46th IFAWPCA CONVENTION NEPAL 2023

Resilient and Sustainable Infrastructure Development

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23 November 2023

The World Federation of Engineering Organizations (WFEO)

- The peak international organization for the engineering profession
- Founded in 1968
- Under the auspices of UNESCO
- 90+ national engineering institutions
- Representing some 30 million engineers

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- Associate status with UNESCO
- Co-leader of the Scientific and Technological Community Major Group at the UN
- 13 Standing Technical and Policy Implementation Committees and Working Groups
- Executive Council and Executive Board
- General Assembly
- Supported by a secretariat based in Paris

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WFEO – UNESCO Declaration, signed on March 7, 2018

WFEO / FMOI

CELEBRATING 50 YEARS OF INTERNATIONAL ENGINEERING LEADERSHIP

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World Federation of Engineering Organizations
Fédération Mondiale des Organisations d'Ingénieurs

United Nations Educational, Scientific and Cultural Organization

Paris Declaration

Advancing the United Nations Sustainable Development Goals through Engineering

SUSTAINABLE DEVELOPMENT GOALS

The World Federation of Engineering Organizations (WFEO) is the main body for engineering globally, representing nearly 100 nations and some 30 million engineers.

The members of WFEO are the national and regional professional engineering institutions of the world. WFEO is a member of the United Nations Scientific and Technological Community (UN STC) Major Group and has an official Associate status with UNESCO.

UNESCO, as the United Nations agency for education, science and culture, supports engineering through its Natural Sciences Sector, and acknowledges engineering as a powerful means to achieve sustainable development, capacity-building in engineering education and gender equality in developing countries, as well as the safeguarding of world heritage.

UNESCO World Engineering Day for Sustainable Development - 4th March

A WFEO-led initiative that celebrates engineers worldwide, launched in 2020.

- Since WED 2022, two new international events are held:
  1. 4th March LIVE streaming of engineers' events from around the world
  2. World Engineering Day Students Hackathon
- +100 Global Events - Webinars, Stream, Talks and Competitions, from over 80 countries covering all continents, reaching more than 56 million via social media channels.

Source: https://www.worldengineeringday.net

CLIMATE-RELATED RISKS AND CHALLENGES

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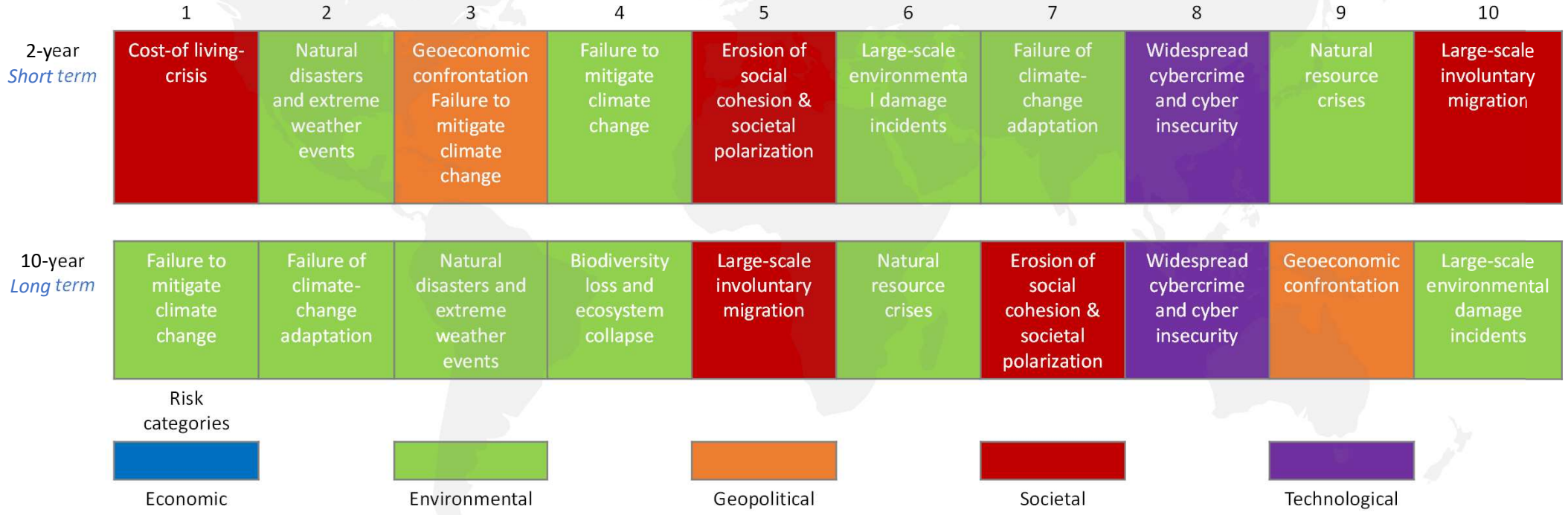
Global Risks

The likely impact (severity) of the following risks over a 2-year and 10-year period ranked by severity

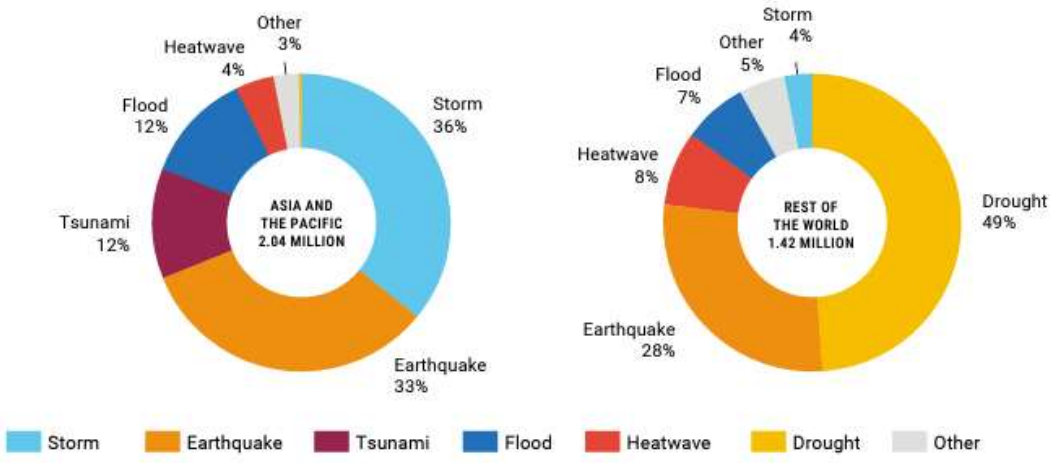


Source: The Global Risk Report, 2023

Disaster Impact in Asia Pacific

According to the ESCAP 2023 report, in 2022, over 140 disaster events occurred in the Asia-Pacific region which caused over 7,500 deaths, affected over 64 million people, and brought economic damage estimated to be over $57 billion

FIGURE 1.2 Number of fatalities from disasters in the Asia-Pacific region and the rest of the world, 1970-2022

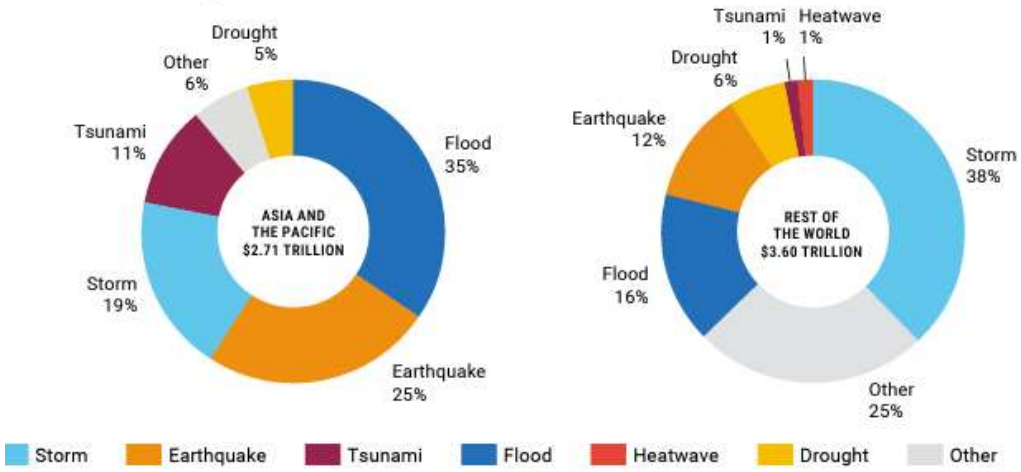


Source: EM-DAT, The International Disaster Database, 2009. Available at https://www.emdat.be (accessed on 14 June 2023).

APAC: 2.04 Million

Others: 1.42 Million

IGURE 1.4 Economic damage from disasters in the Asia-Pacific region and the est of the world, 1970-2022



ource: EM-DAT, The International Disaster Database, 2009. Available at https://www.emdat.be. (accessed on 14 June 2023).
ote: some numbers are still under assessment, for example economic losses caused due to heat.

APAC: USD2.71 Trillion

Others: USD3.60 Trillion

Source: ESCAP, 2023, Asia-Pacific Disaster Report

Climate Risk

Possible Implications of Different Temperature Increases

Warming by 2100	<2°C		3°C	5°C
Physical Impacts	1.5 °C	2 °C		
Sea-level rise	0.3-0.6 m	0.4-0.8 m	0.4-0.9 m	0.5-1.7 m
Chance of ice-free Arctic summer	1 in 30	1 in 6	4 in 6 (63%)	6 in 6 (100%)
Frequency of extreme rainfall	+17%	+36%	+70%	+150%
Increase in wildfire extent	x1.4	x1.6	x2.0	x2.6
People facing extreme heatwaves	x22	x27	x80	x300
Land area hospitable to malaria	+12%	+18%	+29%	+46%
Economic Impacts				
Global GDP impact (2018: $80tn)	-10%	-13%	-23%	-45%
Stranded assets	Transition: fossil fuel assets (supply, power, transport, industry)		Mixed: some fossil fuel assets and some physical stranding	Physical: uninhabitable zones, agriculture, water-intense industry, lost tourism
Food supply	Changing diets, yield loss in tropics		24% yield loss	60% yield loss, 60% demand increase

Source: TCFD, 2020, Guidance on Risk Management Integration and Disclosure

Demand for Infrastructure in APAC

Developing Asia requires $13.8 T in investment, or $1.7 T annually, in infrastructure from 2023 to 2030 to sustain economic growth, reduce poverty, and respond to climate change.

Table 4.6: Climate-adjusted Infrastructure Investment Needs under Low and High GDP Growth Scenarios, 2016–2030
($billion in 2015 prices)

Region	Low Growth Scenario				High Growth Scenario			
	Projected Average GDP Growth	Infrastructure Needs	Average	% of GDP	Projected Average GDP Growth	Infrastructure Needs	Average	% of GDP
Central Asia	2.1	526	35	7.9	4.1	605	40	7.6
East Asia	4.1	14,807	987	5.3	6.1	17,389	1,159	5.2
PRC	4.6	14,097	940	5.9	6.6	16,504	1,100	5.7
South Asia*	5.5	5,930	395	9.0	7.5	6,777	452	8.5
India	5.8	4,811	321	9.0	7.8	5,504	367	8.5
Southeast Asia	4.1	2,951	197	5.9	6.1	3,355	224	5.5
Indonesia	4.5	1,158	77	6.3	6.5	1,304	87	5.8
The Pacific	2.1	43	2.9	9.3	4.1	49	3.3	8.8
Asia and the Pacific	**4.3**	**24,257**	**1,617**	**6.0**	**6.3**	**28,175**	**1,878**	**5.8**

Source: ADB, 2023, Reinvigorating Financing Approaches for Sustainable and Resilient Infrastructure in ASEAN+3

GDP = gross domestic product; PRC = People's Republic of China.
*Pakistan and Afghanistan are included in South Asia.

CHALLENGES ON INFRASTRUCTURE SECTOR

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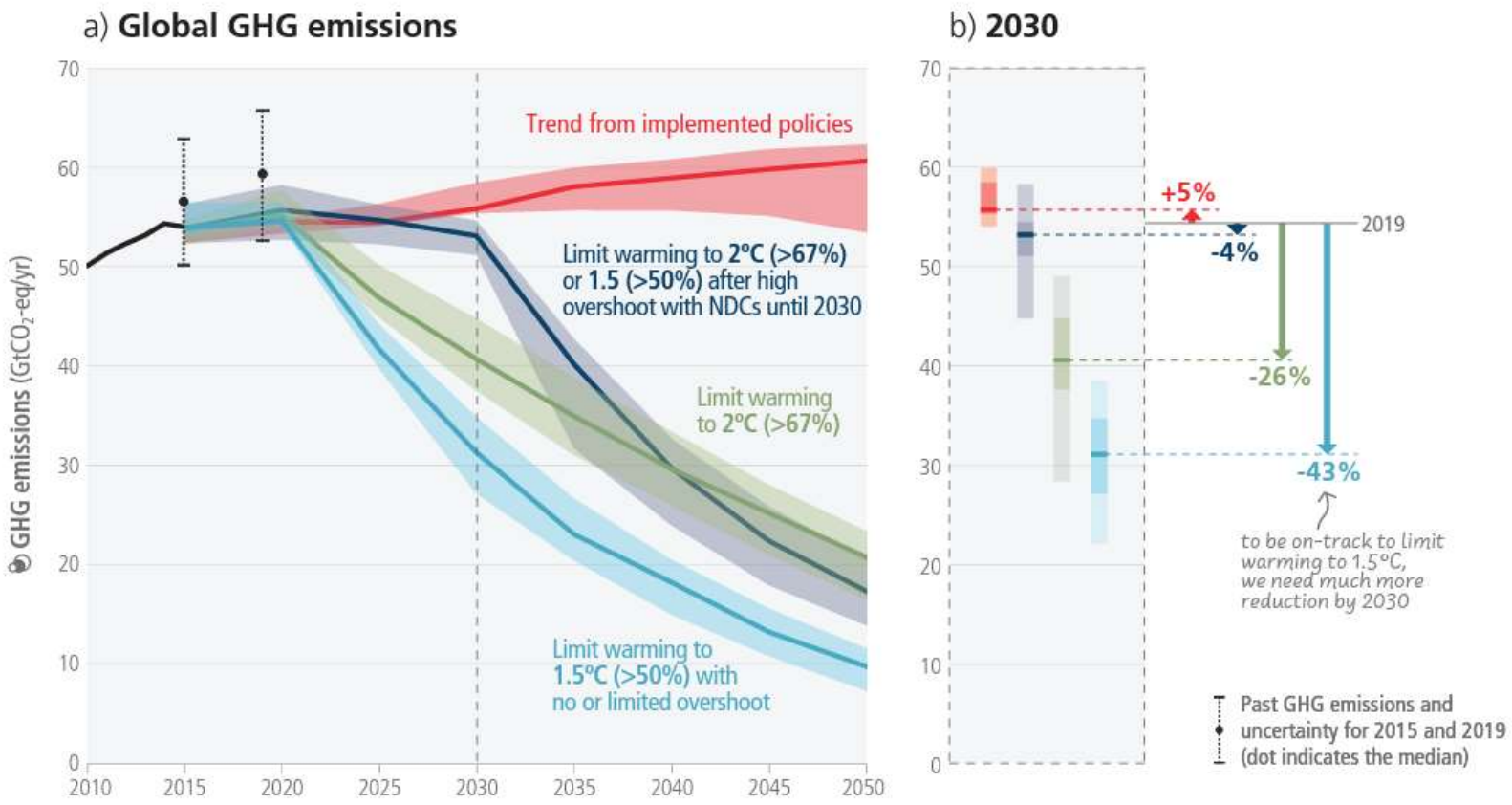
Projected Global Emissions in 2030

Projected global GHG emissions from NDCs announced prior to COP26 would make it likely that warming will exceed 1.5°C and also make it harder after 2030 to limit warming to below 2°C



Source: IPCC, 2023, AR6 Synthesis Report

Global Infrastructure Sector GHG Emission

Figure 2: Infrastructure sector contribution to total GHG emissions.[14,15,16]

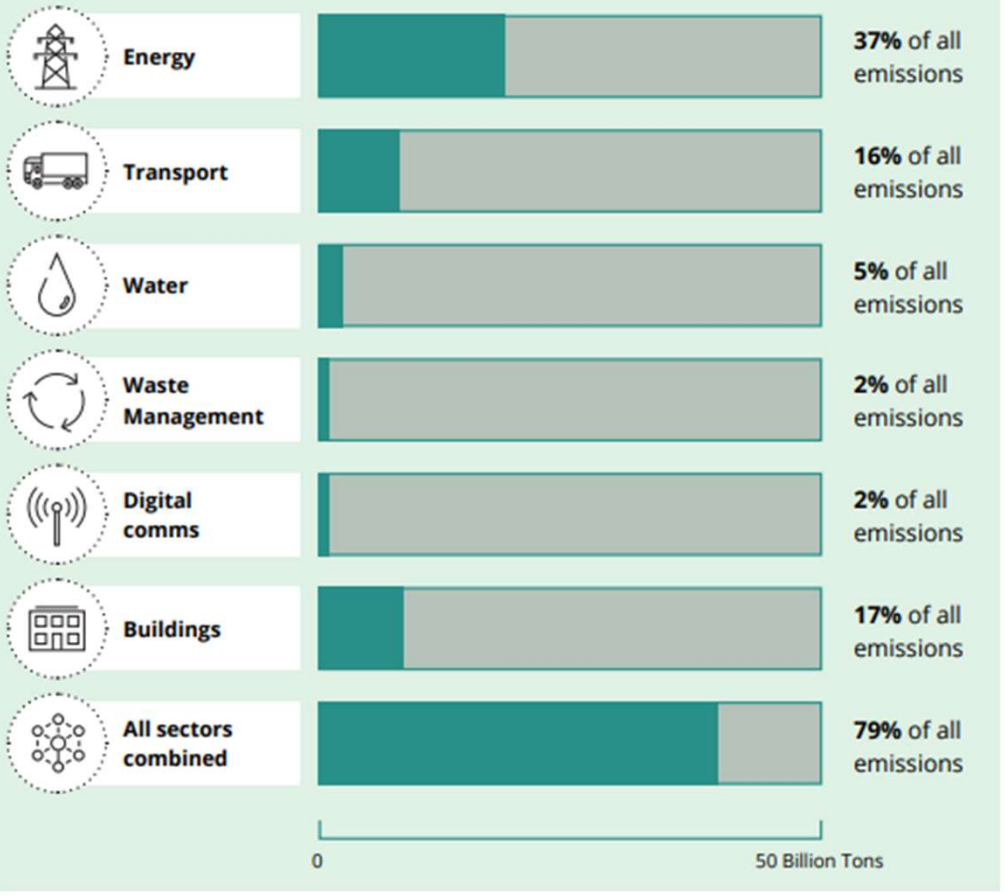
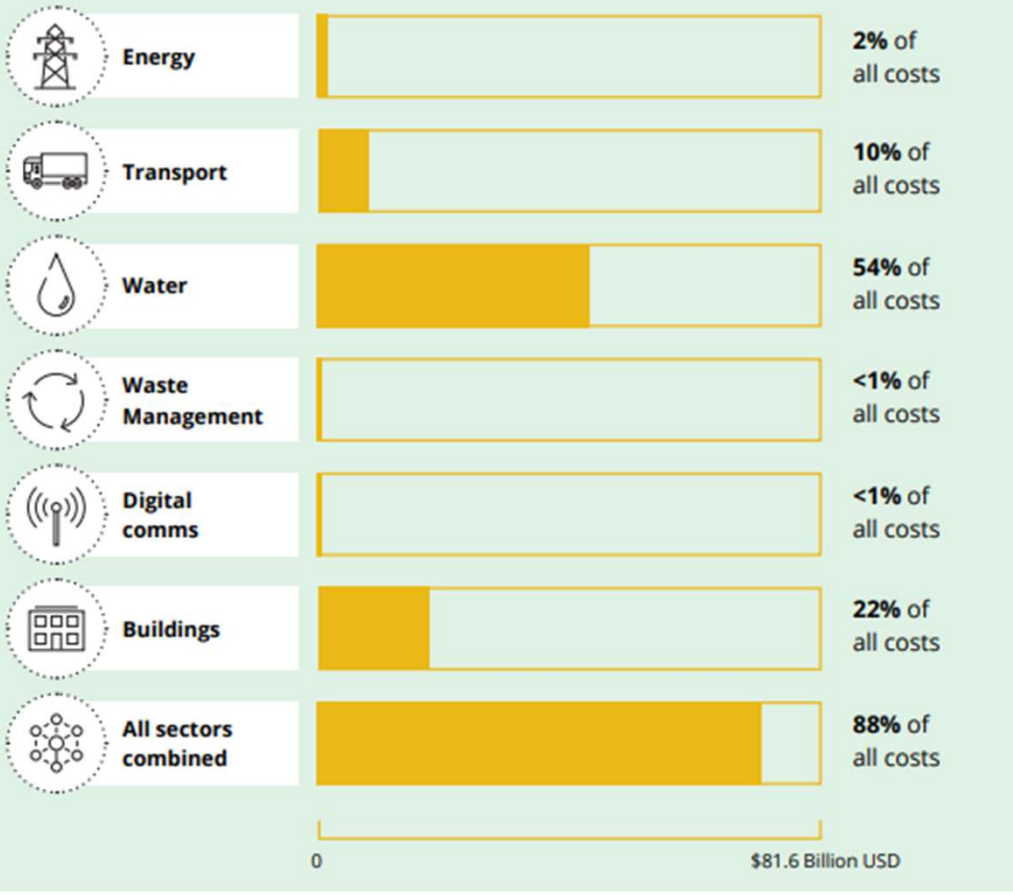


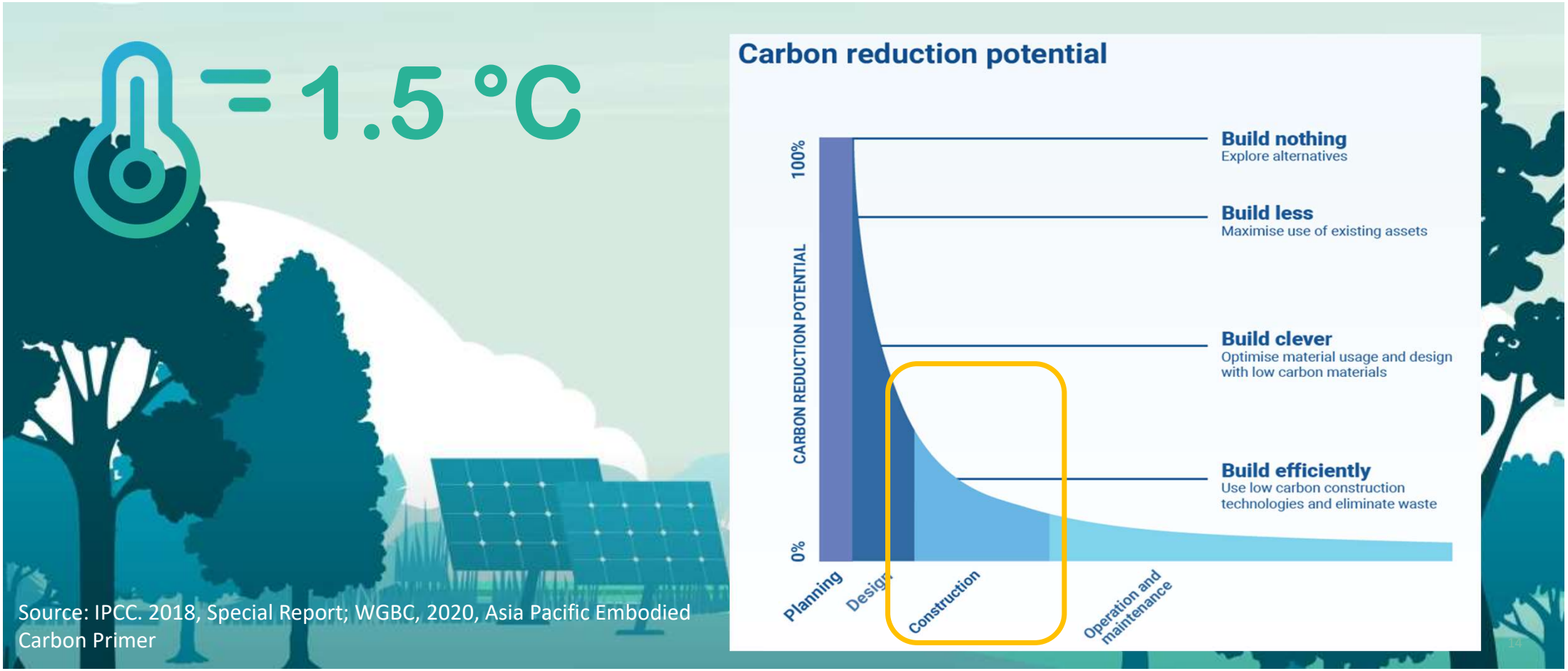
Figure 3: Infrastructure sector share of global climate adaptation costs (2010-50 estimates).[19]



Source: UNOPS (UN Office for Project Services), 2021, Infrastructure for climate action

Carbon Reduction Potential

Global GHG Emissions must reach Net-zero between 2040 & 2055 to limit global temperature rise to 1.5°C.



Source: IPCC. 2018, Special Report; WGBC, 2020, Asia Pacific Embodied Carbon Primer

GUIDING PRINCIPLES FOR SUSTAINABLE INFRASTRUCTURE

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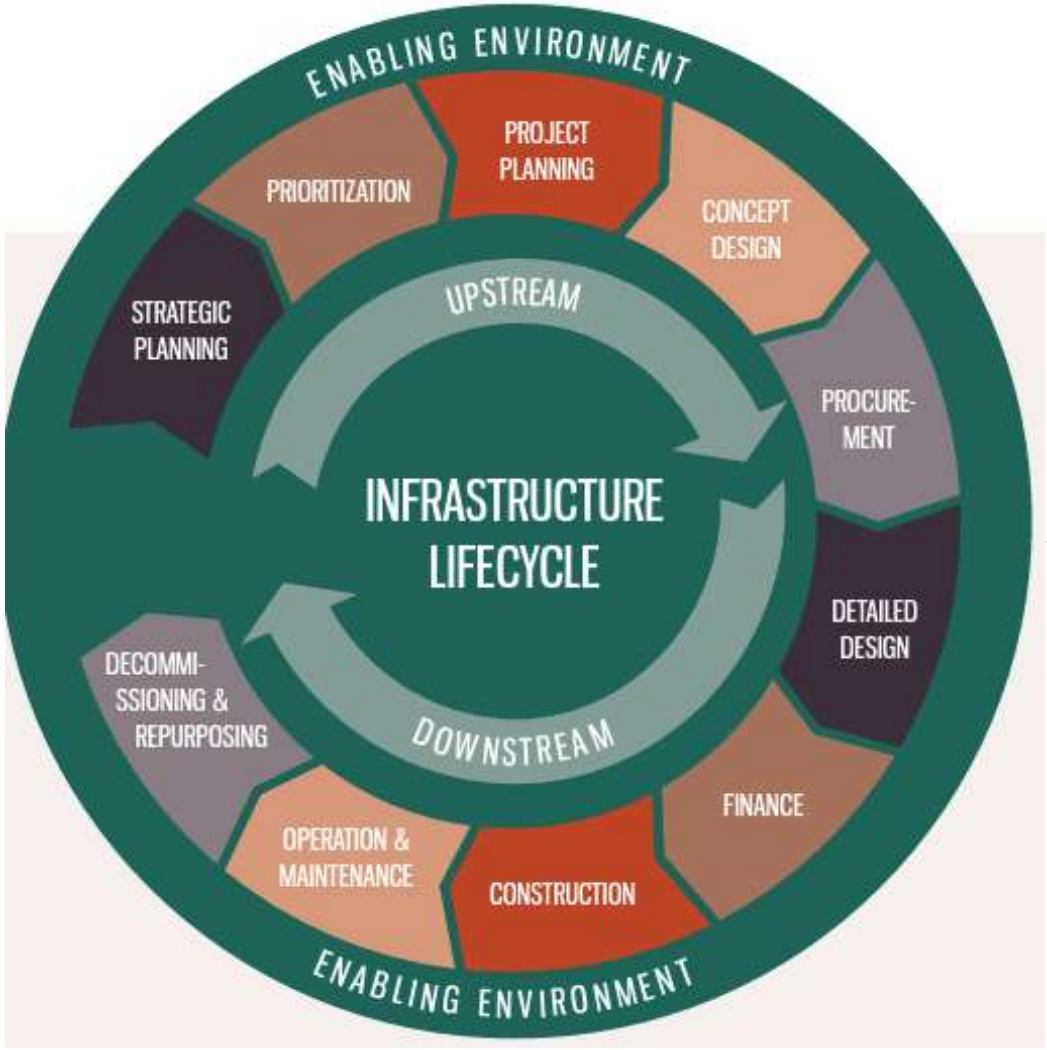
Infrastructure Lifecycle

Infrastructure Lifecycle

- ✓ More than single project lifecycle
- ✓ Includes decision-making phases

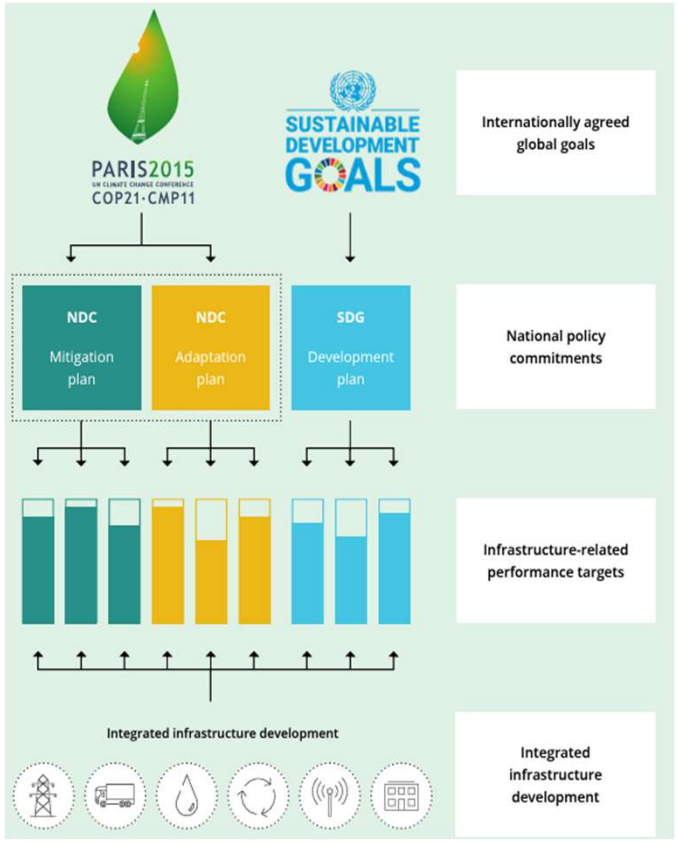
Enabling Environment

- ✓ Comprises institutions, polices and rules and regulations that govern the planning, delivery, operation and decommissioning of infrastructure systems
- ✓ Applies to entire infrastructure lifecycle



Source: UNEP, 2021, International Good Practice Principles for Sustainable Infrastructure

Collaboration to Reach Net-zero



Government

- Deliver education and training
- Provide financial incentives
- Create national roadmaps
- Set low carbon public procurement policy
- Set benchmarks, targets and require disclosure

Investors

- Require a holistic whole lifecycle approach
- Provide sustainable financial products to incentivise low or zero carbon products/ projects
- Investor groups to agree and set embodied carbon benchmarks and targets
- Collaborate with stock exchanges

Developers

- Use LCA and whole lifecycle approach
- Optimise structural design
- Prioritise low carbon or carbon positive materials and require disclosure
- Seek innovative solutions
- Use financial incentives or contractual obligations

Designers

- Educate clients
- Specify low carbon or carbon positive materials
- Use LCA and whole lifecycle approach
- Optimise structural design
- Seek innovative solutions

Manufacturers

- Develop product specific EPDs
- Implement recycling and circularity principles
- Maximise process energy efficiency
- Implement renewable energy sources
- Work with industry to standardise EPDs
- Develop innovative low/ zero carbon construction materials and products

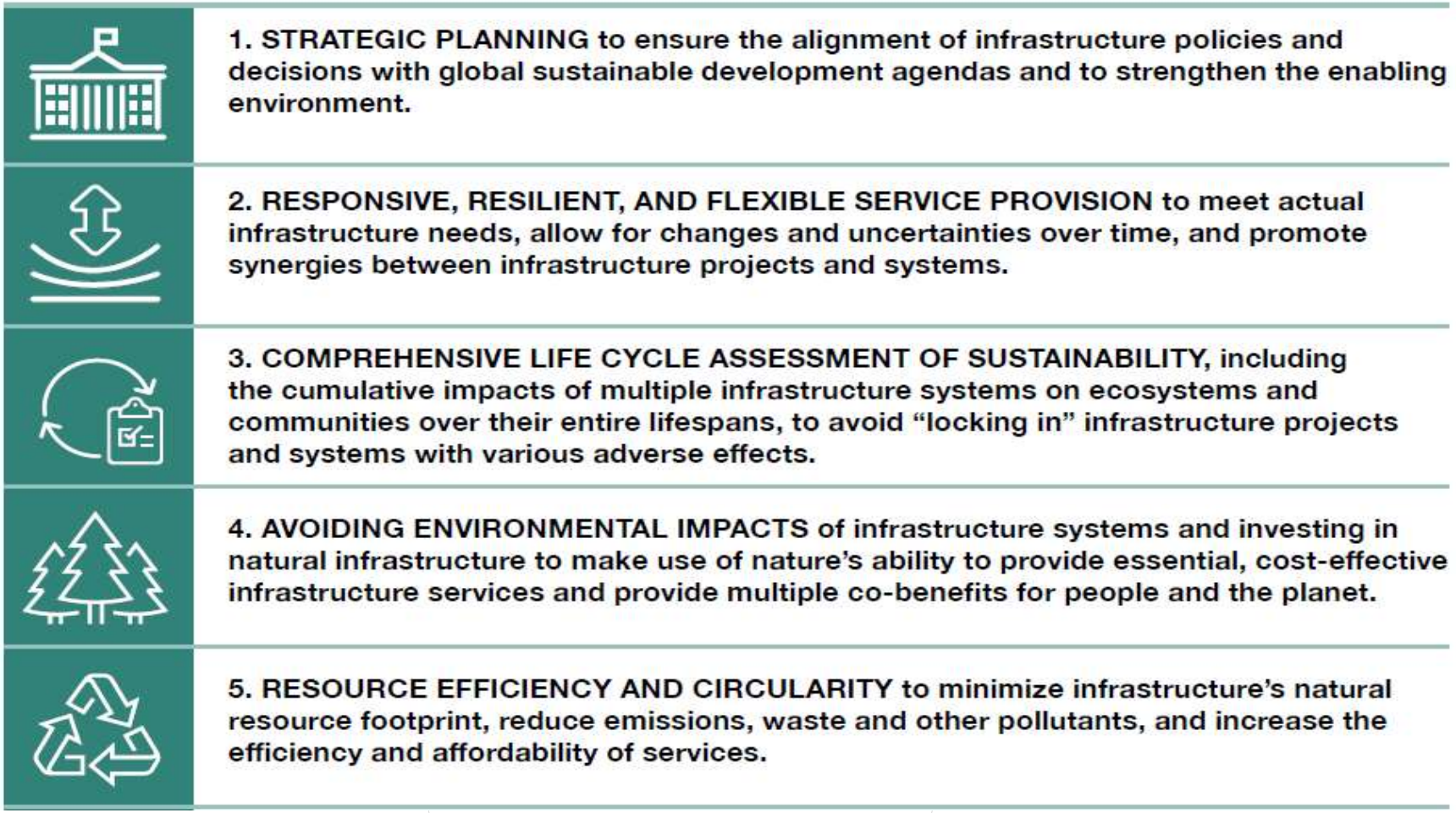
NGOs, networks and researchers

- Contribute to the collection of embodied carbon data
- Promote the findings of key research
- Work with government
- Work with public and private sector
- NGOs and networks deliver training
- Certification schemes require disclosure, EPDs and set measurement and performance targets

Source: UNEP, 2021, International Good Practice Principles for Sustainable Infrastructure

EPD – Environmental Product Declaration (ISO14025)

Guiding Principles on Infrastructure Planning and Development



1. STRATEGIC PLANNING to ensure the alignment of infrastructure policies and decisions with global sustainable development agendas and to strengthen the enabling environment.

2. RESPONSIVE, RESILIENT, AND FLEXIBLE SERVICE PROVISION to meet actual infrastructure needs, allow for changes and uncertainties over time, and promote synergies between infrastructure projects and systems.

3. COMPREHENSIVE LIFE CYCLE ASSESSMENT OF SUSTAINABILITY, including the cumulative impacts of multiple infrastructure systems on ecosystems and communities over their entire lifespans, to avoid "locking in" infrastructure projects and systems with various adverse effects.

4. AVOIDING ENVIRONMENTAL IMPACTS of infrastructure systems and investing in natural infrastructure to make use of nature's ability to provide essential, cost-effective infrastructure services and provide multiple co-benefits for people and the planet.

5. RESOURCE EFFICIENCY AND CIRCULARITY to minimize infrastructure's natural resource footprint, reduce emissions, waste and other pollutants, and increase the efficiency and affordability of services.

Source: UNEP, 2021, International Good Practice Principles for Sustainable Infrastructure

Guiding Principles on Infrastructure Planning and Development

6. EQUITY, INCLUSIVENESS, AND EMPOWERMENT through a balance between social and economic infrastructure investment to respect, protect and fulfil human rights and promote well-being, particularly of more vulnerable or marginalized groups.

7. ENHANCING ECONOMIC BENEFITS through employment generation and support for the local economy.

8. FISCAL SUSTAINABILITY AND INNOVATIVE FINANCING to close the infrastructure investment gap within the context of increasingly constrained public budgets.

9. TRANSPARENT, INCLUSIVE, AND PARTICIPATORY DECISION-MAKING that includes stakeholder analysis, ongoing public participation, and grievance mechanisms for all stakeholders.

10. EVIDENCE-BASED DECISION-MAKING that includes regular monitoring of infrastructure performance and impacts based on key performance indicators and the promotion of data sharing with all stakeholders.

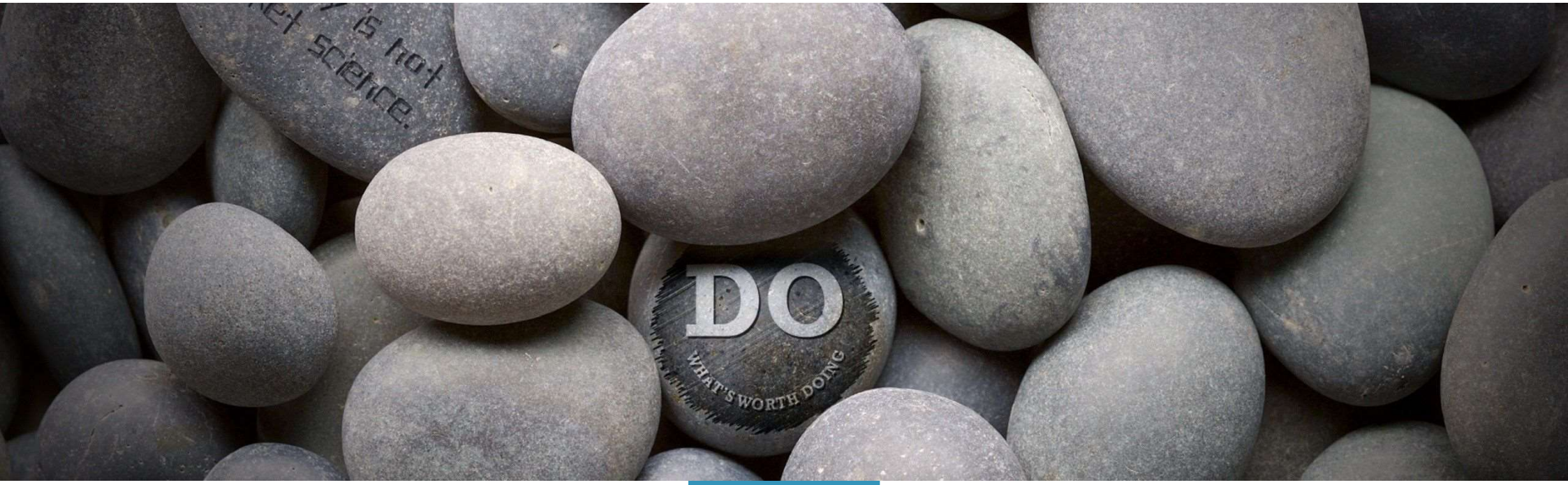
Source: UNEP, 2021, International Good Practice Principles for Sustainable Infrastructure

CASE STUDY: STOCKHOLM METRO EXTENSION

The US$3.35bn project, currently underway and slotted for completion by 2026, comprises 20 km of new track and 11 new train stations.

- To reduce the carbon footprint of the stations' construction, the project team first calculated the cost and the carbon footprint for a model station.
- Concrete and steel were the main contributors to the carbon footprint. The team then identified measures to reduce the amount of new material required, redesigning the station and replacing some design aspects with recycled steel and other materials.
- A second iteration of the process — a calculation followed by a redesign — reduced the carbon footprint even further.

Ultimately, the team was able to reduce the overall carbon emissions of the project by 40%, along with a 30% reduction in costs.



INFRASTRUCTURE 4.0

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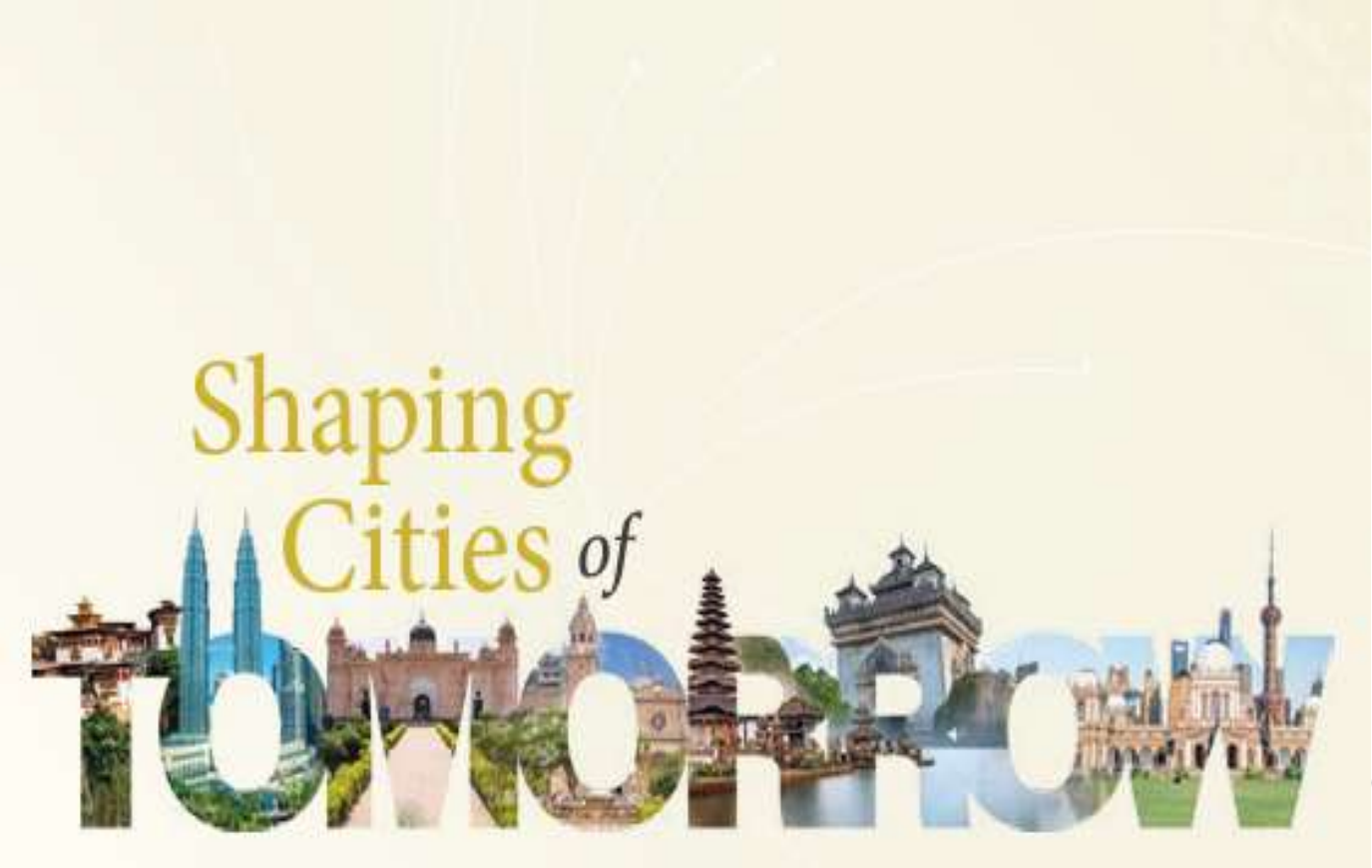
Transformation - Technology and Systems Thinking



Source: CLC & TF, 2022, Shaping Cities of Tomorrow: 10 Years of Partnership with Asian Cities

Impacts of…

Urbanisation

Digitalisation

Climate Change

Growing need in Transformation and requirement in due consideration of how infrastructure and construction project is **planned, delivered and managed**.

To meet industry needs…

Embrace digitalisation,
establish new working practices
increase collaboration

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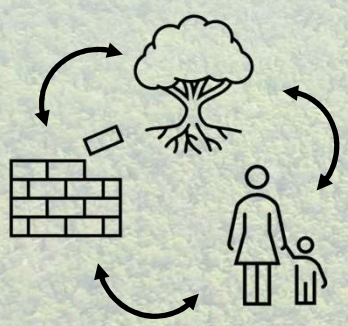
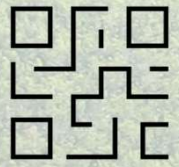
NEW Ecosystems

Focus



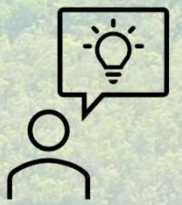
Formulate



Encourage

Develop

Empower



Source: WEC, 2021, Why the world needs a fresh take on smart and sustainable infrastructure

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NEW Business Models

Frame

- ✓ Economic
- ✓ Environmental
- ✓ Social

Design

- ✓ Collaborative
- ✓ Optimise risk allocation
- ✓ Full life cycle value

Reframe

- ✓ New financial and non-financial considerations in cost-benefit analysis

Source: WEC, 2021, Why the world needs a fresh take on smart and sustainable infrastructure

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Skills & Education

Project

Future skills needs

Promote

Impact-focused

Upskill

Boardrooms

Build

Infrastructure engineering & information management

Improve

Government skills

Source: WEC, 2021, Why the world needs a fresh take on smart and sustainable infrastructure

CONCLUSION

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RESILIENCE FOR SUSTAINABLE INFRASTRUCTURE

'Infrastructure investment is a key tool for improving productivity, stimulating economic growth, generating decent jobs, addressing inequalities and building resilience. But infrastructure will only deliver on these objectives if sustainability is embedded at its core – increasing society's resilience while reducing climate risk'

UN Secretary-General António Guterres

THANK YOU

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