



PASS Training Workshop No. 2

ESG Transformation & Evolution: Driving Impactful Changes through Technology

AGENDA

09:00-12:15 (Break at 10:30-10:45)

- **Session 1:** Overview of the intersection between ESG and technology
- **Session 2:** Discussion of green technologies driving ESG transformation
- **Session 3:** Experience sharing: GreenTech in practice – connecting technology with environmental action

14:00-17:30 (Break at 15:30-15:45)

- **Session 4:** Exercises to identify ESG challenges within participants' organizations
- **Session 5:** Group activities to brainstorm technology-driven solutions for addressing ESG challenges
- **Session 6:** Guidance on aligning technology choices with organizational ESG goals



Ir Prof C.F. LAM

(林卓峯教授,工程師)

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Your ECOMATIC (Green-Committed-Pragmatic)
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PASS Training Workshop No. 2

ESG Transformation & Evolution: Driving Impactful Changes through Technology

INSTRUCTOR

Ir Prof Lam is a widely recognized professional civil and environmental engineer with extensive experience in managing a broad spectrum of infrastructure, sustainability and environmental management projects.

On professional service, he is a founding member of the organizing committee and judging panel of the Hong Kong Green Award, Hong Kong ESG Award, various environmental awards and competitions. Ir Prof Lam is a distinguished leader of prominent professional bodies including the Hong Kong Green Strategy Alliance, Hong Kong Institution of Engineers and Hong Kong Waste Management Association.

On academic front, he is the Adjunct Professor of The University of Hong Kong and part-time lecturer of HKUST teaching master courses on corporate environmental management and regulatory compliance, carbon neutral engineering, environmental impact assessment, ESG and green finance. He is also a sought-after expert witness for court proceedings, speaker and trainer on various environmental and management topics.



ESG & TECHNOLOGY

INTERSECTION OF ESG AND TECHNOLOGY

Leading a New Era of Green
Transformation

Speaker: Ir Prof CF LAM



The "Well-being" Narratives

Grouping ESG Efforts for Reporting

Built Environment
Cost & Resource Saving

Climate Change
Mitigation
Energy & Water

Climate Change
Adaptation &
Resilience

Public Health
Air Ventilation,
Humidity, Heat,
Noise, Diseases, Safety

Digital Living
Smart/Carbon/Money/
Shopping

Asset Enhancement
Green Tech
Green Finance

Evolution of ESG

Evolution of ESG

- CSR → ESG → ESG Transformation
- Increasing regulatory and investor pressure
- Shift from disclosure to performance

Why ESG Needs Technology

- Operational execution of ESG commitments
- Real-time measurement and verification
- Scalability and cost efficiency

Evolution of ESG

Technology as ESG Enabler

- Digital data platforms
- AI and advanced analytics
- IoT and automation
- Green and climate technologies

Future ESG Model

- Outcome-driven ESG
- Technology-enabled transparency
- Integration into core business strategy

How GreenTech Operationalises ESG Commitments



Environmental Pillar Impact

GreenTech reduces emissions and pollution through renewable energy, carbon capture, and circular materials.

Social Pillar Contributions

Technologies improve public health, create jobs, and support climate resilience via cleaner air and safer mobility.

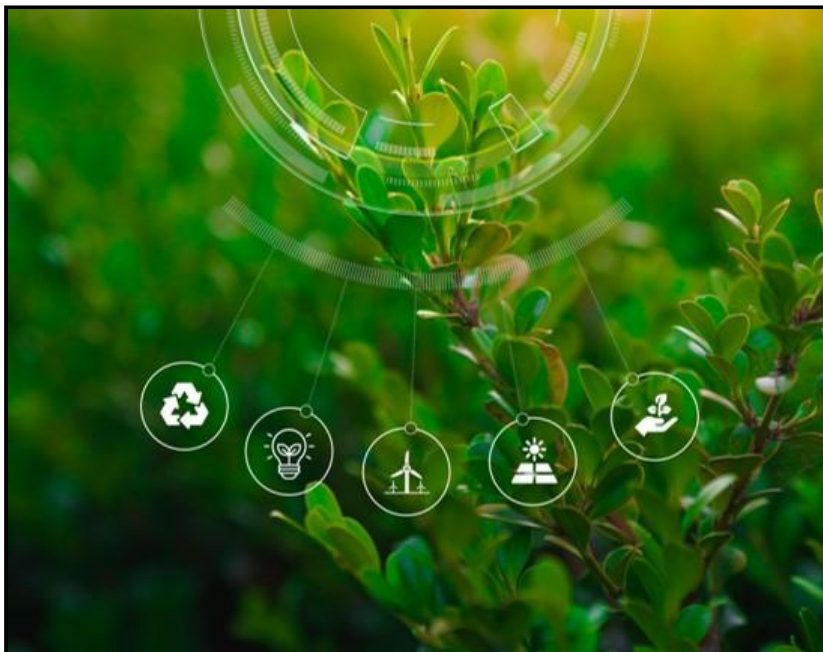
Governance Enhancements

Digital platforms enable accurate ESG reporting and accountability through robust data measurement and verification.

Addressing ESG Credibility

Carbon accounting software and sensor networks prevent greenwashing by providing verifiable ESG data.

Why ESG and GreenTech are Converging Now



Evolution of ESG Framework

ESG evolved from risk screening to a core factor in capital allocation and regulatory compliance.

GreenTech as ESG Execution

GreenTech provides scalable technologies essential for reducing emissions and achieving ESG goals.

Drivers Accelerating Convergence

Regulation, investor strategies, and climate risks drive ESG and GreenTech integration.

Hong Kong's Strategic Role

Hong Kong acts as a global financial hub enabling ESG adoption and GreenTech scaling across borders.

Global GreenTech Market Shifts and Asia's Rising Role

Shifting Global Investment

US GreenTech investment share declined from 76% to 49%, while China's share rose to over 22% by 2023.

Asia's Qualitative Leap

Asia transitions from early-stage GreenTech to large-scale deployment in renewable energy and smart infrastructure.

Hong Kong's Strategic Role

Hong Kong acts as a capital and professional services hub linking global investors to Asia's GreenTech growth.



Emerging ESG Models

Technology Central to ESG

- Real-time monitoring vs. annual snapshots
- Data automation (moving away from spreadsheets)
- Predictive modeling for climate risks
- Supply chain transparency (Scope 3)

Future ESG Models

- Outcome-driven ESG
- Technology-enabled transparency
- Integration into core business strategy



ESG x Technology Framework

Environmental:

IoT, AI, Digital Twins, Smart Grids

Social:

Workforce analytics, health & safety tech

Governance:

RegTech, Blockchain, ESG data platforms

From ESG Strategy to Digital Roadmap

ESG Tech Investment Matrix

- Evaluating options based on:
- Impact (Carbon reduction)
- Cost vs Savings
- Scalability across assets
- Data Availability

Future ESG Model

- Define Ambition
- Identify Material Issues
- Map Tech Enablers
- Prioritize Investments
- Measure ROI

GLOBAL GREEN TECH MARKET DIVERSIFICATION

Investment Trends & Geopolitics

Megadeals Surge: Since 2021, Megadeals (>US\$100M) have increased, showing confidence in commercial-scale green tech.

Geographic Shift: Global investment is moving from US concentration to diversification, with China leading in patents and unicorns.

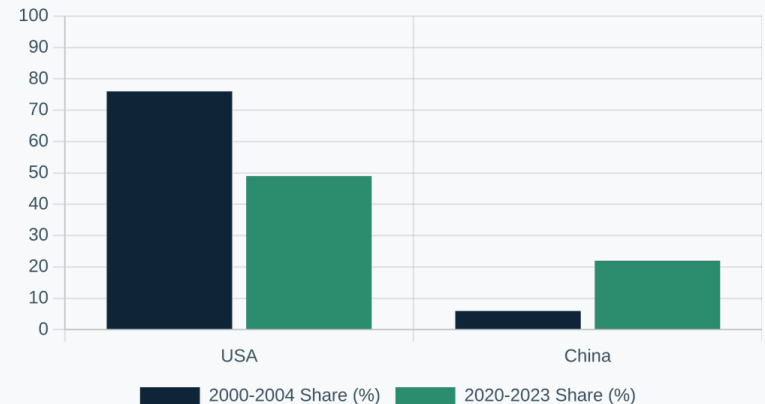
80

GLOBAL GREEN TECH UNICORNS

30%

CHINA'S UNICORN SHARE

Investment Share Change (2000 vs 2023)

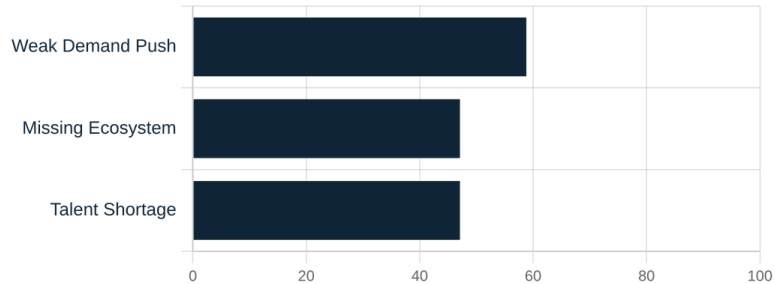


Source: InvestHK 2025 Report / Deloitte Analysis

CHALLENGES & SUCCESS FACTORS FOR ADOPTION

Main Challenges

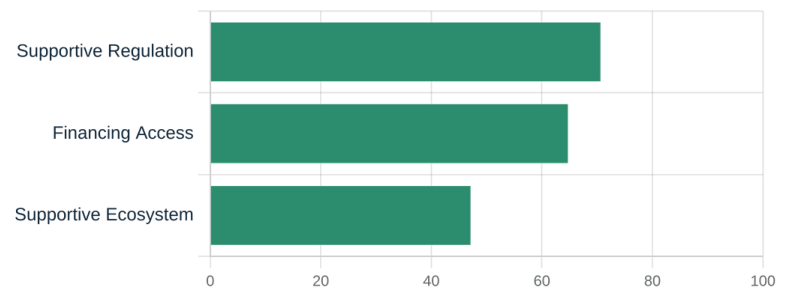
Top barriers from expert survey:



Core Pain Point: Weak demand-side push is a cross-sector challenge, especially in buildings and transport.

Success Factors

Core drivers for tech adoption:



Key Path: Policy efficiency (not just subsidies) is critical for lowering regulatory hurdles and pilot projects.

Insights from Green Tech Market Experts

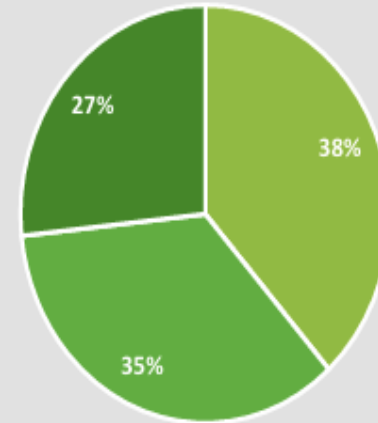
Green Tech Expert Profiles across Sectors



n:

Geographic Distribution of Green Tech Experts

APAC Europe North America



Insights from Green Tech Market Experts

Supportive Ecosystem

Ecosystem can help on two key aspects:

- Reduce regulatory hurdles (e.g. through collaboration with academic institutions on R&D, Green Tech solution providers can show the readiness of their technology for specific market environment)
- Increase attractiveness of business case

Functioning Business

- A functioning business case requires a rather mature technologies with a secured customer basis and a sound financial situation and a customization of the Green Tech solution to the respective market.
- A strong demand-side push is advantageous for the business case.

Policy Support

- Supportive policy and financial incentives can effectively facilitate entry of new Green Tech technologies into the market.
- Developing blueprints, frameworks, and initiatives for emerging technologies.
- Landing of tech ventures and promoting of Green Tech R&D, encouraging go-to-market adoption through pilot projects and commercialization.



InvestHK

The Government of the Hong Kong Special Administrative Region
of the People's Republic of China

Deloitte.

GUIDE TO NAVIGATE THE GREEN TECH MARKET

Hong Kong's Path to Carbon Neutrality

December 2024

Hong Kong is positioning itself as a gateway for global green tech, leveraging policy support, ecosystem development, and strategic infrastructure to attract investment and scale adoption.



Green Tech Market – Five Focus Sectors

Hong Kong positioned to become a Green Tech hub in APAC, leveraging projects like the San Tin Technopole and Hong Kong –Shenzhen Innovation & Technology Park.

Focus areas:

- Building trusted investment frameworks with robust reporting standards.
- Expanding ESG training and capacity building.
- Driving collaboration between academia, industry, and government.

A person wearing a white shirt is shown from the chest up, holding a small, round, moss-covered ball in their hands. The background is blurred, suggesting an outdoor setting. The text 'Hong Kong as the Global Green Tech Hub' is overlaid on the image in white, bold, sans-serif font. A horizontal dashed line is positioned below the text.

Hong Kong as the Global Green Tech Hub

Hong Kong's ambition to be a trusted **global hub for green tech investment and innovation**, with ecosystem development and policy support as the backbone for scaling adoption.

It emphasizes opportunities in **renewable energy, sustainable construction, mobility, and biodiversity**, while noting challenges in financing, demand creation, and talent development.

HONG KONG: A Global GreenTech & Finance Hub



Hong Kong is committed to promoting comprehensive development of five core green tech sectors, building a complete industrial ecosystem.

POLICY DRIVEN

National Strategy & Local Blueprint

The 14th Five-Year Plan supports HK as an I&T hub; "HK Climate Action Plan 2050" and Hydrogen Strategy provide clear paths.

INNOVATION ECOSYSTEM

San Tin Technopole & GBA Synergy

HSITP and San Tin Technopole connect upstream R&D with downstream markets, creating an international green tech city.

GREEN FINANCE

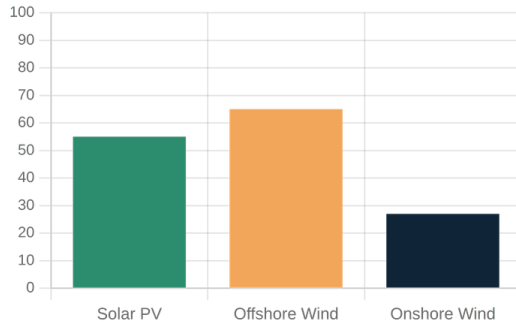
International Financial Center

Asia's leading green bond hub, offering abundant VC/PE opportunities to support green ventures from seed to scale.

SECTOR 1 Decarbonization in Power & New Energy

Global Cost Trends

Renewable energy costs have dropped significantly:



Insight: Renewables will account for 100% of global power capacity increase by 2025.

Key Technology Paths

1. **Storage Systems:** Critical for grid bottlenecks and flexibility.
2. **Hydrogen:** Clean fuel for power generation and industry.
3. **Carbon Capture (CCS):** Transition tech for fossil fuel plants.
4. **Digital Grids:** AI-driven optimization for power dispatch.

Trend: Hybrid platforms (e.g. Wind + Hydrogen) are emerging.

Hong Kong Targets

2050 Vision: Net-zero electricity generation.

Fuel Mix: Phasing out coal to gas and zero-carbon energy.

Renewables: Target increase to 15% of fuel mix.

Regional: Increase nuclear imports and regional cooperation.

70% Reduction Potential

from power fuel transition

SECTOR 1 Decarbonization in Power & New Energy

Green Economy Taxonomy – Power & New Energy Sector

Focus Sector	Power & New Energy Sector						
Subcategories	Wind	Solar	Bioenergy	Hydrogen	Energy efficiency	Energy storage / Grid energy storage	Carbon Capture
	Floating offshore wind turbines	Floating solar photovoltaics (FSPV)	Biogas from anaerobic digestion	Direct solar water splitting	Advanced metering infrastructure	Lithium-ion batteries	Solid direct air capture
	Floating hybrid energy platform	Perovskite solar cell	Biomethane from gasification & methanation	Seawater electrolysis	Household appliance	Smart inverters	Liquid direct air capture
	Hydrogen storage in wind turbine towers	Building-integrated photovoltaics		Liquified hydrogen (hydrogen storage)	Energy management	Lithium iron phosphate	Membrane-based direct air capture
		Energy optimization		Compressed hydrogen in pressure vessels (hydrogen storage)		Liquid air energy storage	
				Ammonia to Energy			

SECTOR 2 Sustainable Built Environment

HK Challenge: Buildings account for 90%+ of electricity usage and 50%+ of carbon emissions.

Smart Management

EMS & AI Optimization: Real-time monitoring with AI algorithms to optimize HVAC performance and reduce energy waste.

Digital Twins: Creating virtual models for energy simulation and predictive maintenance to lower operational costs.

Innovative Materials

Modular Construction (MiC): Factory pre-fabrication and on-site assembly to reduce construction waste and energy.

Low-Carbon Materials: Adopting carbon-neutral concrete, recycled steel, and high-efficiency insulation coatings.

Smart City Integration

DC Data Centers: Promoting high-efficiency Direct Current (DC) power architectures to reduce conversion losses.

BIPV: Integrating Building-Integrated Photovoltaics to transform buildings into urban micro-power plants.

US\$1.8 Trillion

GLOBAL GREEN BUILDING MARKET BY 2030

60%

BUILDING-RELATED ENERGY EMISSIONS SHARE

37%

BUILDING OPERATIONS CONTRIBUTION TO CO2

SECTOR 2 Sustainable Built Environment

Green Economy Taxonomy – Sustainable Built Environment

Focus Sector	Sustainable Built Environment Sector			
Subcategories	Energy management in buildings	Heating ventilation & cooling in buildings	Green building materials	Smart construction
	Direct current data centres	Air conditioning using liquid or solid desiccants	Bio-based materials	Electric construction vehicles
	Smart energy management system	Automated climate control for buildings	Carbon neutral concrete, steel and glass	Modular integrated construction
	Digital twin & data analytics	Hydrogen boilers	Reflective and cool coating / painting	Distributed clean energy battery systems for construction sites
	Rooftop and building-integrated solar PV systems	Various heat pumps	Recycled bricks / timber from construction waste	
			Recycled interior design materials	

SECTOR 3 Green Mobility

Transport accounts for 20% of HK's emissions — Transition is imperative

Private Electrification

2035 Vision

The HK government has announced to cease new registration of fuel-propelled private cars by 2035 or earlier.

Tax concessions up to HK\$250,000 via the "One-for-One Replacement" Scheme to accelerate the shift.

Public & Commercial

Alternative Fuels

Electric Ferries: HK\$350M earmarked for trials on Victoria Harbour routes.

Hydrogen: Promoting hydrogen buses and heavy-duty vehicles for long-haul and high-load needs.

Infrastructure & Tech

Supportive Ecosystem

EHSS Scheme: HK\$3.5B to subsidize EV charging infrastructure in existing private residential car parks.

Smart Tech: Exploring V2G (Vehicle-to-Grid) to turn EVs into mobile energy storage units.

SECTOR 3 Green Mobility

Green Economy Taxonomy – Green Mobility Sector

Focus Sector	Green Mobility Sector				
Subcategories	EV Charging	Commercial road vehicles	Passenger road vehicles	Aviation	Maritime
	Destination charging	Biodiesel/bioethanol buses	E-motorcycles	Electric Green Taxiing Systems	Green maritime fuels production
	Electrified roads	Hydrogen fuel-cell buses	ICE-EV	Sustainable aviation fuels production	Alternate fuel powered ships
	EV fleet charging solutions	Hydrogen fuel-cell heavy duty vehicles	Micro-mobility	Hydrogen powered aircrafts	Battery electric ships
	EV smart charging	ICE-EV or CNG conversion	Passenger electric vehicles	Short-distance electric aircraft	Wind assisted ship propulsion
	Fast charging		Solar electric cars	Green ammonia powered aircraft	Green bunker infrastructure
	Modular EV battery swapping				
	Vehicle to grid charging				

SECTOR 4 Waste Reduction & Circular Economy

Circular Business Models

1. Cradle to Cradle (C2C)

Design for zero waste

2. Take-back Management

Producer responsibility for EOL

3. Deposit Systems

Encouraging packaging reuse.

4. Repair & Refurbish

Extending product lifespan

5. Remanufacturing

Using old parts for new products

6. Rematerialization

Recycling waste into raw materials.

Tech-Enabled Waste Management

AI Imaging & Sorting

Automated waste classification to improve recycling purity.

Blockchain Traceability

Ensuring transparent flow of hazardous or electronic waste

Smart Bins (IoT)

Sensors for fill-level monitoring to optimize collection routes

Core Insight:

Circular models can reduce embedded emissions by one-third.

Focus: EV Battery Recycling

Resource Scarcity

Recycling critical minerals like Lithium and Cobalt to ease supply chain pressure.

Market Growth

Global EV battery recycling market is set to accelerate significantly.

US\$10B+

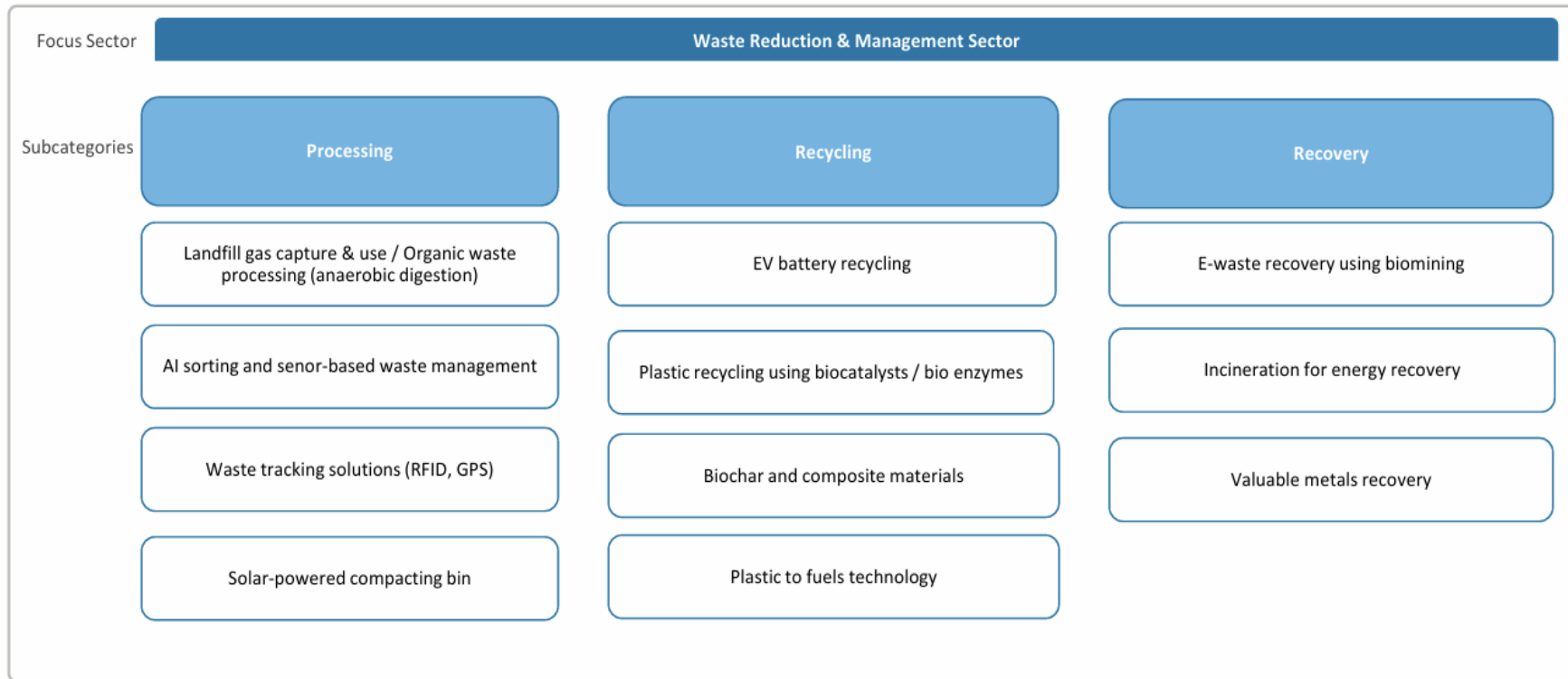
Global Market Size by 2030

HK Opportunity:

Establishing a regional hub for battery recycling and second-life use

SECTOR 4 Waste Reduction & Circular Economy

Green Economy Taxonomy – Waste Reduction & Management Sector



SECTOR 5 Biodiversity Protection

High-Tech Monitoring

Environmental DNA (eDNA): Monitoring species distribution and ecosystem health by analyzing DNA fragments in water, soil, or air without capture.

Remote Sensing & AI: Using drones and satellite imagery combined with AI for large-scale habitat monitoring and tracking illegal activities.

Restoration Innovation

Coral Restoration: Using 3D-printed artificial reefs and Biorock electrolysis technology to accelerate coral growth and rebuild marine ecosystems.

Automated Reforestation: Utilizing planting robots and drones for precision seeding to enhance the efficiency of terrestrial ecosystem recovery.

US\$150 Trillion

ANNUAL VALUE OF GLOBAL ECOSYSTEM SERVICES
(APPROX. 2X GLOBAL GDP)

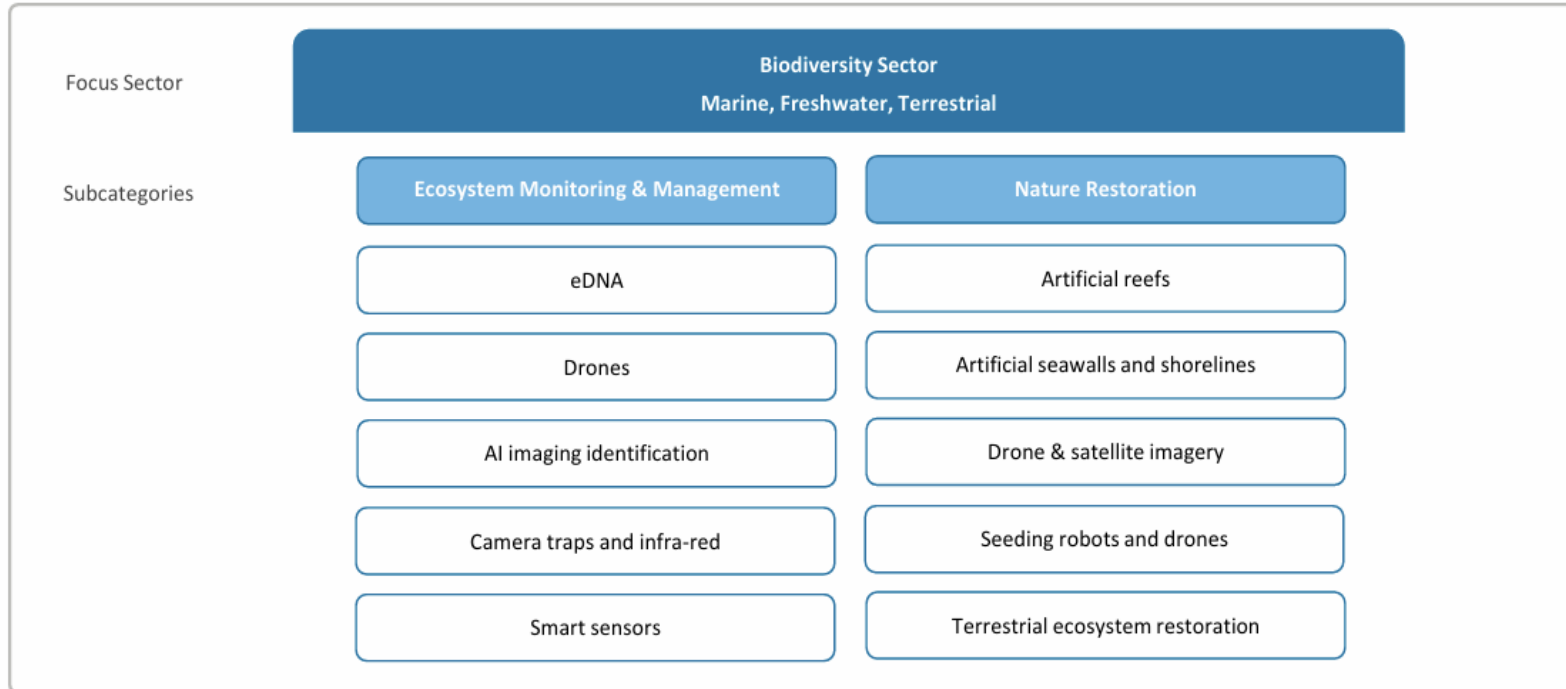
Frameworks & Disclosure

TNFD Framework: The Taskforce on Nature-related Financial Disclosures (TNFD) guides firms to assess and disclose nature-related dependencies and

Global Goals: Aligning with the Kunming-Montreal Global Biodiversity Framework to protect 30% of global land and sea by 2030.

SECTOR 5 Biodiversity Protection

Green Economy Taxonomy – Biodiversity Sector



Tech-Enabled ESG Data & Disclosure

Reliable, transparent data is the cornerstone of ESG investment

MONITORING

Real-time IoT

Automated data collection via IoT sensors:

- Smart meters for energy tracking
- Air quality sensors for emissions
- Satellite imagery for land use

REPORTING

Standardized Reporting

Big data platforms integrating sources:

- Alignment with ISSB & TNFD
- Automated ESG performance reports
- Enhanced data comparability

VERIFICATION

Verification & Trust

Strengthening data credibility:

- Blockchain to prevent tampering
- AI to identify data anomalies
- Mitigating "Greenwashing" risks

Core Value: Shifting from "static annual reports" to "dynamic performance management," technology enables firms to identify ESG risks in real-time and optimize resource allocation.

FUTURE OUTLOOK: Towards 2070 Green Economy

Global Economic Dividend

US\$43T

Deloitte Economics Institute research indicates that a well-managed climate transition could increase the world economy by US\$43 trillion by 2070.

"GREEN COLLAR" JOB GROWTH

Effective climate action is expected to generate 300 million "green collar" jobs in the low-carbon economy, transforming the global workforce structure.

JUST TRANSITION & EQUITY

Ensuring a "Just Transition" is vital during restructuring to ensure that the benefits of green tech reach all social strata and leave no one behind.

From ESG Screening to Solutions and Transition Finance



Shift from ESG Screening

Traditional ESG screening excludes risky sectors but is insufficient to drive decarbonisation. Investors now focus on solutions and transition finance.

Capabilities Beyond ESG Scoring

Investors must develop skills in technology due diligence, policy analysis, and deployment risk understanding for effective GreenTech investment.

Hong Kong's Financial Ecosystem

Hong Kong provides a strong foundation with project finance, capital markets, and professional services to support complex GreenTech strategies.

Impact on Cost of Capital

Credible ESG outcomes improve cost of capital and attract long-term investments from asset owners with net-zero goals.



Embedding GreenTech into Corporate and Policy Strategies

Corporate GreenTech Adoption

Companies integrate GreenTech in operations to reduce emissions and enhance efficiency using energy-efficient buildings and electrified fleets.

Policy Incentives and Leadership

Governments set targets and incentives, leading adoption with public buildings, transport infrastructure, and green finance frameworks.

Coordinated ESG-GreenTech Integration

Effective ESG and GreenTech integration relies on corporate demand, policy alignment, and financial support within connected ecosystems.

Key Takeaways

Global Trends

Investment is diversifying globally, with China's green tech rise and megadeals validating market maturity.

Core Sectors

Intersection of tech in Power, Buildings, Mobility, Waste, and Biodiversity is central to the transition.

HK's Hub Status

With policy support and green finance, HK serves as the gateway connecting the GBA with global markets.

Data Value

Reliable ESG monitoring and disclosure are the cornerstones of investment, effectively mitigating greenwashing risks.

Q&A

THANK YOU



ESG & TECHNOLOGY

Driving ESG Transformation in Hong Kong

Key Technologies and Success
Stories for a Sustainable Future

Speaker: Ir Prof CF LAM

HONG KONG'S ESG LANDSCAPE & 2050 GOALS

Carbon Neutrality

The HKSAR Government's "*Climate Action Plan 2050*" sets a clear roadmap for roadmap for decarbonization decarbonization across four four major strategies.

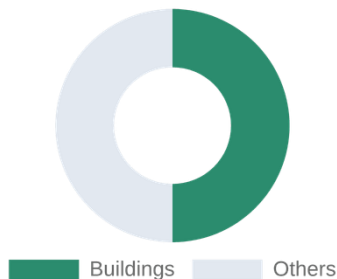
2050

Target for achieving Carbon Neutrality in Hong Kong.

Building Emissions

Buildings are primary focus for decarbonization in Hong Kong's dense urban environment.

Share of Carbon Emissions



*Buildings account for 90% of electricity use.

Key Targets

Net-zero Electricity: Phasing out out coal and increasing zero-carbon energy.

Energy Saving: Reducing electricity consumption in commercial buildings by 30-40%.

Green Transport: Promoting electric vehicles and hydrogen fuel cell technology.

ESG & Better Buildings

- Be outcome oriented – focus on well-being of people.
- Climate era means air-con becomes even more necessary.
- Improving indoor environment has many benefits that fit ESG.

E = Energy Saving & Carbon Reduction.

S = Improved health because you manage humidity & IAQ.

G = Board focusing on the right things to invest in.

- Building management is part of digital & sustainability revolution.

A Strong Green Building Movement in Nearly Three Decades



Cumulative Achievements

BEAM Plus & HK-BEAM ¹	Registered	Certified ²
No. of Buildings	8,307	5,010
No. of Projects	3,094	1,781
2FA (m ²)	103.4 million	80.8 million

Aiming High

2025 Performance

76%
of New Building projects

achieved Provisional Gold or above ratings

73%
of BEAM Plus Projects (all types)³

achieved Gold or Very Good or above ratings

Cumulative No. of Registered Properties (BEAM Plus)

Existing Buildings
1,859

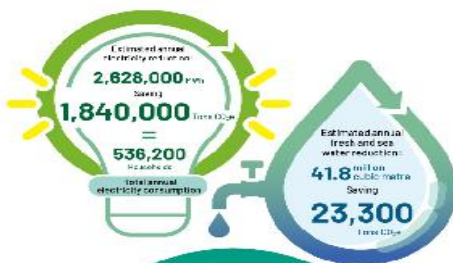
New Buildings
7,025

BEAM Plus certified area per capita in Hong Kong:

9.05 m²

New Buildings: Building Green Future

Total saving of 3EAM Plus New Buildings assessed projects compared to the baseline:



Total estimated carbon emissions saved each year:

1,863,000 Tons CO₂e

= Planting **81** million trees

= Taking **4.05** million round-trip flights from Hong Kong to Tokyo

= Emissions from **14,333** double-decker diesel buses per year

Existing Buildings: Strive for Improvement

There are **Over 62,000** existing buildings in the private sector in Hong Kong, offering massive potential for **energy savings**.

Mean energy savings⁴ achieved by 87 commercial buildings and 7 industrial buildings in our BEAM Plus Existing Buildings database:

12.5%



Commercial Buildings

30.7%



Industrial Buildings

⁴ EA 1486 (Provisional) Assessment results in BEAM Plus Existing Buildings v2.0.

Establishing a Mature Green Product Market



CIC Green Product Certification



Leading Industry's Transformation Towards Carbon Neutrality

HKGBC's Publications



Hong Kong Circular Built Environment Guidebook



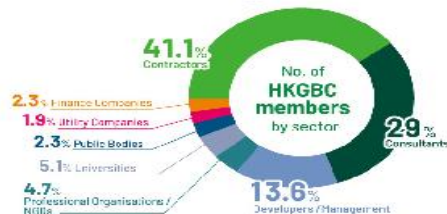
HKGBC Climate Change Framework for Built Environment Version 3.1



HKGBC Handbook for Sustainable Built Environment Version 2.1

Turning Engagement into Impact

Cross-sector Influence



Strong Capacity

No. of green building practitioners >7,100 with qualifications related to BEAM Plus and HKGBC schemes

4,414 BEAM Professionals
1,237 BEAM Affiliates
84 BEAM Assessors
147 Green Building Faculty Members

886 R&P Professionals & Practitioners

132 Certified Carbon Auditor

131 Energy Assessor-ZCRB



No. of training hours

>629,000

training man-hours of CPD activities undertaken by BEAM Practitioners, R&P Professionals and Practitioners in Hong Kong during our 2012-2025.

Buildings as Key Energy and Emissions Lever in Hong Kong



Buildings as Major Energy Consumers

Buildings dominate Hong Kong's energy use due to dense urban form, vertical development, and extensive air conditioning needs.

GreenTech Solutions for Efficiency

Innovations like smart energy systems, advanced materials, and digital twins enhance building efficiency and reduce carbon footprint.

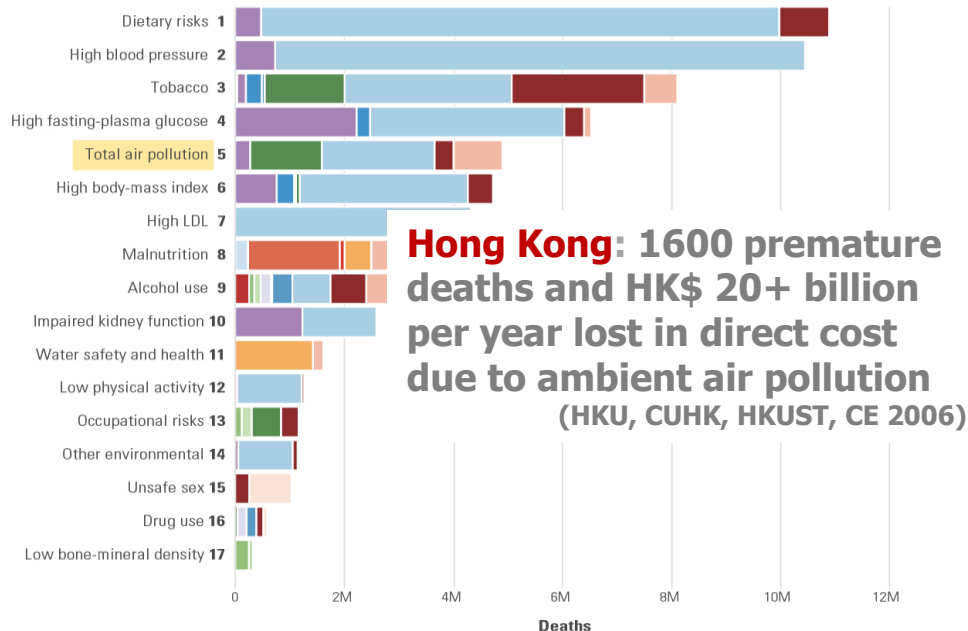
Strategic Role of Stakeholders

Real estate developers and managers lead demand for GreenTech, supported by public-private partnerships and green finance.

Economic and ESG Alignment

Green building investments deliver financial returns and sustainability benefits, aligning with ESG goals and corporate strategies.

Indoor Air Quality vs Health Risk



Air Pollution-Related

- Respiratory infections & TB
- Neoplasms
- Cardiovascular diseases
- Chronic respiratory disease
- Diabetes & chronic kidney disease

Selected Other

- HIV/AIDS & STIs
- Enteric infections
- NTDs & malaria
- Other infections
- Maternal & neonatal
- Nutritional deficiencies

- Digestive diseases
- Neurological disorders
- Mental disorders
- Substance use
- Transport injuries
- Unintentional injuries
- Self-harm & violence

Global ranking of risk factors by total number of deaths from all causes for all ages and both sexes in 2017

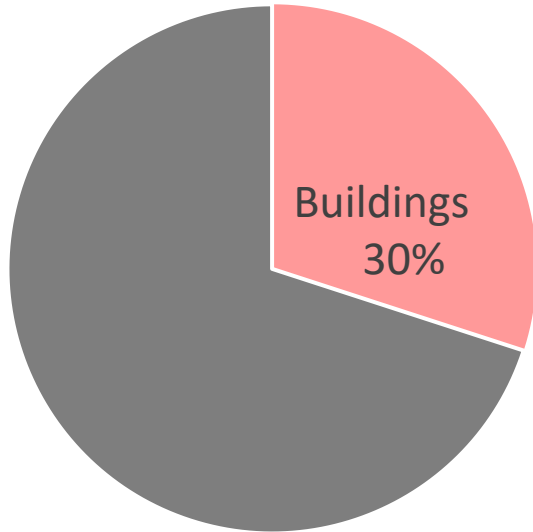
2017年所有年齡和性別的所有原因死亡總人數的風險因素全球排名

Health Effects Institute. 2019. State of Global Air 2019. Special Report. Boston, MA: Health Effects Institute

Building Energy Consumption & HVAC

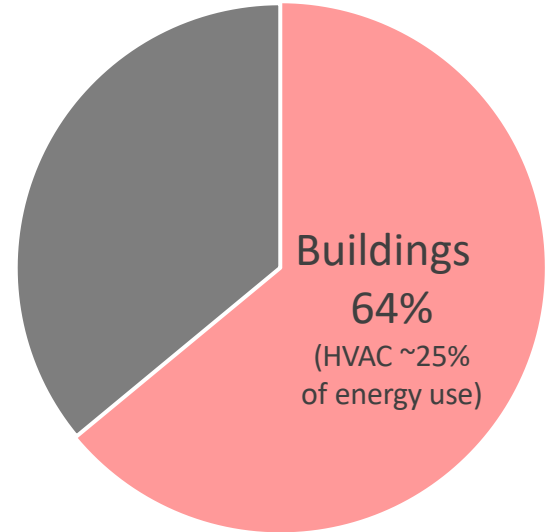
Buildings: single biggest potential sector for energy savings

Global final energy use in 2015



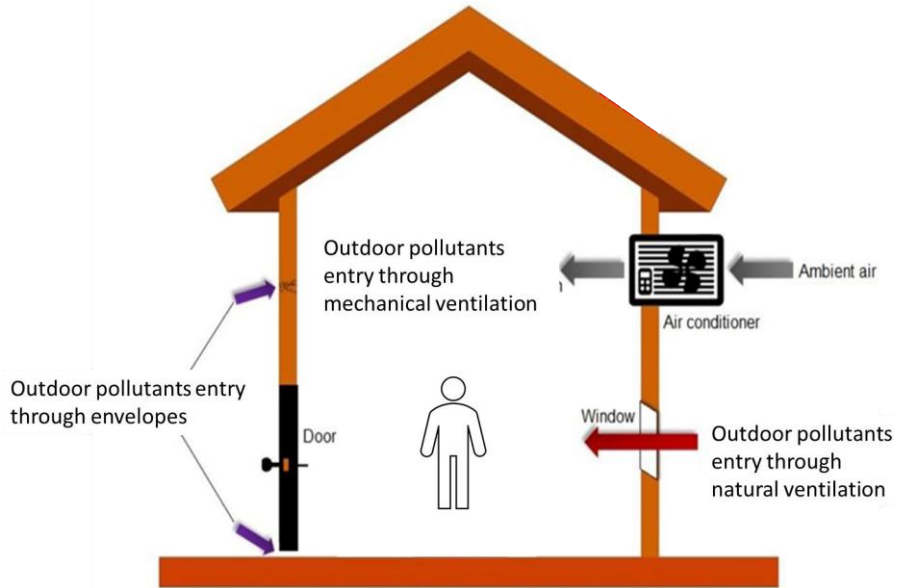
(UN Environment and International Energy Agency (2017))

Hong Kong final energy use in 2015



(Electrical & Mechanical Services Department, 2017)

Heat, Ventilation, Air Conditioning (HVAC) Energy, IAQ & Humidity



$$C_{indoor} = f(C_{outdoor})$$

Increase infiltration

- Open window/doors
- Increase fresh air intake
- Leakage & Openings
- Short air pathways, ...

Decrease infiltration

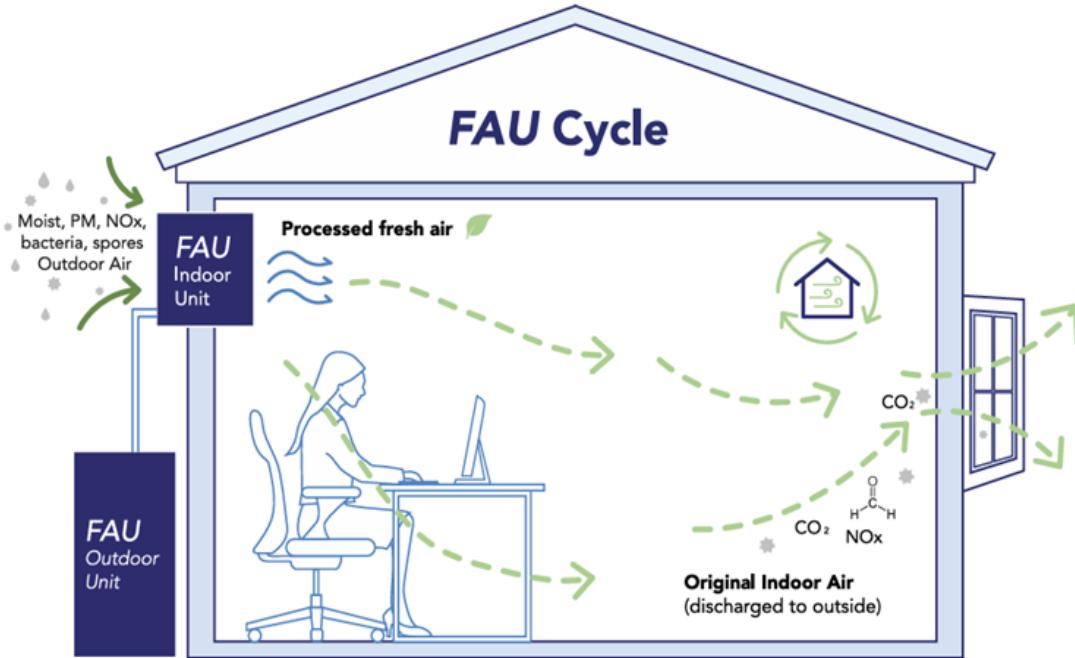
- Close windows/doors
- Decrease fresh air intake
- Use filters/purifiers
- Long air pathways, ...



**Fresh Air Units:
Energy, IAQ & Humidity**

Fresh Air Units: Energy, IAQ & Humidity

FAU Cycle



How can the FAU Cycle be beneficial?

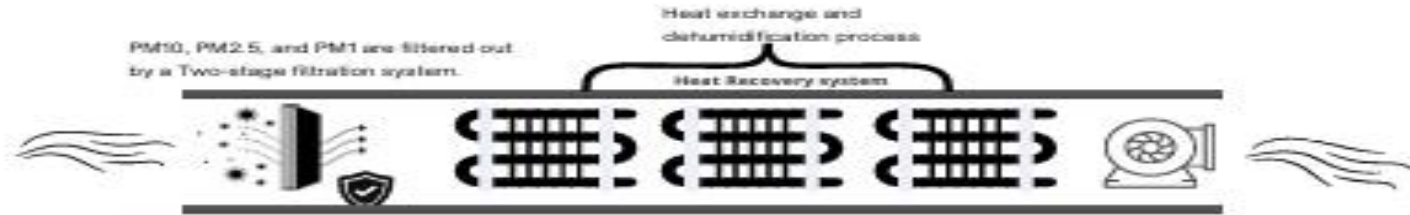
- FAU cycle ensures fresh air supply is dry, clean, and maintained at a comfortable temperature based on different weathers, as well as a good air ventilation.
- It effectively removes outdoor harmful substances and indoor pollutants. This significantly enhances indoor air quality (IAQ) and prevents mold growth, ensuring a healthier indoor environment.

Fun Fact

Under lower humid conditions, a relatively high indoor temperature level is acceptable for the thermal comfort.

For example, at a relative humidity of 70%, the maximum allowable temperature in an indoor environment to achieve acceptable thermal comfort is 27.5°C, while it is 29.1°C at a relative humidity of 40%.

Fresh Air Units: Energy, IAQ & Humidity



With various selectable modes, FAU is able to adapt to changing weather conditions, ensuring that you enjoy the utmost comfort and fresh air in your indoor environment.*

FAU 3 in 1



Temperature control

+



Relative Humidity Adjustment

+



Fresh Air Supply

=



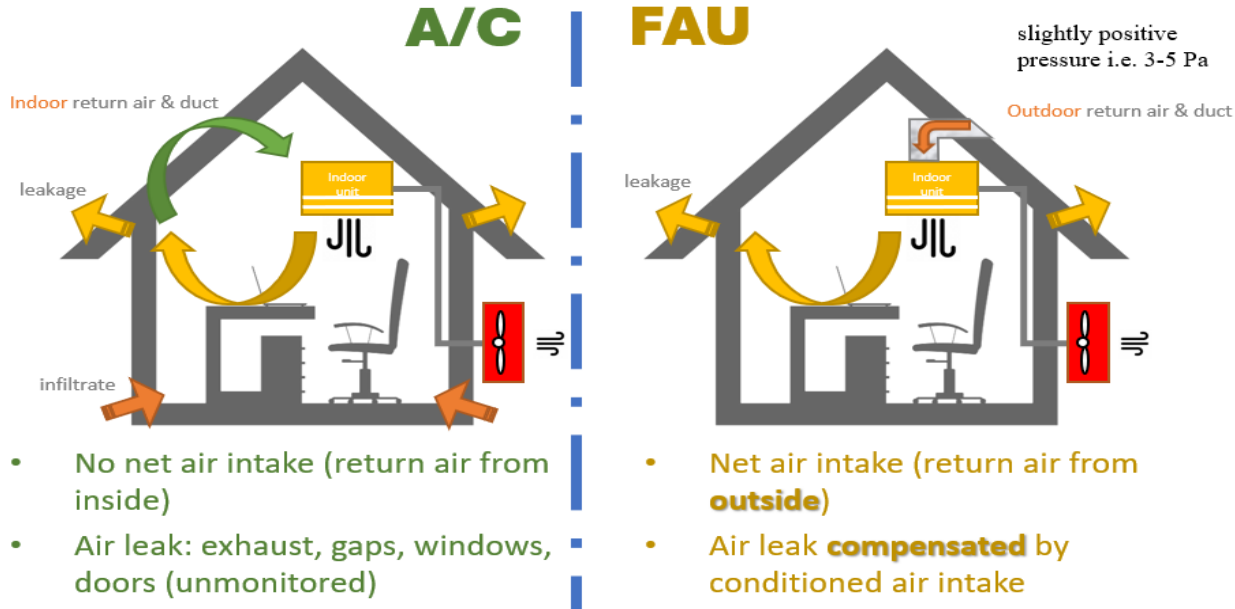
- Mini BMS Control (Online)
- Temperature and Relative Humidity Adjustment
- Fresh Air Supply

→

SAVE UP TO
30%
ON
RUNNING
COSTS
UNDER CONTROLLED
ENVIRONMENT

Fresh Air Units: Energy, IAQ & Humidity

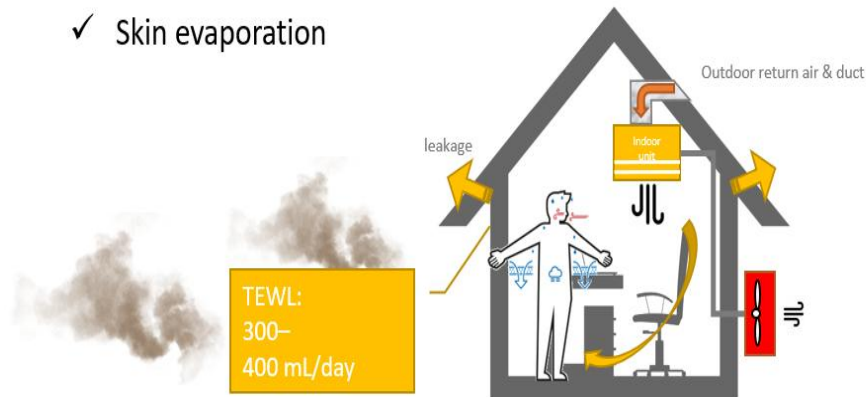
Air Cycles



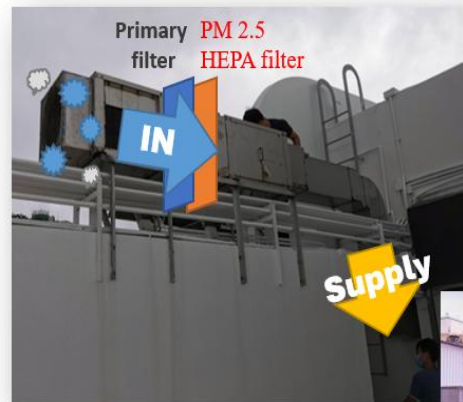
Fresh Air Units: Energy, IAQ & Humidity

Positive Pressure and Fresh Air

- Positive pressure
 - ✓ Barrier for outdoor infiltrate
 - ✓ Reduce cooling load
- Air change
 - ✓ IAQ ($\text{CO}_2 < 700\text{ppm}$)
 - ✓ Skin evaporation



Filter Treatment



- 100% fresh air
- Medical grade HEPA filter
- Gaseous contaminant removal during dehumidification



Fresh Air Units: Energy, IAQ & Humidity

Case Study – TAL Apparel Building

Co-benefits: energy saving (50%), IAQ & humidity + improved tech for building management from HVAC retrofit



ELSEVIER

Energy and Buildings

Available online 17 June 2019

In Press, Corrected Proof



Energy consumption, indoor thermal comfort and air quality in a commercial office with retrofitted heat, ventilation and air conditioning (HVAC) system

<https://www.sciencedirect.com/science/article/pii/S0378778819303640>

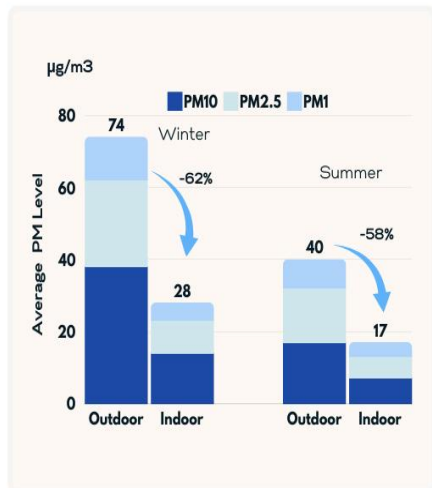
- Payback 3.5 year
- Initial investment: \$ 2.4 million
- Replacement of pleated filter: \$ 0.06 million/per year
- Energy saving: 670,000 kWh per year (equivalent to \$0.78 million)
- Net return: \$ 0.72 million/per year

Fresh Air Units: Energy, IAQ & Humidity

Case Study – TAL Apparel Building



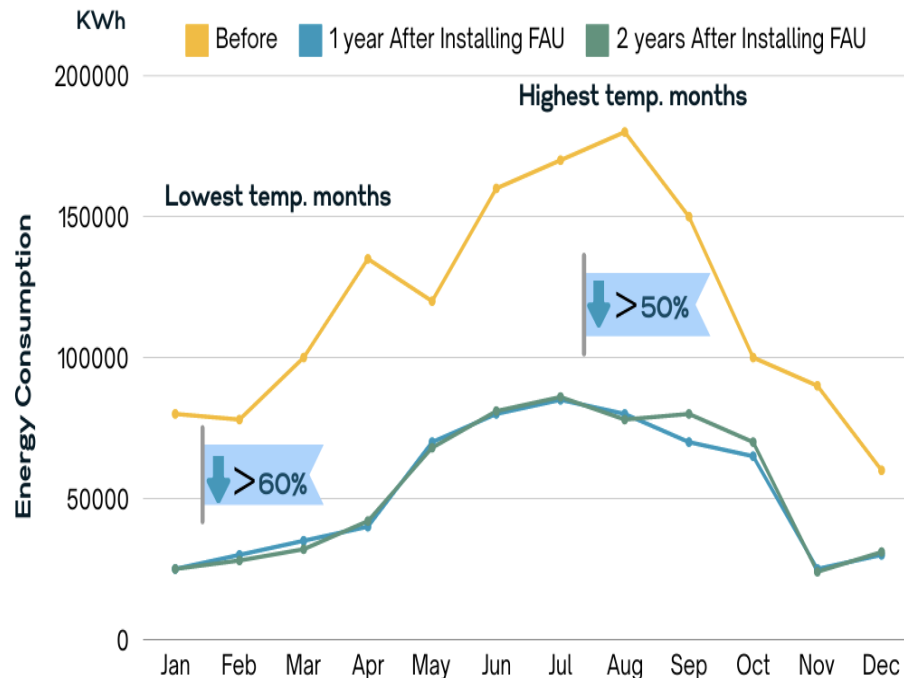
1.1 Indoor Air Quality Result



- The indoor PM10, PM2.5 and PM1 were substantially lower than outdoors.
- The filtration system not only cleans indoor air but also substantially helps improve ambient air quality by up to 60%!
- When the outdoor air quality is worse, such as in winter, we can see that the air filter is working more efficiently.



1.2 Energy Consumption



Fresh Air Units: Energy, IAQ & Humidity

Case Study – TAL Apparel Building

1.3 Payback Period Analysis and potential benefits

- Total Energy Consumption Before : 1423000KWh
- Total Energy Consumption After 1 year : 635000KWh
- Energy Saving: 788000KWh => 55.4%
- Total Energy Consumption After 2 year : 645000KWh
- Energy Saving: 778000KWh => 54.7%

- If Total retrofit cost = HK\$2.4 millions
- Net energy saving \approx 645000KWh (55%)
 \approx HK\$0.84 millions
- Payback period = $2.4/0.84 \approx$ 3years !



How does FAU protects your indoor space?

- In high-altitude and coastal regions, high relative humidity is common and often leads to damage to indoor furnishings and mold growth. Traditional air conditioning systems and standard dehumidifiers frequently fail to effectively address these issues, especially in cold and rainy weather.
- FAU presents a superior solution, maintaining optimal temperature and humidity levels to protect interior decor and furniture, while ensuring a comfortable, healthy indoor environment.
- Not only can you save on energy costs, but you can also reduce expenses related to redecorating, replacing furniture, and maintenance.



Before



After



Retrofit & IAQ Co-benefit Example

Case Study – Jao Tsung I Academy (Exhibition Hall)

- Reduced relative humidity by 25%; maintained at 65%.
- IAQ met local & international standards.
- ~30% electricity savings with 2-year payback.



Fresh Air Units: Energy, IAQ & Humidity

Case Study – Jao Tsung I Academy

03.

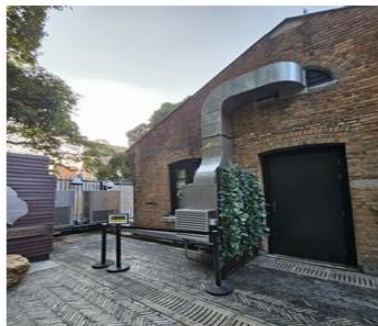


JIAO TSUNG-I ACADEMY

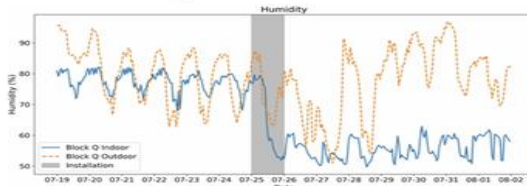
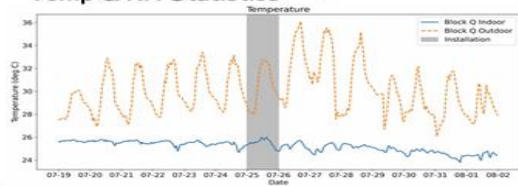
Design



Finished



Temp & RH Statistics



*Data from JTIA

3.1

How does FAU safeguard heritage?

LIMITATIONS OF ORIGINAL AIR CONDITIONING SYSTEM

- The original air conditioning system struggles with high relative humidity levels.
- High relative humidity can cause significant damage to sensitive items, such as books, manuscripts and artifacts.
- This inadequacy also leads to mold growth on ceilings and deterioration of irreplaceable materials.



What Fau Can Do

- Effectively regulate humidity levels, preventing excess moisture accumulation.
- Maintain optimal indoor air quality
- Preserve the structural integrity of the heritage site.
- Preservation of JTIA's cultural and historical significance for future generations.



↓ Interior maintenance cost

Fresh Air Units: Energy, IAQ & Humidity

Retrofit HVAC for better energy use and healthy indoor environment

Two-stage
filtration

Variable flow

Sensor-based building
management system

Fresh Air

Dehumidification

Energy usage: ↓ 50%

Thermal comfort : Acceptable

Outdoor PM ingress: ↓ 60%~90%



**A win-win situation on energy savings & environment
Can we get more like this?**

Permanent Magnet Synchronous Motor

Suitable for 24-hour central air-conditioned places



Data Center



Hotel



Convenience Store



Hospital

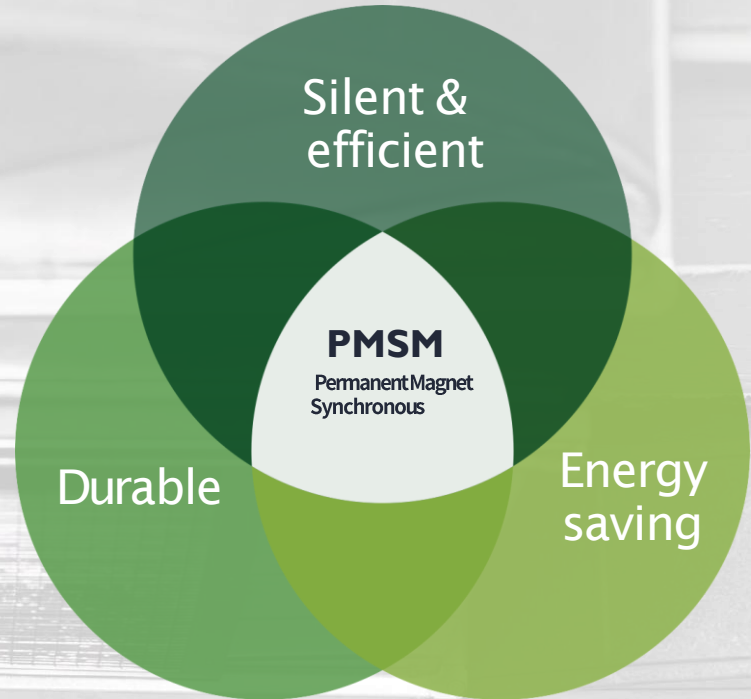
Permanent Magnet Synchronous Motor (PMSM)

Permanent magnet synchronous motor demonstrates commitment to environmental, social and governance (ESG) standards and its efficient design significantly reduces energy consumption and greenhouse gas emissions. This innovative motor prioritizes environmental and social responsibility, ideal for businesses aligning with ESG goals.

FUNCTIONAL FEATURES (COMPARED TO AC MOTORS)

- Up to 50% less energy consumption
- Durable for at least 9 years (versus 4 years or less for AC motors)
- Quieter in operation (Motor noise $\leq 45\text{dB}^*$)

*Background noise 29.9dB



Permanent Magnet Synchronous Motor (PMSM)

PRODUCT FEATURES

- Can match three-speed thermostat direct input (HIGH, MED, LOW)
- 3 sets of 9-speed preset speed setting range: 500 rpm~1270 rpm
- Up to 120W power output
- Overall power saving rate: 50-60%

PMSM Permanent Magnet Synchronous Motor



ELECTRICAL PARAMETERS

Item	Parameters
Operating voltage range(V)	AC 220 - 240V
Power output(W)	8 - 120W
Power factor	0.95 - 0.99
Operating temperature (approx °C)	-25°C to +50°C
Three speed range(rpm)	HIGH : 880-1270 rpm
	MED : 720-1080 rpm
	LOW : 500-930 rpm

Permanent Magnet Synchronous Motor (PMSM)

PMSM

Permanent Magnet Synchronous Motor vs AC Motor

POWER CONSUMPTION COMPARISON

RPM	Power/hour		Energy saving	
	AC Motor	PMSM	(W)	(%)
High speed	87.99 W	49.38 W	- 38.61 W	-44%
Medium speed	75.74 W	31.10 W	- 44.64 W	-59%
Low speed	65.23 W	16.50 W	- 48.73 W	-75%
Annual electricity consumption (kWh)	663.482 kWh	272.436 kWh	- 391.046 kWh	-59%
CO2 emissions per year	252 kg / CO2	104 kg / CO2	- 148 kg / CO2	
Equivalent number of trees planted			6 trees (each 5 meters tall)	

- Annual electricity consumption is calculated at medium speed (24/7)
- The carbon dioxide emission intensity of CLP Power's local electricity sales in 2024 is 0.38 kilograms per kilowatt hour.
- The number of trees planted is determined based on their average annual carbon dioxide absorption over their lifespan. A tree that grows taller than 5 meters absorbs approximately 23 kg of carbon dioxide per year.

* The annual electricity consumption figure is calculated based on the medium speed

*The above is only a rough idea. Actual parameters will depend on the specific environment and situation.

Permanent Magnet Synchronous Motor (PMSM)

Permanent Magnet Synchronous Motor

OTHER PRODUCTS

- Fan coil unit
- Sterilization, Disinfection, Dustproof treatment



SMART ASSET MANAGEMENT: **SUCCESS STORY**

DEVELOPER

Swire Properties

LOCATION

Quarry Bay, Hong Kong

STATUS

Triple Grade A Rated

LEED
PLATINUM

WELL
PLATINUM

BEAM
PLUS

"Neuron" Smart Platform

- ✓ Developed by Arup to enhance sustainability and efficiency.
- ✓ Centralized digital platform for Grade A office operations.
- ✓ Provides actionable insights through advanced data analysis.
- ✓ Sets a new benchmark for smart buildings in Hong Kong.

"A data-driven approach to building operation and occupant well-being."

AI AND DIGITAL TWINS

DRIVING OPERATIONAL EXCELLENCE

3D Digital Twin

A virtual replica of Two Taikoo Place that integrates real-time data from thousands of IoT sensors.

- Real-time spatial visualization of building performance.
- Simulation of "what-if" scenarios for energy optimization.
- Enhanced situational awareness for facility managers.

BIM + AM Integration

Seamless connection between Building Information Modeling (BIM) and Asset Management (AM).

- Unified data environment from construction to operation.
- Instant access to technical specifications and maintenance history.
- Improved lifecycle management of critical building assets.

Machine Learning

Advanced algorithms that continuously learn from building data to optimize complex systems.

- Assisted Chiller Plant optimization for dynamic load matching.
- Significant reduction in energy waste during off-peak hours.
- Automated set-point adjustments based on weather forecasts.

Predictive Maintenance

Shifting from reactive to proactive maintenance using AI-driven fault detection and diagnostics.

- Identification of equipment anomalies before failure occurs.
- Reduced downtime and extended lifespan of mechanical systems.
- Optimized maintenance schedules based on actual usage data.

ENVIRONMENTAL MANAGEMENT AT WENT LANDFILL: **SUCCESS STORY**

Project Overview: Landfill Gas-to-Energy

OPERATOR

CLP Power Hong Kong Limited

LOCATION

West New Territories (WENT) Landfill, Nim Wan

GENERATION CAPACITY

10MW (Largest in Hong Kong)

STATUS

Full Operation since 2020

STRATEGIC SIGNIFICANCE

- A major milestone in Hong Kong's **Circular Circular Economy** journey, transforming transforming waste into a valuable resource. resource.
- A **local, renewable energy source** for the CLP the CLP grid by capturing methane-rich landfill gas that would otherwise be flared. flared.
- A key role in diversifying Hong Kong's fuel mix and supporting the city's **decarbonization targets**.

TURNING WASTE INTO CLEAN ENERGY

TECHNICAL INNOVATION



Capture

Methane-rich gas extracted from landfill



Drive

High-efficiency power generators



Power

Clean electricity for the local grid

Environmental Impact

Significantly reduces greenhouse gas emissions by preventing direct methane release into the atmosphere, which is 25x more potent than CO₂.

Grid Integration

Direct connection to the CLP grid provides a stable, local source of renewable energy, enhancing Hong Kong's energy security.

Future Scalability

Modular design allows for expansion as landfill gas availability increases, with potential for hydrogen production in future.

DIGITALIZATION AND INNOVATION

CORNERSTONES OF ESG

MRV & Transparency

Technology enables "Monitoring Reporting and Verification" (MRV) essential for ESG transparency and investor trust.

Smart Assets

IoT, AI, and Big Data transform static buildings into dynamic, responsive assets that optimize resource use in real-time.

Reducing Green Premium

GreenTech innovation reduces the cost gap between sustainable and traditional solutions, making them economically viable.

Global Scaling Hub

Hong Kong serves as a global hub for testing, validating, and scaling green technologies for international markets.

AI-POWERED ENERGY OPTIMIZATION

Predictive HVAC Control

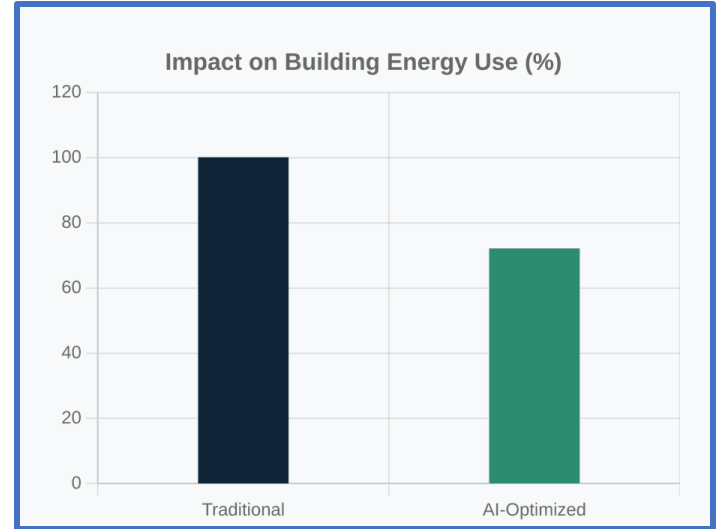
AI algorithms analyze weather forecasts, occupancy patterns, and thermal mass to optimize HVAC operations, reducing energy waste by up to 30%.

Demand-Side Management

Real-time AI balancing of grid loads helps reduce peak demand charges and integrates intermittent renewable energy sources more effectively.

Continuous Learning Loops

Machine learning models continuously refine their performance based on historical data, ensuring long-term efficiency gains and adaptive control.



AI-driven chiller plant optimization is now a standard for Hong Kong Grade A offices.

IoT AND SMART SENSORS

THE PULSE OF ESG DATA



IoT sensors provide granular, real-time data required across all five core GreenTech sectors to ensure measurable impact and operational transparency.

REAL-TIME VISIBILITY

Smart meters and environmental sensors provide instant visibility into resource consumption, allowing for immediate corrective actions and efficiency gains.

SMART WASTE MANAGEMENT

IoT-enabled smart bins and tracking systems optimize collection routes and improve recycling rates by monitoring fill levels and waste composition.

VERIFIABLE TRANSPARENCY

Granular data from IoT devices reduces "Greenwashing" risks by providing verifiable, tamper-proof evidence of environmental performance for ESG reporting.

Connectivity (5G/LORAWAN) enables city-wide monitoring of environmental parameters.

ESG by Environmental Tech

Environmental Tech

- Layer 1: Sensors & IoT (Data capture)
- Layer 2: BMS / EMS (Operational control)
- Layer 3: Carbon Accounting Software (Aggregation)
- Layer 4: AI Optimization (Intelligent action)

ESG Data Value Chain

- Capture (Sensors/Meters)
- Aggregation (Centralizing data)
- Analytics & AI (Pattern recognition)
- Reporting (Automated disclosure)
- Optimization (Strategy adjustment)

ESG by Environmental Tech

Digital Twin

- Simulating energy-saving measures
- Building energy optimization (10-30% potential reduction)
- Construction waste reduction and predictive maintenance

AI & Machine Learning

- Energy load forecasting
- Climate risk modeling
- Carbon footprint estimation
- Portfolio optimization

ESG by Environmental Tech

Blockchain & Supply Chain Transparency

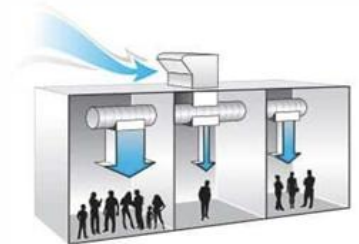
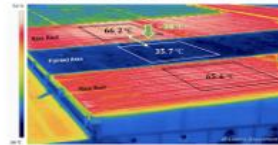
- Material traceability (Green sourcing)
- Carbon credit validation (Preventing double-counting)
- ESG data integrity and secure Scope 3 sharing

From Spreadsheets to ESG Software as a Service (SaaS)

- Automated disclosure and KPI dashboards
- Direct ISSB / TCFD mapping
- Eliminating manual errors and ensuring auditability

Retrofit Tech for Existing Office Buildings

- Centralize asset monitoring and feedback system (iBMS)
- VRV (for those with decentralized split type / window units)
- HVAC RCx & Tuning (those with centralized plant)
- Demand Control Ventilation (DCV) for fresh air / exhaust / ventilation
- VFD motor for fan / pump system
- Thermal performance enhancement (roof / window / wall) and façade retrofitting
- Electricity & thermal sub-metering
- Renewable energy with storage
- LED lightings and controls upgrade



A Financing Model for Retrofitting Buildings

10 October 2025





Creating a Retrofit Market in Hong Kong

- Demonstrate how **proven retrofit measures** can be implemented through EPC.
- Use real examples to show the process, benefits, and risk-sharing in action.
- Raise awareness about EPC as a scalable tool for buildings in Hong Kong.

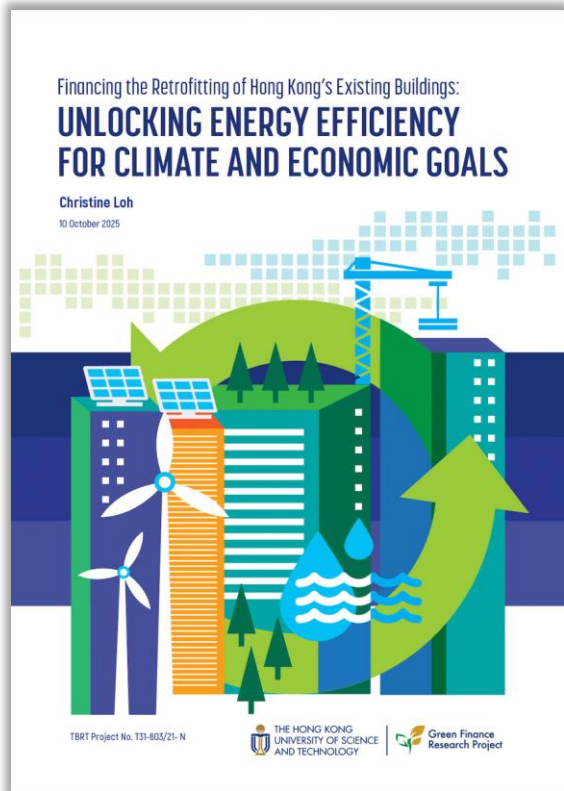
Why retrofit matters

- Buildings: 90% of electricity use and 50% of carbon emissions. Most of today's stock will still stand in 2050.
- Buildings = **major share of energy use and emissions**, making them a key mitigation sector under the Paris Agreement.
- **Highly urbanized Hong Kong** has dense clusters of energy-intensive high-rises.
- **Retrofits** can deliver substantial energy and carbon savings.

FINANCING PROBLEM

- Smaller owners lack cash reserves in both strong and weak economic cycles.
- Traditional financing often fails because **returns on investment are gradual**.
- A scalable solution must **share costs and risks** and work within different market conditions

KEY POLICY FOCUS



Adopt PBC – a model that shares costs, risks & benefits of the low-carbon transition.



Do pilots – use public sector buildings & infrastructure to stimulate market.



Establish Retrofit Finance Platform – possibly use HKMA's CDI and EMSD's audit information.



De-risk private investment e.g. guarantees, revolving funds etc.



Build trust – through raising awareness; promote standard contract terms, and transparency.

Building Energy Performance Contracting



Building Energy Performance Contracting

A business model undertaken by Energy Services Companies (ESCOs) to help owners speed up their decarbonization journey.

Payment made to ESCOs is directly linked with energy savings achieved.

Energy Performance Contracting (EPC) achieves energy savings by:

- ❑ Monitoring, optimization and system engineering with/without major capital investment
- ❑ Behaviour engineering through the use of innovation and IT

It can be conducted in the manner of hire purchase

Building Energy Performance Contracting

Benefits of EPC

- ❑ Continuous improvements guaranteed in energy performances - payment received by ESCO directly tied to amount of energy saved.
- ❑ Upfront CAPEX borne by ESCO, including IoT network, smart devices, monitoring equipment and hardware upgrade, if needed.
- ❑ Pay-back by Employer, depending on the percentage saving
- ❑ of electricity, via instalments over a period of time.
- ❑ Contract usually last for 10 years to ensure payback for capital investment

Energy Performance Contract Model (Case Study – A Secondary School)

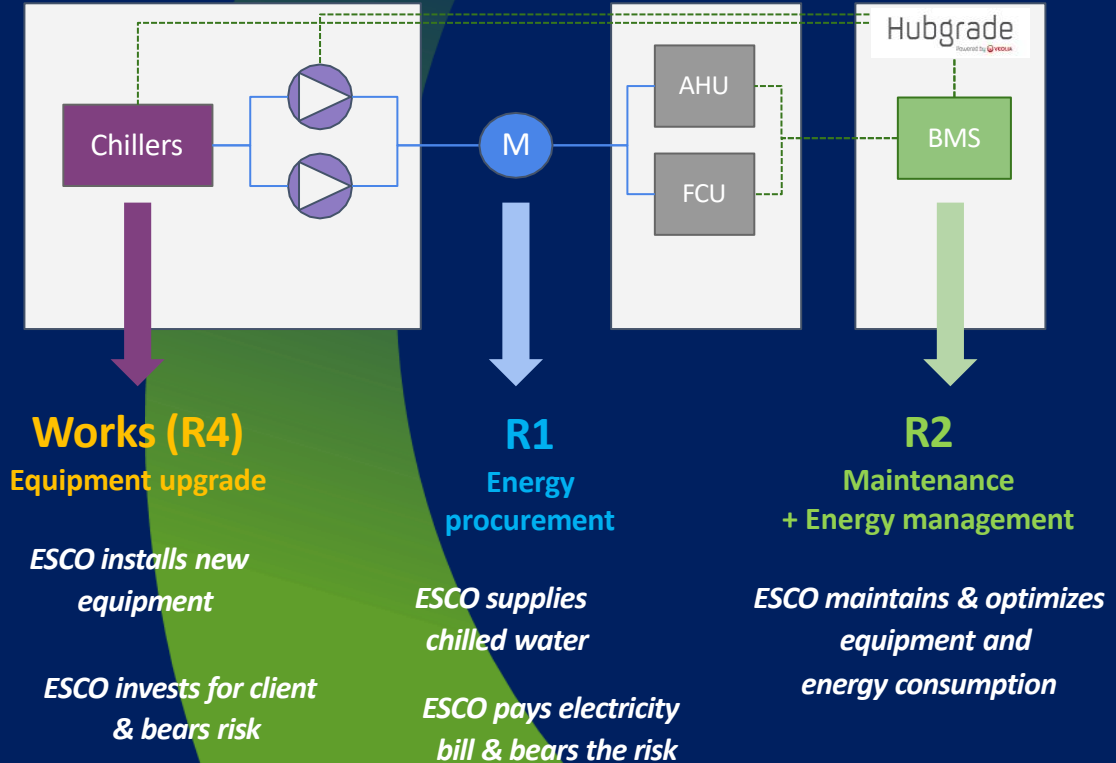
ESCO's Commitment

- Availability of energy
- Reliability of equipment
- Plant efficiency
- Consumption of building
- Maintenance



Contractual model

- Service contract with guarantee on energy consumption



Measures implemented to save energy

(Case Study – A Secondary School)



Monitoring System Installation

- Installation of automation system coupled with AI for optimization.
- Installation of web-based monitoring devices to track energy consumption across various facilities and for students to learn decarbonization



System Engineering Improvements

- Replacement of the aged chillers
- Improvement of automatic controls to reduce energy consumption



Behavioral Engineering

- Web based energy monitoring system for users to understand how their behavior affects energy consumption
- User engagement to encourage green lifestyle



Maintenance

- Condition based maintenance using state of the art technology such as Computerized Maintenance Management System

Energy Performance Contract Model

(Case Study – A Secondary School)

CAPEX

- Initial investment paid by ESCO

Scope of EPC

- Capital Works
- Energy Management, and
- Maintenance which is needed with or without EPC

Guaranteed savings & penalty

- Expected savings: 30%, i.e. 0.7million kWh per year (HK\$1 million)
- From 15% upwards to be shared with ESCO
- Saving lower than 15%, client to be reimbursed by ESCO

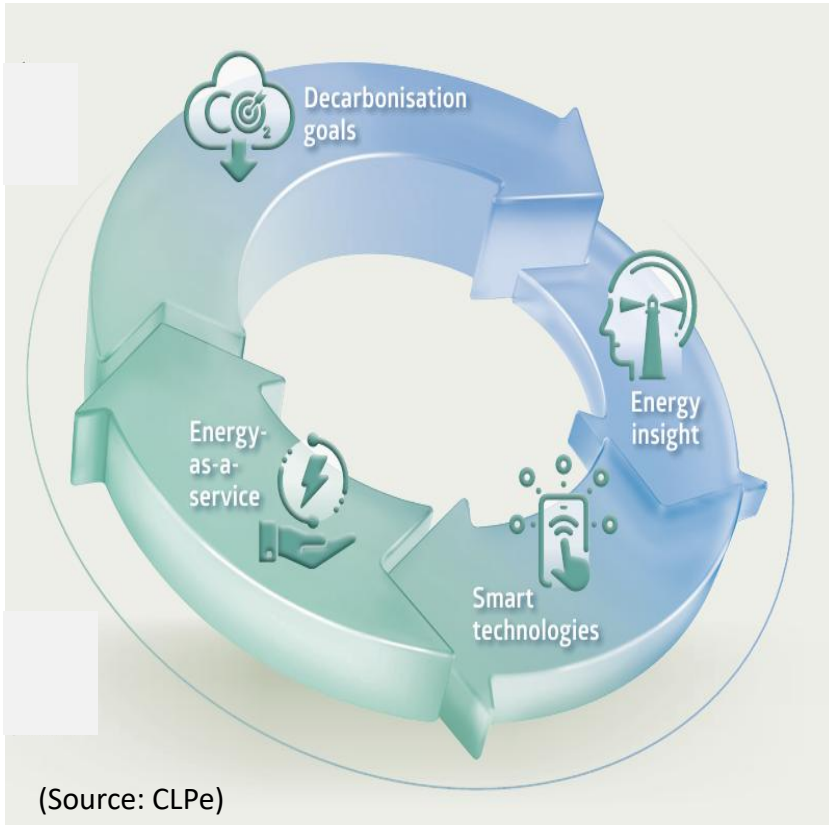
Payment

- Half of savings to be shared
- Fee for energy management, HK\$5K/month
- Installment to cover part of the CAPEX (HK\$0.15 million per month)
- Payment for maintenance needed with or without EPC

Energy Performance Contract Variants



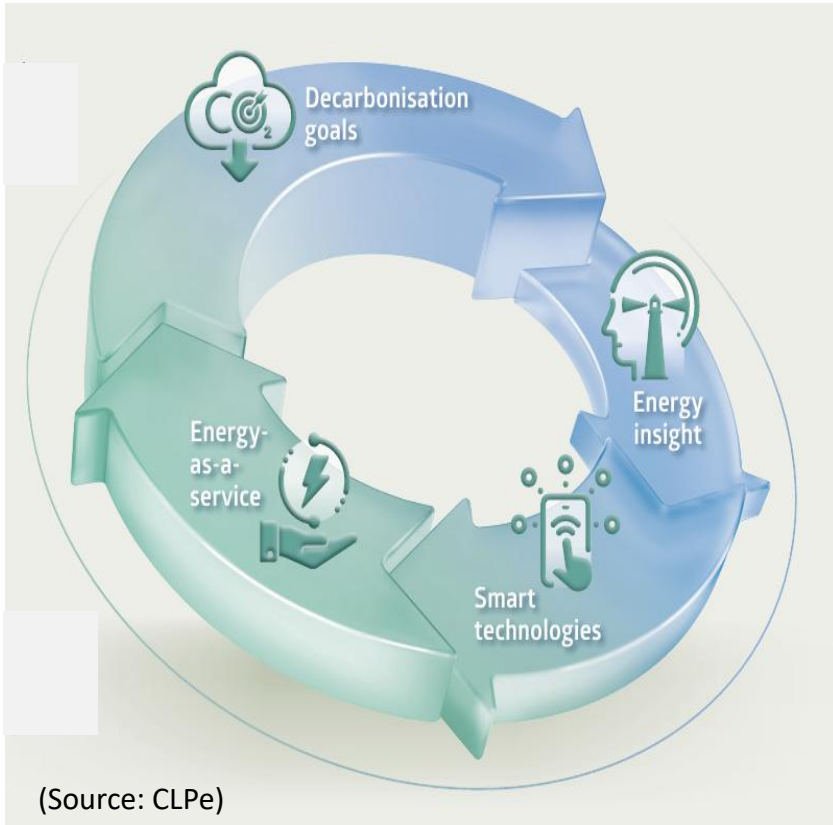
Energy-as-a-Service (EaaS)



Energy-as-a-Service Model

- ❑ One-solution business model combining hardware, software and services for demand management and energy efficiency services.
- ❑ Facilitates adoption of renewable energy and optimises balance between demand and supply.
- ❑ Subscription for electrical devices owned by a service company or management of energy usage to deliver desired energy service.
- ❑ Two typical EaaS models:
 - ❑ **Solar-as-a-Service (SaaS)** is the service model for residential and community solar systems.
 - ❑ **Cooling-as-a-Service (Caas)** is an innovative business model that enables customers to benefit from high end and energy-efficient cooling technologies without the need of an upfront investment.

Energy-as-a-Service (EaaS)



(Source: CLPe)

Benefits of EaaS

- ❑ Service providers provided with steady revenue streams.
- ❑ Customers benefitted by enjoying the simplification of an increasingly multifaceted service without purchasing it outright or directly managing its use.
- ❑ Customers pay for energy service without any upfront capital investment, avoid direct electricity payments, expensive upgrades for electrical equipment or software, and device management.
- ❑ Promote advanced technology and the potential for expanding deployment of low-carbon technologies.

Energy-as-a-Service (EaaS) Success Stories



中電源動出資為瑞安中心設計、建造、營運、維修及保養的全新淡水冷卻機組，配以人工智能系統「PlantPRO」及樓宇管理系統，較現有的海水冷卻機組節省超過三成用電量，相當於每年370噸的二氧化碳排放量。

(Source: CLPe)



中電源動集團為宏利金融中心打造全新的供冷系統，結合高效製冷設備及人工智能技術，預計新系統可提升供冷系統的能源效益超過 60%，每年節省超過30%的供冷用電量，減少約900噸碳排放量。



如心廣場位於荃灣西的核心地段，內設酒店、寫字樓、商場及木化石公園「如心園」，佔地超過18 萬平方米。新設的水冷式空調系統能夠大幅提升能源效益，預計較現有系統節省超過5成的用電量，相等於每年減少7,000公噸的二氧化碳排放量。

HONG KONG AS A GLOBAL GREEN TECH HUB

Strategic Location

- Gateway to Greater Bay Area and international markets
- Unique "One Country, Two Systems" advantage
- Proximity to world-class manufacturing in the GBA
- Ideal testing ground for global green tech solutions

Policy Support

- Government funding and supportive regulations drive innovation
- Green Tech Fund for R&D and commercialization
- Clear roadmap via the Climate Action Plan 2050
- Incentives for green building and transport adoption

Innovation Ecosystem

- Vibrant ecosystem for startups and established tech firms
- HKSTP and Cyberport as key innovation engines
- Strong collaboration between academia and industry
- Access to a diverse pool of international talent

Green Finance

- Asia's leading hub for green bonds and sustainable investment.
- Abundant capital for green ventures and infrastructure
- Robust regulatory framework for green finance.
- Leading the way in ESG disclosure and standards

OVERCOMING BARRIERS: THE PATH TO 2050

Current Challenges

⚠️ Economic Barriers

High initial capital expenditure for green tech retrofitting and the perceived long payback periods for investors.

👤 Talent Shortage

A critical gap in specialized skills for green engineering, ESG data analytics, and sustainable asset management.

📊 Data Standardization

Fragmented reporting frameworks and the lack of standardized, verifiable ESG data across different sectors.

Strategic Path Forward

🤝 Public-Private Partnerships

Leveraging government funding (Green Tech Fund) with private sector innovation to de-risk pilot projects.

🧪 Emerging Technologies

Accelerating the adoption of Hydrogen fuel, Carbon Capture (CCUS), and advanced long-duration energy storage.

🎯 Policy Efficiency

Streamlining regulatory approvals for green building materials and promoting unified ESG disclosure standards.

COLLABORATION ACROSS SECTORS IS ESSENTIAL TO MEET THE 2050 NET-ZERO GOAL
NET-ZERO GOAL



KEY TAKEAWAYS

Economic Opportunity

ESG transformation is a significant economic driver for Hong Kong, creating new markets in green tech and sustainable finance.

Proven Viability

Success stories like Two Taikoo Place and WENT Landfill demonstrate that green technologies are technically mature and commercially viable.

Strategic Hub

Hong Kong is uniquely positioned as a global green tech hub, bridging the Greater Bay Area with international innovation ecosystems.

Q&A

Questions & Discussion

Thank you for your attention.
Driving a Sustainable Future Together.



 **GREENTECH IN PRACTICE:
CONNECTING TECHNOLOGY AND ENVIRONMENTAL
ACTION**



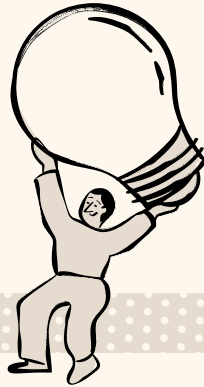
Project Experience



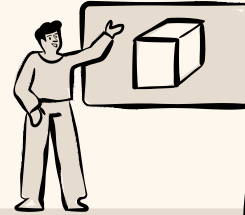
Smart meter infrastructure
~2.5m customers



AI-enabled building
management system



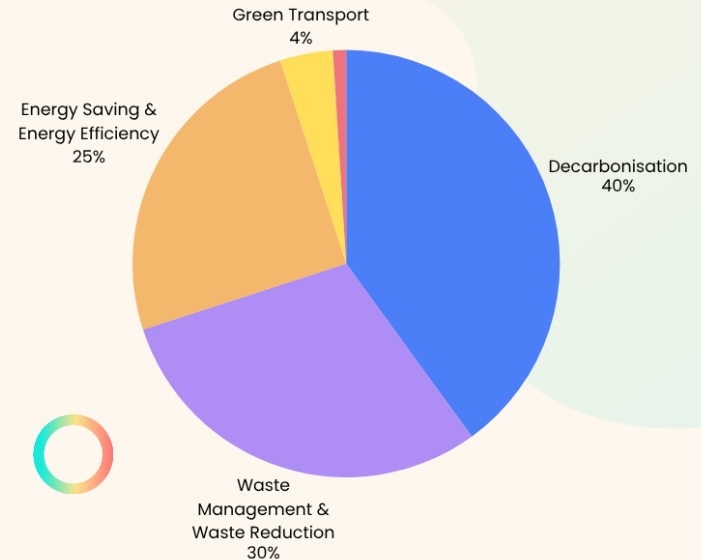
Sustainability data system





Green Tech Fund

The Green Tech Fund (GTF) is a Hong Kong government initiative that supports applied R&D projects to develop and pilot innovative green technologies, with a focus on **decarbonisation, energy efficiency, waste reduction** and **circular economy solutions**.





About Greentech

1

Clean & Renewable Energy

- Solar PV, wind turbines, hydropower
- Energy storage (batteries)
- Green hydrogen
- Smart grids

2

Energy Efficiency & Electrification

- Smart buildings and energy management systems
- Heat pumps
- High-efficiency industrial equipment

3

Sustainable Mobility

- Electric vehicles (EVs)
- Charging infrastructure
- Sustainable aviation fuels (SAF)
- Rail and mobility-as-a-service platforms

4

Environmental Monitoring & Digital Greentech

- AI / IoT for emissions, water, and biodiversity monitoring
- Satellite and drone-based environmental assessment
- Climate and nature risk analytics

5

Circular Economy & Waste Reduction

- Recycling and waste-to-energy technologies
- Biodegradable materials
- Industrial symbiosis platforms

6

Water & Nature Solutions

- Water treatment and desalination
- Nature-based solutions
- Biodiversity restoration technologies



About Greentech



Technology

Efficiency
Data quality



Environment

Make the environment
better

- air
- water
- waste
- noise





About Greentech

1

Clean & Renewable Energy

- Solar PV, wind turbines, hydropower
- Energy storage (batteries)
- Green hydrogen
- Smart grids

2

Energy Efficiency & Electrification

- Smart buildings and energy management systems
- Heat pumps
- High-efficiency industrial equipment

3

Sustainable Mobility

- Electric vehicles (EVs)
- Charging infrastructure
- Sustainable aviation fuels (SAF)
- Rail and mobility-as-a-service platforms

4

Environmental Monitoring & Digital Greentech

- AI / IoT for emissions, water, and biodiversity monitoring
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Circular Economy & Waste Reduction

- Recycling and waste-to-energy technologies
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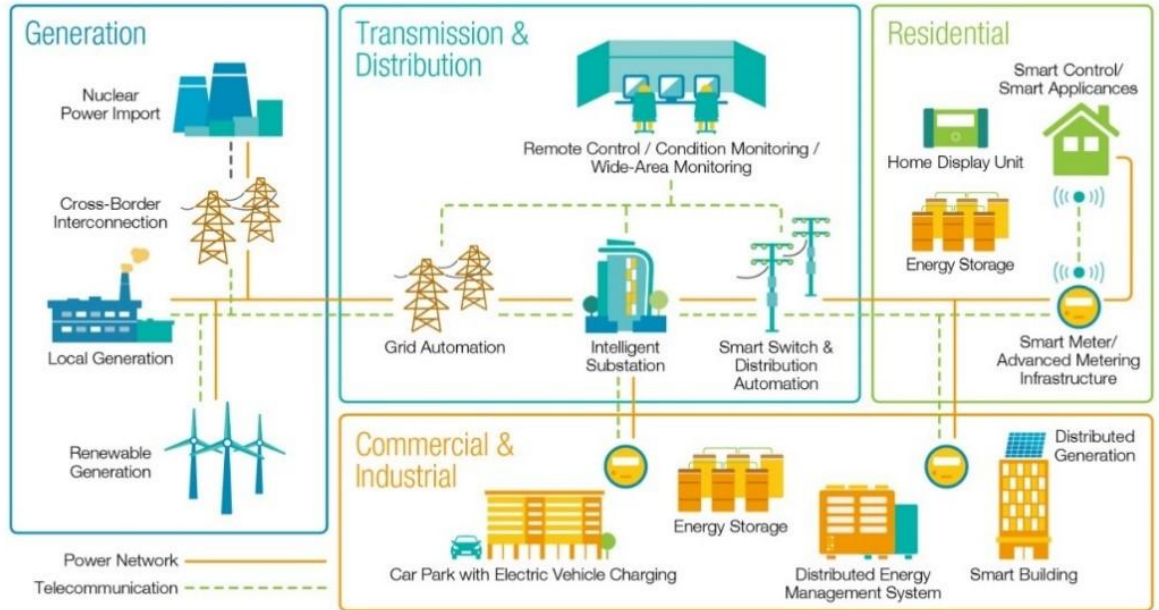
6

Water & Nature Solutions

- Water treatment and desalination
- Nature-based solutions
- Biodiversity restoration technologies



Smart Grids



The first official definition of Smart Grid was provided by the [Energy Independence and Security Act of 2007 \(EISA-2007\)](#)

- **Digital & data-driven**

Uses digital information, sensors, and control technologies to improve grid reliability, security, and efficiency.

- **Optimised & secure operations**

Enables real-time, dynamic optimisation of grid operations and resources, supported by robust cybersecurity.

- **Integration of distributed energy resources**

Supports large-scale integration of renewable energy and other distributed generation sources.

- **Active demand-side participation**

Incorporates demand response, energy efficiency measures, and other demand-side resources.



Smart Grids



- **Advanced smart infrastructure (AMI)**
Deploys smart meters, automated distribution systems, and real-time communication technologies for grid monitoring and control.



Smart Grids

• Empowered consumers (Residential customers)

Provides consumers with timely information and control options over energy use.

Consumption History at a Glance

Steps to review
Log in > Discover > View Consumption

Forecast and Energy Management

As of today	Projected
26 Sep - 27 Oct	26 Sep - 25 Nov
1,108.90 Units	2,113.80 Units
-	\$3,319.68

Customised Consumption Alert*

How to receive consumption alert:
Log in > Profile > Notification settings > View consumption

*Activate notifications on your CLP App to receive alerts.

Customised Consumption Alert*

How to receive consumption alert:
Log in > Profile > Notification settings > View consumption

*Activate notifications on your CLP App to receive alerts.



- **Empowered consumers (Commercial customers)**

Provides consumers with timely information and control options over energy use.

Smart Grids

Data Download & Monitoring

- Clear and concise graphs displaying your business's monthly/daily/half-hourly energy consumption and peak demand data; and
- Hassle-free downloads of load profile data for up to 10 accounts/meters.

Carbon Footprint Calculation

- Support for the quantification of carbon emissions related to energy consumption and comparisons of year-to-year assessments; and
- Useful for sustainability reports and carbon reduction target reviews.

Energy Analysis

- Access to temperature and energy consumption data; and
- Help your business analyse its operational models better energy management opportunities.

Benchmarking

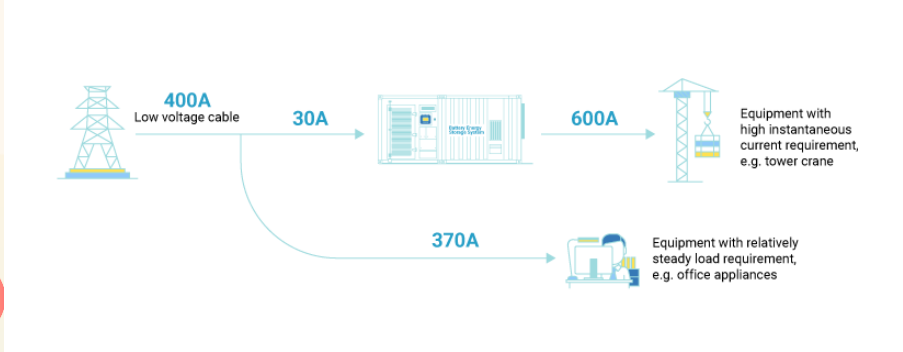
- Comparison of energy consumption patterns across different accounts over the same period or across different periods for the same account to evaluate the efficacy of your business's energy-saving practices.

Proactive Energy Management

- Email alerts to your designated staff in the event that your business's energy consumption or demands exceed pre-set limits to enable timely adjustments.



Smart Grids



- **Energy storage & peak management**
Integrates advanced energy storage, EVs, hybrid EVs, and other peak-shaving technologies.

- **Interoperable standards**
Develops and applies communication and interoperability standards across grid infrastructure, equipment, and appliances.

- **Enabling adoption**
Identifies and reduces technical, regulatory, and institutional barriers to smart grid deployment.

- **Smart consumer devices & appliances**
Integrates smart appliances and consumer devices that can interact with the grid.



////// Beyond Smart Grids

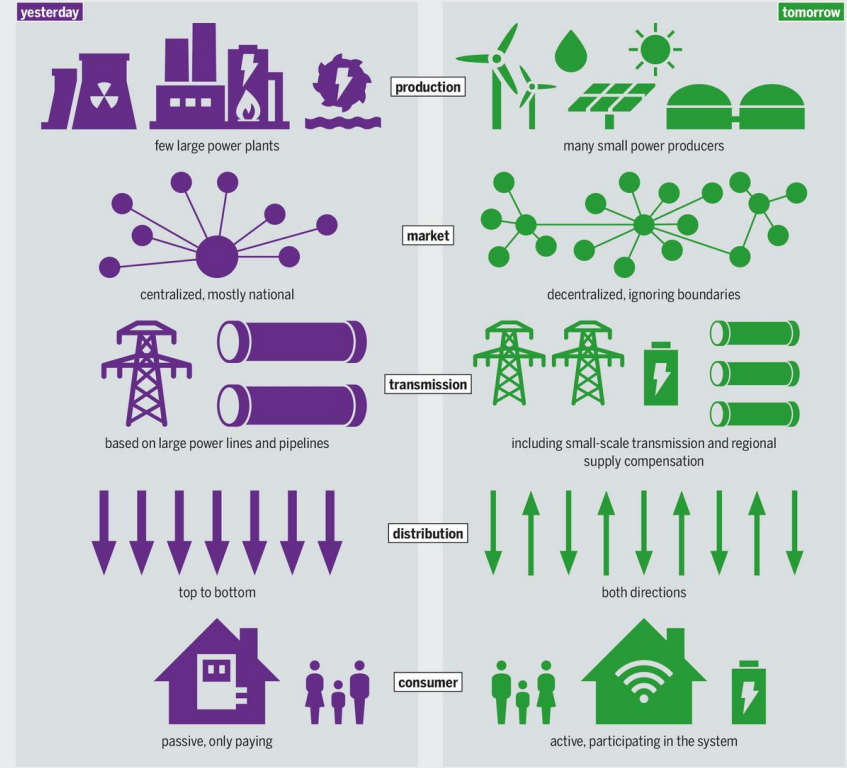




Smart Grids

STAYING BIG OR GETTING SMALLER

Expected structural changes in the energy system made possible by the increased use of digital tools



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Smart Grids



- 1 Timely visibility of external events
- 2 Event information processed at the edge of the Grid
- 3 Insights delivered to field workforce quickly
- 4 Business-wide situational awareness
- 5 Grid & Asset Management Analytics
- 6 Personalised customer support
- 7 Insights to customers



Sustainability Data System

Various generation type with

- operational controls
- equity-shared assets

Data points captured

- energy sent out
- air emission,
- water,
- waste,
- GHG
- safety incidents
- man-hours
- etc



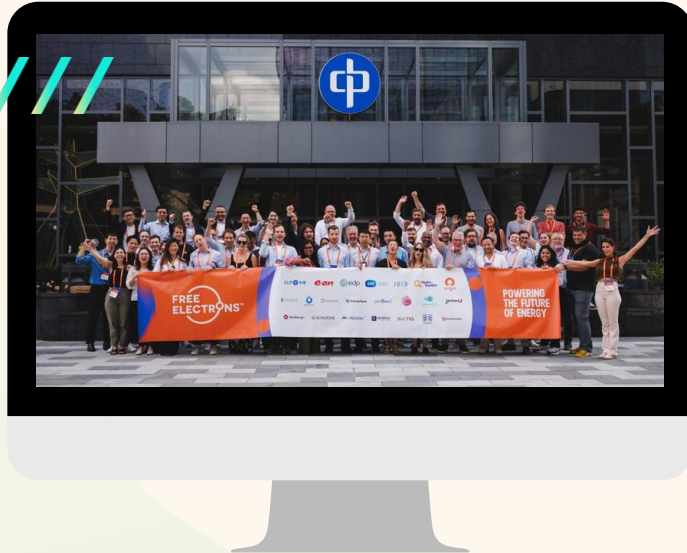


Generator Inspection Robot

CLP Power Hong Kong Limited (CLP Power) and The Hong Kong Polytechnic University (**PolyU**) have jointly developed a smart “Generator Inspection Robot”. By integrating robotics with **fibre-optic sensing technology** for generator inspections, the project overcomes traditional manual inspection limitations, significantly enhancing the **efficiency** of inspections and operational **safety**. The project won a Gold Medal and a special prize—Best International Invention & Innovation, from the National Research Council of Thailand—at the 51st International Exhibition of Inventions Geneva.



Free Electrons



From strategy to execution, the components combine to deliver a cohesive and impactful innovation approach

Strategy

Establishing a future direction



Innovation Insights

Empowering decisions through knowledge

Research

Academic research and advocacy to prepare for the future

Ecosystems

Connecting strategically relevant solutions with our business needs

Innovation Enablement

Uplifting innovation capability, culture, and performance



ESG Transformation & Evolution: Driving Impactful Changes through Technology

Session 4: ESG Challenge Diagnostic

- Objective:** Identify real ESG challenges beyond reporting
- Focus:** Operational, data, governance, execution gaps
- Output:** One priority ESG challenge per group

ESG Challenge

Describe one ESG challenge your organisation struggles to execute.

Why is this difficult?

Root Cause Analysis

Tick the dominant root causes:

- Data
- Systems
- Governance
- Incentives
- Skills
- Other





PASS Training Workshop No. 2

ESG Transformation & Evolution: Driving Impactful Changes through Technology

Session 5: Execution Gap & Technology Enablers

- Translate ESG challenges into execution problems
- Explore technology as an enabler, not a silver bullet
- Do not ask for vendors. Focus on capabilities

Execution Gap:

What prevents progress today?

What information is missing?

What is manual, delayed, or invisible?

Potential Technology Enablers:

Tick and explain relevance:

- | | | |
|---|---------------------------------------|---------------------------------------|
| <input type="checkbox"/> IoT / sensors | <input type="checkbox"/> Smart meters | <input type="checkbox"/> AI analytics |
| <input type="checkbox"/> ESG data platforms | <input type="checkbox"/> Automation | <input type="checkbox"/> Other |
| <input type="checkbox"/> Building / energy management systems | | |



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ESG Transformation & Evolution: Driving Impactful Changes through Technology

Session 5: Execution Gap & Technology Enablers

Impact & Feasibility:

- ESG impact - What improves concretely?
- Operational impact - What changes day to day?
- Pilot feasibility - Pilotable in 12–24 months?
- Risks - What could fail?



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ESG Transformation & Evolution: Driving Impactful Changes through Technology

Session 6: Alignment & Prioritisation of Technology Choice with Organizational ESG Goals

Align technology with:

- ESG objectives
- Core strategy
- Governance and ownership

ESG Alignment

Alignment Area	Question
ESG goal	What does this support?
KPIs	Which metrics improve?
Operations	Who uses it?
Governance	Who owns decisions?



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ESG Transformation & Evolution: Driving Impactful Changes through Technology

Session 6: Alignment & Prioritisation of Technology Choice with Organizational ESG Goals

Ownership

Who should own this?

Operations Sustainability IT Finance

Is this core or peripheral?

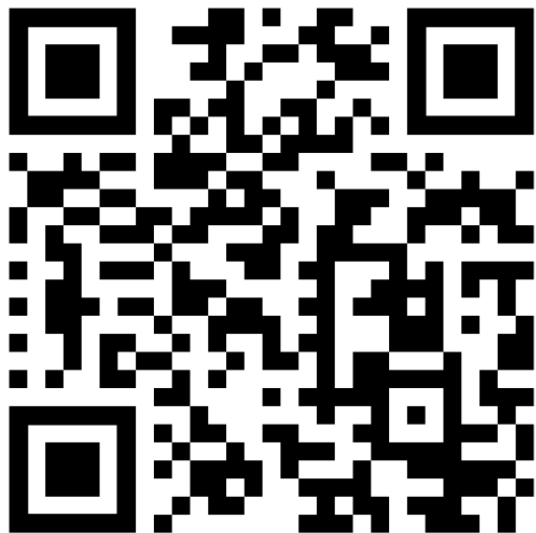
Is this compliance or capability related?

How does this affect regulation, finance, and risk?

Final Takeaway

One ESG execution gap your organization could realistically address with technology in 2 years.

FEEDBACK SURVEY



<https://forms.gle/ft1sHya4nVh2Ht2x9>

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