Practice Cases
- Pohang ESG Youth Leaders Club
- Other Carbon Neutrality Activities



Why AI-Based Living Lab?

Residents identify carbon neutrality challenges

Challenges of Conventional Living Lab

- *One-off activites
- *Unmeasurable impacts
- *Limited policy use

AI measures actual activities as quantitative data

Key Goal

Build activity data needed for GHG emission reduction baseline (emission factor) development

| Why AI-Based Living Lab?

?

What is dæp visions ?

Social Impact by Vision AI Technology

| Existing Public Bicycle Emission Reduction Formula

Source: Korea Environment Corporation (K-eco)

The existing emission reduction factor for public bicycle use is based on a fixed assumed average travel distance per trip.

Emission Reduction Factor Formula

Emission Factor
(Replaced Mode)

182 gCO₂eq/km

× Average
Travel Distance

3.16km/trip

× Public Transport
Connection Rate

56.4%

= Factor
per Trip

324.5
gCO₂eq/trip

| 324.5 gCO₂eq/trip = 0.0003245 tCO₂eq/trip

| Emission Reduction = Number of Trips × 0.0003245 tCO₂eq/trip

| Example: 10,000 trips × 0.0003245 tCO₂eq/trip = 3.245 tCO₂eq

| AI-Based Living Lab: Project Overview

2

Domains

20

Cyclists

15

ID Plates

44

Idling Tests

This project uses CCTV footage and AI video analysis to measure real-world carbon-neutral activities — cycling and vehicle idling — as structured activity data for emission reduction baseline development.

Bicycle Domain

- Detect, identify, and track cyclists using custom ID plate Classification

Idling Domain

- Multi-signal detection: vehicle + person + brake light + duration

| Sensitivity: AI-Observed vs. Assumed Travel Distance

The existing method applies 3.16 km/trip as a fixed average. AI-based route data allows testing how the result changes when the observed average differs from the assumption.

Fixed assumptions: 10,000 trips | 182.05 gCO₂eq/km | 56.4% connection rate | Only average travel distance varies

Scenario	Avg. Distance	Reduction / Trip	Total (10,000 Trips)
Existing Factor (Assumed)	3.16 km	0.3245 kgCO ₂ eq	3.245 tCO ₂ eq
Lower AI-Observed Distance ↓ 21% lower than assumed	2.5 km	0.2567 kgCO ₂ eq	2.567 tCO ₂ eq
Higher AI-Observed Distance ↑ 27% higher than assumed	4.0 km	0.4107 kgCO ₂ eq	4.107 tCO ₂ eq

| Key message: AI-based activity data does not inflate emission reductions. It reduces uncertainty by testing whether the existing assumed distance reflects actual field conditions.

Trained on Clean Images — Deployed in Harsh CCTV

Training Data — Internet Photos

- Taken in bright, front-facing conditions
- High resolution and sharp focus
- Well-composed, unobstructed scenes
- Consistent lighting and angles

Real-World CCTV Footage

- Camera mounted high, angled downward
- Night-time, rain, and backlit conditions
- Blurry, partially occluded, or distorted
- Highly variable weather and lighting

Using the model as-is causes a sharp accuracy drop → Adaptation to the real deployment environment is essential.

Sensitivity: Idling Time-Based Emissions Using Video Observation

Source: Argonne National Laboratory, Korea Environment Corporation (K-eco)

The emission amount is calculated using an idling emission rate of **21.98 gCO₂/min**. This value is derived by combining **Argonne/DOE idling fuel consumption data with the Korean gasoline emission factor**. Since U.S. and Korean sources are used together, the value is presented as a reference indicator for explaining the calculation mechanism, not as a final domestic emission factor.

Fixed assumptions: 21.98 gCO₂/min per vehicle | Gasoline passenger car | Only idling time varies

Scenario	Idling Time	Emission / Vehicle	Total Emissions
Short Idling	5 min	0.1099 kgCO ₂ eq	1.099 tCO ₂ eq/10,000vehicles
Medium Idling	10 min	0.2198 kgCO ₂	2.198 tCO ₂ / 10,000 vehicles
Extended Idling	20 min	0.4396 kgCO ₂ eq	4.396 tCO ₂ eq/10,000 vehicles

Key message: Video-based observation does not change the emission factor itself. It improves the activity data by measuring actual idling time, which allows a more realistic estimation of emissions.

Vehicle Idling — How the System Decides

1

Is it stationary?

The vehicle's position does not change for a defined time window — confirmed by frame-by-frame position comparison.

2

Is someone inside?

A person is detected in the driver's seat area — distinguishing an occupied vehicle from an empty parked one.

3

How long has it been?

Duration threshold of 20–30 seconds applied — brief stops at traffic lights are excluded from the idling count.

All three conditions met → classified as 'idling'

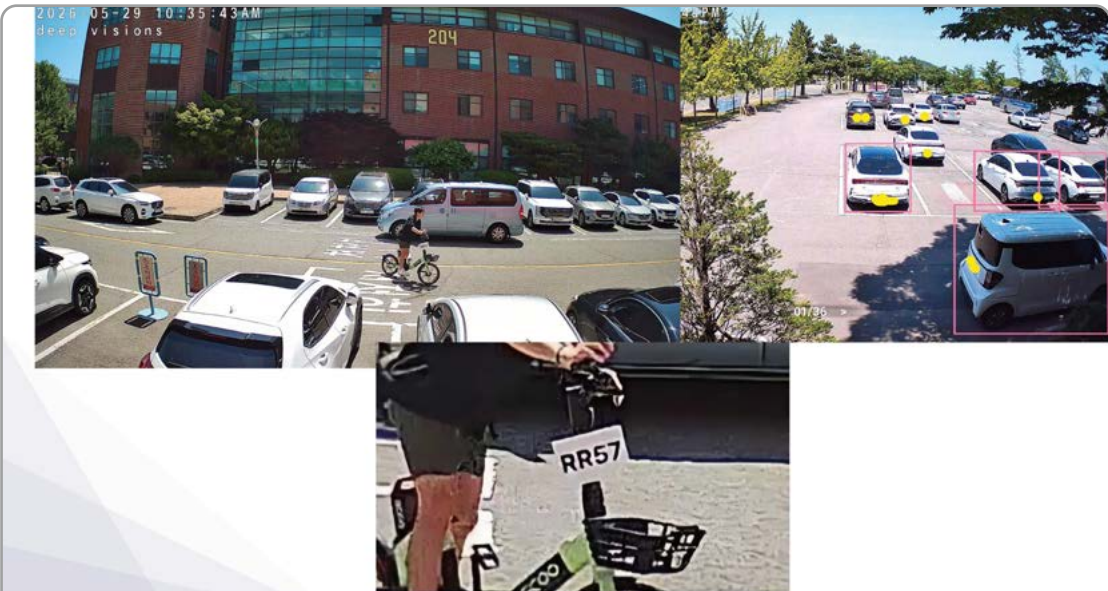
Experiment Design

Bicycle Experiment

- Participants: 20 recruited cyclists
- ID System: 15 custom variable plates
- Detection: Bicycle + plate classification
- Tracking: Frame-to-frame object tracking
- Output: Time-stamped route data

Idling Experiment

- Tests Conducted: 44 idling scenarios
- Vehicle Detection: Locate car in frame
- Person Detect: Driver presence check
- Brake Light: ON/OFF classification
- Output: Idling probability data



| Limitations & Future Directions

Current Limitations

- Small scale
- Controlled conditions
- No night/rain tested
- Privacy protocol needed
- Pre-emission factor stage

Future Enhancement

- Expand data scale
- Night / rain / backlight data
- Infrared & depth imaging
- Synthetic data generation
- Accuracy validation system
- Emission factor linkage

| Technological Significance

"The differentiation of this project lies not in developing new AI algorithms, but in converting existing video AI technologies into a field-ready carbon neutrality activity data collection system."

Field Applicability

Applied to real CCTV footage: bicycle, vehicle, person, brake light recognition in live environments

Purpose-Built Data Design

Custom ID plates, participant recruitment, and experiment structure designed for emission reduction purposes

Activity Data Conversion

AI outputs are not raw detections — they are converted into structured activity records for baseline development

| Expected Impact & Conclusion

From Awareness to Measurement

Extends the living lab paradigm from education-based to data-driven

Emission Reduction Baseline

Activity data connects cycling & idling to GHG emission calculations

AI-Driven Local Policy

Supports cycling promotion, idling reduction, and local monitoring programs

Bridging Participation & Technology

Residents surface problems → AI measures them → policy acts on data

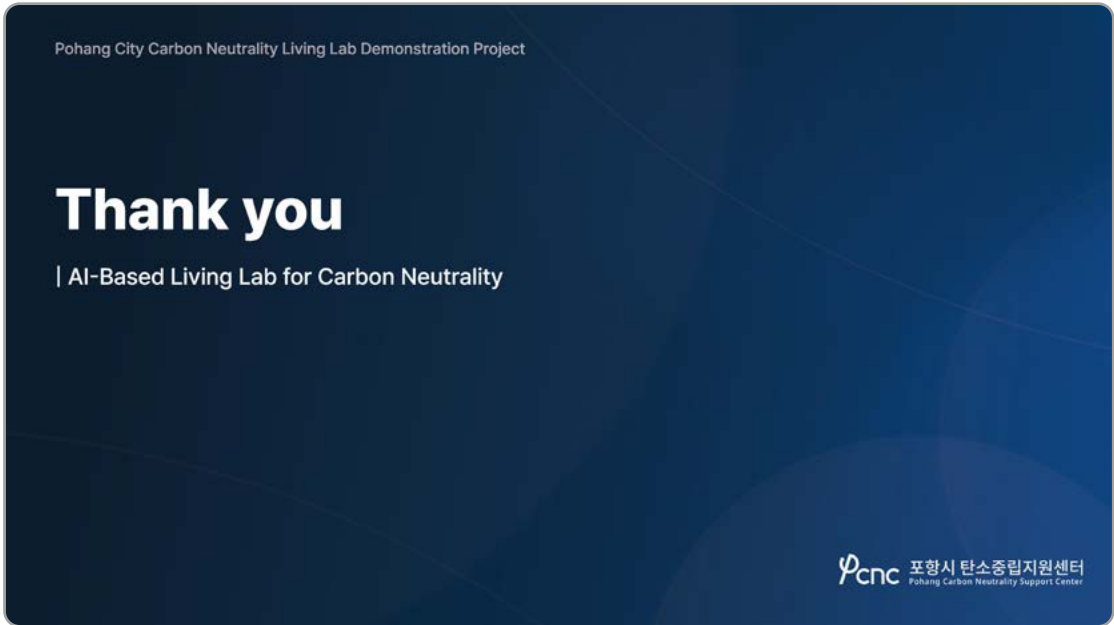
Leveraging Existing CCTV Infrastructure

Enables immediate implementation using existing public CCTV infrastructure, reducing installation costs and improving policy scalability.

Foundation for Carbon Incentives

Provides a quantitative basis for estimating individual emission reductions, supporting future incentive and reward programs.

| "If the previous living lab found carbon neutrality actions, this project measures them."



WORLD
GREEN GROWTH
FORUM 2026
2026 세계녹색성장포럼



철강슬래그 활용 바다숲 조성을 통한 지역 상생협력

Regional Cooperation through Steel Slag-Based Marine Forest Restoration

연사 Speaker

진영주 Young-Ju Jin

포스코 환경에너지기획실 실장
Head, POSCO Environmental & Energy Planning Office

주요경력

- 1992 포스코 환경안전부 입사
- 2009-2011 포항제철소 환경보건그룹 팀리더
- 2012-2014 WorldSteel Steel Fellow
- 2015 환경사회공헌실 환경자원그룹 리더
- 2016-2018 포항제철소 환경자원그룹 리더
- 2018-2020 포항제철소 환경자원그룹장
- 2020-2023 안전환경기획실 부산물자원화그룹장
- 2023-2025 환경기획실 환경기획그룹 그룹장(상무보)
- 2025-현재 환경에너지기획실장(상무)

Biography

- 1992 Joined POSCO, Environment & Safety Department
- 2009-2011 Team Leader of Pohang Works Environment & Health Group
- 2012-2014 World Steel Association, Steel Fellow
- 2015 Leader of Environment & Social Contribution Department Environmental Resources Group
- 2016-2018 Leader of Pohang Works Environmental Resources Group
- 2018-2020 Head of Pohang Works Environmental Resources Group
- 2020-2023 Head of Safety & Environment Planning Department By-product Recycling Group
- 2023-2025 Head of Environmental Planning Department Environmental Planning Group(Vice President)
- 2025-Present Head of Environment & Energy Planning Department(Senior Vice President)

WGGF· 2026

Regional Cooperation through
Steel Slag-Based Marine Forest Restoration

2026.7.10

Young-Joo Jin,
Head of Environment and Energy Planning Office, POSCO

Posco Triton Marine Forests

02 / 12

POSCO Brings Life back to the Ocean

Posco Triton Marine Forests

03 / 12

What Threats Are Our Oceans Facing Today?

✓ Marine Desertification



< Status of Marine Desertification in Korea >
Marine Desertification now covers over 17,000ha - the equivalent of 58 Yeosu Island



* Source: Korea Fisheries Resources Agency (KFRA), 2018

< Impacts of Marine Desertification >



How can we restore ocean health and reverse marine desertification?

Posco Triton Marine Forests

05 / 12

POSCO Spotlights the Potential of Steel Slag (2/2)

✓ Stability of Steel Slag

- Does not corrode or release toxins
- Proven to be safe for the environment and marine life

※ Studies conducted by government agencies have confirmed that steel slag meets marine ecosystem protection standards and heavy metal safety thresholds for marine applications

✓ Different Types of Triton Reef

	Type-A Triton	Type-T Triton	Steel-Combined Triton	Triton Block
Sample				
Size(m)	1.8 x 1.8 x 1.5	2.6 x 2.6 x 1.3	2.6 x 2.3 x 2.0	0.6 x 0.6 x 0.4
Weight (ton)	5.8	4.2	6.5	0.35

+



"3D Printing Technology"

* Utilization of Steel Slag, Oyster Shells, and Slag Cement (Ministry of Oceans and Fisheries, RIST)

	Pb	Cu	As	Hg	Cd	Cr6+	CN
Blast furnace slag	ND	ND	ND	ND	ND	ND	ND
Steel making slag	ND	ND	ND	ND	ND	ND	ND
Threshold	3	3	1.5	0.005	0.3	1.5	1

* ND (Not Detected)

Designing and deploying Triton reefs that ensure both environmental stability and ecological integrity

Posco Triton Marine Forests

04 / 12

POSCO Spotlights the Potential of Steel Slag (1/2)

✓ Characteristics of Ionized Iron in Seawater

- Provides favorable conditions for habitat, such as improving the photosynthetic efficiency of seaweeds and seagrasses.

* Paine, S. R., et al. (2022). Iron limitation of kelp growth may prevent ocean afforestation. *Communications Biology*.
Jang, W., et al. (2022). Aspects of iron nutrition in macroalgae *Ulva pertusa* (Chlorophyta) under iron stress

✓ Application of By-Products from Steelmaking Process

- By-products of the steelmaking process are rich sources of iron
- Steel slag : rocky component after extracting iron from iron ore → Natural resources
- Utilization : construction, road paving, agriculture, and marine structures

✓ Triton Reef



- Made of 90% steel slag
- High mineral content including iron and calcium
- High durability and great specific gravity

"Triton is the name of POSCO's artificial reef brand made from steel slag"
- the concrete structure combining steelmaking slag aggregate and slag cement

Maximizing the value of steel slag and applying it as a sustainable cooperation model

Posco Triton Marine Forests

06 / 12

How POSCO Marine Forests Are Built



STEP 01
Cultivate algae on Triton reefs



STEP 02
Install on the seafloor



STEP 03
Settle & take root



STEP 04
Form an ecosystem

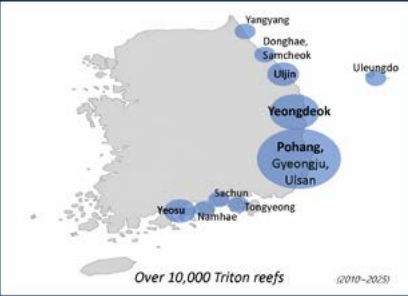
Posco Triton Marine Forests

07 / 12

From Triton Reefs to Sea Fertilizer

✓ Expanding Marine Forest Coverage

[Major Triton Marine Forests in Korea]



Over 10,000 Triton reefs (2010~2023)

✓ Development of Sea Fertilizer for Areas Where Artificial Reefs Are Difficult to Deploy

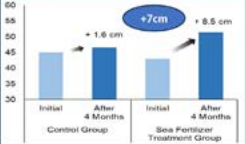
- Sea Fertilizer : a pelletized product using steel slag and chelating agents to promote seaweed restoration

- Application of Sea Fertilizer resulted in an average increase in seaweed length of +7 cm

[Sea Fertilizer]



[Changes in Ecklonia Cava Length According to sea Fertilizer]



Posco Triton Marine forests

08 / 12

Marine Forests Implementation Case Study : Pohang

✓ Establishment of Marine Forests at Pohang : 2023 and 2024

- Location : Cheongjin shore / Area : 4,000m²

Gupyeong and Mopo shore / 5,000m²

additional Marine Forest planned for Pohang

[Establishment of a Marine Forest in Cheongjin Shore]

Pre-Marine Forest Creation



Naturally Attached Seaweed



[Establishment of a Marine Forest in Gupyeong and Mopo Shore]

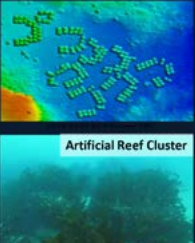
Pre-Marine Forest Creation



Growth of Seaweed



Artificial Reef Cluster



Posco Triton Marine Forests

09 / 12

Marine Forests Implementation Case Study : Ulleungdo

✓ Establishment of a Marine Forest at Ulleungdo in 2020

- Location : Namyang shore in Ulleungdo / Area : 4,000m²

[Design of Marine Forest]



[Status of Namyang Shore(2019)]



[Establishment of Marine Forest(2020)]



[Seaweed Detachment Following Typhoon(2020)]



[Status of the Marine Forest 9 Months after Installation(2021)]



[Seaweed Transplantation Process(2021)]



Posco Triton Marine Forests

10 / 12

Blue Carbon, A New Milestone for Marine Forest

✓ Blue Carbon in the international agenda

* Blue Carbon : Carbon absorbed by ecosystems, including coastal vegetation and sediments

- Growing international discussions on recognizing seaweed as a blue carbon sink are further elevating the value of Triton Marine Forests

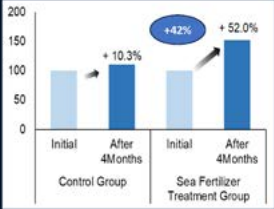
- Absorbs carbon up to 50 times faster than terrestrial ecosystems and stores it in sediments for extended periods

✓ Sea Fertilizer Pilot Result : Confirmed Enhancement of Blue Carbon Sequestration

[Blue Carbon Absorption Mechanism of Marine Forests]



[Variation in Carbon Content of Ecklonia Cava under Sea Fertilizer Treatment]



Posco Triton Marine Forests

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POSCO Marine Forests : A Globally Recognized Model for Community Partnership

Award-Winning Marine Forest Restoration with Steel Slag



Steelie Awards
Winner (2020, WSA*)



Featured in UN CBD
GPBB** Newsletter
(2025)



THE CORPORATE CITIZEN



Asia's First -
Environmental
Innovation Awards
Winner (2023, BCCCC**)

Continued Collaboration with Communities,
Government and More



WGGF- 2026 Posco Triton Marine Forests

Toward healthier oceans and a sustainable future,
POSCO will continue this journey – together.
Thank you.

Macroalgae and fish populating a deployed Triton site — photographed on Ulleungdo in Korea

PHOTO : POSCO NEWSROOM

패널 Panel

권태중 TAE JUNG KWON

포항시 기후대기과 기후대기과장
Deputy Director, Climate & Air Quality Division, Pohang City

주요경력

2020. 7.-2025. 6.

2025. 7.-현재

포항시 수소에너지산업과 산업생활에너지팀장

포항시 기후대기과장

Biography

2020. 7.-2025. 6.

2025. 7.-Present

Industrial&Residential Energy Team Leader, Hydrogen Energy Industry Division

Deputy Director, Climate & Air Quality Division, Pohang City



패널 Panel

김수정 Sujung Kim

포항 YWCA 사무총장
Secretary General, Pohang Young Women Christian Association

주요경력

- 2009. 8.-2012. 2. 포항YWCA 사회문제, 직업개발 간사
- 2012. 2.-2016. 9. 포항여성인력개발센터 프로그램 및 여성새로일하기센터 업무총괄 차장
- 2016. 9.-2017. 11. 포항YWCA 업무총괄 부장
- 2017. 12.-2024. 12. 포항여성인력개발센터 관장
- 2025. 1.-현재 사단법인 포항YWCA 사무총장

대외활동

- 경상북도 평생교육협의회 위원(현)
- 포항시 규제개혁위원회 위원(현)
- 포항시 노사민정 실무협의회 위원(현)
- 포항시 보육정책위원회 위원(현)
- 포항시지역사회보장협의체 여성가족분과 실무위원(현)
- 포항시 성별영향평가 위원회 위원(현)
- 포항시 성매매집결지 대책 지역협의체 위원(현)
- 포항남부경찰서 집회·시위 자문위원회 위원(현)
- 대구지방검찰청 포항지청 검찰시민위원회 위원(현)
- 포항고용복지+센터 운영위원(전)
- 포항시 청년일자리창출지원위원(전)
- 포항시 인구정책위원(전)
- 포항시 평생교육협의회 위원(전)
- 포항형 일자리 실무위원(전)

주요경력

- 2009. 8.-2012. 2. Pohang YWCA, Social Issues and Vocational Development Coordinator
- 2012. 2.-2016. 9. Pohang Women Resources Development Center, Deputy Director of Program Management and Women's New Work Center Operations
- 2016. 9.-2017. 11. Pohang YWCA, General Affairs Director
- 2017. 12.-2024. 12. Pohang Women Resources Development Center, Director
- 2025. 1.-Present Pohang YWCA, Secretary General

Biography

- Committee Member, Gyeongsangbuk-do Lifelong Education Council(Present)
- Committee Member, Pohang City Regulatory Reform Committee(Present)
- Committee Member, Pohang City Labor-Management-Government Practical Council(Present)
- Committee Member, Pohang City Childcare Policy Committee(Present)
- Working-Level Committee Member, Women and Family Division, Pohang City Community Security Council(Present)
- Committee Member, Pohang City Gender Impact Assessment Committee(Present)
- Committee Member, Pohang City Regional Council for Countermeasures Against Prostitution Districts(Present)
- Advisory Committee Member, Assembly and Demonstration Advisory Committee, Pohang Nambu Police Station(Present)
- Committee Member, Prosecutorial Citizen Committee, Pohang Branch of the Daegu District Prosecutors' Office(Present)
- Former Operating Committee Member, Pohang Employment Welfare+ Center
- Former Committee Member, Pohang City Youth Employment Creation Support Committee
- Former Committee Member, Pohang City Population Policy Committee
- Former Committee Member, Pohang City Lifelong Education Council
- Former Working-Level Committee Member, Pohang-type Job Creation Committee



패널 Panel

김옥경 Ok Kyung Kim

포항 YWCA 차장
Deputy Manager, Pohang Young Women Christian Association

주요경력

- 1991. 7.-1998. 4. ㈜애경피앤씨 영양사
- 2003. 12.-2008. 8. 프리벨가베문화센터 은물교사
- 2018. 5.-2018. 12. 포항시 농업기술센터 농업인교육지원
- 2019. 1.-2020. 12. 포항 YWCA 노인사회활동지원사업 전담
- 2021. 1.-2025. 12. 포항 YWCA 회계회계, 사업부사업부, 교육부 간사
- 2026. 1.-현재 사단법인 포항 YWCA 차장

Biography

- 1991. 7.-1998. 4. Aekyung P&C Co., Ltd. n utritionist
- 2003. 12.-2008. 8. Froebel Gaben Cultural Center , Gift Education Teacher
- 2018. 5.-2018. 12. Pohang Agricultural Technology Center, Agricultural Education Support Staff
- 2019. 1.-2020. 12. Pohang YWCA, Program Coordinator, Senior Social Activity Support Program
- 2021. 1.-2025. 12. Pohang YWCA, Administrative Officer(Finance, Program Management & Education Affairs)
- 2026. 1.-Present Pohang YWCA Deputy Manager

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GREEN GROWTH
FORUM 2026
2026 세계녹색성장포럼

세션 6. 이클레이 세션

Session 6. ICLEI Session

자연기반해법을 활용한 산업도시의 녹색전환

Green Transition of Industrial Cities through Nature-based Solutions

좌장 Moderator

손봉희 Bonghee Son
이클레이 한국사무소 부소장
Deputy Director, ICLEI Korea Office

도시 산업 유산의 탈탄소화: 선전 산업 단지 재생을 위한 친환경 해법

Decarbonizing Urban Industrial Heritage: Green Interventions to Renew the Industrial Zones in Shenzhen

레이산 꾸오 Leixian Guo
선전 도시계획설계연구소 기획국장
Chief Planning Director, Urban Planning & Design Institute of Shenzhen (UPDIS), China

숲길과 물길이 연결된 정원도시 포항

Garden City Pohang, Connected by a Green Network

정성진 Seong-jin Jeong
포항시 그린웨이 운영팀장
Greenway Project Operations Manager, Pohang City

자연기반해법을 활용한 녹색전환

Green Transition through Nature-based Solution

켈리 왕 Keli Wang
이클레이 동아시아본부 베이징사무소 선임 프로그램 담당관
Senior Program Officer, ICLEI East Asia Secretariat Beijing Office



좌장 Moderator

손봉희 Bonghee Son

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Deputy Director, ICLEI Korea Office

주요경력

- 2010-2012 이클레이 세계본부 국제회의 담당관
- 2012-2019 이클레이 동아시아본부 전략팀장
- 2019-2021 한-EU기후행동사업 (유럽연합 지원사업) 책임전문관
- 2022-현재 이클레이 한국사무소 부소장

Biography

- 2010-2012 ICLEI World Secretariat, Congress Assistant
- 2012-2019 ICLEI East Asia Secretariat, Strategy Manager
- 2019-2021 EU-Korea Climate Action Project (EU funded project) Key Expert
- 2022-Present ICLEI Korea Office, Deputy Director

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도시 산업 유산의 탈탄소화: 선전 산업 단지 재생을 위한 친환경 해법

Decarbonizing Urban Industrial Heritage: Green Interventions to Renew the Industrial Zones in Shenzhen

연사 Speaker

레이산 꾸오 Leixian Guo

선전 도시계획설계연구소 기획국장
Chief Planning Director, Urban Planning & Design Institute of Shenzhen (UPDIS), China

학력

- 2007-2011 중국 칭화대학교 건축학 학사과정
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주요경력

- 2018-2020 중국 선전시 도시계획설계연구원(UPDIS) 수석기획가
- 2021-2023 중국 UPDIS 부원장
- 2024-2025 중국 UPDIS 원장
- 2025-현재 중국 UPDIS 총괄기획책임자

Education

- 2007-2011 Tsinghua University, BArch student
- 2011-2018 Tsinghua University, PhD student in City and Rural Planning

Biography

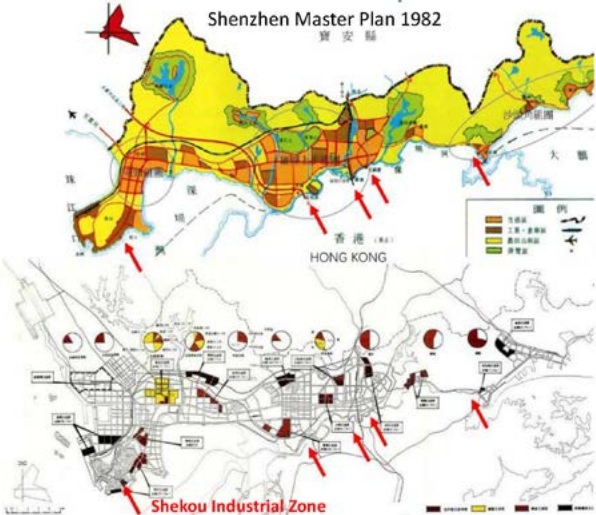
- 2018-2020 Urban Planning & Design Institute of Shenzhen (UPDIS), Principal Planner
- 2021-2023 Urban Planning & Design Institute of Shenzhen (UPDIS), Deputy Director
- 2024-2025 Urban Planning & Design Institute of Shenzhen (UPDIS), Director
- 2025-Present Urban Planning & Design Institute of Shenzhen (UPDIS), Chief Planning Director



Decarbonizing Urban Industrial Heritage: Green Interventions to Renew the Industrial Zones in Shenzhen

Guo Leixian
Urban Planning & Design Institute of Shenzhen
July 2026

Shenzhen has a history of just over 40 years, starting as a Special Economic Zone focused on processing trade in over 10 industrial zones



“Three-plus-one” trading mix

- Processing of imported materials
- Processing according to supplied samples
- Assembling of supplied parts
- Compensation Trade



Shekou Industrial Zone stands as the earliest example of this development, among those 10 industrial zones



In 1982, Shekou was under construction



Shekou Industrial Zone developed China's earliest post-reform industries including flour, glass, machinery, paint, and coastal tourism



After 15 years of renewal, Shekou has become a vibrant coastal district integrating R&D, culture, commerce, and eco-living, pioneering the shift from manufacturing to green innovation and setting a benchmark for Shenzhen's industrial renewal



Meanwhile, over the past 15 years, other industrial zones in Shenzhen, like Shekou, have undergone a process of urban renewal from points to areas

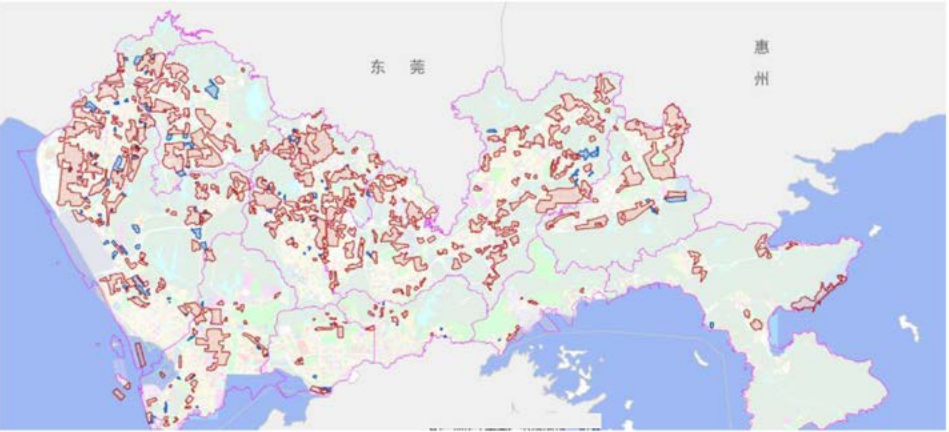


- Functionally, industrial zones for processing trade have been transformed into integrated urban districts combining R&D, office, consumption, culture, and short-term residence
- Regarding spatial transformation, green spaces and public facilities have been supplemented and historically valuable industrial relics preserved, while green development has been implemented in land redevelopment to require green buildings and sponge cities
- From the perspective of urban systems, industrial zone renewal is linked to Shenzhen's mountain-to-sea open space system to optimize the relationship between the city and nature



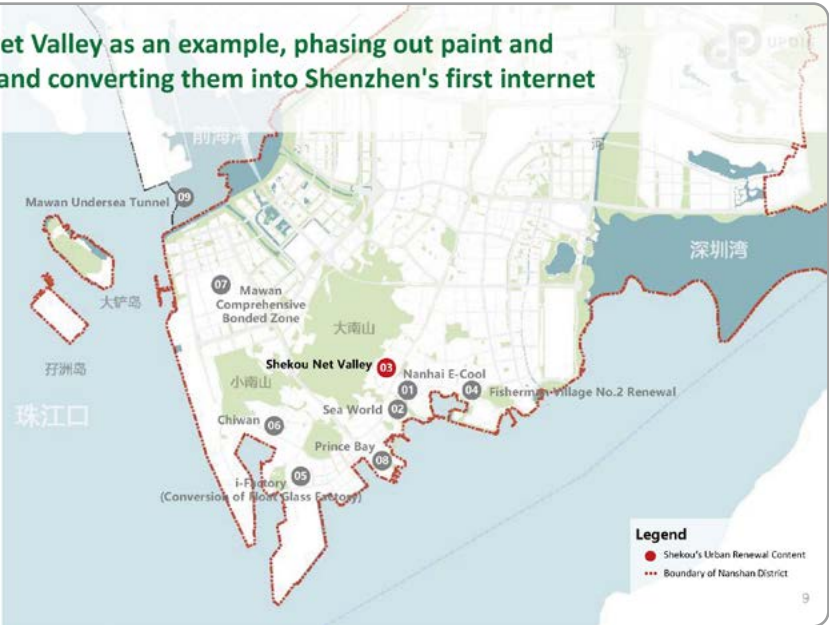
1. Formulating a systematic urban renewal plan

On one hand, preserving the "industrial block line" (280km²) to prevent market-driven urban renewal from displacing industrial production and ensuring sufficient space through strict land-use management



7

Taking the Shekou Net Valley as an example, phasing out paint and aluminum factories and converting them into Shenzhen's first internet industrial park



9

1. Formulating a systematic urban renewal plan

On the other hand, issuing macro policies and guidelines at the city level, while coordinating the location, scale, function, and renewal methods of industrial renewal units at the district level to transform industrial zones into key spatial carriers for green and smart economic transformation

Examples of Macro Policies and Regulatory Guidelines at the City Level

Municipal Urban Renewal and Land Consolidation Plan (2021-2025)



Coordinated Research on Industrial Renewal Units at the District Level

The Second Batch of the 2021 Urban Renewal Unit Plan for Bao'an District, Shenzhen

序号	单元名称	单元编号	单元面积 (公顷)	单元性质	备注
1	XX工业区块	XX-01	120	工业用地	XX工业区块
2	XX工业区块	XX-02	150	工业用地	XX工业区块
3	XX工业区块	XX-03	180	工业用地	XX工业区块

Schematic Map of the Demolition Scope for XX Industrial Park Urban Renewal Unit in Bao'an District



8

Shekou Industrial Zone redeveloped as Shekou Net Valley

History: Originally comprising old factory sites within Shekou Industrial Zone, primarily engaged in processing industries such as glass and foam manufacturing, including the Baoyao Factory, Huayi Aluminium Plant, and Haihong Paint Factory. The old factory district was in need of new opportunities for revitalisation.



10

Shekou Industrial Zone redeveloped as Shekou Net Valley



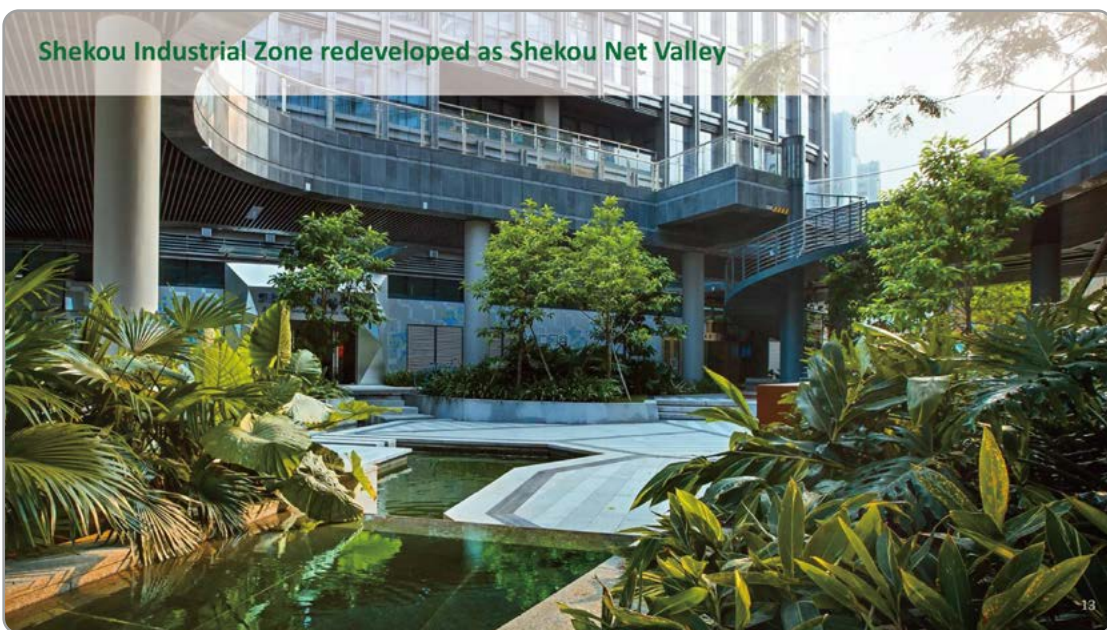
Area: land area of 170,000m² with a total floor area of 420,000m²
Project Positioning: An internet and e-commerce industrial base integrating high technology with cultural industries, serving as a hub for innovation
Function: IT, e-commerce, Internet of Things, and digital creative industrial park; talent apartments, catering facilities, and landscaped areas

Redevelopment: In May 2010, China Merchants Shekou and the Nanshan District Government of Shenzhen jointly launched the 'Shekou Net Valley – Internet and E-commerce Industrial Base', integrating high technology with cultural industries.



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Shekou Industrial Zone redeveloped as Shekou Net Valley



13

Shekou Industrial Zone redeveloped as Shekou Net Valley



1 Phased development of diversified innovation spaces



- The old factory buildings are demolished and rebuilt, undergoing renewal and transformation to upgrade into R&D office spaces
- Emerging industries are introduced and nurtured to achieve industrial upgrading in the ageing industrial zone
- Through phased development of diversified industrial innovation spaces, 22 buildings have been established

2 Developing a themed industrial park



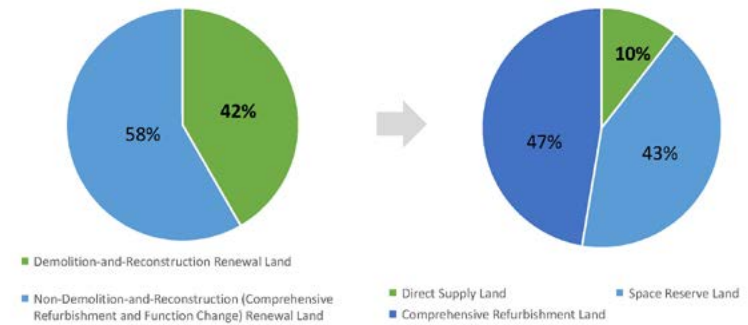
- A digital technology-themed park concentrating innovative industries such as software information, network communications, and digital creativity
- Core industry concentration exceeding 70%
- Featuring a clearly defined industrial positioning, a highly targeted industrial platform, a comprehensive supporting industrial infrastructure, and operational services

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2. Preserving existing buildings and structures as much as possible to improve reuse levels



Shifting the orientation from “Demolition and Reconstruction” to “Preservation, Transformation, and Refurbishment”, reducing demolition volume and assigning new functions to old buildings



Note: direct supply land refers to development and construction land granted through contracts via demolition-and-reconstruction urban renewal (excluding land transferred to storage), as well as land granted via land preparation (including reserved land, requisition-returned land, swapped land, resettlement housing land, etc.); space reserve land refers to land transferred to storage through urban renewal and land transferred to government management through land preparation (excluding reserved land, requisition-returned land, swapped land, resettlement housing land, etc.)

The Scales for Various Types of Urban Renewal Land in the 13th Five-Year Plan of Shenzhen

The Scales for Various Types of Urban Renewal Land in the 14th Five-Year Plan of Shenzhen

14

Transforming former industrial buildings into spaces for culture, exhibition, consumption, and office to create new landmarks for urban public activities in industrial zones



Float Glass Factory and Dacheng Flour Mill transform into cultural and creative areas through exhibitions



2015 The 6th Bi-City Biennale of Urbanism/Architecture (Shenzhen)
Theme: Urban Origin
Location: Former Dacheng Flour Mill and Warehouse No. 8



Float Glass Factory and Dacheng Flour Mill transform into cultural and creative areas through exhibitions

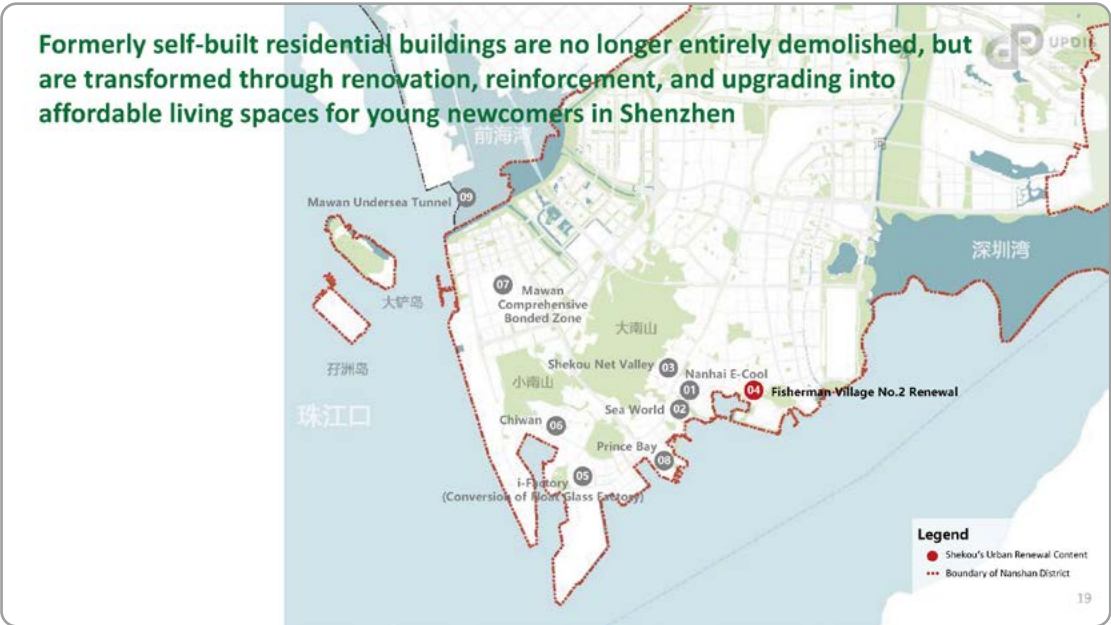


2013 The 5th Bi-City Biennale of Urbanism/Architecture (Shenzhen)
Theme: Urban Edge
Location: Former Float Glass Factory (Hall A: i-Factory) Shekou
Passenger Terminal Old Warehouse (Hall B: Document Repository)



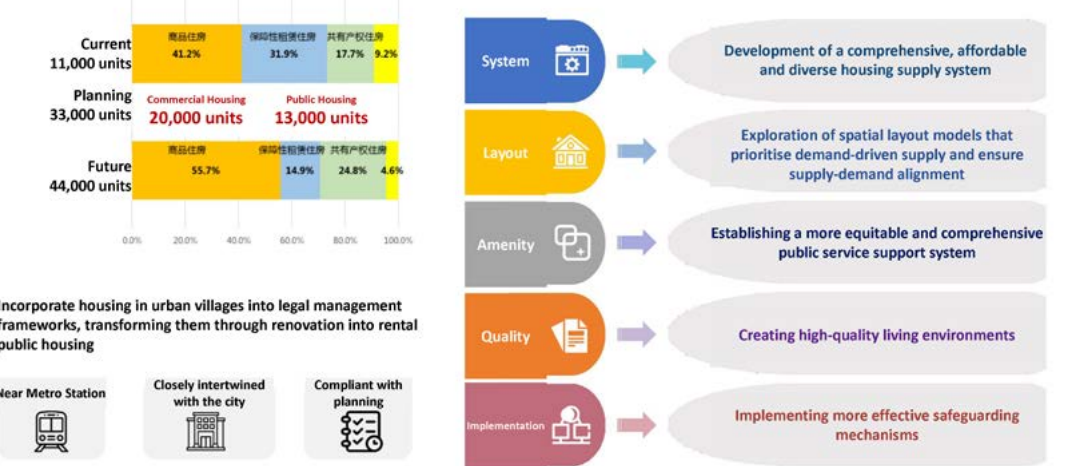
Other similar industrial zone renewal cases in Shenzhen





Fisherman Village No.2 Renewal

In addition to commercial housing, a certain proportion of public housing are reserved in urban renewal



Fisherman Village No.2 Renewal

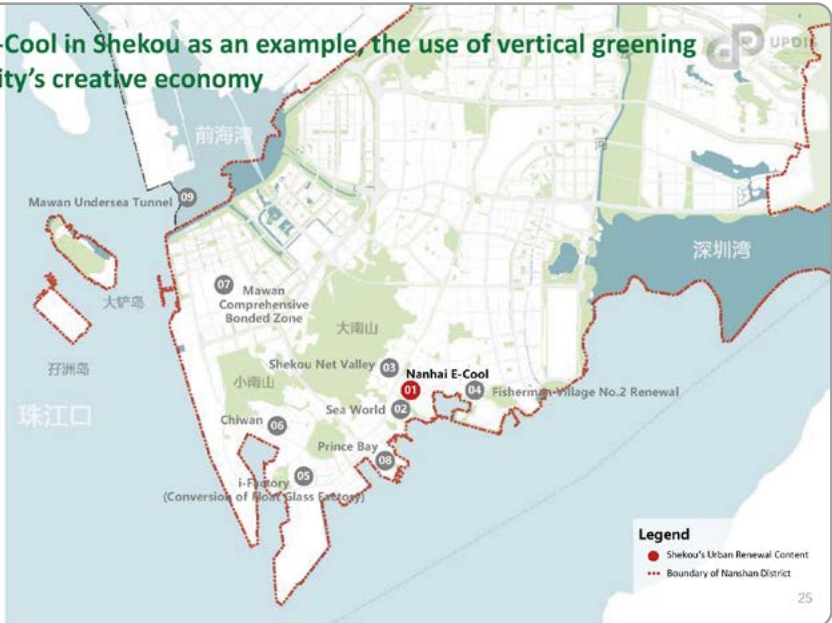


Fisherman Village No.2 Renewal

18-30m² apartment for young migrant citizens to settle in the city decently.

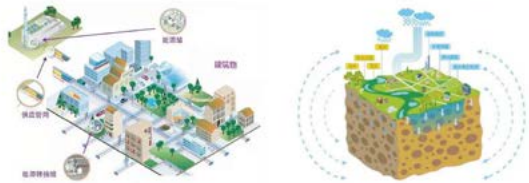


Taking the Nanhai E-Cool in Shekou as an example, the use of vertical greening has revitalized the city's creative economy

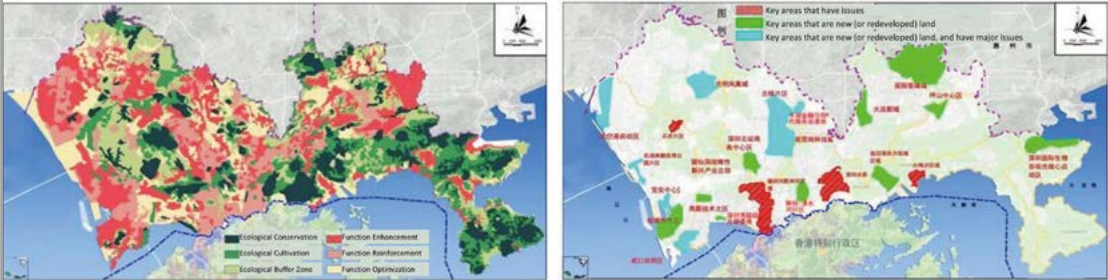


3. Widely practicing green buildings and eco-cities in urban renewal

Through legally binding guidelines in planning approval processes, it is required that green building standards be applied within urban renewal units, and requirements for sponge cities and new energy facilities be implemented

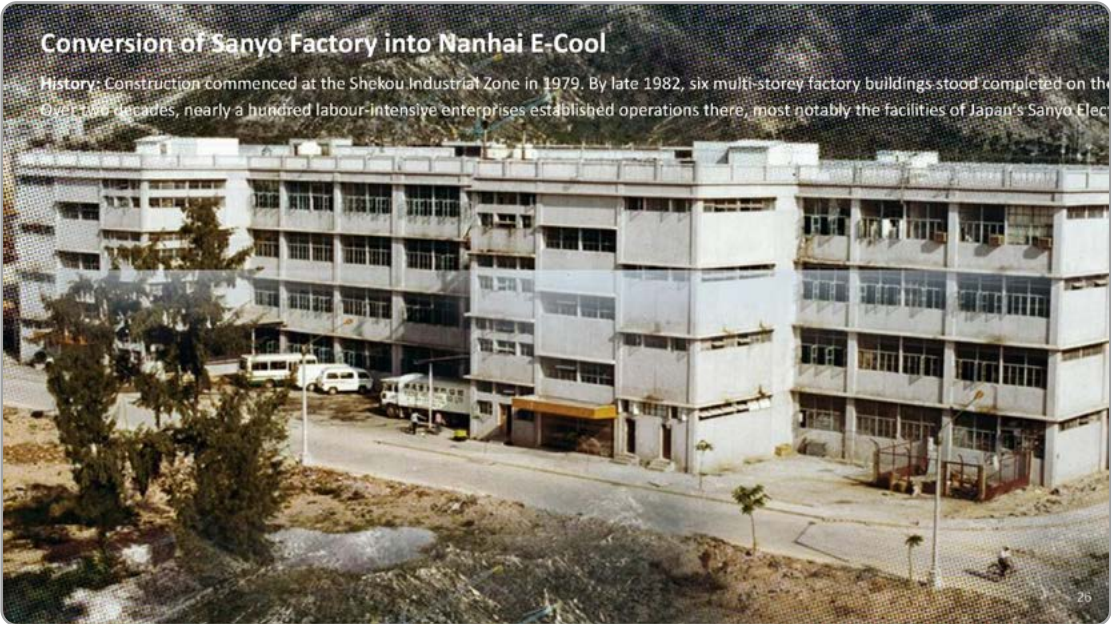


Specialized Plan and Implementation Scheme for Shenzhen's Sponge City Development



Conversion of Sanyo Factory into Nanhai E-Cool

History: Construction commenced at the Shekou Industrial Zone in 1979. By late 1982, six multi-storey factory buildings stood completed on the site. Over two decades, nearly a hundred labour-intensive enterprises established operations there, most notably the facilities of Japan's Sanyo Elec





Conversion of Sanyo Factory into Nanhai E-Cool



Green Technology
From Old Factory Buildings to Low-Carbon Industrial Parks



- The historical gravitas of industrial architecture merges with green technology
- While preserving iconic elements such as red brick walls and vintage trusses, extensive use is made of energy-saving techniques, renewable energy sources and ecological design
- A smart, green-oriented modern cultural and creative office space, cultivating a unique atmosphere where vintage charm and ecological sustainability converge

Diversified Business
Integration of Culture, Commerce, Tourism, and Creativity



- Focusing on the cultural industry. It creates a digital creative park that harmoniously blends a vibrant, everyday atmosphere with ecological sensibility and modernity.
- Industrial concentration exceeds 80%, with approximately 180 tenant enterprises.
- Regularly hosting cultural expos, creative markets, art exhibitions, industry salons, and wellness activities, we continuously showcase the achievements of the cultural and creative industries.

Conversion of Sanyo Factory into Nanhai E-Cool



Area: Site area of 44,000m² with a total floor area exceeding 110,000m²
Project Highlight: Shenzhen's sole dual demonstration project for both existing building renovation and renewable energy, setting a benchmark for the green transformation of industrial heritage sites
Function: A cultural and creative industry ecosystem centred on architectural design, industrial design, apparel, advertising and film production, and art galleries

Renovation: As industries evolved, the ageing factory buildings gradually proved inadequate for contemporary demands. In 2005, through comprehensive re-planning and redesign of the Sanyo premises, the entire complex underwent transformation while preserving the original structures and maximising existing functionalities. It was subsequently rebranded as Nanhai E-Cool



Conversion of Sanyo Factory into Nanhai E-Cool



Nanhai E-Cool Upgrading Strategies

- Renovation of building facades and business mix replacement for workshops
- Transformation of a garden to create public gathering spaces;
- Implement mixed-use roads, open north-south public corridors, and upgrade commercial offerings
- Upgrade Jinyuan Park to revitalise building functions on both sides and integrate with the park system;
- Establish clearly marked pedestrian routes connecting



4. Integrating urban renewal with the city-nature framework

Shenzhen’s “integrating the city with mountains and seas” initiative connects coastlines and mountain areas through a network of public spaces. These connections, together with industrial renewal projects, have produced a rich mix of urban spaces and improved the accessibility and vitality of the city’s natural systems.



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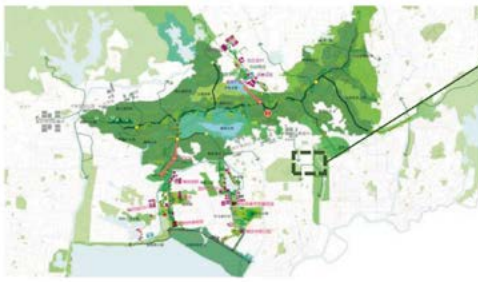
Conversion of Hitachi Factory into UpperHills

Area: Site area of 64,000m²; Total floor area of 105,000m²

Project Highlights:

- **Rooftop LOFT Town** – Open-air pedestrian street atop the mall, with colorful modular boxes. Acts as a central social hub bridging Lianhua & Bijia mountains
- **Two Park Connectors** – Two elevated skywalk (~300m each) linking directly to both parks, forming a seamless 1km skywalk from green to town to green

Function: Shopping center, apartment, hotel, office

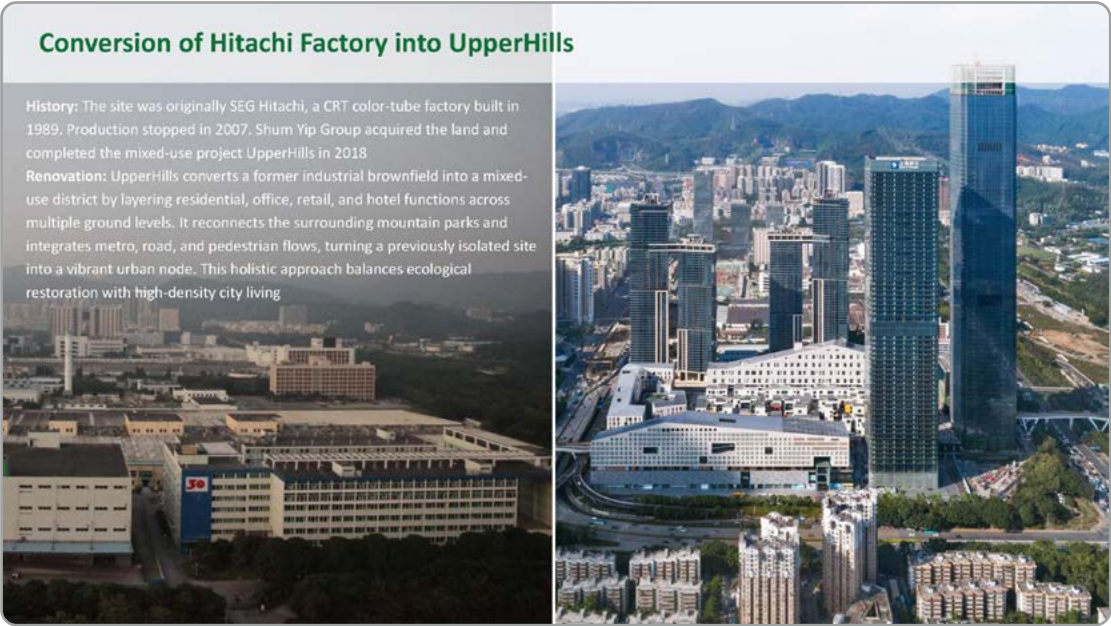


33

Conversion of Hitachi Factory into UpperHills

History: The site was originally SEG Hitachi, a CRT color-tube factory built in 1989. Production stopped in 2007. Shum Yip Group acquired the land and completed the mixed-use project UpperHills in 2018

Renovation: UpperHills converts a former industrial brownfield into a mixed-use district by layering residential, office, retail, and hotel functions across multiple ground levels. It reconnects the surrounding mountain parks and integrates metro, road, and pedestrian flows, turning a previously isolated site into a vibrant urban node. This holistic approach balances ecological restoration with high-density city living



Summary

Since 2012, strengthened national and municipal land-use controls and ecological protection policies have driven Shenzhen’s shift from outward expansion to urban renewal within its existing built-up area

US\$549M GDP per km² of built-up area

US\$759B / US\$174B Industrial output / industrial value added

No. 1 among Chinese mainland cities

404,900 / 19,660 Valid invention patents / PCT patent applications

No. 1 among Chinese cities

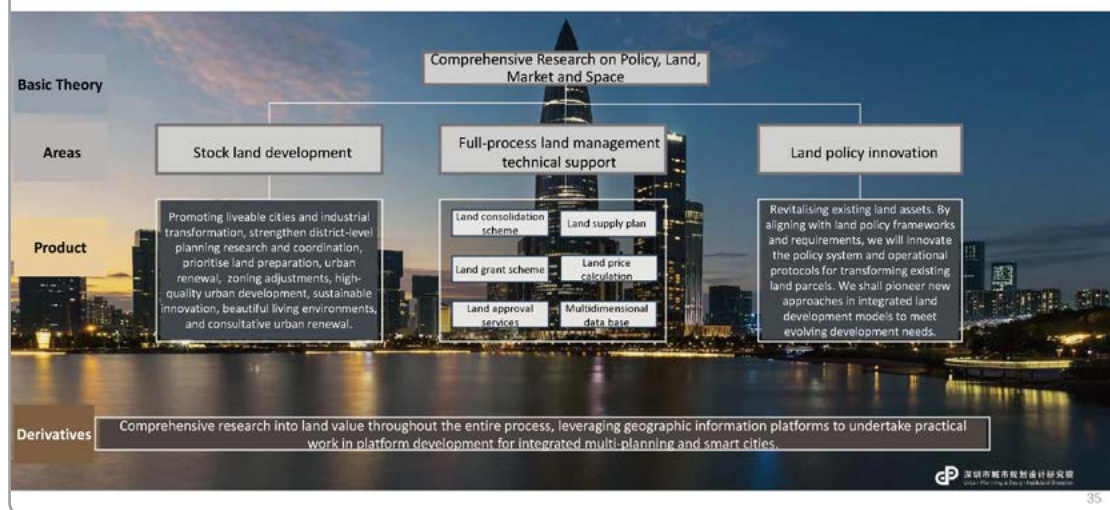
<0.20 tCO₂ per RMB 10,000 of GDP carbon intensity in 2022
1/5 of China’s average

16.8 µg/m³ Annual average PM2.5 concentration in 2025
Among China’s cleanest megacities

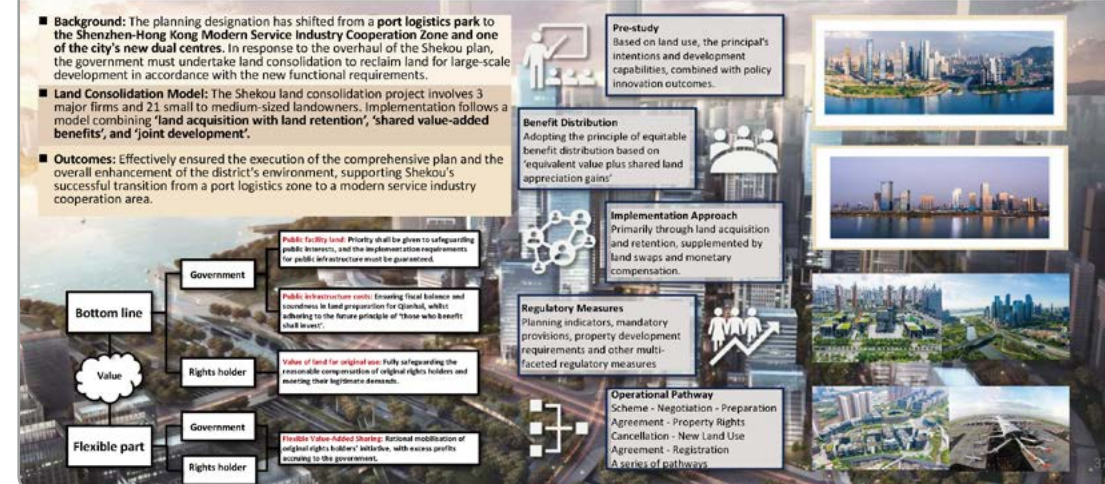
Green industrial renewal has been a key driver of Shenzhen’s high-output, lower-carbon urban development model, with key points in the following pages:

34

The government plays a systematic leadership role through planning, programs, policies, and project approval



Meanwhile, the government creates room for market initiative across planning, development and construction, making building retention and green development profitable



The government adopts land-use controls to ensure that sufficient land is available for green development and the public interest during urban renewal



More importantly, escalating environmental and climate challenges demand ongoing responses from all stakeholders

Hotter summers, wetter conditions, and more extreme tropical storms...





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숲길과 물길이 연결된 정원도시 포항
Garden City Pohang, Connected by a Green Network

연사 Speaker

정성진 Seong-jin Jeong

포항시 그린웨이 운영팀장
Greenway Project Operations Manager, Pohang City

학력

- 2011-2015 중국 서남대학교 도시계획학 학사
- 2017-2018 미국 컬럼비아대학교 건축-도시설계학 석사과정

주요경력

- 2019-2021 AECOM 도시설계 전문가
- 2021-2023 AEDAS 도시설계 전문가
- 2023-2025 중국 산둥대학교 주권차관 컨설턴트
- 2025-현재 ICLEI 동아시아사무국 베이징사무소 선임 프로그램 담당관

Education

- 2011-2015 Southwest University, Bachelor of Urban Planning
- 2017-2018 Columbia University, Master Student in Architecture and Urban Design

Biography

- 2019-2021 AECOM, Urban Designer
- 2021-2023 AEDAS, Urban Designer
- 2023-2025 Shandong University, Sovereign Loan Consultant
- 2025-Present ICLEI EAS Beijing Office, Senior Program Officer





사람중심 걷는 문화 정착

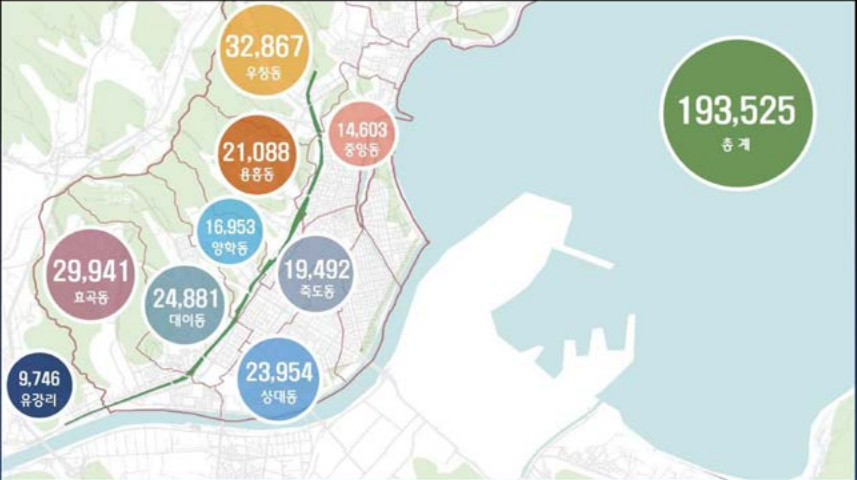
The establishment of a civil walking culture



철길숲을 걷는 시민들
Citizens Walking in the Forail

철길숲 배후인구

The population around Forail



철길숲 도보권에 9개동 위치 There are 9 villages within walking distance of Forail
도보 15분 거리에 193,000명 거주, 포항시민의 39.3%
193,000 people live within a 15-minute walk from Forail, 39.3% of Pohang citizens

철길숲 이용자 현황

Number of Forail users

Weekday
26,833
People

Holiday
31,476
People

5.4% ~ 6.3% of Pohang City's Population

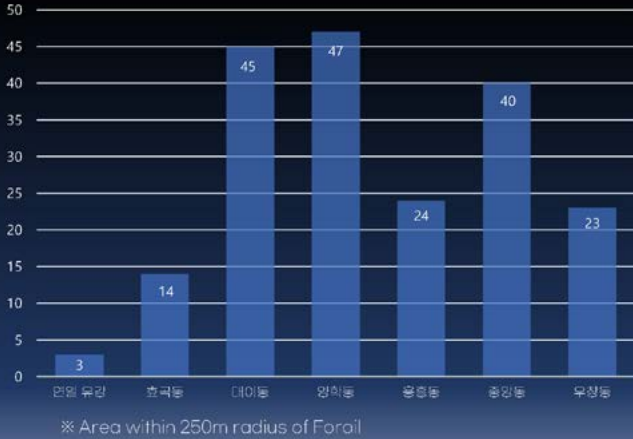
지역경제 활성화 및 도시재생 촉진

Revitalizing local economy
and promoting urban regeneration

도시재생 촉진

Urban regeneration

Building
196_{Case}



지역경제 활성화

Revitalization of
local economy



철길숲 주변 상가 연간 매출액 4,347억원
Annual sales of commercial facilities around Forail : 311 million USD/2022

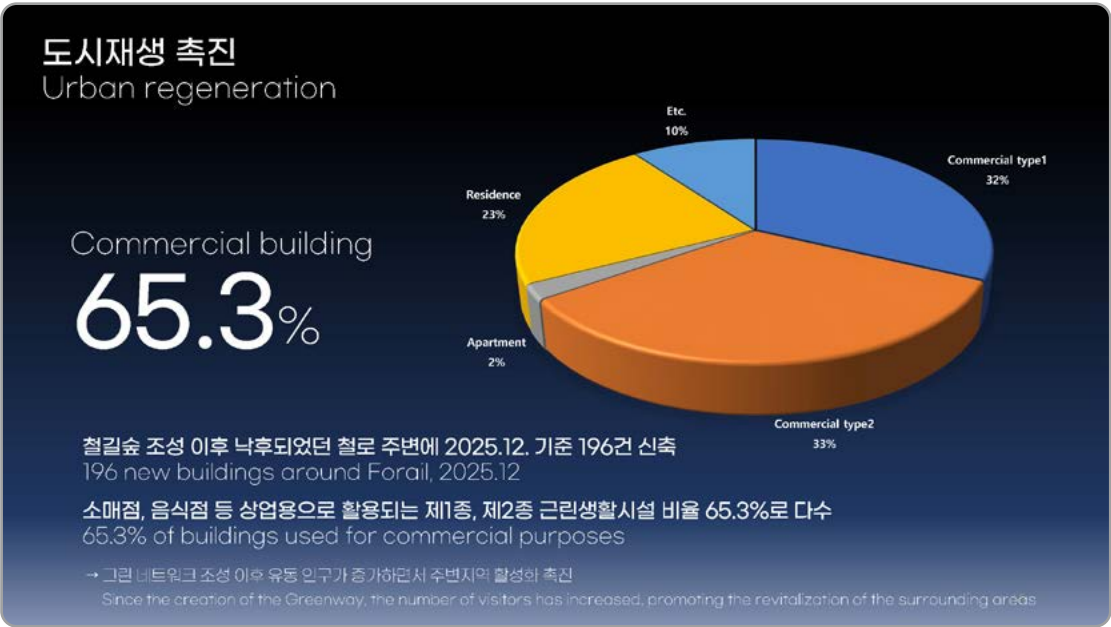
총사업비 430억원의 10배 이상의 경제효과 발생
More than 10 times the economic effect of the total project cost(31 million USD)

도시재생 촉진

Urban regeneration

Building
196_{Case}





정원도시 비전 2030

Garden City Vision 2030

전략 01. Strategy

숲길과 물길이 이어지는
Green Network

Green Network
Which Link Park and
Waterfront

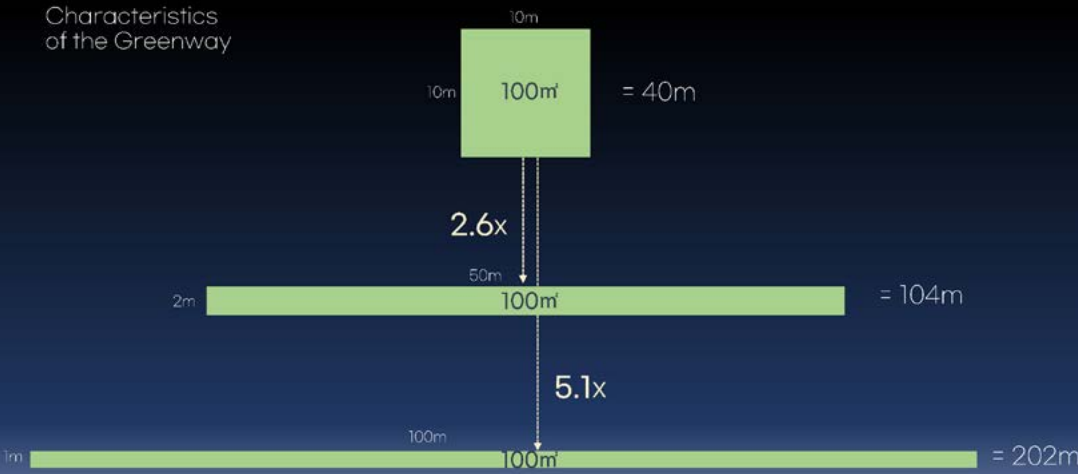


Garden City Vision 2030

3대 전략

- 01. 숲길과 물길이 이어지는
Green Network
- 02. 도보로 일상을 즐기는 사람 중심
Compact City
- 03. 기후위기 대응을 위한
도시 회복력 확보

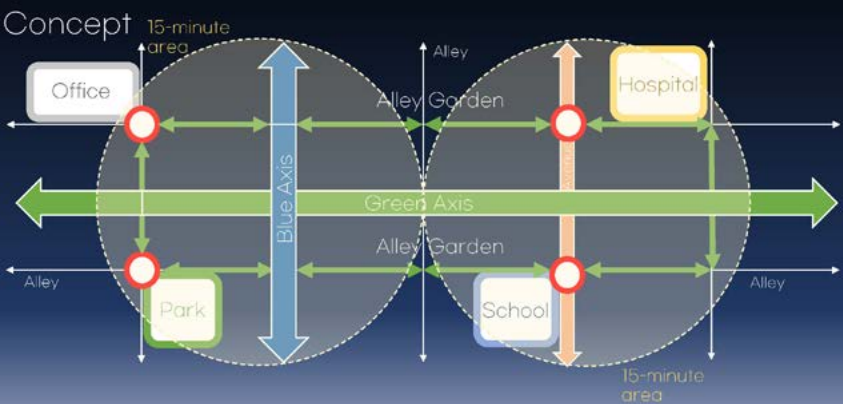
선형녹지의 특징 Characteristics of the Greenway



15 Minutes City

Strategy 02. Compact City Where the Citizens Walk and Enjoy Lives

정원도시에서 즐기는 일상 **쾌적하고 편리한 15분 도시**
A pleasant and convenient 15-minute city



Strategy 02. Compact City Where the Citizens Walk and Enjoy Lives

정원도시에서 즐기는 일상 **쾌적하고 편리한 15분 도시**
A pleasant and convenient 15-minute city



도시기능 재배치
Relocation of Urban Functions
일상, 상업, 의료, 교육, 여가, 등을 도보권
에서 해결할 수 있도록 구성

도시계획의 관점과 기준 전환
Transition of Urban Planning
Viewpoint and Standards
시설과 공간중심에서 시민의 일상과 시간중심
으로 전환
도보, 자전거 이용, 공원 등 녹지공간 확보를
통해 탄소저감 및 친환경 녹색도시 조성

Strategy 02. Compact City Where the Citizens Walk and Enjoy Lives

정원도시에서 즐기는 일상 **쾌적하고 편리한 15분 도시**
A pleasant and convenient 15-minute city



전략 03.
Strategy

기후위기 대응을 위한
도시회복력 확보

Securing Resilience
in Response to the
Climate Crisis

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Strategy 03. Securing Resilience in Response to the Climate Crisis

그린인프라 조성을 통한 **기후변화 대응력 증진**
Increasing climate change responsiveness



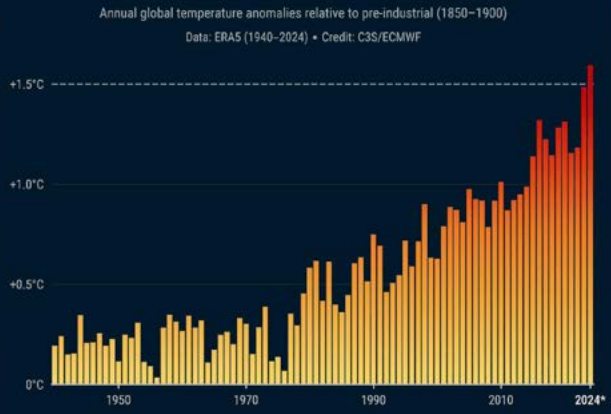
도시열섬현상 완화
3~7°C lower
Alleviator for
Urban Heat Island

습도조절
9~23% increase
Atmospheric
Humidity Control

미세먼지 흡수
47 trees = 1680g
Fine dust absorption
Annual fine dust generation 2 diesel vehicle

2024 on track to be **warmest year**
and first **above 1.5°C**

Annual global temperature anomalies relative to pre-industrial (1850–1900)
Data: ERA5 (1940–2024) • Credit: C3S/ECMWF



* Provisional estimate for 2024 based on 10 months (January to October)



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도시숲 조성에 의한 탄소흡수원 확보

Creating Carbon Absorbers
with the Construction of Urban Forest

33

Strategy 03. Securing Resilience in Response to the Climate Crisis

6Parks

ETS(Emissions Trading Scheme)
off-site projects Registration

- 국가 온실가스 총배출량 목표를 지키기 위해 국가는 배출기업체에 연간 배출량 할당
- 배출기업체간 초과분과 부족분에 대해 거래를 허용하는 시장기반 온실가스 감축제도

Yonil Park
9tons(co2)/1y

Forail
40tons(co2)/1y

Haedo Park
26tons(co2)/1y

Baseball Park
6tons(co2)/1y

Bukku Office Park
5tons(co2)/1y

Culture Forest
8tons(co2)/1y

Strategy 03. Securing Resilience in Response to the Climate Crisis

녹지조성을 통한 재해대응능력 확보

Ensuring disaster response capabilities through green space

도심내 투수면 확보
Securing water absorption areas

재해발생시 대피공간으로 활용
Use as an emergency evacuation space

Strategy 03. Securing Resilience in Response to the Climate Crisis

Creating Carbon Absorbers
with the Construction of Urban Forest

Now(2025)

2,032,107m²
285 Equivalent to Football Pitches
94 CO₂ tons

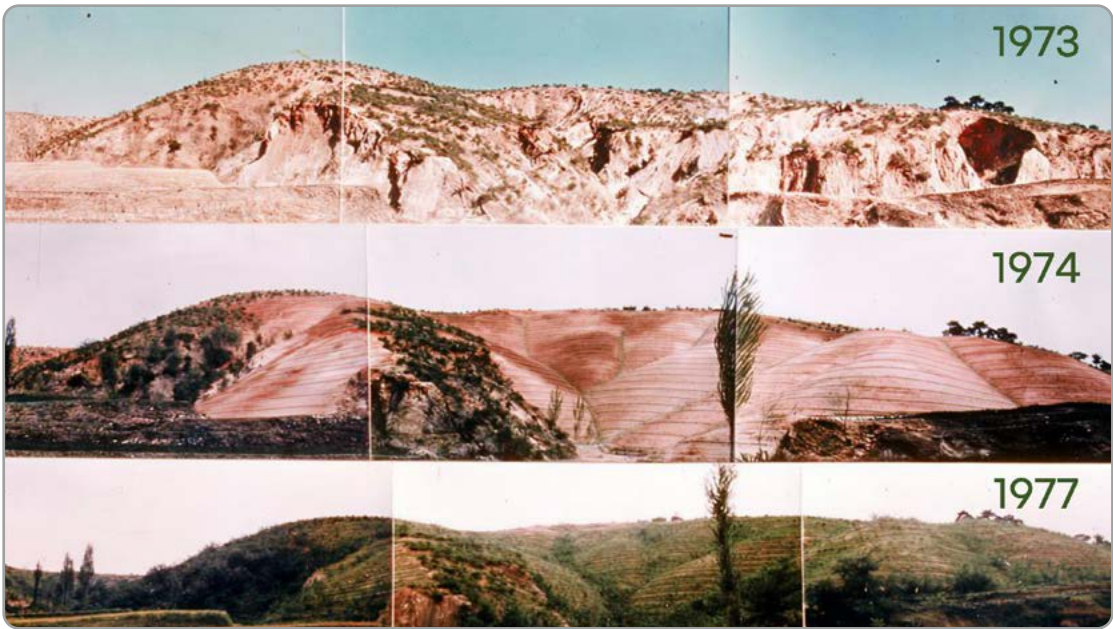
New 3 millionm² of Park will be created

Vision(2030)

5,038,689m²
705 Equivalent to Football Pitches
2,520 CO₂ tons
Greenhouse gas absorption /Year(Presumptive)

녹색전환을 위한 포항시의 저력

Pohang City's Power for Green Transformation





WORLD GREEN GROWTH FORUM 2026

2026 세계녹색성장포럼





자연기반해법을 활용한 녹색전환
Green Transition through Nature-based Solution

연사 Speaker

켈리 왕 Keli Wang

이클레이 동아시아본부 베이징사무소 선임 프로그램 담당관
Senior Program Officer, ICLEI East Asia Secretariat Beijing Office

학력

- 2011-2015 중국 서남대학교 도시계획학 학사
- 2017-2018 미국 컬럼비아대학교 건축-도시설계학 석사과정

주요경력

- 2019-2021 AECOM 도시설계 전문가
- 2021-2023 AEDAS 도시설계 전문가
- 2023-2025 중국 산둥대학교 주권차관 컨설턴트
- 2025-현재 ICLEI 동아시아사무국 베이징사무소 선임 프로그램 담당관

Education

- 2011-2015 Southwest University, Bachelor of Urban Planning
- 2017-2018 Columbia University, Master Student in Architecture and Urban Design

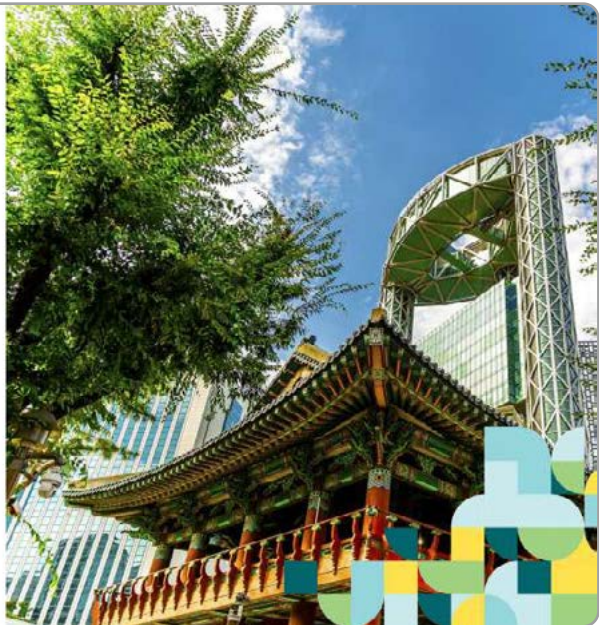
Biography

- 2019-2021 AECOM, Urban Designer
- 2021-2023 AEDAS, Urban Designer
- 2023-2025 Shandong University, Sovereign Loan Consultant
- 2025-Present ICLEI EAS Beijing Office, Senior Program Officer



基于自然的解决方案
助力工业城市绿色转型
Green Urban Transition through
Nature-based Solutions

宜可城北京办公室高级项目官员 王科力
Keli Wang
Senior Program Officer, ICLEI Beijing Office



通过地方行动推动全球可持续发展
Global Sustainable Development through Local Actions

在联合国支持下成立的宜可城—地方可持续发展协会，是由全球2,500多个地方政府共同组成的合作组织，旨在推动城市和地区可持续发展。宜可城的会员遍布超过125个国家，积极倡议制定可持续发展相关政策，并在地方层级推动迈向低碳、基于自然、公平、韧性和循环的发展行动。

ICLEI—Local Governments for Sustainability is a global network of more than 2,500 local and regional governments committed to sustainable urban development. Active in 125+ countries, we influence sustainability policy and drive local action for **low emission, nature-based, equitable, resilient and circular development**.



宜可城地方领导们携手推进全球可持续发展
ICLEI Global Leaders stand ready to drive Sustainable Urban Development Worldwide
2019.09-19-22 | Montreal, Canada | 加拿大蒙特利尔

宜可城五大发展路径
The Five ICLEI Pathways to Sustainability

宜可城的五大发展路径，旨在创造系统性变革。此框架可引导设计出有助于人与城市和自然环境和谐共生的综合性解决方案，并在充分考量城市系统复杂性的基础上，迈向可持续发展。

The Five ICLEI Pathways are designed to create systemic change. The pathways are a framework for designing integrated solutions that balance the patterns of human life and the built and natural environments.



城市的重要地位
Cities on the Globe



全球面临三大危机：
气候变化、生物多样性破坏及环境污染
Three Challenges: Climate Change, Biodiversity Loss and Environment Pollution



城市发展趋势：减速增长阶段，预计2050年城市人口占2/3
Urban Development Trend: Entering a Phase of Decelerating Growth, with Urban Population Projected to Account for Two-thirds of the Global Total by 2050



三大危机的影响，在高强度的工业活动中被叠加放大

The Impact of the Three Major Crises as Been Compounded and Amplified Amid the Intense Industrial Activities

高强度排碳

High-Intensity Carbon Emissions

2011-2020年，天津工业年均碳排放占全市总排放量的67.83%

From 2011 to 2020, Tianjin's industrial carbon emissions accounted for 67.83% of the city's total annual average.

持续性蓄热

Heat Accumulation

1990-2017年东北工业城市热岛强度年均增幅为非工业城市的2.7倍

From 1990 to 2017, the annual average increase in urban heat island intensity in Northeast China's industrial cities was 2.7 times that of non-industrial cities

栖息地破坏

Habitat Destruction

印度恩诺尔沿海燃煤电厂，重工业厂区侵占原生红树林滩涂，废水外泄，污染淤积

Ennore India, coal plants and heavy factories encroach on mangrove flats, with wastewater pollution and siltation

水土污染

Water And Soil Pollution

巴西库巴唐河流沉积物Hg是非工业区域的84倍，重度污染土壤占比86%，是非工业区的8倍

Cubatão, Brazil: river sediment Hg 84x non-industrial levels, heavily polluted soil 86% (8x non-industrial)

绿色转型-借助自然的力量

Green Transformation – Leveraging the Power of Nature

基于自然的解决方案 NbS

"Through the conservation, restoration, and sustainable management of natural and modified ecosystems, we can effectively and adaptively address societal challenges—including climate change, food security, and disaster risk reduction—while providing benefits for human well-being and biodiversity, and achieving harmony between people and nature."

—European Commission



泰国曼谷本嘉琦公园，是通过基于自然的解决方案，来治理和改造烟草工厂的案例
Benjakitti Park in Bangkok, Thailand, represents a prominent example of applying nature-based solutions to remediate and repurpose a former tobacco factory site

工业城市的危机与转型挑战

The Crises and Transition Challenges for Industrial Cities



资源枯竭 发展根基崩塌

Resource Depletion

城市发展高度依赖资源，而经过长期高强度粗放式开采，逐步枯竭，资源红利彻底消退
High-intensity resource extraction has led to the depletion of development dividends.



经济衰退 增长动能断层

Economy Recession

依托资源与重工业的单一经济模式抗风险能力极差，极易引发系统性经济下滑
Heavy-industry-dependent economies lack the capacity to withstand shocks.



生态破坏 环境治理难度大

Ecology Degradation

长期粗放式工业生产与资源开采，造成不可逆的生态环境损伤，成为转型的刚性约束
Resource exploitation has led to serious ecology degradation.



民生问题 加剧社会不公平

Society Injustice

产业衰退与城市衰败直接引发一系列民生与社会治理难题，如贫民窟、结构性失业等
Urban decay has triggered a series of livelihood and governance challenges.

NbS的核心优势及原则

Core Advantages and Principles of NbS

Core Advantages of NbS:



A Highly Cost-effective Response

More cost-effective than grey infrastructure, while delivering long-term, sustainable returns.



Key Levers For Climate Action

NbS have the potential to contribute about one-third of the emissions reductions.



An Engine For Biodiversity Conservation

NbS require that actions deliver a net gain for biodiversity.



A win-win for socio-economy and communities

The project fully respects local communities and indigenous peoples throughout its design, implementation, and management, enhancing community well-being and ensuring social justice

Eight Principles of NbS:

- 1、明确社会挑战 / Identify social challenges**
项目需清晰地定义所要解决的具体社会问题（如气候变化、粮食安全等）
- 2、按照尺度设计 / Design To Scale**
解决方案的设计需在适当的空间尺度和时间框架内有效运作，而非仅局限于小范围
- 3、确保环境可持续 / Ensure Environmental Sustainability**
项目必须带来生物多样性的净增长，并维护生态系统的完整性与健康
- 4、确保经济可行性 / Ensure Economic Viability**
证明NbS项目在经济上是可行的，其成本效益需优于或等同于传统方案
- 5、确保社会公平 / Ensure Social Equity**
项目需保障人权，促进性别平等与社会公正，过程透明且广泛参与
- 6、平衡长短期利益 / Balance Short- And Long-term Benefits**
需识别并平衡短期与长期效益之间、以及不同利益相关方需求之间的潜在权衡
- 7、适应性管理 / Adaptive Management**
项目需具备灵活性，能够根据监测结果和新信息进行学习和调整
- 8、主流化融入 / Mainstreaming**
需将NbS整合到更广泛的政策和决策过程中，而非作为孤立项目存在

NbS协同应对工业城市的危机

NbS as Synergistic Responses to Industrial City Crises

TYPICAL PROBLEMS FOR INDUSTRIAL CITIES	EFFECTIVENESS OF ENGINEERING MEASURES	THE SYNERGISTIC EFFECTIVENESS OF NBS
High Carbon Emissions / Heat Island Effect	Point-source capture is highly efficient, yet it is energy-intensive and extremely costly.	Urban forests, vertical greening, and wetland restoration can create long-term carbon sinks, absorb pollutants, and reduce temperatures—but they require sufficient scale and long-term maintenance.
Water & Soil Pollution	Methods such as incineration, landfilling, and chemical oxidation-reduction are extremely costly, damage soil structure, and generate secondary waste.	Phytoremediation, degradation, and wetland filtration are low-cost, restore soil ecological functions, and enhance carbon sinks—but require a long remediation timeframe.
Habitat Loss & Biodiversity Decline	Establishing isolated nature reserves, zoos, ex situ conservation, and gene banks cannot restore fragmented habitats.	Building ecological corridors and restoring native plant communities can deliver net biodiversity gains, but require large spatial scales and long-term management.
Urban Flooding	Expanding drainage pipes, using pumping stations, and hardening riverbanks may worsen downstream risks, incur extremely high costs, and damage ecosystems.	Permeable pavements, rain gardens, sunken greens, green roofs: retention, infiltration, slow release, groundwater recharge, pollution control, microclimate benefits—but vulnerable to extreme storms.

从“城市疮疤”到绿城名片——徐州采煤塌陷地和宕口生态修复

From "Urban Scars" to Green City Landmarks – Ecological Restoration of Coal Mining Subsidence Areas and Quarries in Xuzhou

应对措施/RESPONSE

- 1、完善政策体系 / POLICY REFINEMENT
- 2、探索多种模式 / MODEL DIVERSIFICATION
 - “生态修复+土地复垦利用”模式
 - “Ecological Restoration + Land Reclamation and Utilization” Model
 - “生态修复+建设用地改造”模式
 - “Ecological Restoration + Construction Land Redevelopment” Model
 - “生态修复+园林景观建设”模式
 - “Ecological Restoration + Landscape Architecture” Model
- 3、制定相关技术标准 / STANDARD SETTING



从“城市疮疤”到绿城名片——徐州采煤塌陷地和宕口生态修复

From "Urban Scars" to Green City Landmarks – Ecological Restoration of Coal Mining Subsidence Areas and Quarries in Xuzhou

城市挑战/CHALLENGES

徐州市作为全国老工业基地之一，随着长期的资源开采和矿业资源逐渐枯竭，累计形成采煤塌陷地42.33万亩和采石宕口400余处。Xuzhou, a national old industrial base, has accumulated 423,300 mu of coal subsidence land and 400+ abandoned quarries from long-term mining and resource depletion.



修复前 / Before



修复后 / After

一条河流的再生——石家庄滹沱河生态修复案例

The Revival of a River – The Ecological Restoration of the Hutuo River in Shijiazhuang

城市挑战/CHALLENGES

- Shijiazhuang sits on the edge of the North China Plain's groundwater "funnel zone," with per capita water resources of only 216 cubic meters. For years, the city has over-exploited groundwater to fuel its economic development.

应对措施/RESPONSE

- Around 2009, the Hutuo River began receiving water on a periodic basis.
- In 2019, the influx of water from the South-to-North Water Transfer Project made year-round ecological replenishment possible.
- By 2021, the river—which had been completely dry for over 40 years—was fully restored to flowing across its entire course. This revival not only allowed farmland along both banks to be restored to cultivation but also stimulated the growth of tourism and health and wellness projects in surrounding villages.



一条河流的再生—石家庄滹沱河生态修复案例

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工业城区重建 - 巴西阿雷格里港案例

Revitalizing an Industrial District – The Porto Alegre, Brazil, Story

项目直接受益人口超过 135,000人

The project directly benefits over 135,000 people

➤ 应对洪涝 / Addressing Flooding

- Significantly reduce the extent and duration of flooding in the central city.
- Protect approximately 35,000 residents living in high-risk flood zones

➤ 促进社会包容性与经济发展 / Improving Society Justice

- Provide improved housing conditions for at least 500 low-income households directly.
- Create short-term job opportunities and stimulate long-term investment and entrepreneurial activity.

➤ 提升城市绿色空间 / Improving Green Space

- Add and renovate over 20 hectares of public green space to improve the urban microclimate and mitigate the heat island effect.
- Enhance biodiversity and improve air quality.

➤ 加强机构与社区能力 / Strengthen institutional and community capacity

- Involve residents—especially vulnerable groups—throughout the entire process of project design, implementation, and monitoring
- Provide technical training for government officials on resilient urban planning, green infrastructure design, project management, and related topics

工业城区重建 - 巴西阿雷格里港案例

Revitalizing an Industrial District – The Porto Alegre, Brazil, Story

建设目标 / CONSTRUCTION GOALS

To transform Porto Alegre's historic but declining central district into a more climate-resilient, sustainable, and socially inclusive urban demonstration area.

融资方式 / FINANCING

World Bank loan: USD 84.55 million
French Development Agency (AFD): USD 56.37 million
Brazilian government: USD 35.23 million.

主要内容 / CONTENT

- Develop grey-green infrastructure
- Create new parks and green belts, and retrofit existing public spaces to increase vegetation cover
- Provide affordable housing for low-income families
- Enhance community inclusiveness



思考与建议

Suggestion

- 提升地方政府和社区居民对灾害风险、韧性（气候适应）和基于自然的解决方案（NbS）的理解和认识
- 将气候适应作为城市发展规划的关键目标和组成部分
- 开展脆弱性和风险评估，建立灾害早期预警系统，提升规划和实施能力
- 促进多利益相关方合作和多层级治理；政策应特别关注和保障弱势群体
- 构建政府财政资金和市场相结合的多元融资机制
- 与其他城市发展优先事项（例如生物多样性保护、经济增长与创造就业）建立协同效应
- 优先采纳基于自然的解决方案，并应用人工智能、区块链等新技术支持韧性行动的开展

- Enhance local governments and communities' understanding and awareness on disaster risks, resilience (climate adaptation) and Nature-based solutions
- Introduce resilience and climate adaptation as a key objective and component in urban development planning
- Carry out vulnerability and risk assessments, establish disaster early warning system and capacity
- Promote multistakeholder collaboration and multilevel governance; with special attention to vulnerable groups
- Establish diversified financing mechanisms that integrate public and private funding and resources
- Build synergy with other local priorities (e.g. biodiversity, economic growth, job creations etc.)
- Prioritize Nature-based Solutions and apply new technologies such as AI, blockchain etc. to support resilience actions

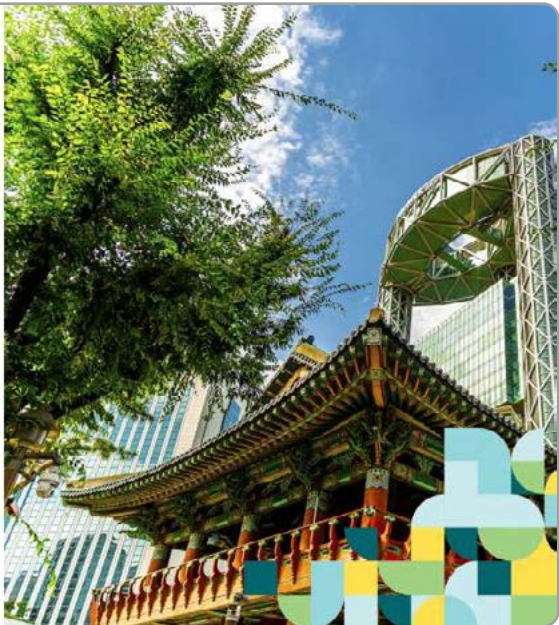


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Thanks for Your Attention

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WORLD
GREEN GROWTH
FORUM 2026
2026 세계녹색성장포럼

세션 7. 시민참여 토크콘서트

Session 7. Citizen Talk Concert

지구를 구하는 일상 속 실천
Daily Actions to Save the Planet

최재천 JAE CHUN CHOE
이화여자대학교 에코과학부 명예교수
Professor Emeritus, Division of EcoScience, Ewha Womans University

홍다경 Da Gyeong Hong
지구를 지키는 배움터 대표
CEO, Learning Center for the Earth



연사 Speaker

최재천 JAE CHUN CHOE

이화여자대학교 에코과학부 명예교수
Professor Emeritus, Division of EcoScience, Ewha Womans University

주요경력

- 1990-1992 하버드대 전임강사
- 1992-1994 미시건대 조교수
- 1992-1995 미시건 소사이어티 오브 펠로우즈 주니어 펠로우
- 1994-2006 서울대 생명과학부 교수
- 2006-2025 이화여대 에코과학부 석좌교수
- 2006-2008 한국생태학회 회장
- 2013-2016 국립생태원 초대 원장
- 2014-2016 세계생물다양성협약 의장
- 2016-2019 동물행동학 백과사전 총괄편집장
- 2018-2019 유엔기후변화협약 특별대사
- 2022-현재 과학기술종합대학원대학교 석학교수

Biography

- 1990-1992 Full-time Lecturer, Harvard University
- 1992-1994 Assistant Professor, University of Michigan
- 1992-1995 Junior Fellow, Michigan Society of Fellows
- 1994-2006 Professor, Seoul National University
- 2006-2025 Distinguished Chair Professor, Ewha Womans University
- 2006-2008 President, Ecological Society of Korea
- 2013-2016 Founding Director, National Institute of Ecology
- 2014-2016 President, Convention on Biological Diversity
- 2016-2019 Editor-in-Chief, Encyclopedia of Animal Behavior, Academic Press
- 2018-2019 Special Envoy, UN Framework Convention on Climate Change
- 2022-Present Scholar Professor, Seoul School of Integrated Sciences and Technologies



연사 Speaker

홍다경 Da Gyeong Hong

지구를 지키는 배움터 대표
CEO, Learning Center for the Earth

주요경력

- 2018. 1.-현재 현재 지구를 지키는 배움터 공동대표
- 2019. 4.-2023. 8. 지구시민연합 청년팀장
- 2023. 1.-2024. 12. 대통령직속 탄소중립녹색성장위원회 이행점검단
- 2024. 3. -2024. 11. 2030 기후클럽 운영사무국장
- 2024. 1.-2024. 12. 서울특별시 시민 에너지 기획단
- 2024. 9.-현재 숨탄것들 교육기획부장
- 2025. 1.-2026. 12. 기후에너지환경부 2,3기 자문단 생태분과장
- 2026. 1.-12. 카카오 Earth 크리에이터 1기
- 2026. 1.-12. 서울대공원 홍보대사

Biography

- 2018. 1.-Present Co-Representative, Learning Center for the Earth
- 2019. 4.-2023. 8. Youth Team Leader, Earth Citizens Organization (ECO)
- 2023. 1.-2024. 12. Member of the Implementation Review Committee, Presidential Commission on Carbon Neutrality and Green Growth
- 2024. 3. -2024. 11. Secretariat Director, 2030 Climate Club
- 2024. 1.-2024. 12. Member of the Citizen Energy Planning Team, Seoul Metropolitan Government
- 2024. 9.-Present Head of Education Planning, Sumtan-geotdeul (Living Creatures)
- 2025. 1.-2026. 12. Chair of the Ecology Subcommittee, 2nd & 3rd Advisory Council, Ministry of Climate, Energy and Environment
- 2025. 1.-12. 1st Cohort, Kakao Earth Creator
- 2026. 1.-12. Public Relations Ambassador, Seoul Grand Park

폐회식

Closing Ceremony

좌장 Moderator

최재철 Jai-chul Choi

기후변화센터 이사장

Chairperson, Climate Change Center



좌장 Moderator

최재철 Jai-chul Choi

기후변화센터 이사장
Chairperson, Climate Change Center

주요경력

2009-2012	주 모로코 대사
2012-2014	주 OECD 대사
2014-2016	외교부 기후변화대사 겸 파리협정 수석대표
2014-2019	국제박람회기구(BIE) 집행위원장
2016-2019	주 덴마크 대사
2019-2022	국립외교원 명예교수, 한국외교협회 이사
2020-2023	국제박람회기구(BIE) 총회 의장
2022-2024	주 프랑스 대사
2025-현재	재단법인 기후변화센터 이사장

Biography

2009-2012	Ambassador to Morocco
2012-2014	Ambassador to OECD
2014-2016	Climate Change Ambassador, MOFA and Chief Negotiator for the Paris Agreement
2014-2019	Chairman of the Executive Committee, BIE
2016-2019	Ambassador to Denmark
2019-2022	Honorary Professor at the Korea National Diplomatic Academy; Board Member, Korean Council on Foreign Relations
2020-2023	President of the General Assembly, BIE
2022-2024	Ambassador to France
2025-Present	Chairperson, Climate Change Center

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GREEN GROWTH
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2026 세계녹색성장포럼

