

2023 BLM秋季論壇  
**降低建築物蘊含碳排 (EC)  
與營運碳排 (OC) 的挑戰**

112年9月15日(五)13:00-17:00  
台北矽谷國際會議中心2B國際會議廳

# ESG in Airports

## An overview

 BLM 台灣人居環境全生命週期管理學會  
TAIWANESE INSTITUTE OF BUILT ENVIRONMENT LIFECYCLE MANAGEMENT



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# Agenda

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## About WSP

# We are WSP

A global professional service firm specializing in providing technical expertise and strategic advice to clients in the Transport & Infrastructure, Property & Buildings, Environment, Industry & Energy sectors.

Approximately 68,000 employees globally, led by an experienced board & management team and supported by long term shareholders.

A leading global provider of design and consultancy services to the built and natural environment

The world's leading Earth Sciences and Environment Consulting firm

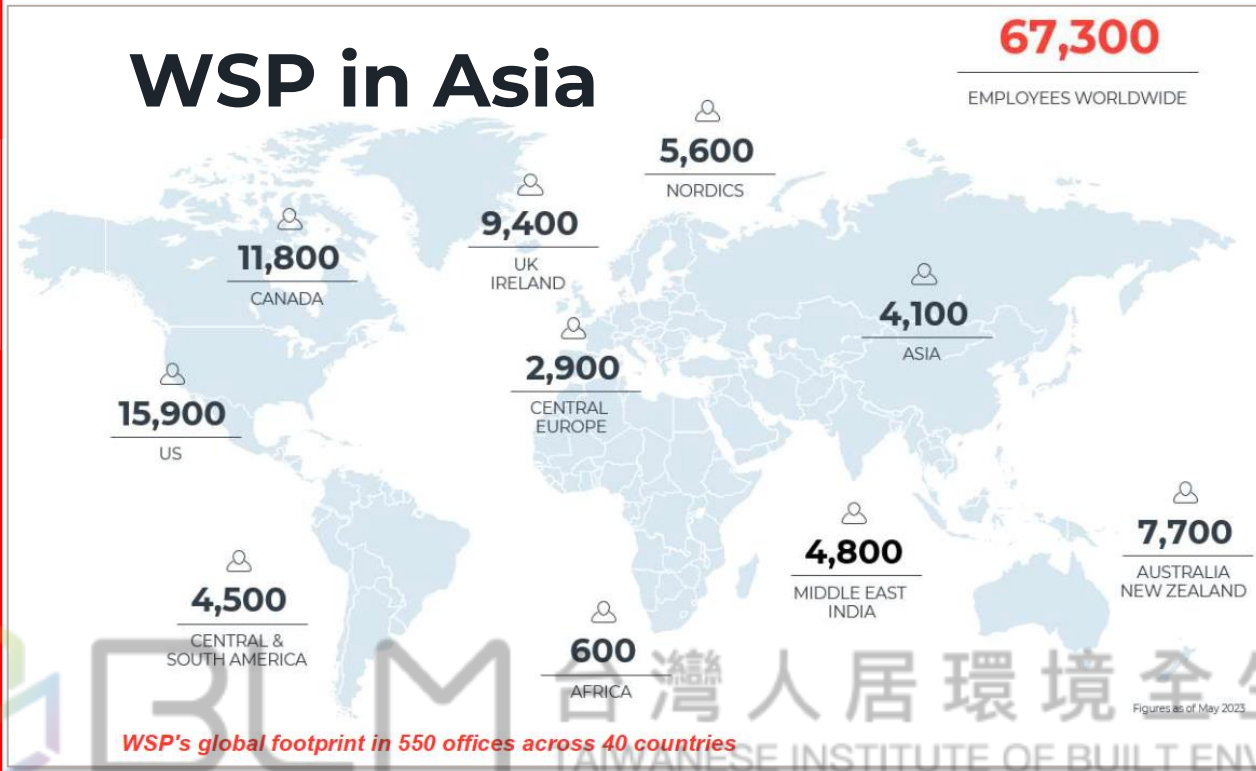
**2023****Creating Resilient & Sustainable Communities Impact****Sustainability M&A of the Year**  
Environmental Analyst Sustainability Consulting Awards**2022****Global Market Leader in ESG & Sustainability Consulting**Verdantix Report:  
Green Quadrant: ESG & Sustainability Consulting**Global No.1 Environmental and Sustainability Consulting Firm**

Based on Environment Analyst data

**Global Market Leader in Digital EHS**Verdantix Report:  
Green Quadrant Digital EHS Technology Implementations**2021****Most Sustainable Company in the Engineering Industry**

World Finance Magazine

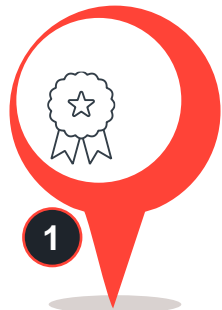
# WSP in Asia



WSP's global footprint in 550 offices across 40 countries

## WSP Global Network

Circular economy, sustainable resources & waste management



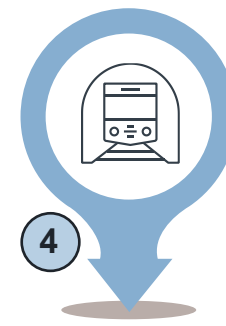
Carbon management & strategy



Climate risk & resilience



Corporate sustainability strategy, ESG reporting & environmental management



Industrial process sustainability, decarbonisation & permitting



## Our key Net-Zero Carbon Service Areas

# WSP's ESG and Sustainability Program



'A' on 2022 CDP Climate Change – one of only 2 in our industry and one of only 2 Canadian firms to make the list



Science-based targets and net zero commitment approved by the science-based targets initiative (SBTi)



Committed to 100% renewable electricity



Published a standalone TCFD Report and Climate Transition Plan



Ranked highly by ESG raters/rankers (e.g., CSA, ISS, Sustainalytics, EcoVadis)



First professional services firm in North America with a sustainability-linked loan



Most sustainable engineering firm 3 years in a row (World Finance Magazine)

## ESG Report

Access WSP's 2022 ESG report [here](#)



## TCFD Report

Access WSP's 2022 TCFD report [here](#).



# verdantix

## Green Quadrant: Climate Change Consulting 2023



Source: Green Quadrant: Climate Change Consulting 2023  
 Copyright © Verdantix Ltd 2007-2023



# Airport Carbon Accreditation Programme

ACI-EUROPE/  
ASIA

We are recognised for our valuable delivery of the **Airport Carbon Accreditation Programme** with the **Airports Council International**.



- + MAPPING**  
Footprint measurement
- + REDUCTION**  
Carbon management towards a reduced carbon footprint
- + OPTIMISATION**  
Third party engagement in carbon footprint reduction
- + NEUTRALITY**  
Carbon neutrality for direct emissions by offsetting
- + TRANSFORMATION**  
Transforming airport operations and those of its business partners to achieve absolute emissions reductions
- + TRANSITION**  
Compensation for residual emissions with reliable offsets

Institutionally-endorsed and supported by:



“WSP worked with us initially to develop the ACA programme and has administered it on our behalf since it was launched over 12 years ago. With their help we have developed a world-leading programme that is helping the global airport sector reduce its climate impacts. It has been a true partnership”

**Marina Bylinsky**  
Head of Sustainability  
ACI-EUROPE

**542** airports  
in the programme

In **90**  
countries across  
the world

Welcoming  
**4.6** billion  
passengers a year

That's  
**44.7%**  
of the global air  
passenger traffic

# Applying Circular Economy Principles to Aviation

Scaling up sustainable practices to achieve net zero



Business pressure on business sectors to set and meet clear targets for sustainable resources requires shifting away from traditional approaches to a synergistic and systemic framework.

This change embraces movement towards the circular economy, which also means to look past the take-make-use-dispose approach to conserving resources to find a more low-waste and damaging way forward. The circular economy concept offers a concrete solution for this. The idea is to reuse resources, creating a closed-loop system. This can be done in many ways, including the elimination of waste and support for regeneration of nature.

Applying the principles of the circular economy can lead to more effective and longer-term achievement of sustainable practices and objectives, including aviation, which is a complex industry. This is particularly important in aviation that has been considered a high-risk area, but there are other sectors like hotels and aviation.

In aviation, demand for new and advanced buildings, infrastructure services, products, technology and services for both land and airside activities, remains significant and is considered directly with the expanding end.



# ELECTRIFICATION OF AIRPORTS FROM LANDSIDE TO AIRSIDE

Generation and storage of electricity to support infrastructure development objectives, operations and cleaner flight

May 18, 2022

The electrification of mobility will be a game changer for aviation. Emerging transportation technologies are shaping the next generation of air and ground transportation, which will also significantly help to reduce environmental footprints.

Electrification will decrease dependency on hydrocarbon-based fuels, improve public health and accelerate progress to achieve net-zero carbon emissions by 2050. Maximizing electricity generated will lead to a future characterized by lower emissions levels, advanced aircraft design, cleaner solutions for the fuel and last mile, new transportation services such as airside or mobility (AMM), an increase of connected and autonomous vehicles within the airport landscape, and innovative business models to support and leverage energy and new technologies. As current and future mobility hubs, airports will need to invest in capacity and resilience of their existing energy distribution grids.

Ground Support Equipment (GSE) is a critical part of airside operations to enable a safe and efficient aircraft turnaround. Not only does GSE electrification save money on fuel and emissions costs, it also contributes positively to the respiratory health of airport workers and surrounding efforts to enhance air quality and reduce carbon footprints. Airlines have been leading the way, but they are often constrained by existing airport electric grid infrastructure.

Electrification is progressing in infrastructure terminal facilities as well as, for instance, replacement of fossil-fuel-based building heating systems with fully electric solutions using...

Net Zero 2050: An Airport Airside Energy Storage (AMM)

## Changing Landscape

### Vehicles and Facilities

Electric powertrains are the future of automobiles. The same is true for zero-emissions (ZEVs) and hydrogen fuel-cell electric vehicles (FCEVs) as part of a larger movement toward connected and autonomous vehicles (CAVs) powered by advanced propulsion technologies. These vehicles will improve mobility from, to and at the airport—both airside and ground. They will also be a key enabler in populating airport landscapes; they are used to provide mass transit solutions for ground access, move passengers from the curbside to parking garages, and provide access to connectivity between terminals and serving airports.

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# Getting Ready for Advanced Air Mobility

Essential steps for integrating aerial innovation into communities—to connect more places, advance equitable transportation solutions, and achieve timely delivery of vital services



A new era of transportation is dawning as advanced air mobility (AAM) becomes part of mobility ecosystems. AAM represents the next generation of aerial transportation, bringing mobility options to communities for passenger, cargo, and emergency services. AAM is part of the overarching Fourth Industrial Revolution (4IR) that is transforming the world through technological advancement, integration of technologies, and the transformation impact these developments bring across industries and societies.

During the first two industrial revolutions, new technologies—steam and electric power, respectively—transformed the means and capacity of production. Today's fourth industrial revolution holds the key to the digital revolution that began in the 1970s and is distinguished by a fusion of technological advances that lie in the intersection between the physical, digital, and biological spheres of life.

To be prepared and better equipped to effectively implement advanced air mobility, governments and regional mobility planners for AAM as part of broader metropolitan and regional mobility planning...

Jorge Alberto Medina, Ph.D. Senior Vice President Managing Director Research and Innovation Services United States

Paul Whelan Director, aerial innovation United States

Guillem Bello, M.Sc. Senior Director Planning Senior Technical Principal United States



# AGILITY UNDERPINS FUTURE-PROOF AIRPORTS

Providing spaces and services to support future travel demand and changing passenger preferences

October 10, 2021

Airports are at a crossroads, challenged to make decisions that will shape a strong future in the aftermath of the COVID-19 pandemic. Moving forward from a severely disrupted airport ecosystem requires a new way of thinking that incorporates agility at the core of all efforts.

What does agility mean? How can agility prepare airports for rebound in air travel and effective responses to heightened passenger expectations? The following Q&A, Tim Morrison, Aviation Director, WSP in the UK, discusses how this capability can facilitate sustained positive change and support performance for years to come.

To fully enjoy the benefits of advanced digital connectivity services, each of these needs must reach their full potential. Taking a Future Ready perspective will enable the best possible impact. Future Ready considers key trends—related to society, climate, resources, and technology—when making decisions to support today and tomorrow's needs.

Airports are dynamic while also being capable for change. The dynamism has already been demonstrated in various ways, such as their business structure, but it is possible to go further. A combination of these, the application of technology enabling seamless home-airport-destination travel experiences as well as customer security and CT (computerized tomography) scanning, and the generation of opportunities to accelerate airport experience rather than encouraging passengers to rush through, is and from the gate. Airports have long embraced Q&A (Change for Manufacture and Assembly) this MAC philosophy is the best way to support and enhance airports while maintaining operations. Utilizing open-assessible...

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# STEPPING UP DECARBONIZATION WITH CARBON CAPTURE AND SEQUESTRATION

A look at how emissions-reduction technology plus the storage of carbon dioxide and hydrogen can accelerate the transition to net zero

May 18, 2022

As an agile airport continues several key actions, embracing digitalization to improve operations and continuously advance the passenger experience, adopting a hybrid economic model, and applying Modern Methods of Construction (MMC) bring transformation—all within an overarching decarbonization wrapper.

To fully enjoy the benefits of advanced digital connectivity services, each of these needs must reach their full potential. Taking a Future Ready perspective will enable the best possible impact. Future Ready considers key trends—related to society, climate, resources, and technology—when making decisions to support today and tomorrow's needs.

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# AIRPORT PLANNING EMBRACES FUTURE TRAVEL

Turning challenges into opportunities within the aviation market

November 17, 2021

In the following Q&A, WSP planning and advisory experts discuss ways to address the airport planning process as aviation grapples with rapid change and heightened uncertainty amid travel restraints.

Equally and understanding more us away from the silver economy that offer characterized past practices to a holistic one, this perspective enables adoption of new approaches and technologies to address the pressing concerns of today and tomorrow. Only through a more cooperative and highly collaborative planning process can airports identify, practice and address issues in a sustainable manner.

John van Wonen, I think the cross-pollination part is true for internal airport stakeholders as well as external ones. In the US, what we sometimes see is a lack of true acceptance, but more support for a plan that was developed in an organizational silo. The plan may be supported by the director, but various departments and stakeholders conclude that the process did not consider their concerns. They will not support it, but they in all likely result in a shared plan, rather than one that could have led to a broadly beneficial outcome.

Boaco Rodrigues, Effective planning also enables airports to respond to a timely way to changing circumstances. Planning has traditionally called for simultaneous consideration of socioeconomic issues and the...

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# Decarbonising Aviation From the Ground Up

From infrastructure to aircraft, embarking on a comprehensive path to achieve net-zero emissions



Published May 22, 2022  
Updated May 4, 2022

Planning for the future of aviation is a multidimensional endeavor that must include decarbonization at the heart of all decisions.

Global air pollution, aviation specifically, is about a percent of carbon emissions (but 35 percent of the growth of climate change). In comparison, the carbon emissions from the transport sector (by far) are 10 percent of greenhouse gas (GHG) emissions and have already taken notable mitigating steps. Moving forward, to do its part in slowing global temperature rise, the aviation sector must embark on a comprehensive path to achieve net-zero emissions.

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What is ESG - Drivers?



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ESG Landscape

# ESG... The Landscape - A Matrix

## WSP ESG Domain Areas of Expertise



# ESG... The Landscape - A Matrix

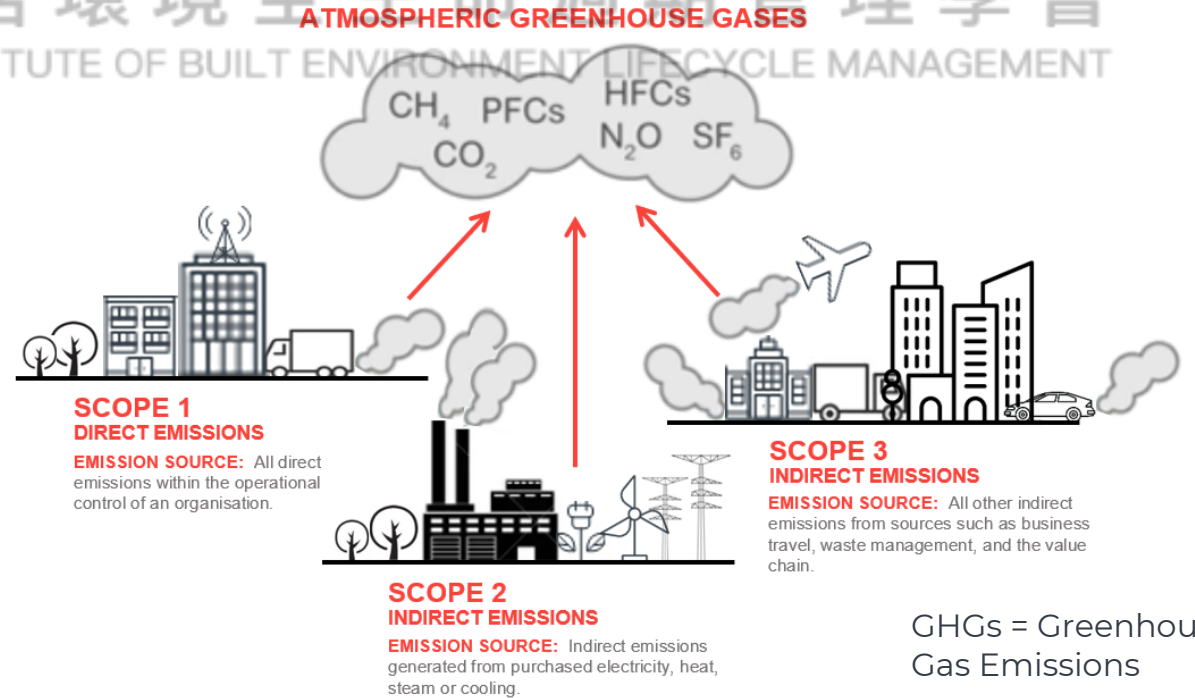
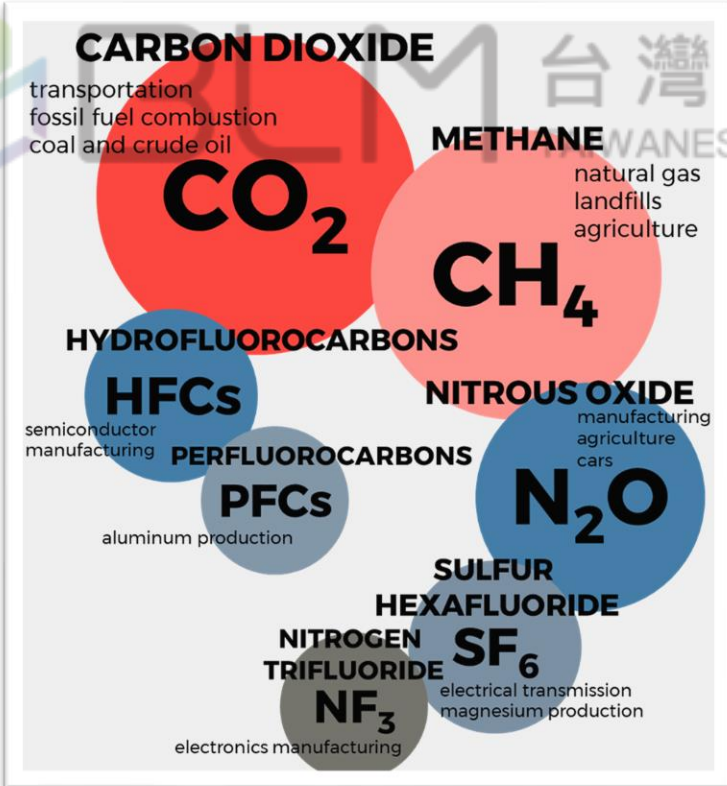
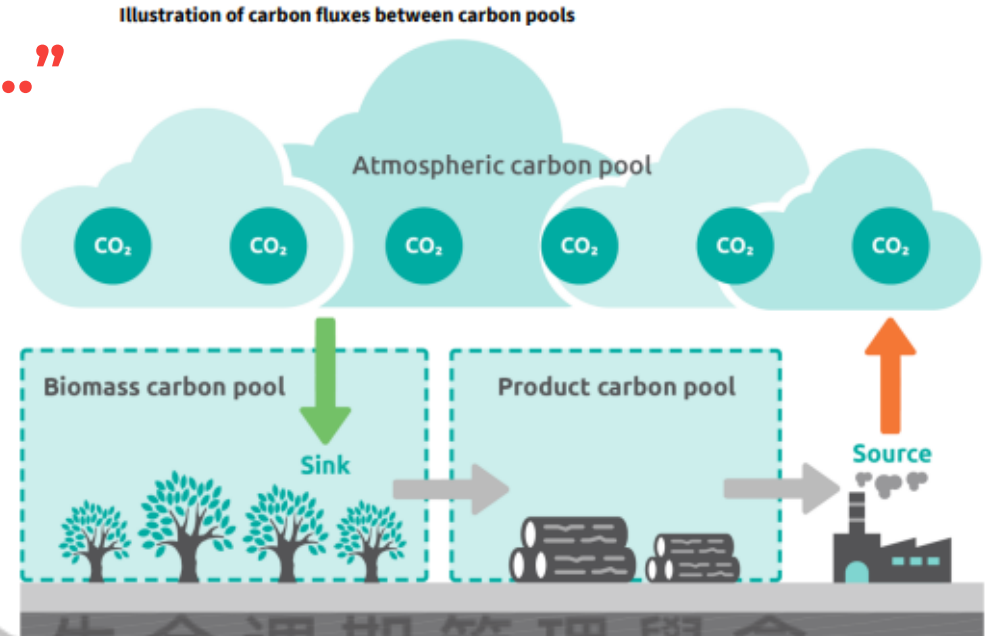
## WSP ESG Domain Areas of Expertise



**Environmental concerns and GHG accounting serve as key starting points for managing airport climate, sustainability, and ESG needs**

# What Are GHG Emissions? – The “E...”

- Greenhouse gases trap heat from the sun and warm the planet's surface
- Primary anthropogenic sources of GHG emissions are the burning of fossil fuels for electricity, heat and transportation



GHGs = Greenhouse Gas Emissions

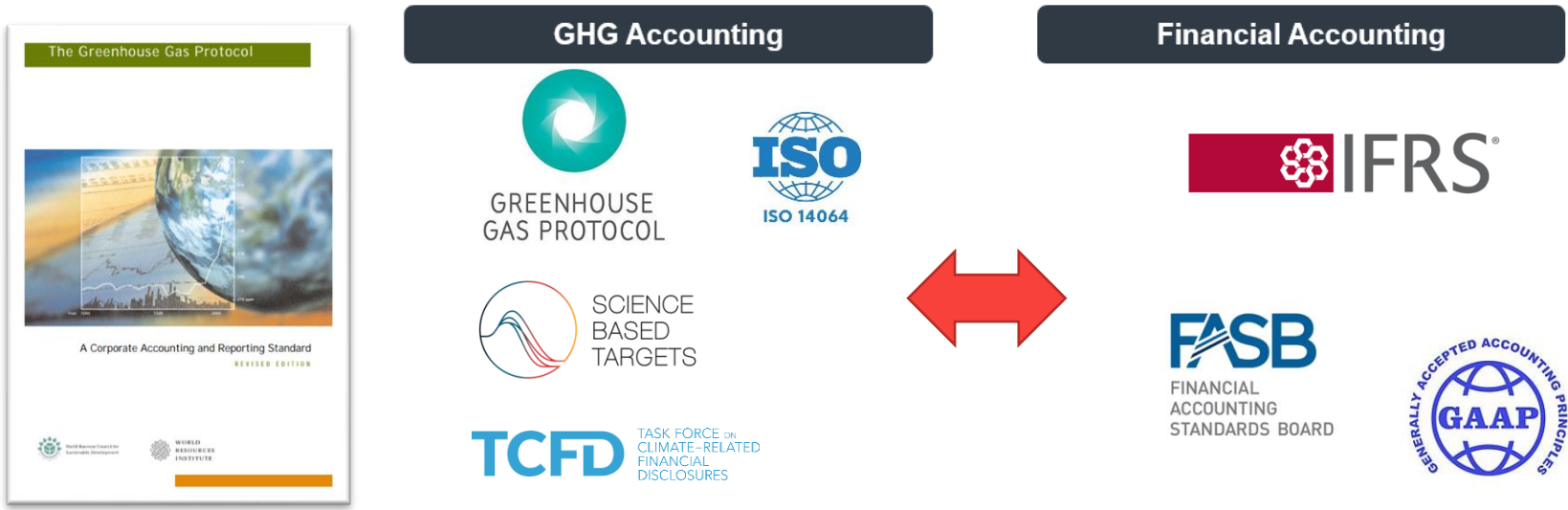
# Corporate ESG for Airport Asset Owners...

## Drivers for Calculating GHG Emissions

1. Regulations
2. Customer Expectations
3. Investor Pressure
4. Action-Oriented Management
5. Climate Risk
6. Decarbonization Targets
7. Consumer Awareness
8. Reducing Emissions

## GHG Reporting & Financial Accounting

GHG emissions accounting differs greatly from financial accounting. While both GHG and financial accounting use globally accepted best practices and standards, GHG accounting relies heavily on estimation and extrapolation.





# Corporate ESG for Airport Asset Owners...

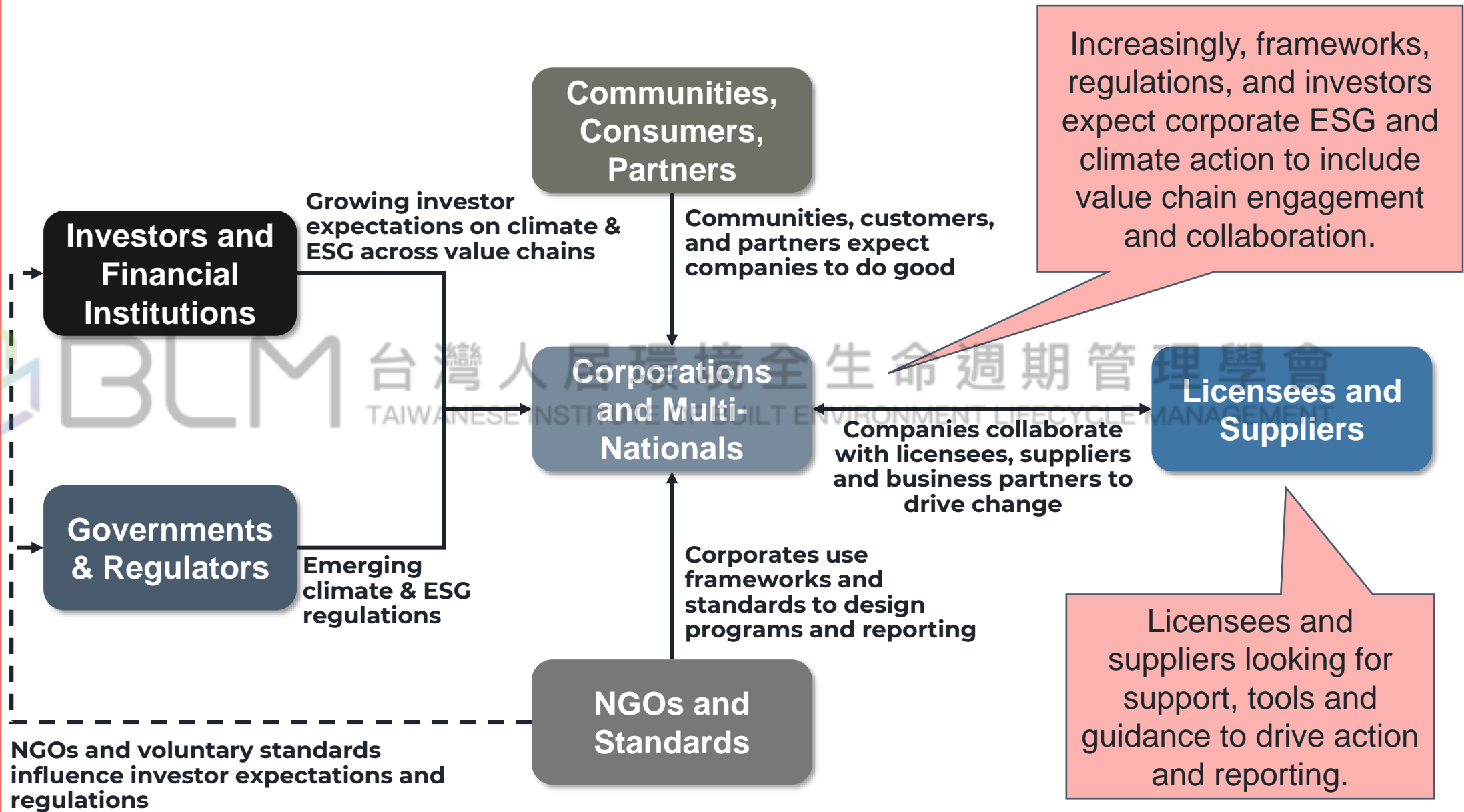
## Drivers for Change in Aviation...

- Airport Upgrades / Refurbishment Programmes
- Climate Resilience / Flood Defense
- Recovery – Pandemic Response Modifications
- Supply Chain Diversification
- Digitisation for Operational Efficiency
- Airspace Management – UAM strategy / eVTOL opportunities

*Even a modest sea level rise, triggered by increasing global temperatures, would place **100 airports** below mean sea level by 2100, a new study has found. (Suvarnabhumi Airport in Bangkok (BKK) and Shanghai Pudong (PVG) top the list)....*



# Growing Calls for Supply Chain Accountability



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# ESG Landscape

## Airport Projects/Case Studies

# Sustainability Coverage – capturing total impact – AVIATION Context ... Case Study (slide 1)

## New Aviation Sustainability Programme – Middle East... Analysis of a range of State-of-the-Art solutions



# AVIATION Context ... Case Study (slide 2)

## New Aviation Sustainability Programme – Middle East... Analysis of a range of State-of-the-Art solutions

### ➤ AIRCRAFT TECHNOLOGIES:

- Emerging eco-efficient aircraft types ranging from conventional, long range commercial airframes, through supersonic, hydrogen, electric, to helium airships. Analyse each solution in terms of sustainability, seat capacity, range, infrastructure dependencies, potential uses (commercial passenger flights, cargo, business travel, etc...), and expected time-frame for market availability.
- Aircraft technologies that are under development that will pave the way for more fuel efficiency gains, such as enhanced aerodynamics and propulsion systems.
- New methods to power and fuel aircraft such as electric, hydrogen and fuel cell, sustainable aviation fuels.

### ➤ AIRLINE OPERATIONS:

- Best practices and recommendations for sustainable aircraft operations that can be developed and applied in the areas of:
  - Aircraft Noise Management;
  - Aircraft Emissions and Local Air Quality;
  - Eco-efficient ground handling;
  - Carbon offsetting schemes.



## AVIATION Context ... Case Study (slide 3)

# New Aviation Sustainability Programme - Middle East... Analysis of a range of State-of-the-Art solutions

### ➤ AIRSPACE MANAGEMENT:

- *Local & Regional Airspace Analysis:*

- *Airspace management concepts including surface management optimisation, performance-based navigation, free route airspace, continuous descent operation, noise abatement procedures, and others.*
- *For each solution, conduct a multi-criteria analysis of impact assessment, maturity level, implementation timeframes and dependencies.*

### ➤ AIRPORT SUSTAINABILITY:

- *Sustainable Solutions for:*

- *Renewable Energy Sources,*
- *Bioclimatic Architectural Concepts,*
- *Material and Waste Management,*
- *Airfield Operations,*
- *Airport Resilience,*
- *Water Management,*
- *Site Sustainability,*
- *Wellness and Thermal Comfort.*

- *Each solution is assessed against chosen KPIs:*

- *Eco-Efficiency;*
- *Technical Feasibility;*
- *relative CAPEX; and*
- *relative OPEX implications.*

- *Airport Carbon Accreditation*

- *Analysis of recommended environmental and certification Frameworks*

## AVIATION Context ... Case Study (slide 4)

# New Aviation Sustainability Programme - Middle East... Analysis of a range of State-of-the-Art solutions

### ➤ **SUSTAINABILITY REGULATION & POLICY:**

- *ICAO, ACI, and IATA (+local) regulations, standards, tools and policies relating to Airline, Aircraft and Airport Sustainability & Carbon Emissions.*
- *Aviation sustainability Incentives and Penalties,*
- *Sustainability drivers, barriers and lessons learned from other Airports*
- *Global Carbon Budget considerations, potential impacts on adjacent Aviation*

### ➤ **REGIONAL POLITICAL CONTEXT:**

- *Regional Competitor Airports - sustainability goals and initiatives*
- *Benchmark Competitor Airlines - sustainability goals and initiatives*
- *Innovation Risks & Opportunities – relating to Airport, Aircraft, & GSE technologies*
- *Synergies and Strategic Partnerships for the Aviation.*

## – AVIATION Context ... Case Study (slide 5)

# New Aviation Sustainability Programme – Middle East...

### ➤ **IMPACT OF PANDEMICS:**

- *Impacts of COVID-19 on Aviation and Sustainability*
- *Industry Consolidation & Cross Sectoral Co-Operation for Better Environmental Performance*
- *New Design Trends*
- *Inter-Modality and More Energy Efficient Transport Modes*
- *Government Policies and Green Recovery*
- *Revenue Diversification and Opportunities to Develop Airport City.*

### ➤ **CUSTOMER PERCEPTION CONSIDERATIONS:**

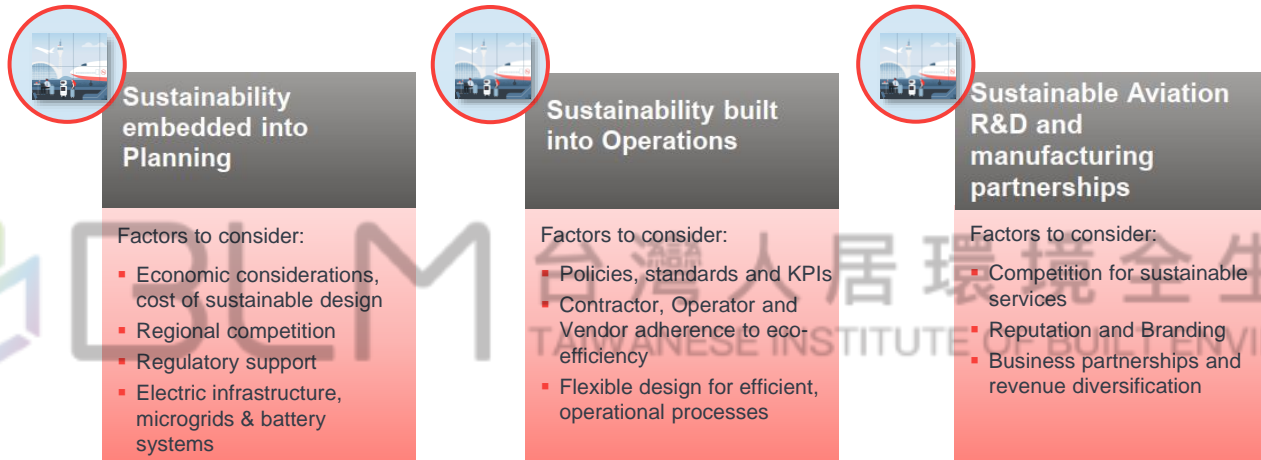
- *Global Climate Change Activism*
- *Positive and Negative Impacts & Risks to neighbouring Aviation*
- *Customer Perceptions: Value of Sustainable Travel*
- *Customer Perceptions: Safety of Unconventional Aircraft Technology*



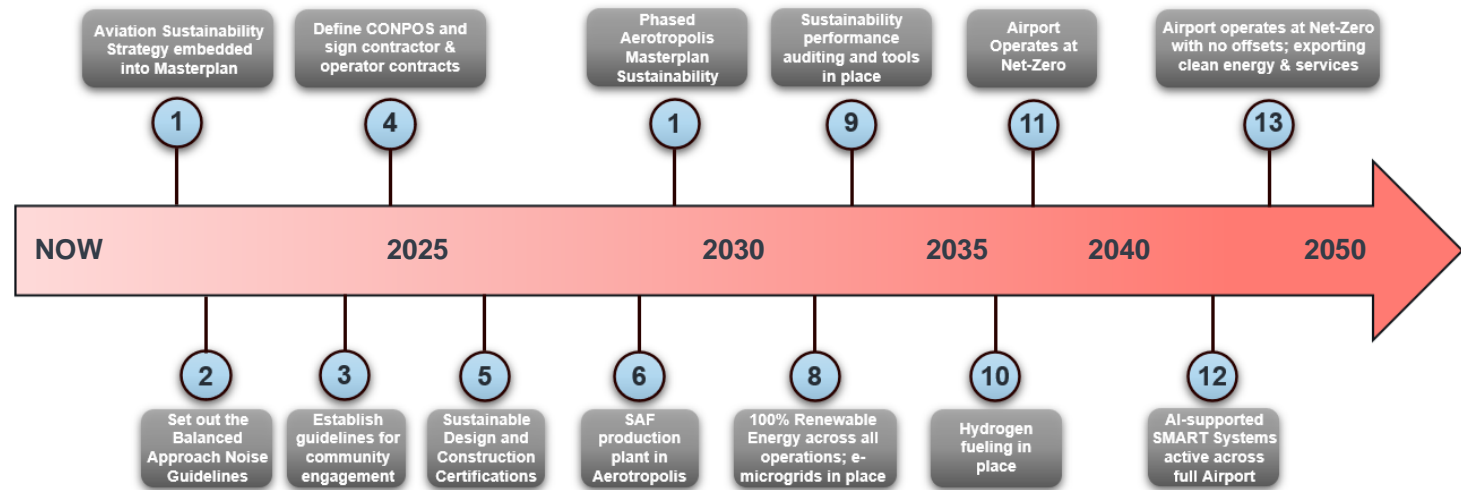
# - AVIATION Context ... Case Study

## New Aviation Sustainability Programme - Middle East... Analysis of a range of State-of-the-Art solutions

### Summary Path to Sustainable Aviation – Key Steps



### Airport Sustainable Roadmap



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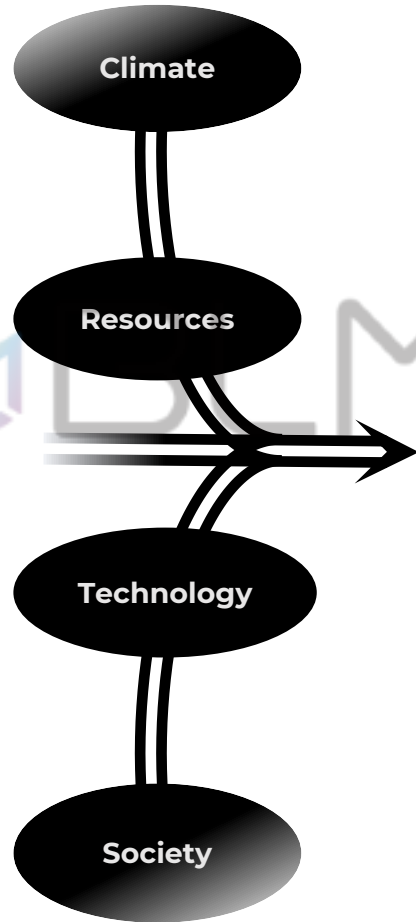
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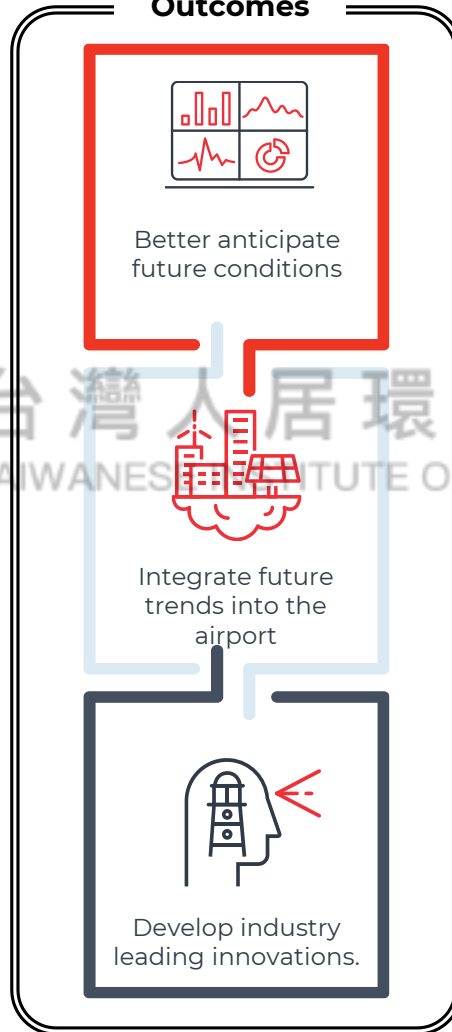
ESG Landscape

# Sustainability Coverage – Future Ready Airports – AIRPORT Context - evaluate & measure...

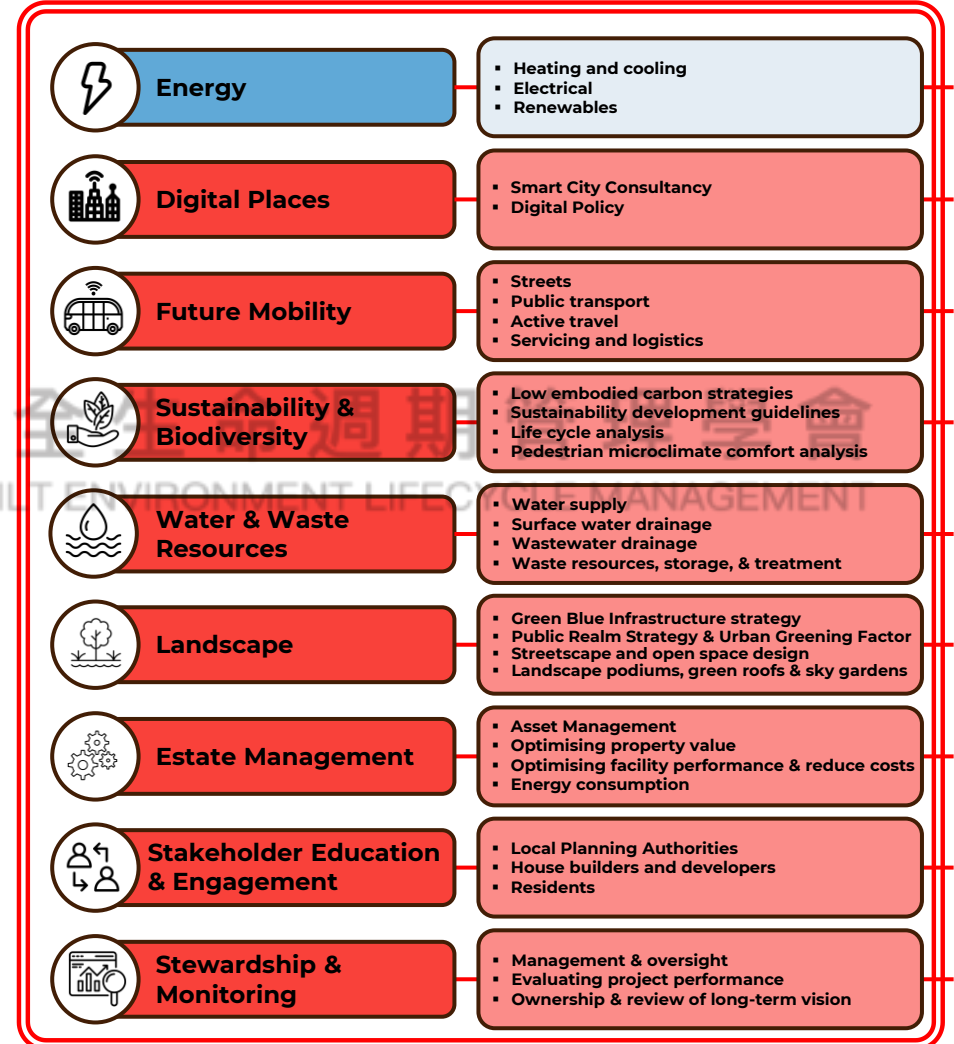
## Future-Ready Megatrends



## Outcomes



## Planning & Delivery Opportunities

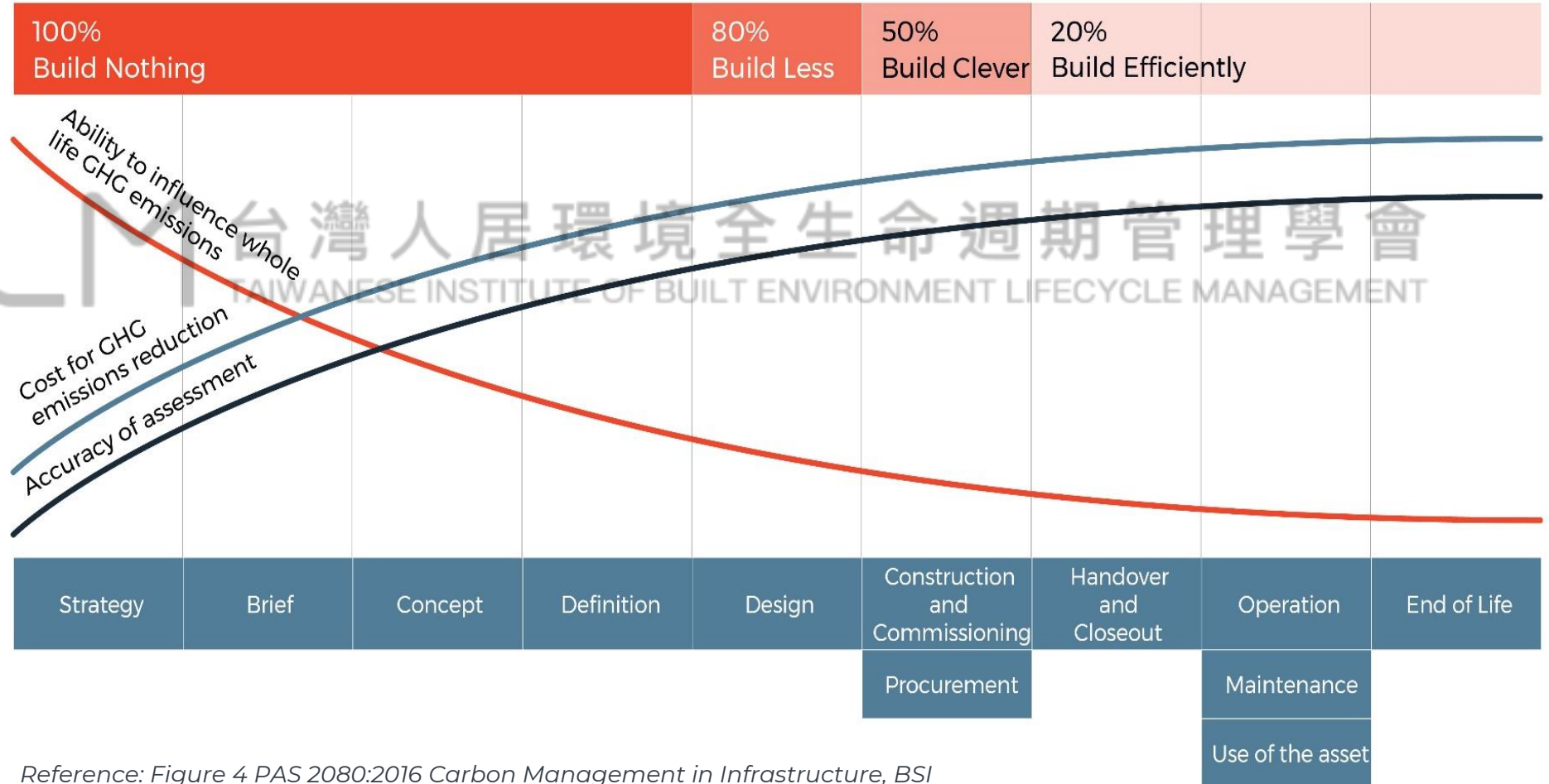


## Techno-Economic Evaluation

# Drivers of Change – For refurbishments or new-build terminals / facilities

Early Engagement is crucial – to make most impact and reduce CAPEX

## Carbon Reduction Curve



Reference: Figure 4 PAS 2080:2016 Carbon Management in Infrastructure, BSI

# Decarbonisation - a journey... understanding emissions

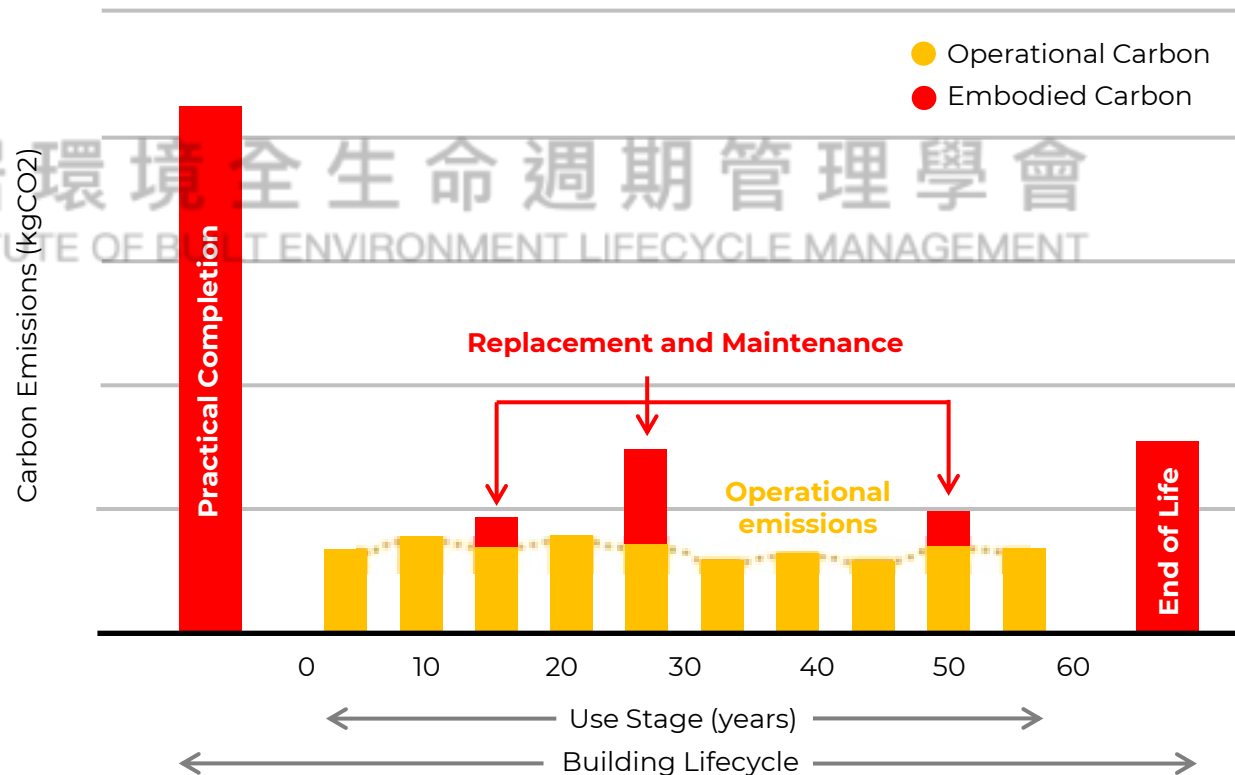
## A NET ZERO BUILDING AND/OR OPERATION? – The Challenge...

What do we actually mean when we talk about net zero carbon buildings?

It is a building that throughout its lifecycle has no net carbon emissions, so the building emissions are balanced with minimising demand.

We utilise low carbon materials and construction techniques and then offset the residual carbon emissions with carbon offsets and with renewable energy.

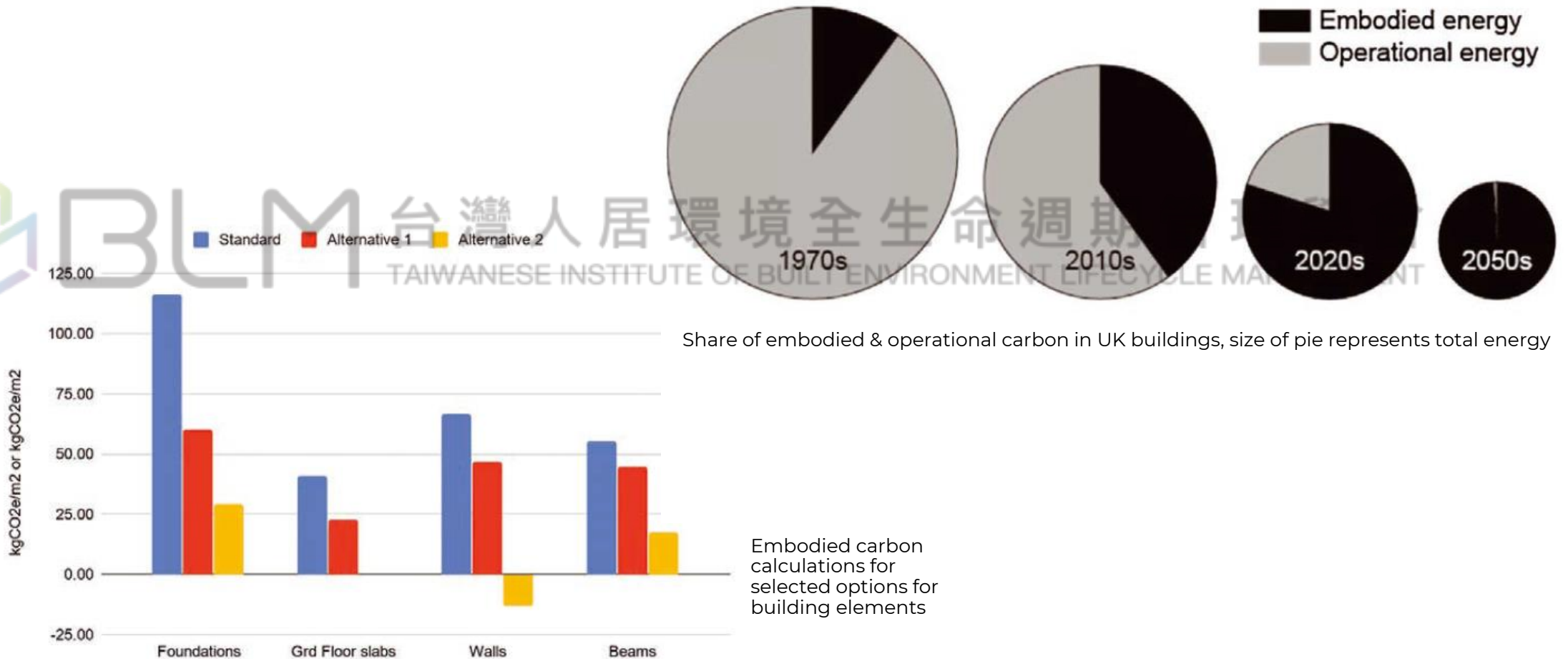
There is no current 'zero-carbon building technical manual'.



Graphs courtesy of LETI – London Energy Transformation Initiative

# Decarbonisation – why does embodied carbon matter?

## A NET ZERO BUILDING AND/OR OPERATION? – The Challenge...



# Carbon Pricing - Ascribing an internal value to carbon

Owing to the necessity for a global reduction in the level of carbon emissions (accelerated by the Paris & Glasgow Climate Agreements), businesses are aware the cost of carbon will increase significantly over a relatively short period of time, as global governments raise the price of carbon emissions through a variety of mechanisms.

Moral drivers are also influencing businesses, as consumers with an increasing focus on Environmental Social and Governance (ESG) credentials are becoming more aware and vocal of the need for positive change, through their purchases and investments.

## Carbon Price:

The price for avoided or released carbon dioxide (CO<sub>2</sub>) or CO<sub>2</sub> equivalent (CO<sub>2</sub> e) emissions – could be the rate of a carbon tax, or the price of emission permits.




Department for  
Business, Energy  
& Industrial Strategy




THE  
LONDON  
PLAN  
EXCITING. EXCEPTIONAL. CONNECTED.




UK  
GBC




INTERNATIONAL  
MONETARY FUND

# EPD Climate impact of building materials Southeast Asia (SEA)

An Environmental Product Declaration, EPD, is a registered document that provides relevant, verified and comparable information about the environmental impact of goods and services.

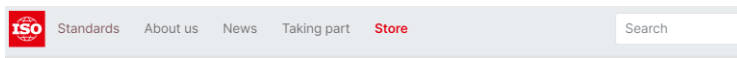
35

The Southeast Asia EPD Programme is a platform for environmental information operating in alignment with our partners The International EPD System

**Southeast Asia EPD Programme is independently verified to ISO 14025, a relevant Product Category Rule (PCR) and the General Programme Instructions (GPIs)...**



# Standards for EPDs



ICS ← 13 ← 13.020 ← 13.020.50

## ISO 14025:2006

Environmental labels and declarations —  
Type III environmental declarations —  
Principles and procedures

### SS ISO 14025:2017

Environmental labels and declarations – Type III environmental declarations – Principles and procedures



**20% of contractor tender evaluation scored on sustainability and evidence of EPDs**

# Environmental Product Declarations (EPDs)

EPDs use consistent measurements; easy and objective comparison of products in the same category



Environmental Facts	Impact
Functional unit = 1 yd <sup>3</sup> of concrete	
Primary Energy Demand (BTU)	9.3x10 <sup>5</sup>
Global Warming Potential (lb CO <sub>2</sub> eq)	~164kg / 360
Acidification Potential (lb H <sup>+</sup> eq)	40
Eutrophication Potential (lb N eq)	0.4
Ozone Depletion Potential (lb CFC-11 eq)	1.98x10 <sup>-5</sup>
Smog Potential (lb O <sub>3</sub> eq)	21

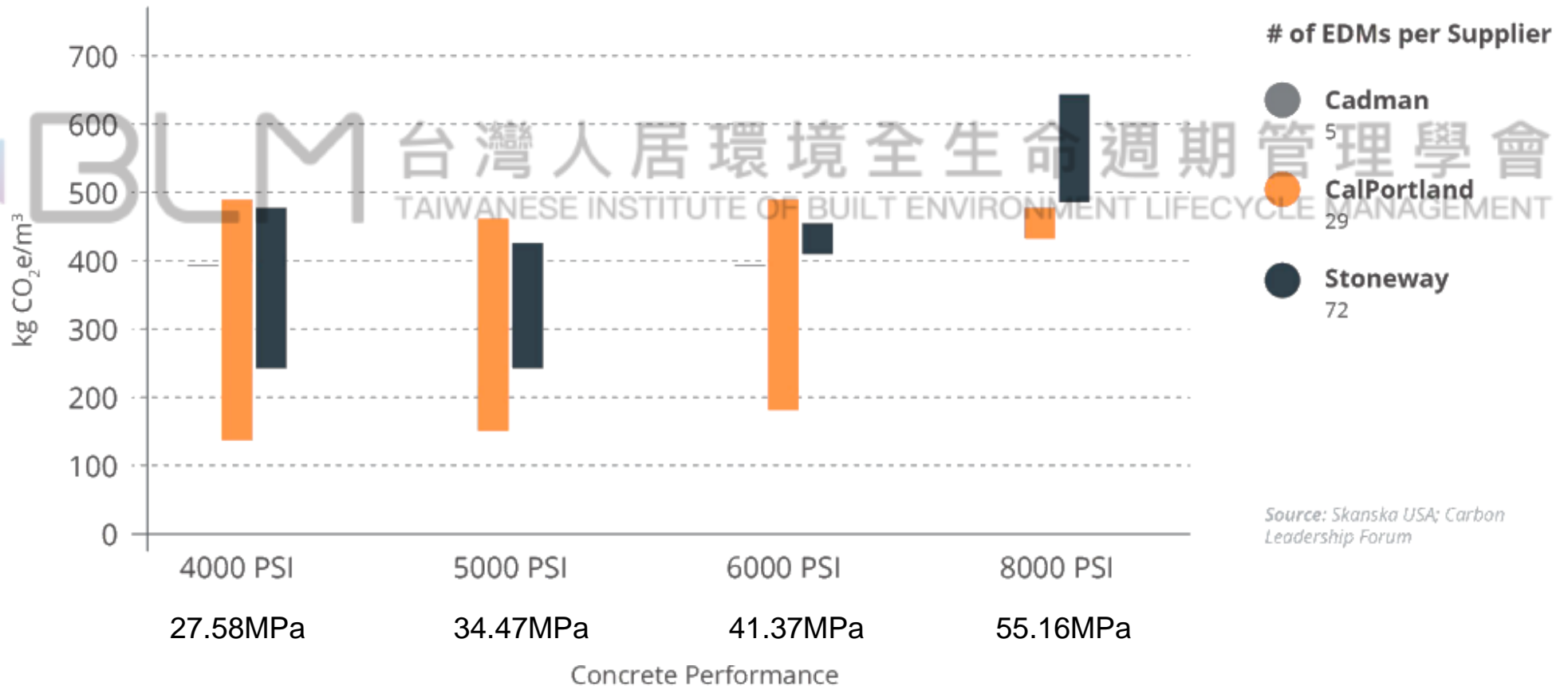
# Environmental Product Declarations (EPDs)

## EC3 Tool Output: Concrete Mix EPDs

[www.buildingtransparency.org](http://www.buildingtransparency.org)



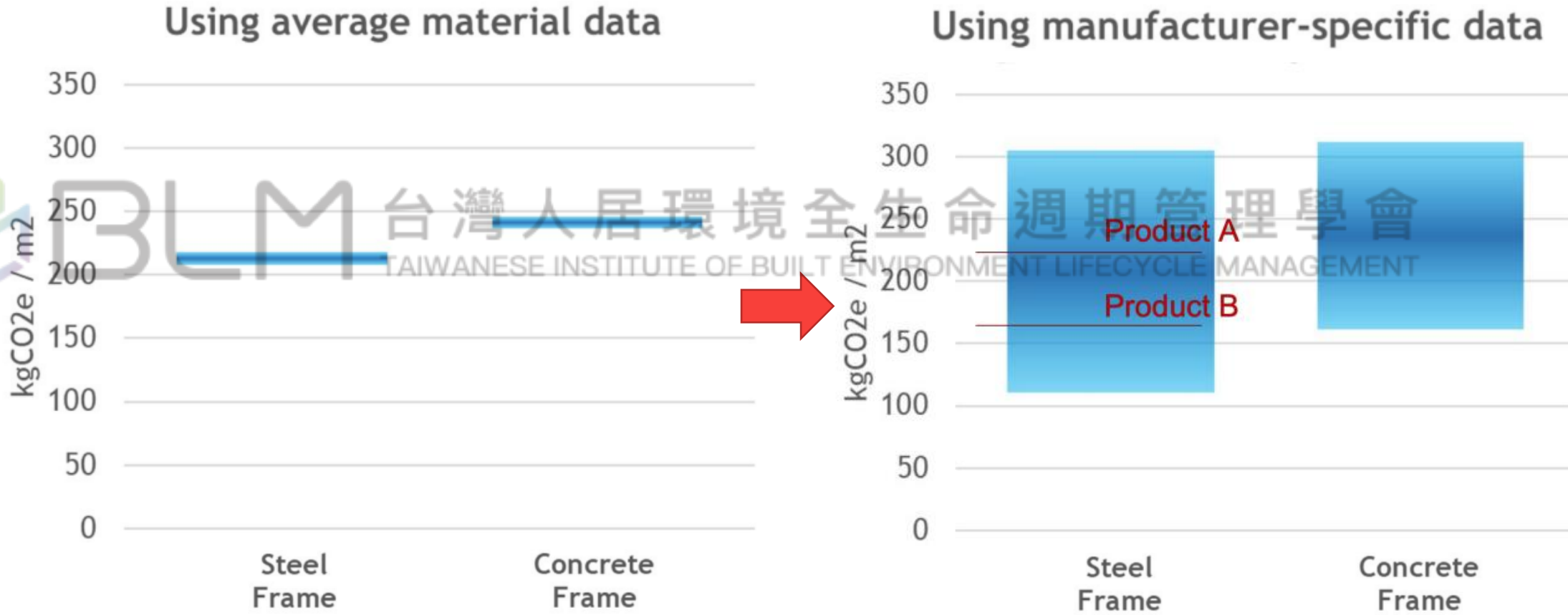
Range of CO<sub>2</sub> Emissions – Seattle Area Concrete Suppliers



Source: Skanska USA; Carbon Leadership Forum

# Environmental Product Declarations (EPDs)

## Comparing Material Decisions



# WSP to lead sector by halving carbon emissions of designs and advice by 2030

WSP will lead engineering consultancy sector by being the first to drive down carbon footprint of its designs and advice to clients.

22 OCTOBER 2020 - UNITED KINGDOM

WSP, the engineering professional services consultancy, will halve the carbon footprint of all designs and advice provided to clients by 2030.

This commitment will span all WSP UK's specialisms and build on the firm's existing pledge to bring its own UK operational carbon emissions to net zero by 2025.

To date, many firms within the consulting and built environment sector have pledged to tackle their own carbon emissions from buildings and travel. This is the first commitment in the engineering consultancy sector to address the carbon footprint of all designs and advice provided to clients – addressing the largest impact and opportunity of all professional services firms.

**David Symons, WSP UK Director of Sustainability, said:** *“This is a transformational commitment which will change every project WSP delivers for our clients. Measuring and halving the carbon footprint of the designs and the advice we give to our clients over the coming decade is a truly exciting prospect and a commitment we’re proud to make.*

*“This is the first commitment of its kind in our sector and will require us to make really substantial investments in skills, R&D, innovation and processes to equip every UK colleague to be carbon leaders as part of WSP’s Future Ready programme.”*

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# “Future Ready” Case Study

## Airport Energy – Net-Zero Solution

### Overview

WSP was commissioned to support one of the largest airport operators in Europe to develop a business case and secure funding to transition to lower emission operations and on-site energy production.

WSP produced business cases for solutions to meet the carbon saving target as the airport agreed in their Concession Agreement.

Energy transition solutions for the airport were identified and analysed regarding the investments needed, the associated operational costs and the (avoided) energy costs.

For each type of energy transition technology considered, the potential total saved carbon emissions were calculated.

### What future trend(s) did we include over current code?

Net Zero 2036: Although the EU aims to be climate-neutral by 2050, the client’s Concession Agreement has introduced aims to cut scope 1 & 2 emissions by half compared to its 2019 emissions baseline by 2026, then fully transition to Net-Zero by 2036 with some allowance to offset and purchase green energy produced outside of the airport by the European ETS scheme.

**Energy Resources:** The client aims to decarbonise their energy supply by using alternate solutions.

**Innovative Technology:** With advances in technology, renewable energy resources are becoming more feasible in large-scale projects compared to traditional carbon-intensive resources.

### How did we consider these trends?

To meet the net-zero target in 2036 with a sub-target goal by 2026, the airport needs to find on-site solutions, as it cannot assume that the grid will become net-zero over time.

To meet the client’s aims for this scheme, carbon emissions calculations per scenario were conducted to define feasible solutions. NPV/IRR calculations were conducted to aid in securing funding in line with the positive sustainable finance social trend.

### How was our final approach better?

On top of analysing the three energy transition solutions (solar power plant, battery-powered energy storage systems and geothermal) for the airport, the best combination of the technologies was calculated.

Moreover, WSP performed a scenario analysis of 3 different day-ahead market prices and advised the client of the risks of their investment and the leverages they have against them. The resulting solutions were achieved:

- On-site solar plant to produce green energy and reduce carbon emissions.
- Addition of a BESS system to decrease the dependence on the grid and allows the airport to meet its emission goals until 2026.
- Reduction of Scope 1 emissions and partial conversion to Scope 2 emissions of natural gas and diesel by adding geothermal heat as a source of thermoregulation means.
- Addition of an energy storage system that allows the airport to utilize more carbon-free energy from the PV plants instead of selling it to the grid, thus, further reducing the Scope 2 emissions.

# Case Study

## Concrete in Airports

Calgary International Airport, Alberta, Canada  
– IATA Code YYC

The YYC East De-icing Apron used a cleantech firm **Carbon Cure** technology to inject CO<sub>2</sub> into the concrete mix process.

“ CarbonCure’s technology enabled the team to provide a **tangible climate benefit** to the Calgary Airport Authority... Early results of this application as seen in Calgary are encouraging... this is a **valuable option for airports** looking at cost-effective options for positive, long-term environmental impacts.”

**Alberto Ruiz**  
National Director,  
Aviation Canada  
WSP



Pouring time: 8 weeks  
Aug - Sep 2019

23,000 cubic meters of concrete,  
Diverted **160 metric tons** of CO<sub>2</sub>  
= 209 acres of Forest  
Sequestering CO<sub>2</sub>



# Case Study

## Captured CO<sub>2</sub> utilised in concrete for Airports



### RUNWAYS

- 258,000 sq.m
- 116,100 cu.m

### TAXIWAYS

- 285,410 sq.m
- 121,300 cu.m

### APRONS

- 756,000 sq.m
- 301,000 cu.m

### TOTAL

- **1,299,410 sq.m**
- **538,400 cu.m**
- **~ 215 Olympic Swimming Pools!**

Concrete is also required for Building Foundations, Parking, Elevated Roadways, sidewalks and more

# Case Study

## How it works: CO<sub>2</sub> Supply & Ready-Mix Concrete

CO<sub>2</sub> is captured and distributed to concrete plants by industrial gas suppliers



**Collection**  
 CO<sub>2</sub> collected from large emitters.



**Purification**  
 The gas is purified by industrial suppliers.



**Delivery**  
 CO<sub>2</sub> delivered to concrete plants by industrial gas suppliers.



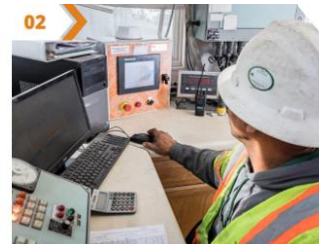
**Storage**  
 The CO<sub>2</sub> is stored in concrete plants in pressurized tanks.



Retrofit technology that operates with no disruption to normal batching procedures



**Installation**  
 CarbonCure engineers install the proprietary equipment into existing concrete plants



**Integration**  
 CarbonCure software integrates seamlessly with the plants batch software



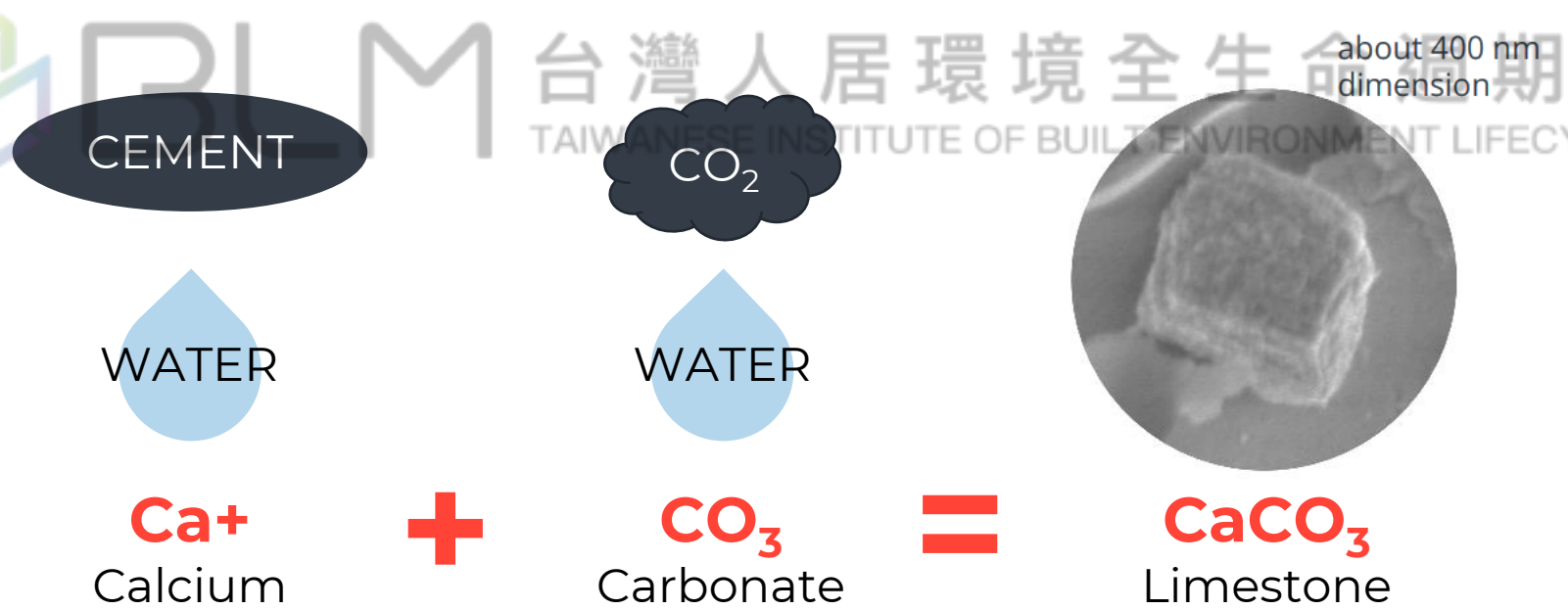
**Injection**  
 The equipment injects a precise dosage of CO<sub>2</sub> into the concrete mix, where it mineralises

# Case Study

## What happens when CO2 is injected?

The CO<sub>2</sub> is formed into limestone and will be in that state forever – it will **not** be returned to the atmosphere even when concrete is broken down

Concrete is “stronger”, thus less cement required and less CO<sub>2</sub> emissions



04

An **Airbus A380** is made up of about four million individual parts produced by 1,500 companies from 30 countries worldwide.

For an A380 to be built, the total quantity of **Tier 1, 2, and 3** suppliers are up in the thousands. The manufacturers depend on the supply chain for components, electronics, finishing, hardware, switches, and much more.



**Just imagine the embodied carbon of component manufacturing before the aircraft gets into service!**

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# Thank You

## 謝謝

 BLM 台灣人居環境全生命週期管理學會  
TAIWANESE INSTITUTE OF BUILT ENVIRONMENT LIFECYCLE MANAGEMENT

# Questions?

## 問題

[in](#) [f](#) [@](#)

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