Insights on Climate Change and Sustainable Finance

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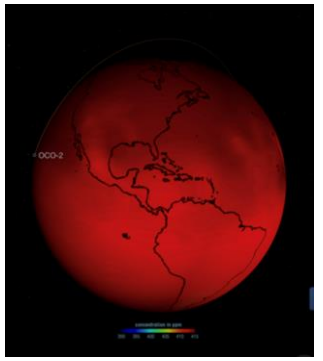
January 2023



"Climate change is spawning a host of long-term and short-term effects that affect businesses broadly and fundamentally. The World Economic Forum ranks climate risks among the top five business risks, saying "climate change is striking harder and more rapidly than many expected."

Source: TCFD Guidance on Scenario Analysis, October 2020

Global Warming Wake-up Call No.1

Researchers drill the highest ice core ever recovered at 27,000 feet elevation with the summit of Mount Everest in the background. (Image credit: Dirk Collins, National Geographic)

Mount Everest covered in heavy snow, taken in May 1921 on an expedition (Image: Royal Geographical Society via Getty Images)

The summit of Mt Everest in May 2019 with noticeably less snow, where climbers queued for hours (Image: AFP/Getty Images)

Global Warming Wake-up Call No. 2: Melting of World Second Largest Ice Sheet in Greenland

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Climate change: For 25th year in a row, Greenland ice sheet shrinks

© WMO/Karolin Eichier | The polar bear's natural habitat is disappearing as ice caps melt due to climate change.

Melting of the Greenland ice sheet is one of the main causes of the global rise in sea level
JONATHAN NACKSTRAND/AFP/GETTY IMAGES

Climate change: Greenland's biggest ice shelf breaking up as temperatures soar

Ben Webster, Environment Editor

Monday September 14 2020, 5.00pm, The Times

My First-hand Experience of Climate Change Effects in Greenland in 16-23 July 2022:

View from the Airplane

The Greenland Glacier Story and My Personal 5-days Sea Journey in Greenland starting 18 July 2022 - incidentally the highest melting day in Greenland this year

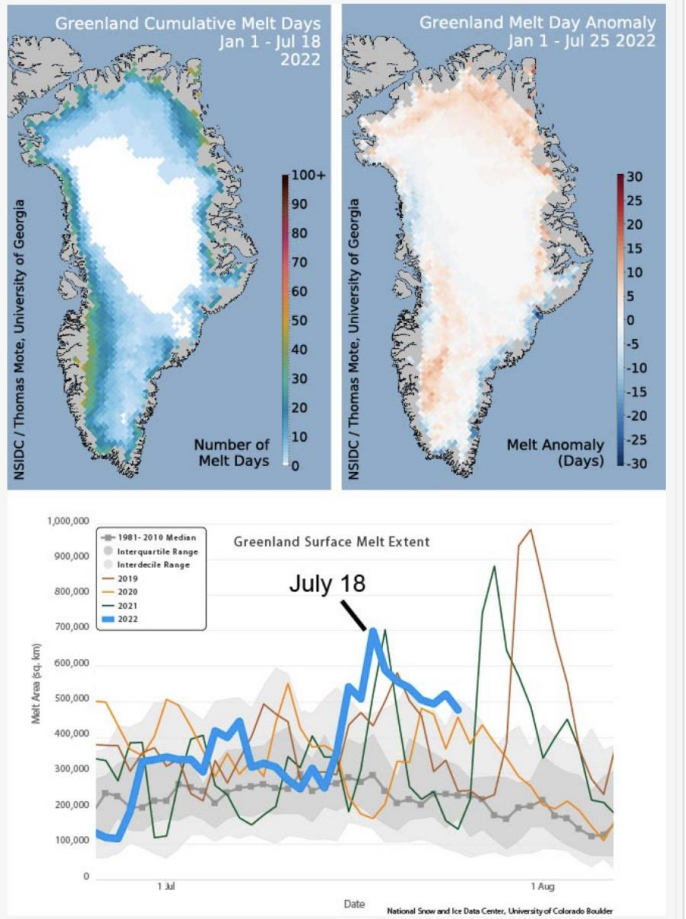


Figure 1. The top left map shows cumulative melt days on the Greenland Ice Sheet for the spring 2022 melt season. The top right map shows the difference from the 1981 to 2010 average melt days for the same period. The bottom graph illustrates daily melt area for Greenland from May 25 through August 6, 2022, with daily melt area for the preceding three years. The grey lines and bands depict the average daily melt area for 1981 to 2010, the inter-quartile range, and the interdecile range.

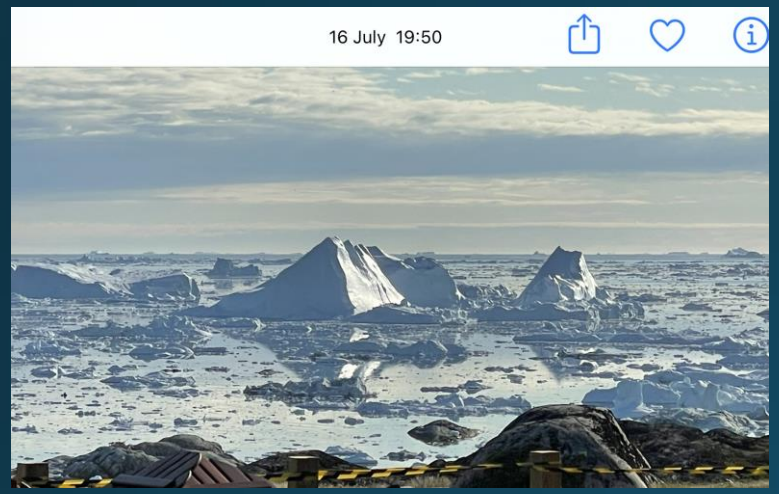
Credit: National Snow and Ice Data Center/T. Mote, University of Georgia

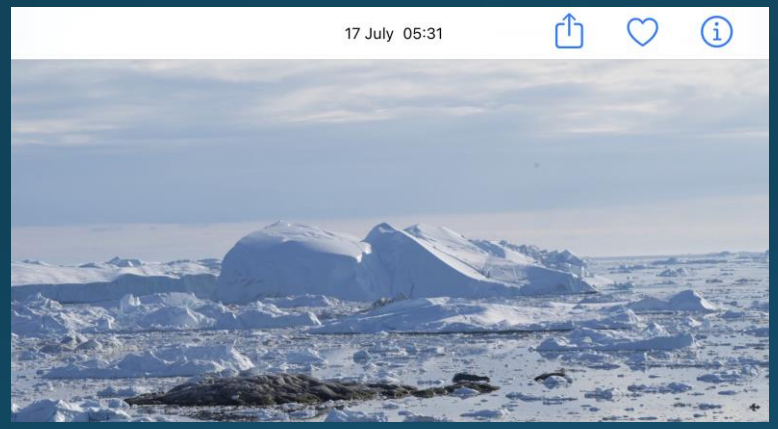
High-resolution image

The Greenland Glacier Story
The Breaking of Ice from Greenland Ice Sheet (the Second Largest in the World)

- showing signs the Vicious Cycle of Ice Melting: more cracks, more ice breaks, less support to the glacier edges, more ice breaks etc;
- More ice melting, less reflection, more heat absorbed by the sea, more ice melting etc

The Greenland Glacier Story
Real Example of Climate Change Effect
Ilulissat Glacier: The Fastest Glacier in the World !





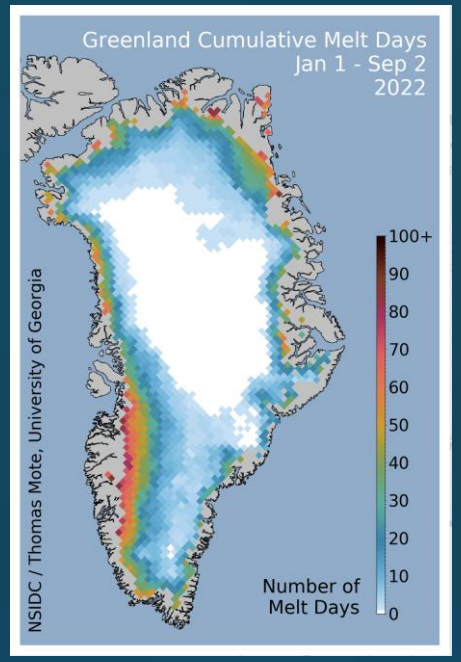
- Iceberg Mountains come and go in one or two days – **Vicious Cycle of Ice Melting !**
- The earlier the melting, the darker the gracier, more heat absorbed, more ice melts etc
- Faster movement of icebergs stirs up the ocean, ice melts **faster**

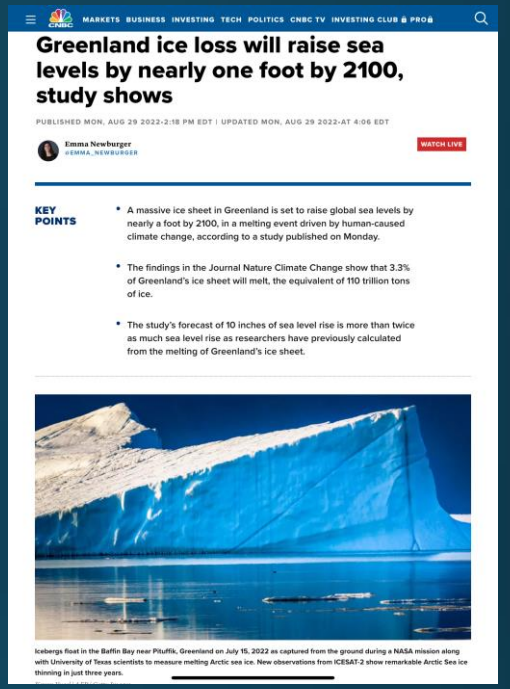
Huge Iceberg Mountain Floating and Moving in the Sea

- Evidence of Considerable Breaking and Melting of Icesheet
- If the Greenland sheet fully melts, sea level in the world would rise by ***about 7.4 metres***, affecting the whole world

Ilulissat Icefjord: World Heritage Site

The Greenland Story – Real Example of Climate Change Effect: Greenland Ice Sheet Melting Alone to Cause Sea Level to Rise *274 to 782 mm* ! Predicted sea level rise already exceeds recent predictions





MARKETS BUSINESS INVESTING TECH POLITICS CNBC TV INVESTING CLUB PRO

Greenland ice loss will raise sea levels by nearly one foot by 2100, study shows

PUBLISHED MON, AUG 29 2022·2:18 PM EDT | UPDATED MON, AUG 29 2022·AT 4:06 EDT

Emma Newburger
@EMMA_NEWBURGER

WATCH LIVE

KEY POINTS

- A massive ice sheet in Greenland is set to raise global sea levels by nearly a foot by 2100, in a melting event driven by human-caused climate change, according to a study published on Monday.
- The findings in the Journal Nature Climate Change show that 3.3% of Greenland's ice sheet will melt, the equivalent of 110 trillion tons of ice.
- The study's forecast of 10 inches of sea level rise is more than twice as much sea level rise as researchers have previously calculated from the melting of Greenland's ice sheet.

Icebergs float in the Baffin Bay near Pituffik, Greenland on July 15, 2022 as captured from the ground during a NASA mission along with University of Texas scientists to measure melting Arctic sea ice. New observations from ICESAT-2 show remarkable Arctic Sea ice thinning in just three years.

Greenland ice sheet climate disequilibrium and committed sea-level rise

Jason E. Box[1]✉, Alun Hubbard[2,3], David B. Bahr[4], William T. Colgan[1], Xavier Fettweis[5], Kenneth D. Mankoff[1], Adrien Wehrlé[6], Brice Noël[7], Michiel R. van den Broeke[7], Bert Wouters[7,8], Anders A. Bjørk[9] and Robert S. Fausto[1]

Ice loss from the Greenland ice sheet is one of the largest sources of contemporary sea-level rise (SLR). While process-based models place timescales on Greenland's deglaciation, their confidence is obscured by model shortcomings including imprecise atmospheric and oceanic couplings. Here, we present a complementary approach resolving ice sheet disequilibrium with climate constrained by satellite-derived bare-ice extent, tidewater sector ice flow discharge and surface mass balance data. We find that Greenland ice imbalance with the recent (2000–2019) climate commits at least 274 ± 68 mm SLR from $59 \pm 15 \times 10^3$ km^2 ice retreat, equivalent to $3.3 \pm 0.9\%$ volume loss, regardless of twenty-first-century climate pathways. This is a result of increasing mass turnover from precipitation, ice flow discharge and meltwater run-off. The high-melt year of 2012 applied in perpetuity yields an ice loss commitment of 782 ± 135 mm SLR, serving as an ominous prognosis for Greenland's trajectory through a twenty-first century of warming.

國際 A15

研究：停化石燃料難阻海面升

世紀末之前 格陵蘭融冰恐致水位增27厘米

一項研究顯示，就算人類現在開始停止燃燒化石燃料，全球暖化問題仍會令各地冰蓋「無可避免地」繼續融化，單是格陵蘭的融冰就會使海平面上升最少27厘米，較聯合國去年的一項研究估算更差。法新社報道，主因格陵蘭和南極冰層融化而上升的海平面，將在未來數世紀讓世界地圖重繪，最終還可能淹沒目前數億人居住的土地。

攝於7月17日的圖片顯示，格陵蘭冰蓋有冰雪融化後的水流入巴芬灣。最新研究顯示，格陵蘭冰蓋融化令海平面大幅上升已成定局。（法新社）

美國太空總署（NASA）表示，北極地區的升溫速度比地球其他地區更快，格陵蘭冰蓋融化是目前海洋膨脹的主因。冰川學家在《自然氣候變化》期刊（Nature Climate Change）發表的新研究發現，撇開未來任何化石燃料使用不談，迄今的暖化將導致格陵蘭3.3%冰蓋（相當於110萬億噸冰）融化，使海平面上升27.4厘米。這是科學家首次計算出全球暖化導致的格陵蘭冰蓋流失量「最小值」。

淹沒低窪海岸線 加劇洪水風暴潮

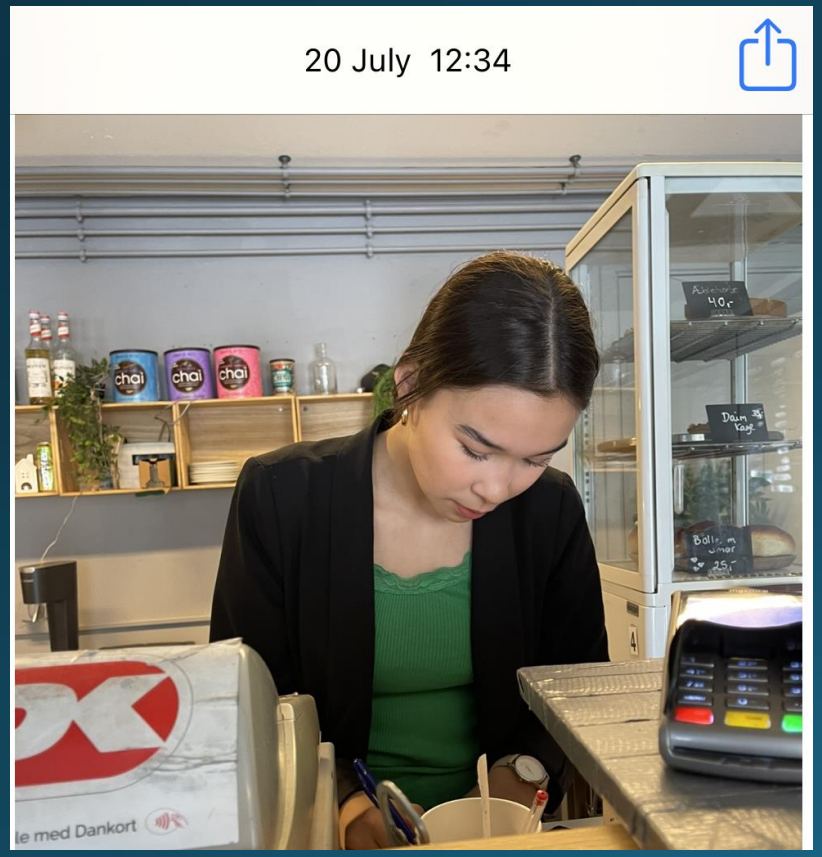
研究人員無法判定上述情況發生的確切時間，但他們說可能會在2100年或之前出現。

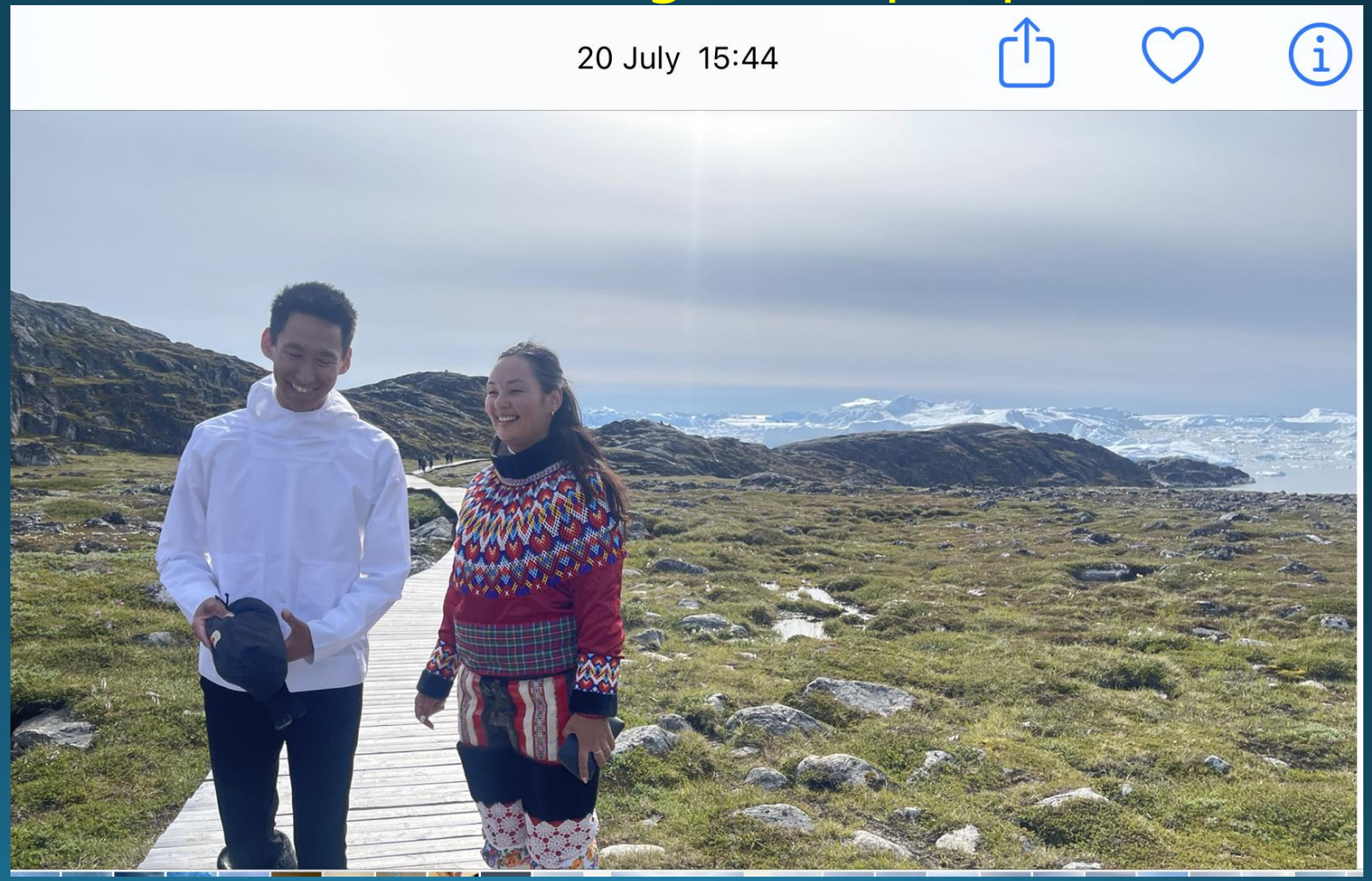
研究主要作者、丹麥和格陵蘭國家地質調查局的博克斯（Jason Box）說，這結果只是最低程度的估計，還未考慮日後的暖化。如果2012年觀察到的冰層大規模融冰每年發生，估計海平面可上升78厘米，足以淹沒大片低窪海岸線，並加劇洪水和風暴潮。研究報告作者說，應把這當作「對格陵蘭21世紀暖化軌迹的不祥預兆」。

聯合國政府間氣候變化專門委員會去年在一份重要氣候科學報告中稱，在最高排放情況下，格陵蘭冰蓋融化將在2100年或之前導致海平面上升18厘米。換言之，今次報告的預測更爲悲觀，有關研究只計算格陵蘭融冰，而是在不可能出現的「現在即時停止燃燒化石燃料」假設下推斷。

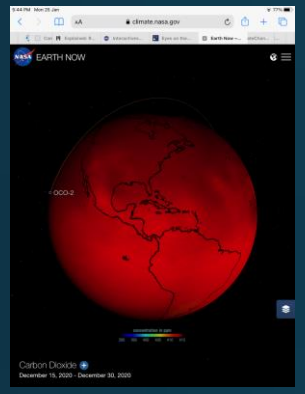
（法新社/衛報/CNN/獨立報）

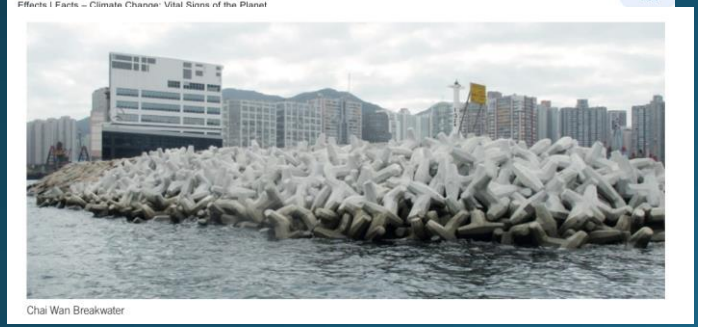
Dilemma: Development Aspirations of Indigenous People in Greenland and Anarctic Versus Minimisation of Climate Change Impacts to the World. How to strike a balance and channel necessary funds to meet the needs of indigenous people ?





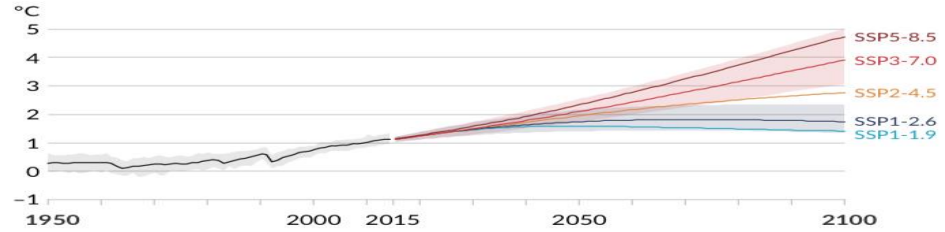
The implications of climate change



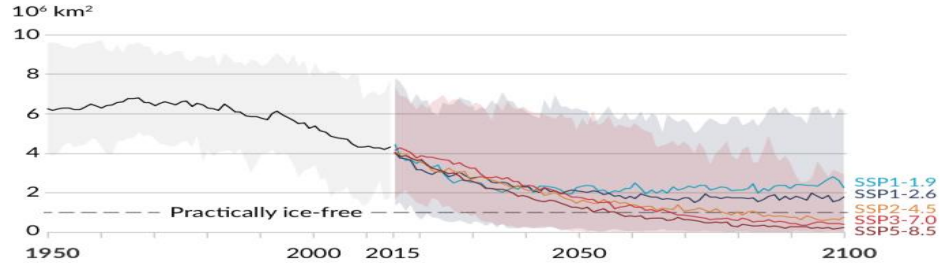


Human activities affect all the major climate system components, with some responding over decades and others over centuries

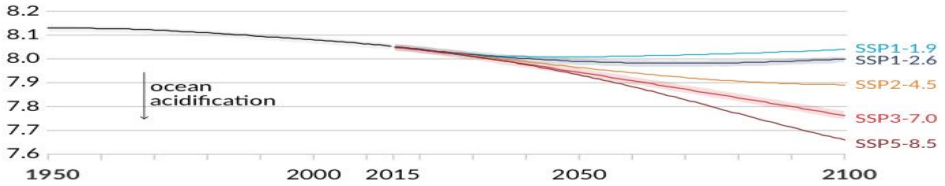
(a) Global surface temperature change relative to 1850–1900



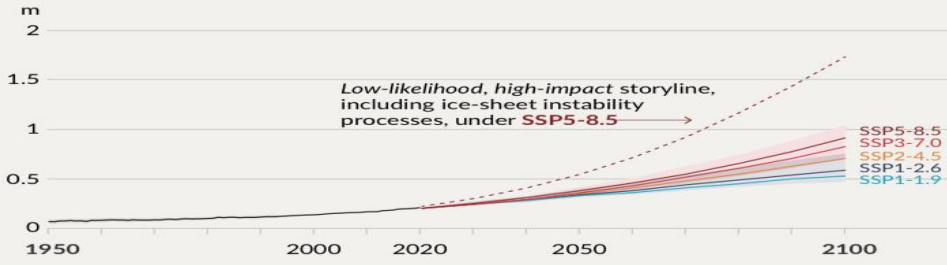
(b) September Arctic sea ice area



(c) Global ocean surface pH (a measure of acidity)



(d) Global mean sea level change relative to 1900



(e) Global mean sea level change in 2300 relative to 1900

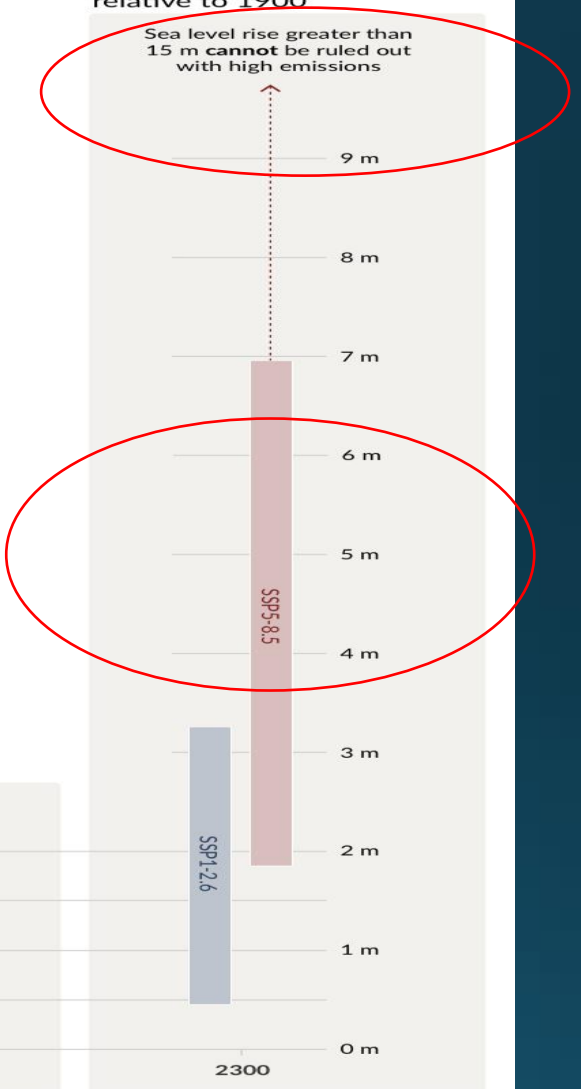
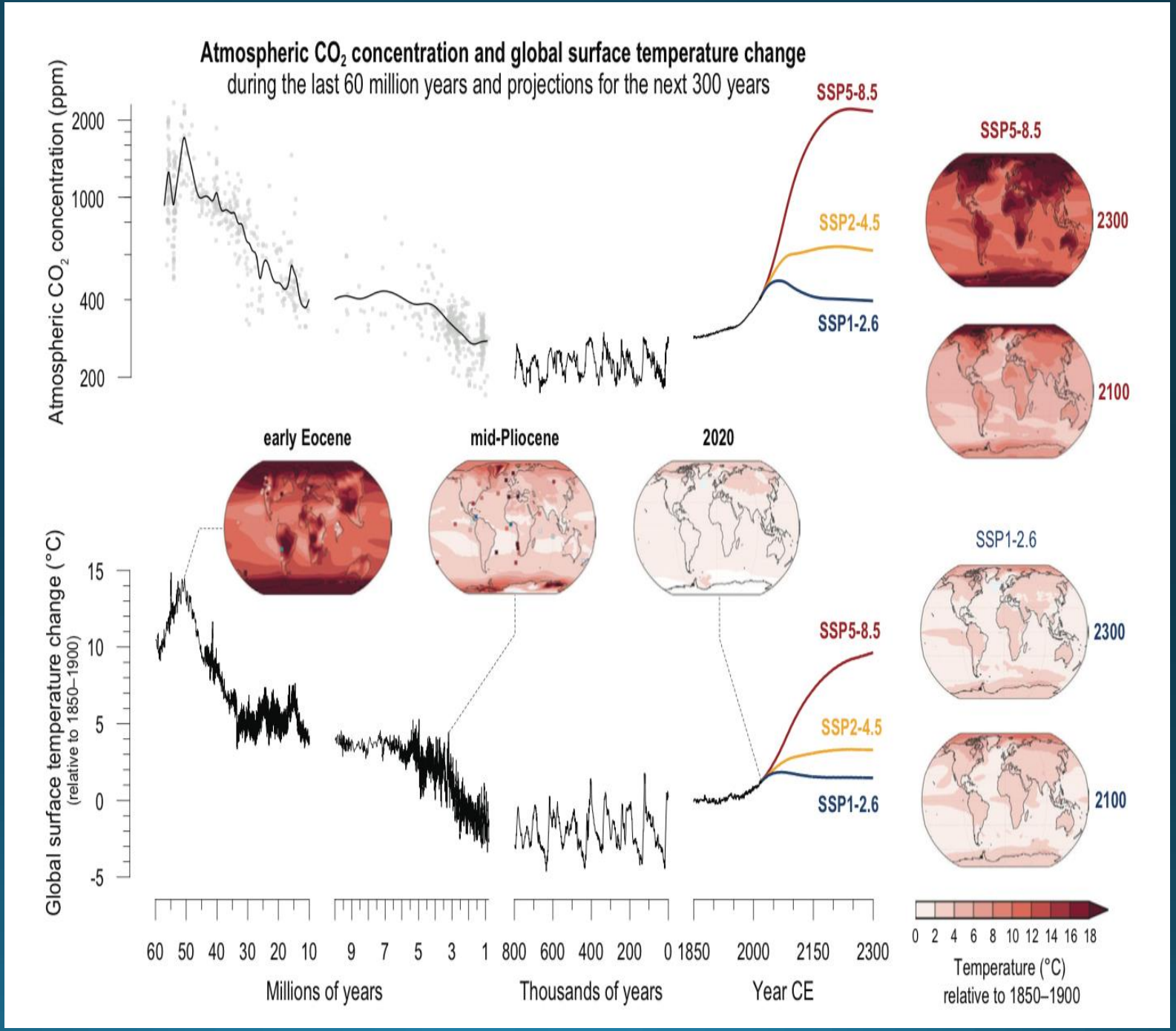


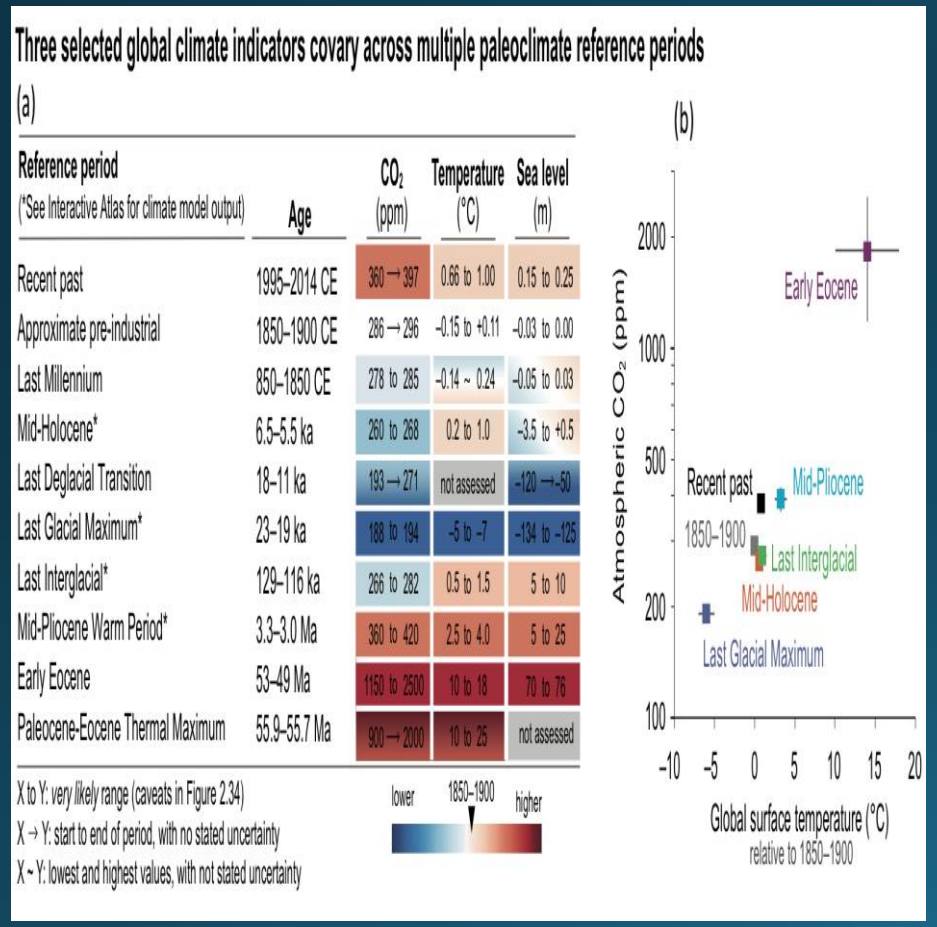
Figure SPM.8 | Selected indicators of global climate change under the five illustrative scenarios used in this Report

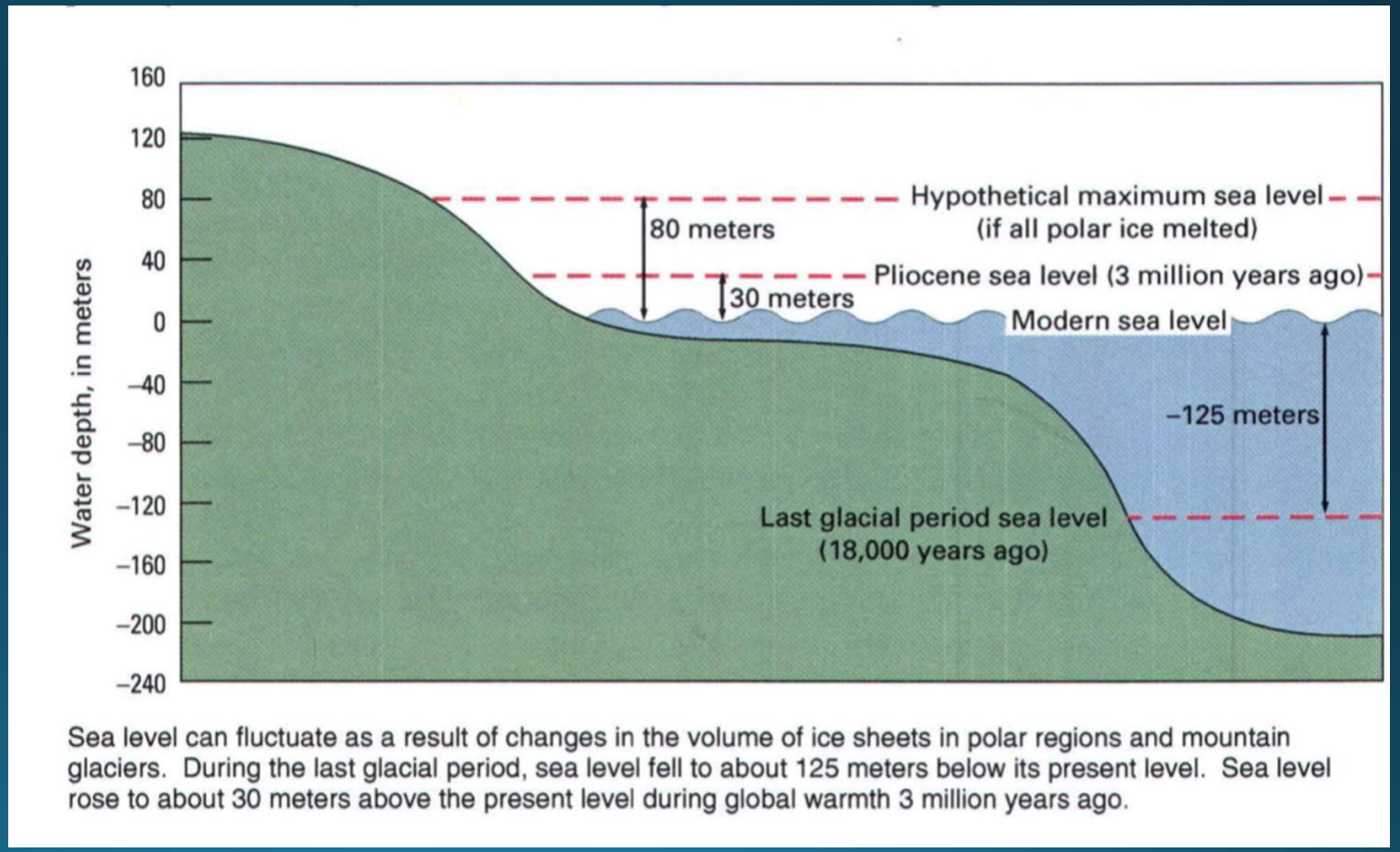
The projections for each of the five scenarios are shown in colour. Shades represent uncertainty ranges – more detail is provided for each panel below. The black curves represent the historical simulations (panels a, b, c) or the observations (panel d). Historical values are included in all graphs to provide context for the projected future changes.

Realities and Scenarios of Global Warming



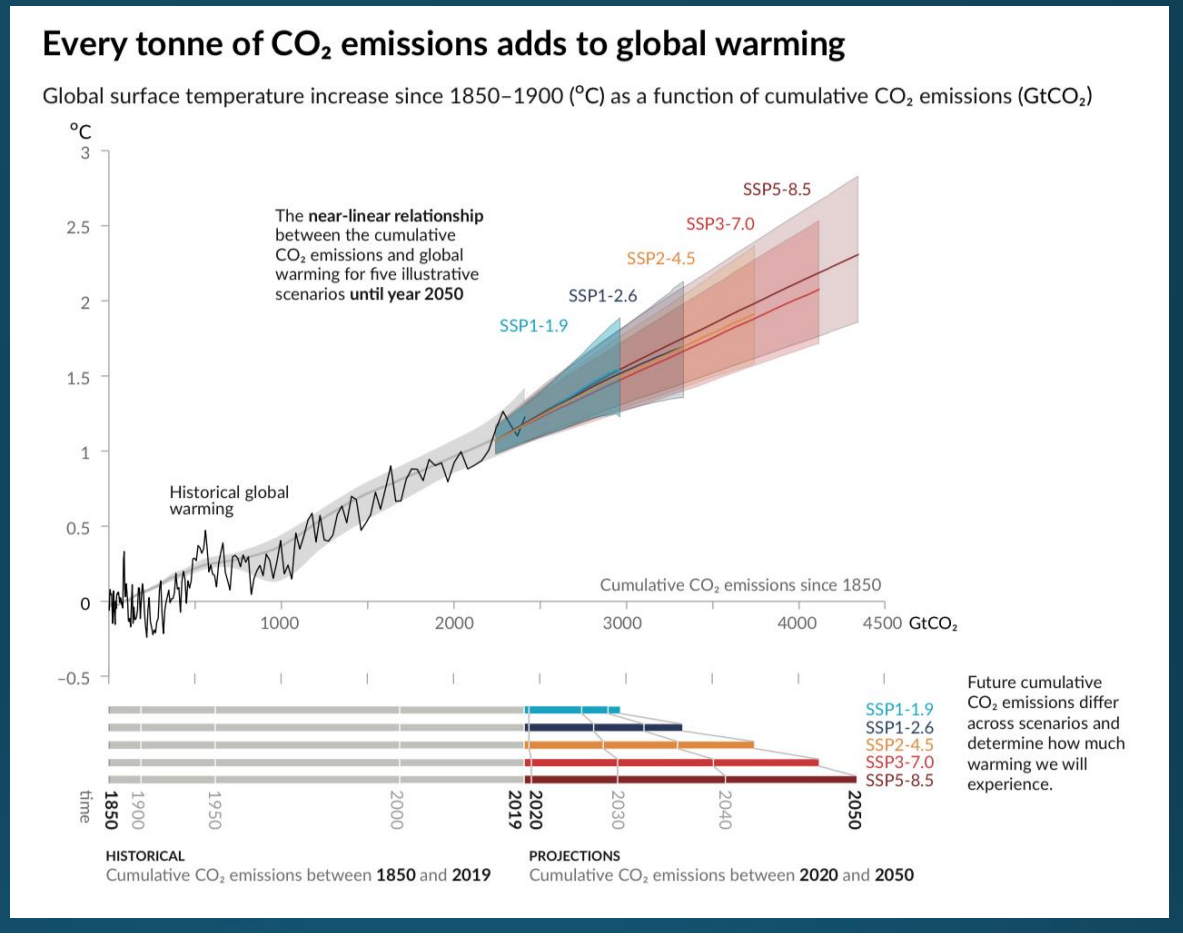
Realities and Scenarios of Sea Level Rise

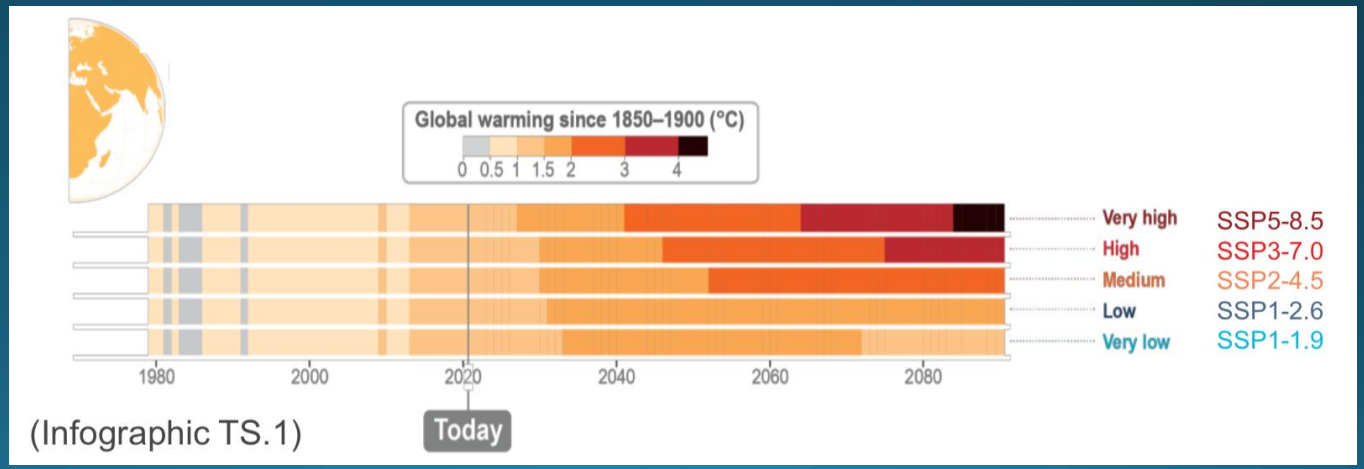


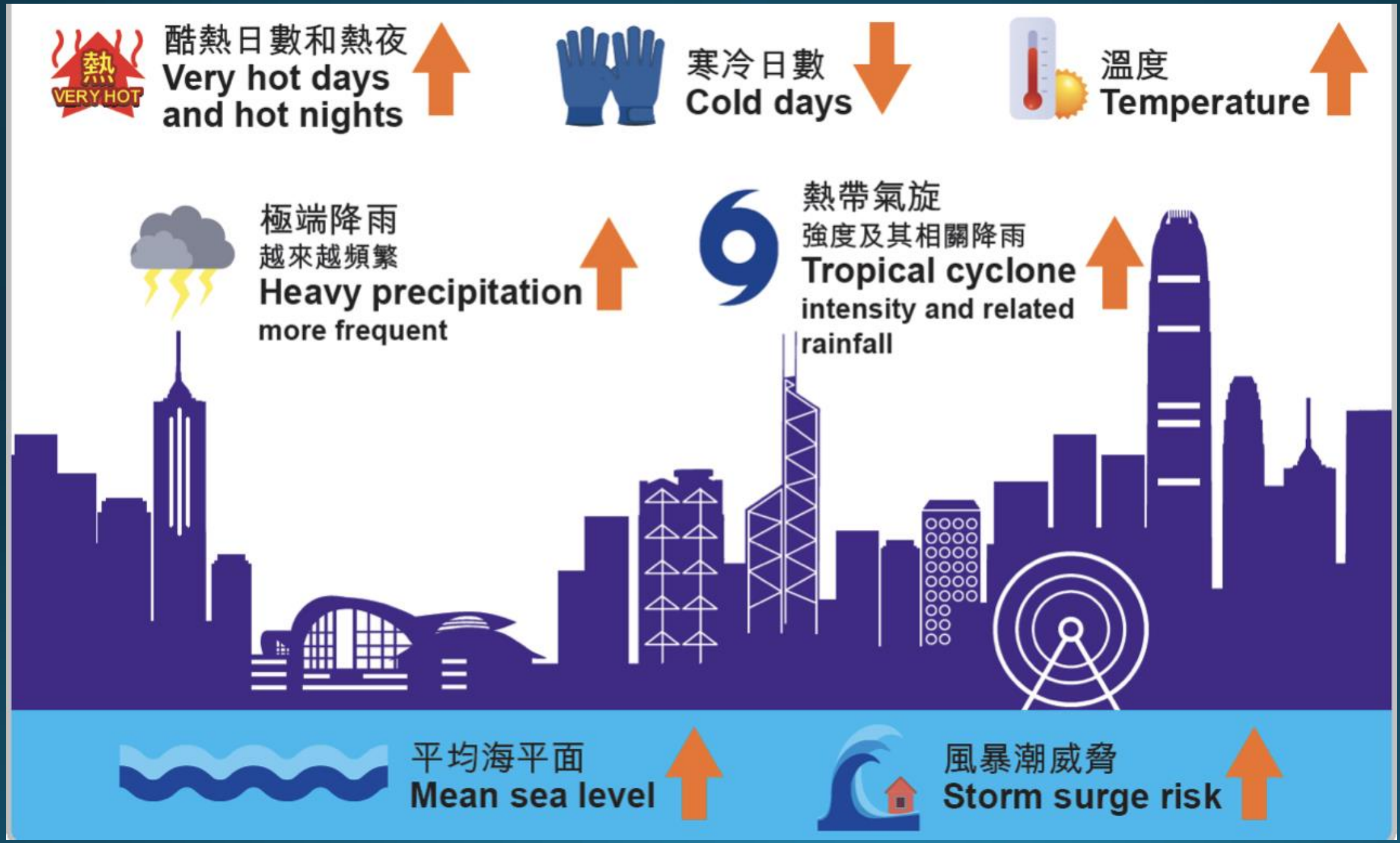


Sea level can fluctuate as a result of changes in the volume of ice sheets in polar regions and mountain glaciers. During the last glacial period, sea level fell to about 125 meters below its present level. Sea level rose to about 30 meters above the present level during global warmth 3 million years ago.

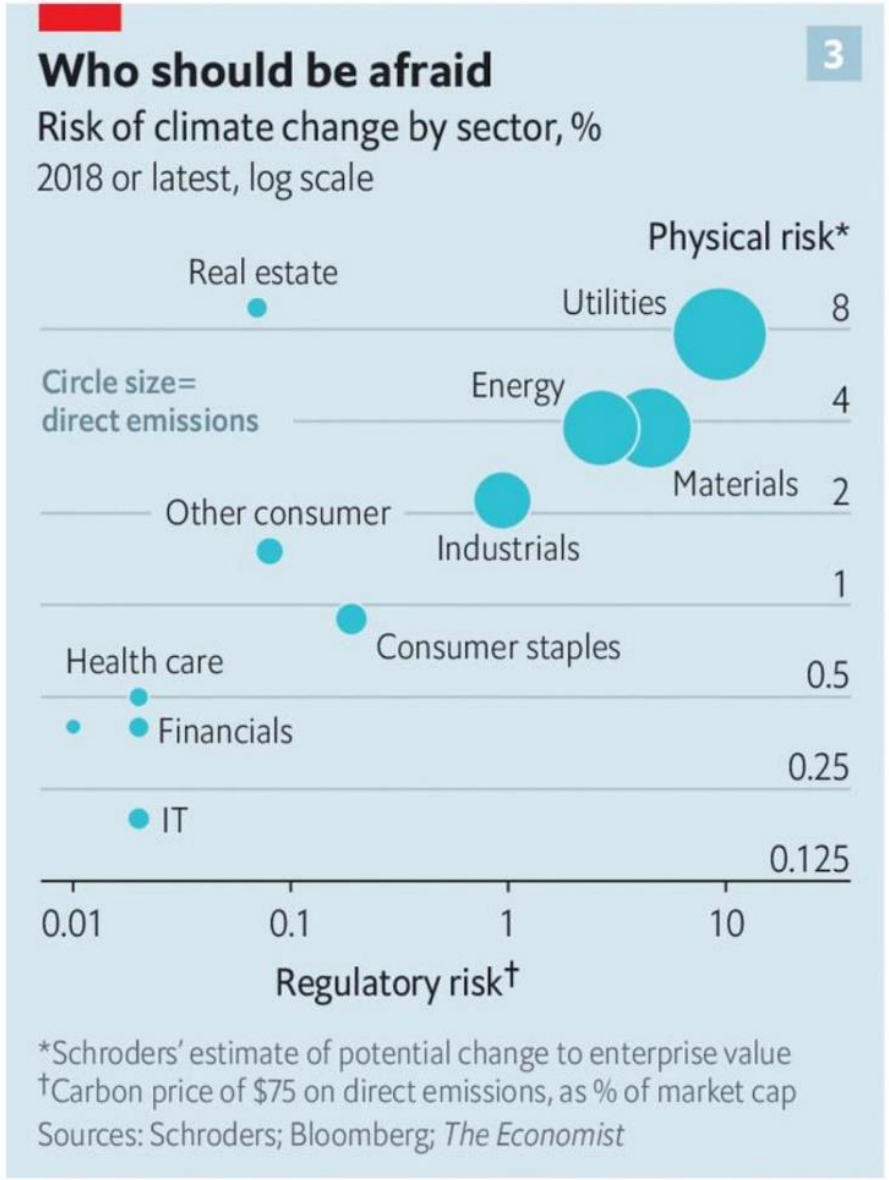
Cumulative Impact of Carbon Footprint and Cross-generational Impacts






熱
VERY HOT
酷熱日數和熱夜
Very hot days
and hot nights
寒冷日數
Cold days
溫度
Temperature
極端降雨
越來越頻繁
Heavy precipitation
more frequent
熱帶氣旋
強度及其相關降雨
Tropical cyclone
intensity and related
rainfall
平均海平面
Mean sea level
風暴潮威脅
Storm surge risk

Economist'S Article on Climate Change: How much can financiers do about climate change ?



The Economist

22/06/2020 Hotting up – How much can financiers do about climate change?| Briefing | The Economist

Hotting up

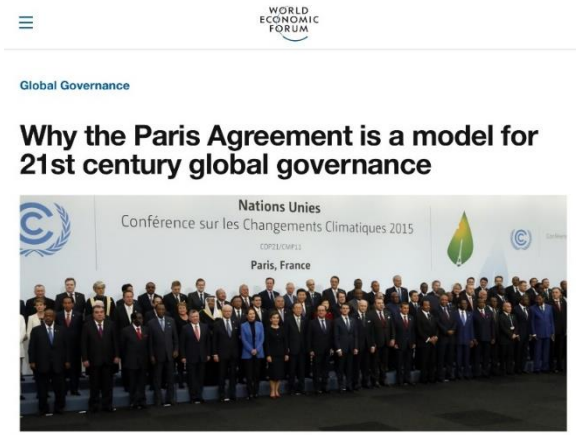
How much can financiers do about climate change?

The role that green investing can play must not be misunderstood or overstated

Briefing
Jun 20th 2020 edition

Jun 20th 2020

Global Drivers of Sustainable Finance

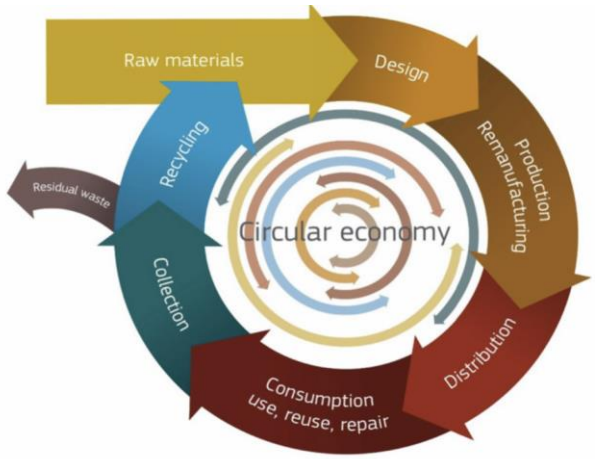


17 United National Development Goals

Three Global Drivers of Sustainable Finance

Climate Change and Paris Agreement

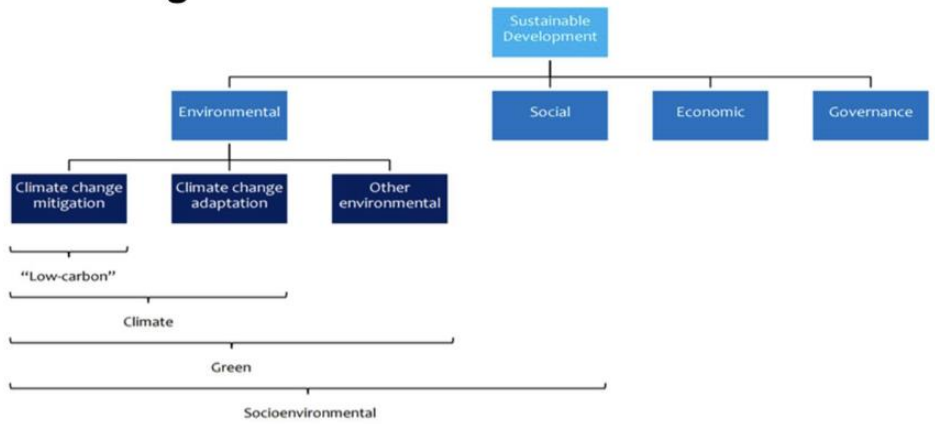
Circular Green Economy and Sustainable Products



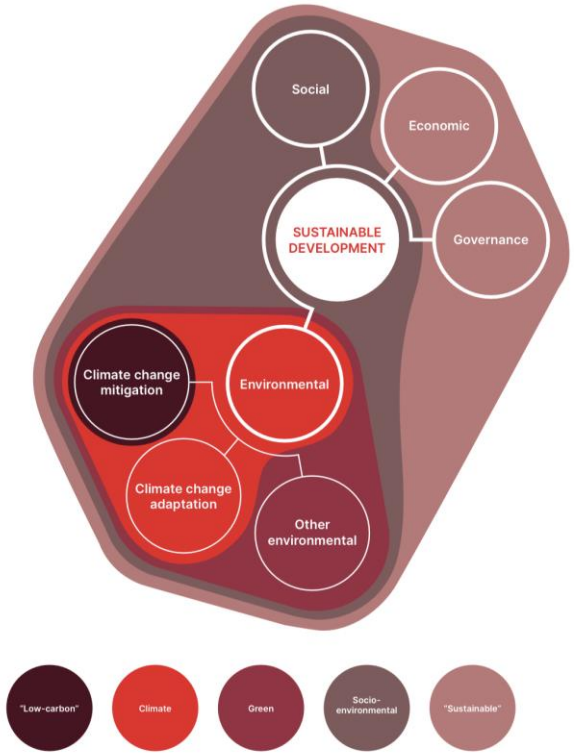
United Nation Environment Programme's and ISO 32210 Definition and Clarifications on Sustainable, Green and Climate Finance

ISO/TC 322 Scope

"Standardization in the field of sustainable finance to integrate sustainability considerations including environmental, social and governance practices in the financing of economic activities"



Linkages between climate, green and sustainable finance



Note: Colour-coded by grouping Source: Inspired by UNEP

- **Sustainable finance** includes environmental, social, governance and economic aspects.
- **Green finance** includes climate finance but excludes social and economic aspects.
- **Climate finance** is a subset of environmental (green) finance.

Climate Finance in Paris Agreement

Article 2

1. This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

(a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and

(c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

2. This Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

WORLD ECONOMIC FORUM

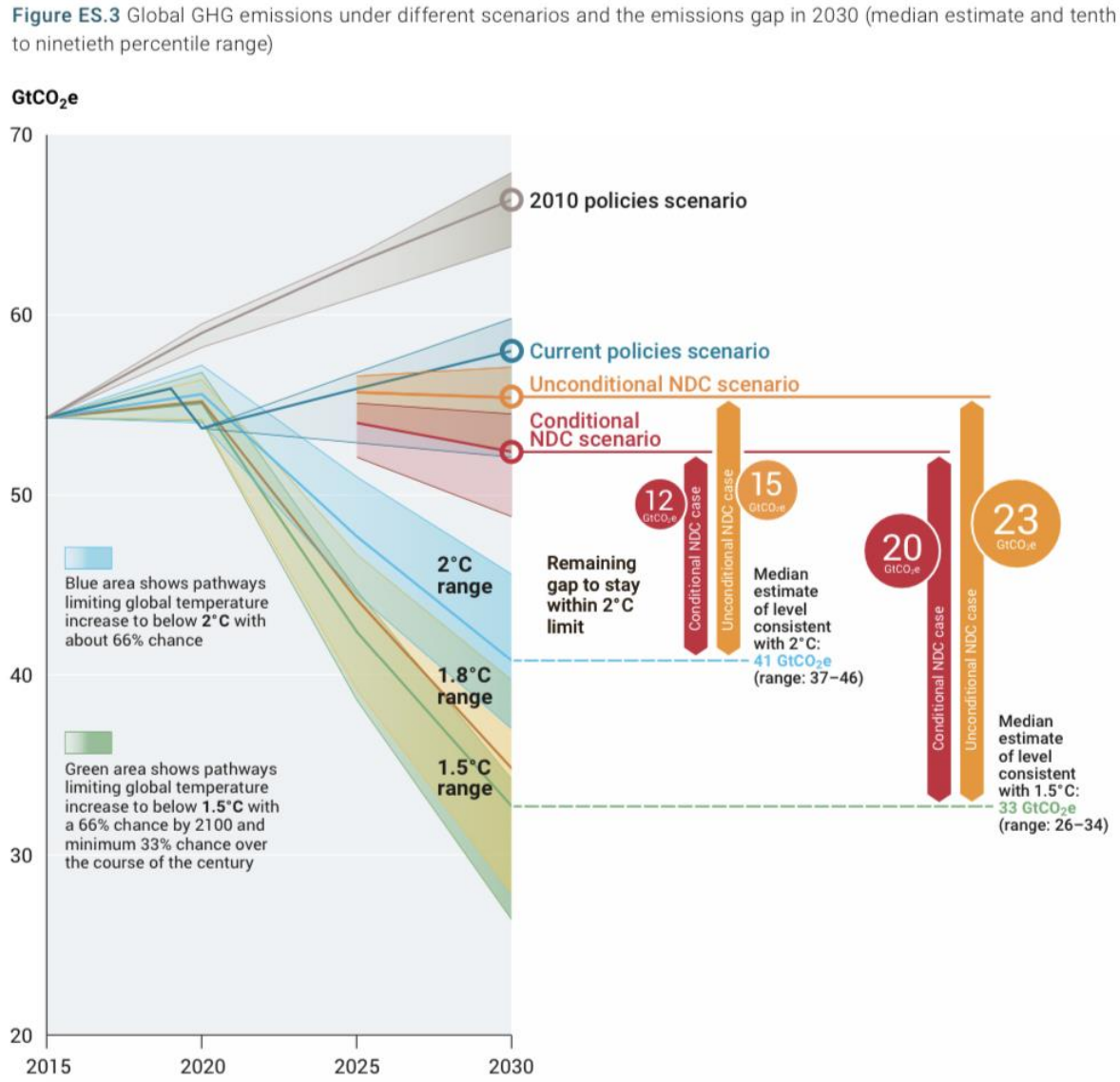
Global Governance

Why the Paris Agreement is a model for 21st century global governance

Not So Encouraging Progress Since Paris Agreement; Need a lot more funds and a lot more urgent actions !

Finance

Public climate finance, including $100 billion that developed countries have agreed to provide to developing countries each year, supports critical infrastructure for adaptation, resilience and the new renewable energy-based economy.



Towards a carbon-neutral community; but channelling of adequate fund is a pre-requisite

Key mitigation strategies	Pathway
Reduce demand	1. Integrated spatial planning
	2. Single-sector efficiency, conservation, and lifestyle changes
	3. Cross-sector urban industrial symbiosis
Switch supply	4. Decarbonize electricity
	5. Electrify heating and mobility
	6. Carbon valorization
Enhance carbon uptake	7. Enhance carbon uptake and stocks

The Important Role of Climate Finance to Channel Investment to Low Greenhouse Gas Emission and Climate-resilient development

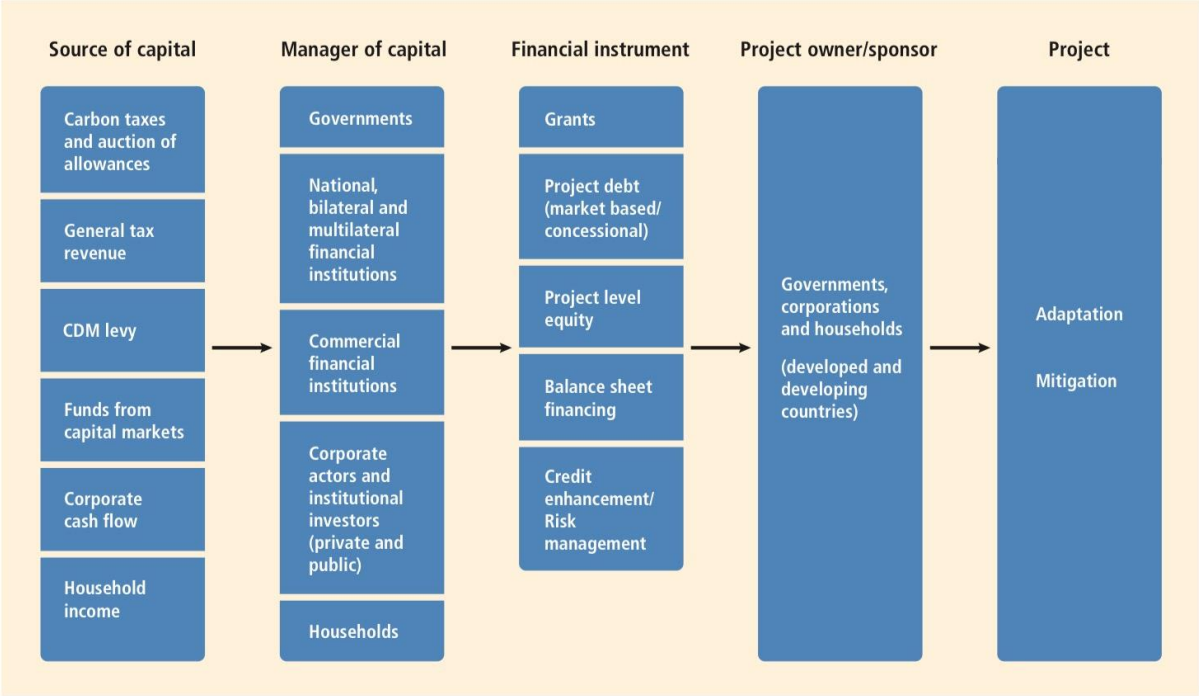


Figure 4.5 | Overview of climate finance flows. Note: Capital should be understood to include all relevant financial flows. The size of the boxes is not related to the magnitude of the financial flow. *{WGIII Figure TS.40}*

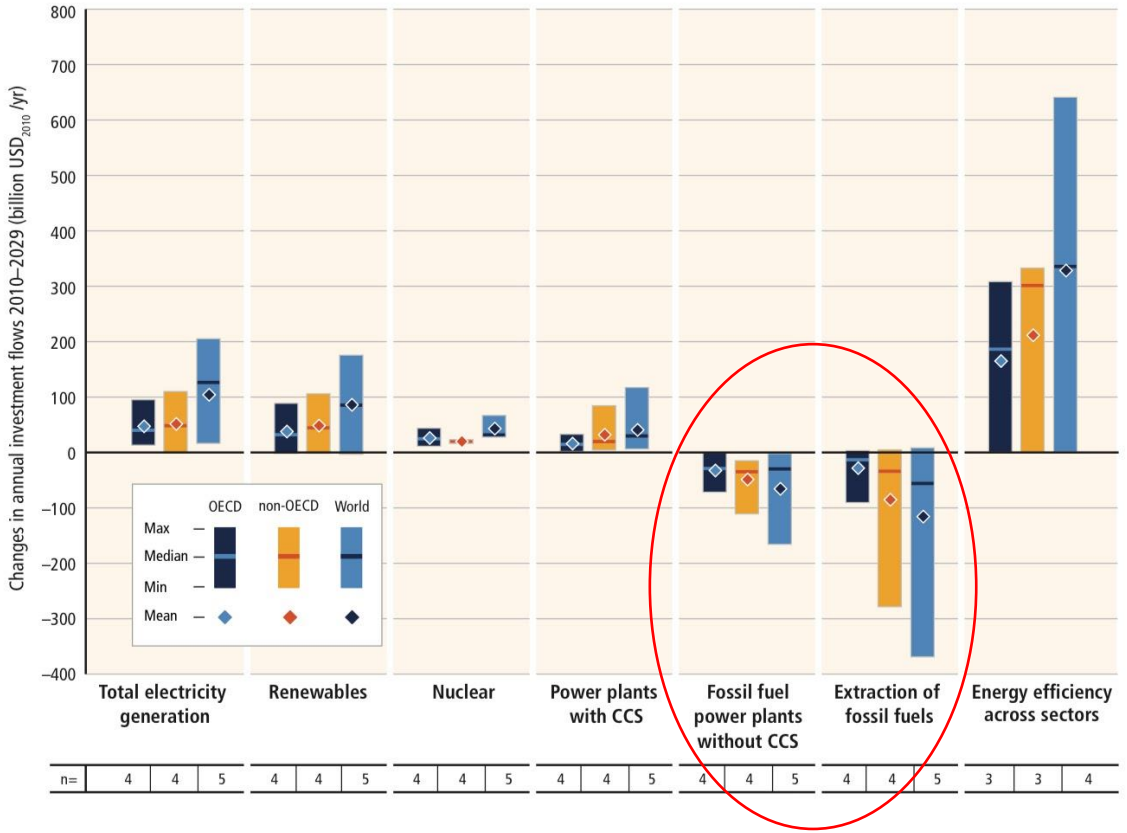


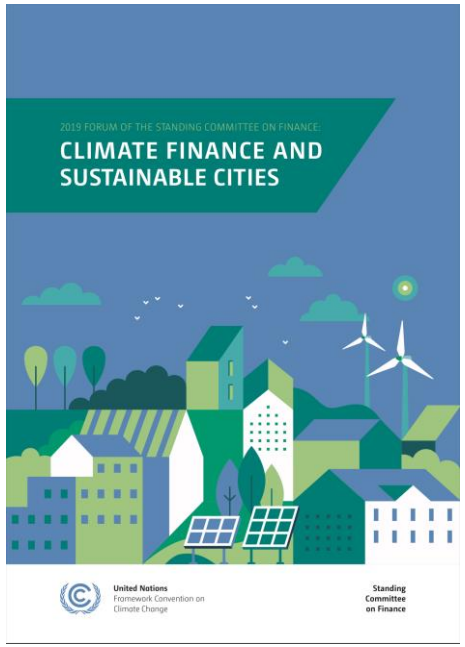
Figure 4.4 | Change in annual investment flows from the average baseline level over the next two decades (2010 to 2029) for mitigation scenarios that stabilize concentrations (without overshoot) within the range of approximately 430 to 530 ppm CO_2-eq by 2100. Total electricity generation (leftmost column) is the sum of renewable and nuclear energy, power plants with CCS, and fossil-fuel power plants without CCS. The vertical bars indicate the range between the minimum and maximum estimate; the horizontal bar indicates the median. The numbers in the bottom row show the total number of studies in the literature used in the assessment. Individual technologies shown are found to be used in different model scenarios in either a complementary or a synergistic way, depending largely on technology-specific assumptions and the timing and ambition level of the phase-in of global climate policies. *{WGIII Figure SPM.9}*

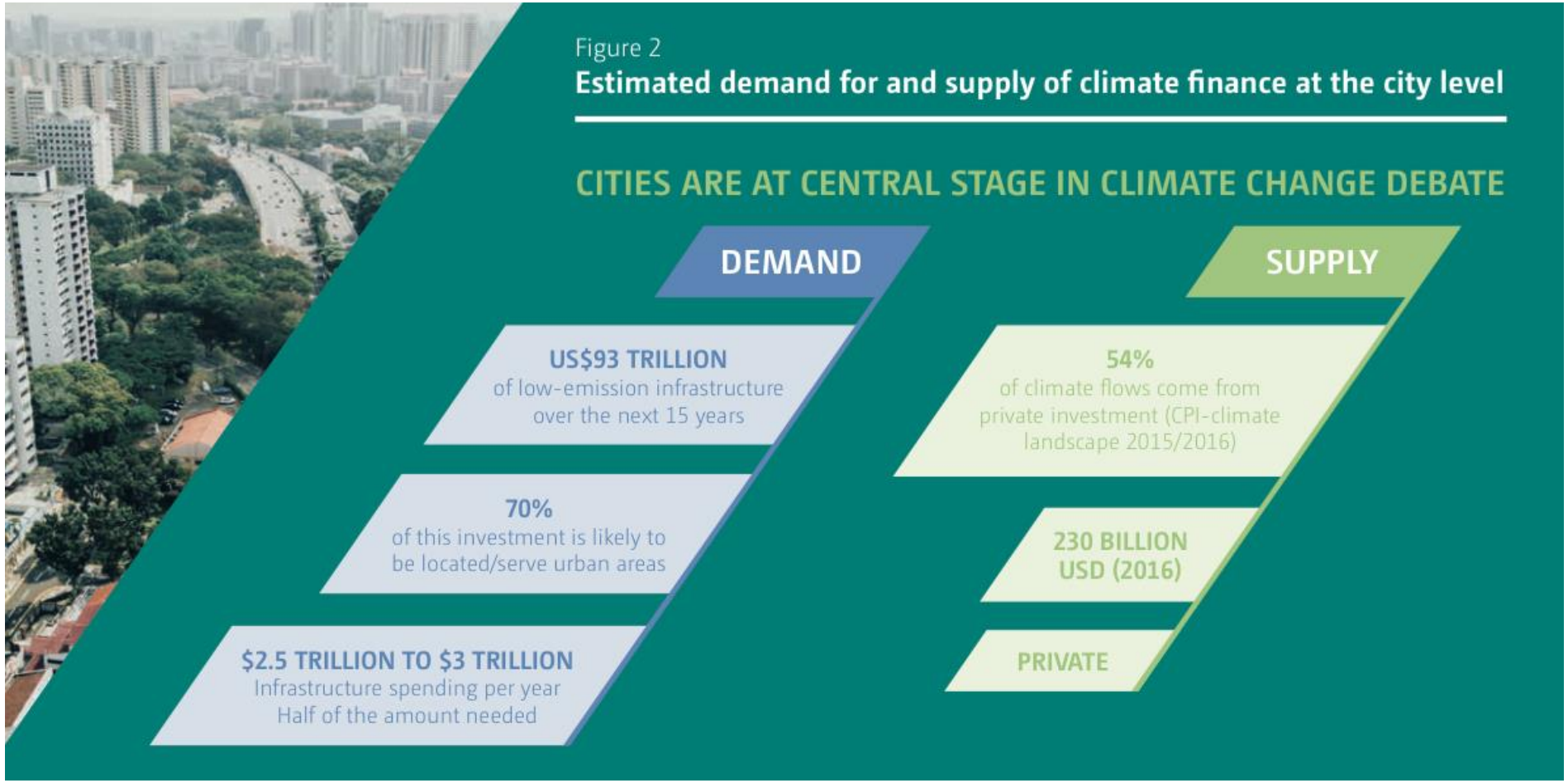
Source: IPCC

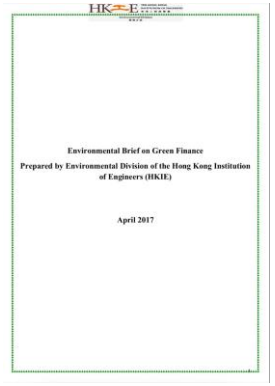
Unsettled issues and uncertainties

- Nuclear ?
- Natural gas (still fossil fuel) as a transition ?
- Brown, grey and green hydrogen
- Technical and economic viability of large scale arbon capture and storage

Sustainable Cities and Climate Finance Needs







Environmental Brief on Green Finance

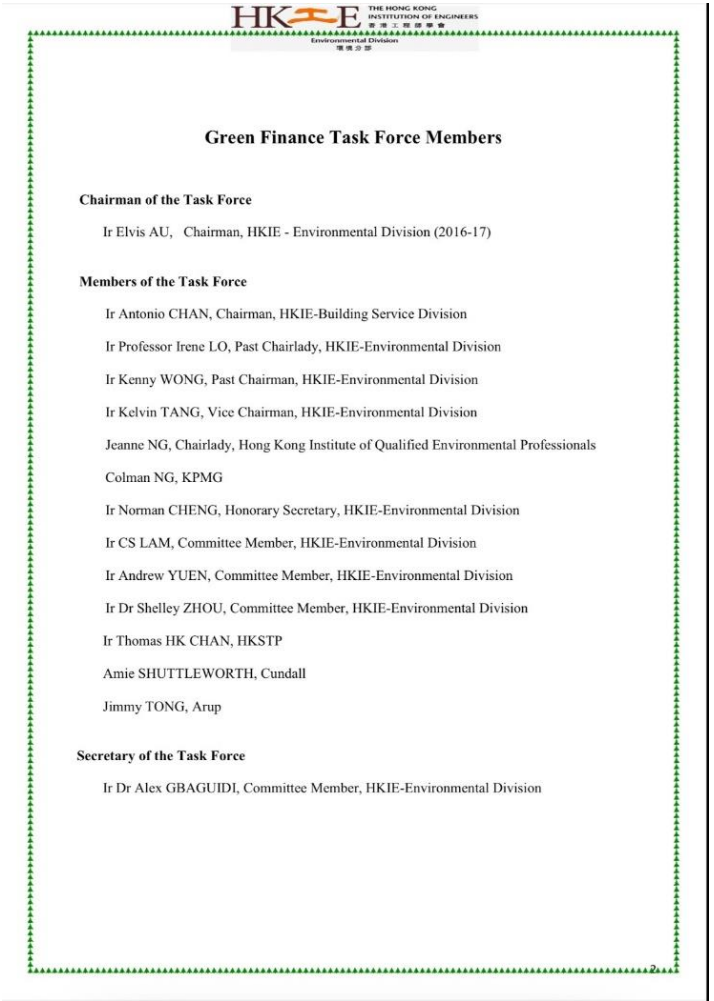
Prepared by Environmental Division of the Hong Kong Institution of Engineers (HKIE)

April 2017

Green Finance Task Force of Hong Kong Institution of Engineers Professional Report on Green Finance in Hong Kong, April 2017

- Why environmental engineers: green finance and green industry go hand in hand; mission to pursue environmental sustainability through holistic and synergistic approach; well placed because of multi-disciplinary strengths, expertise and experiences on classifying and management green projects and project finance,
- Aspire to show environmental leadership, nurture expertise, and build capacity

"Green Finance: represents a shift in the global economy's transition to sustainability through the financing of public and private green investments and policies that support sustainable development."



HKIE THE HONG KONG INSTITUTION OF ENGINEERS

Environmental Division

Green Finance Task Force Members

Chairman of the Task Force

Ir Elvis AU, Chairman, HKIE - Environmental Division (2016-17)

Members of the Task Force

Ir Antonio CHAN, Chairman, HKIE-Building Service Division

Ir Professor Irene LO, Past Chairlady, HKIE-Environmental Division

Ir Kenny WONG, Past Chairman, HKIE-Environmental Division

Ir Kelvin TANG, Vice Chairman, HKIE-Environmental Division

Jeanne NG, Chairlady, Hong Kong Institute of Qualified Environmental Professionals

Colman NG, KPMG

Ir Norman CHENG, Honorary Secretary, HKIE-Environmental Division

Ir CS LAM, Committee Member, HKIE-Environmental Division

Ir Andrew YUEN, Committee Member, HKIE-Environmental Division

Ir Dr Shelley ZHOU, Committee Member, HKIE-Environmental Division

Ir Thomas HK CHAN, HKSTP

Amie SHUTTLEWORTH, Cundall

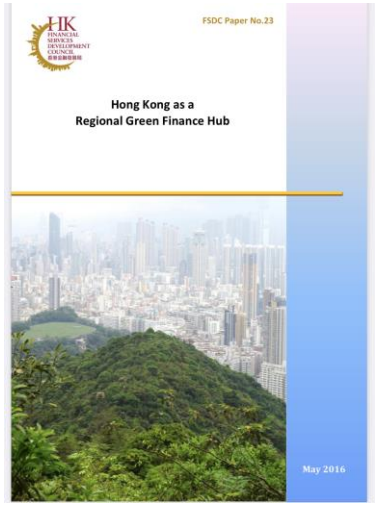
Jimmy TONG, Arup

Secretary of the Task Force

Ir Dr Alex GBAGUIDI, Committee Member, HKIE-Environmental Division

Examples of Recommendations in HKIE Green Finance Taskforce Report April 2017	Green Finance Development in Hong Kong during 2017-2022
Need specific policy reform on green finance	Government's green finance policy and green bond grant etc
Clear policy signals and enabling framework	Government green bond and strategic plan
Banks to enhance their green finance instruments	Banks and financial institutions taking an active role in enabling green finance
Capacity building needs of green finance professionals	Various institutions issuing guidelines and providing training courses
Promote social benefits of green finance	Government's retail green bond to enable citizens to participate

Hong Kong's Journey on Green and Sustainable Finance



Landmark trip by a delegation of FSTB/EPD/SFC/HKMA to Shenzhen to discuss green finance in mid 2017

2015 Paris Agreement with Climate Finance & 2016 G20 Summit with Green Finance Focus

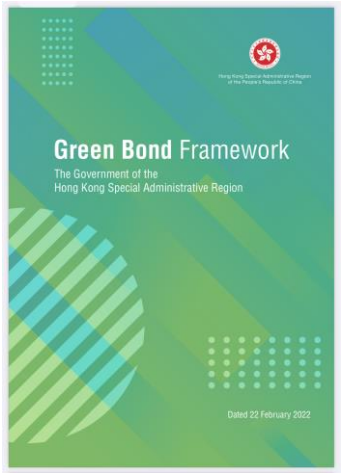
2016

FSDC's Report on Green Finance

April 2017

HKIE's Green Finance Task Force Report

Oct 2017 Policy Address's Commitment on Making Hong Kong a Green Finance Centre



2017-2022

- Issuance of First Government Green Bond
- Green Bond Grant Scheme
- Setting up Cross-Agency Steering Group
- Issuance of retail green bond
- Launch of Core Climate – voluntary carbon trading platform

-

The Hong Kong Monetary Authority (HKMA) and the Securities and Futures Commission (SFC) co-hosted a press conference today (17 December) on the launching of Strategic Plan by the Green and Sustainable Finance Cross-Agency Steering Group. The press conference was co-hosted by Mr Eddie Yue, Chief Executive of the HKMA (second from left) and Mr Ashley Alder, Chief Executive Officer of the SFC (second from right); and was joined by Mr Daryl Ho, Executive Director (Banking Policy) of the HKMA (first from left) and Ms Julia Leung, Deputy Chief Executive Officer and Executive Director, Intermediaries of the SFC (first from right).

Government Policies on Climate Change and Green/Sustainable Finance

"Explore the feasibility of the Government issuing a green bond to promote the development of green finance and to demonstrate the Government's commitment to promote sustainable economic development. "(pg 18)

Chief Executive Policy Address Policy Agenda 2017

"To demonstrate the Government's commitment to promoting green finance, I propose to launch a green bond issuance programme with a borrowing ceiling of $100 billion. The sums borrowed will be credited to the Capital Works Reserve Fund to provide funding for green public works projects of the Government. The measure will encourage more issuers to arrange financing for their green projects through our capital markets. "

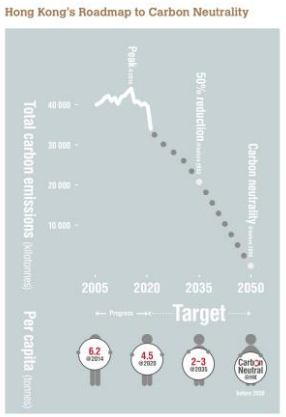
Financial Secretary Budget Speech 2018-19

PRC to promote comprehensive green transformation …and endeavor to have carbon dioxide peak before 2030 and achieve carbon neutrality before 2060

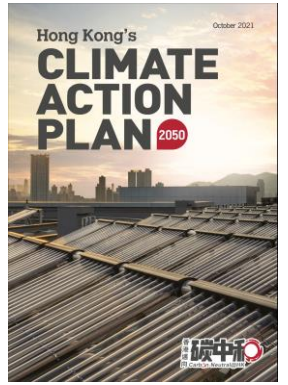
PRC Outline of 14th 5-years Plan

Hong Kong SAR will strive to achieve carbon neutrality before 2050

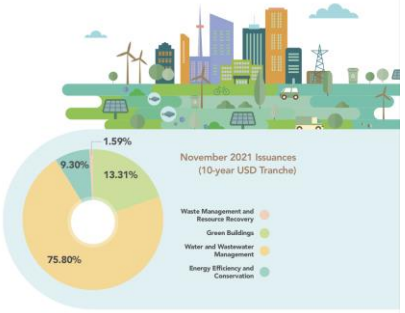
Chief Executive Policy Address 2020



Government Policy Blueprint on Climate Change Action Plan 2050



Hong Kong's Government Green Bond Issuances



Government Green Bond Issuances

Milestone

November 2018
Establishment of GGBP

March 2019
Green Bond Framework (March 2019 version)

May 2019
Inaugural institutional issuance US$1 billion (1 USD tranche)

July 2021
GGBP's borrowing ceiling doubled to HK$200 billion

February 2021
February 2021 institutional issuances US$2.5 billion (3 USD tranches)

January 2021
Establishment of a Global Medium Term Note Programme

November 2021
November 2021 institutional issuances
US$1 billion (1 USD tranche)
EUR1.75 billion (2 Euro tranches)
RMB5 billion (2 RMB tranches)

February 2022
Green Bond Framework (February 2022 version)

May 2022
Inaugural retail issuance HK$20 billion

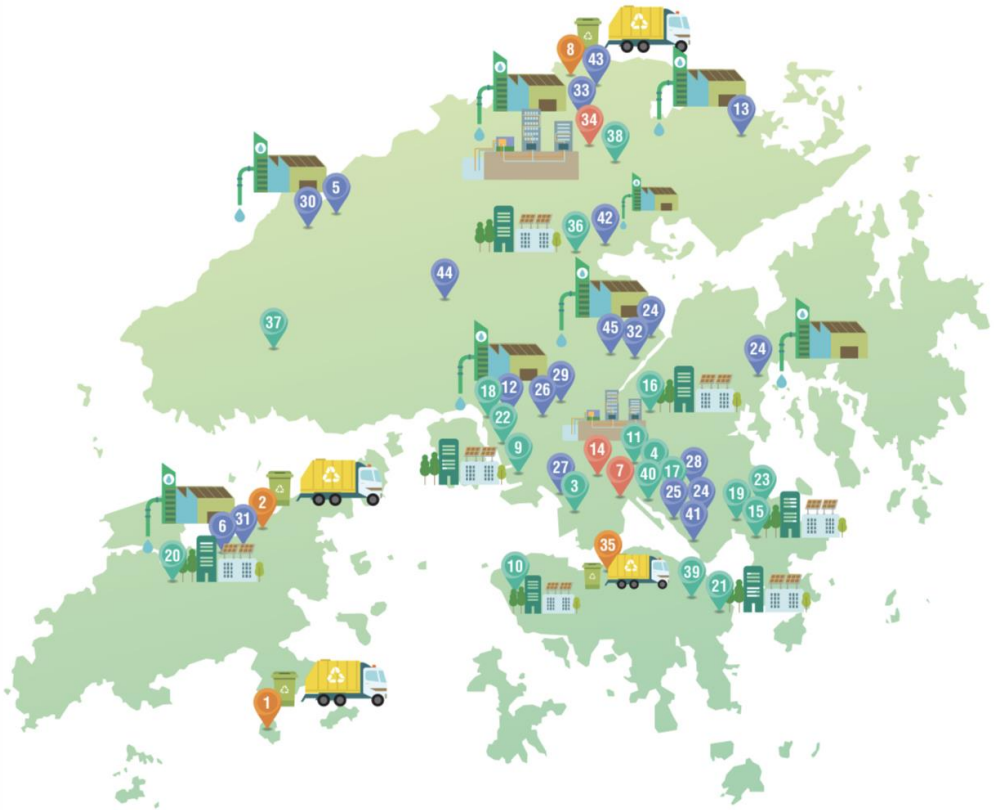
Cumulative Government Green Bond Issuances:

Close to US$ 10 billion

Institutional: ~US$ 7.3 billion

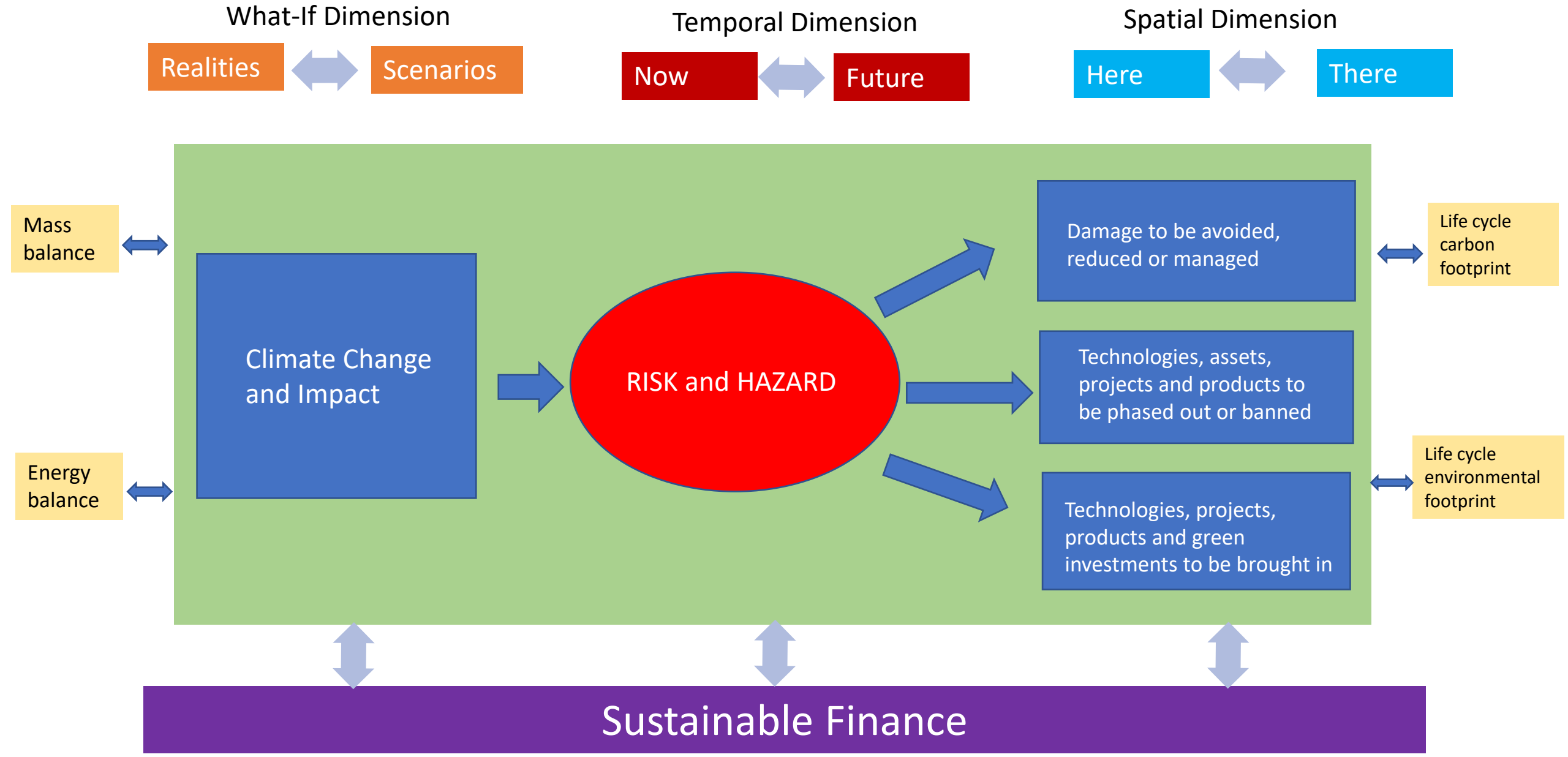
Retail: HK$ 20 billion (~US$ 2.6 billion)

Geographical Locations of the Projects Financed



Waste Management and Resource Recovery
Green Buildings
Water and Wastewater Management
Energy Efficiency and Conservation

Essentials of A Pragmatic Framework for Climate Change and Sustainable Finance Management
Based on over 30 years of experiences

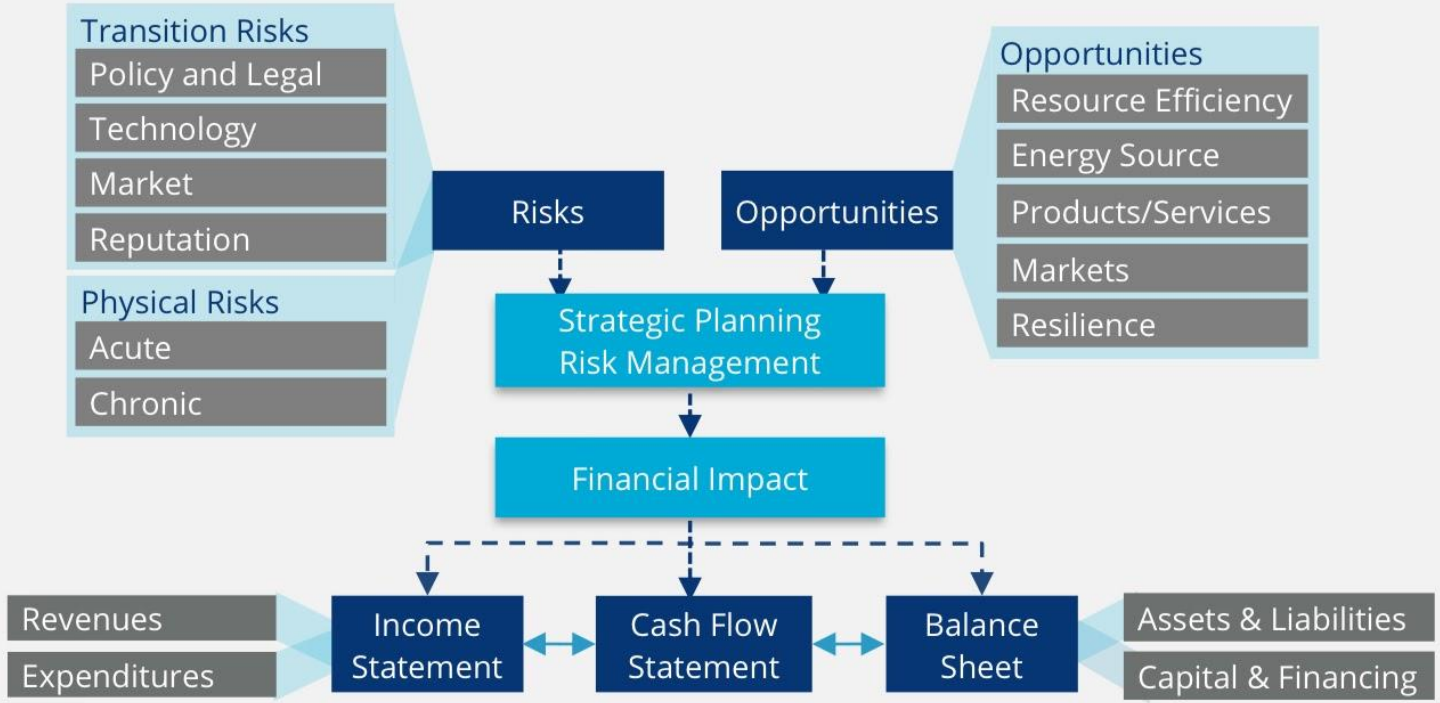


TFCD's Climate Related Financial Disclosures and IPCC's Climate Change Casual Relationships

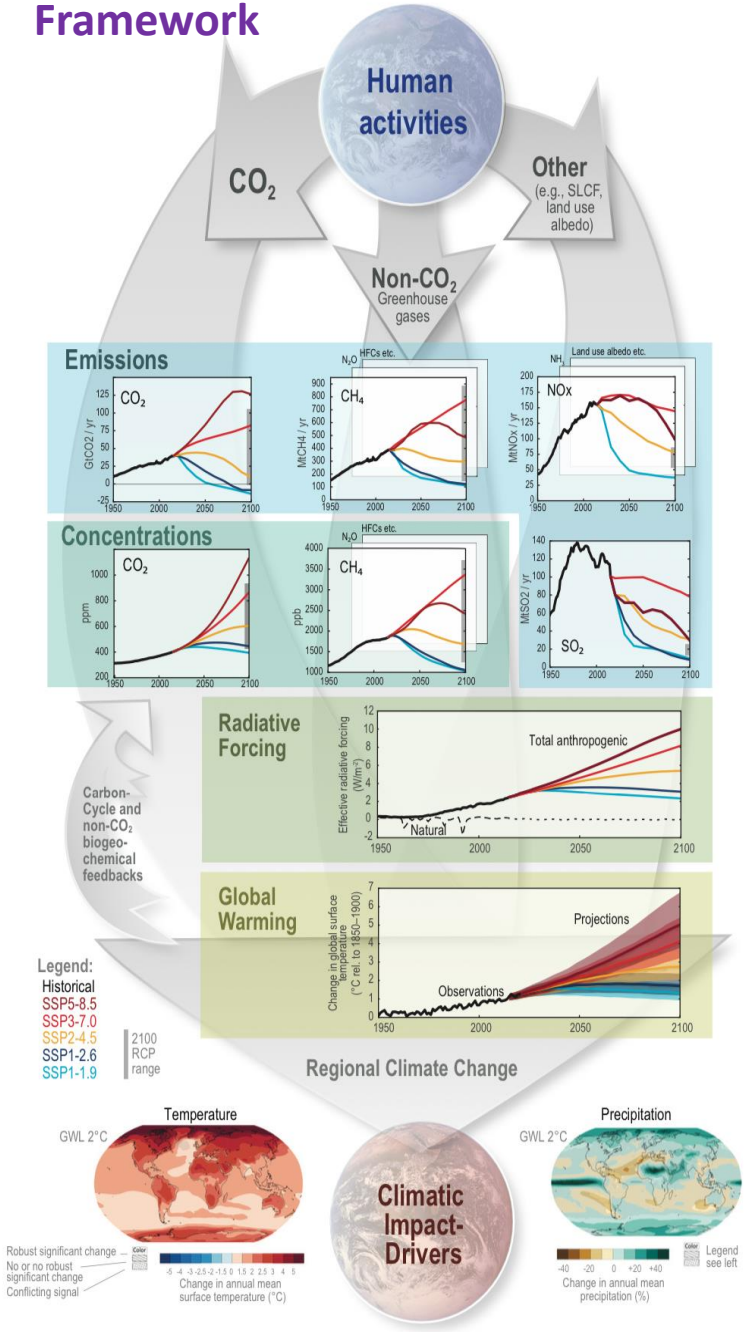
Risk and Hazard Management: Need for *Proactive and Upfront Screening and Scoping* of Scenarios, Impacts, Linkages, Risks and Opportunities

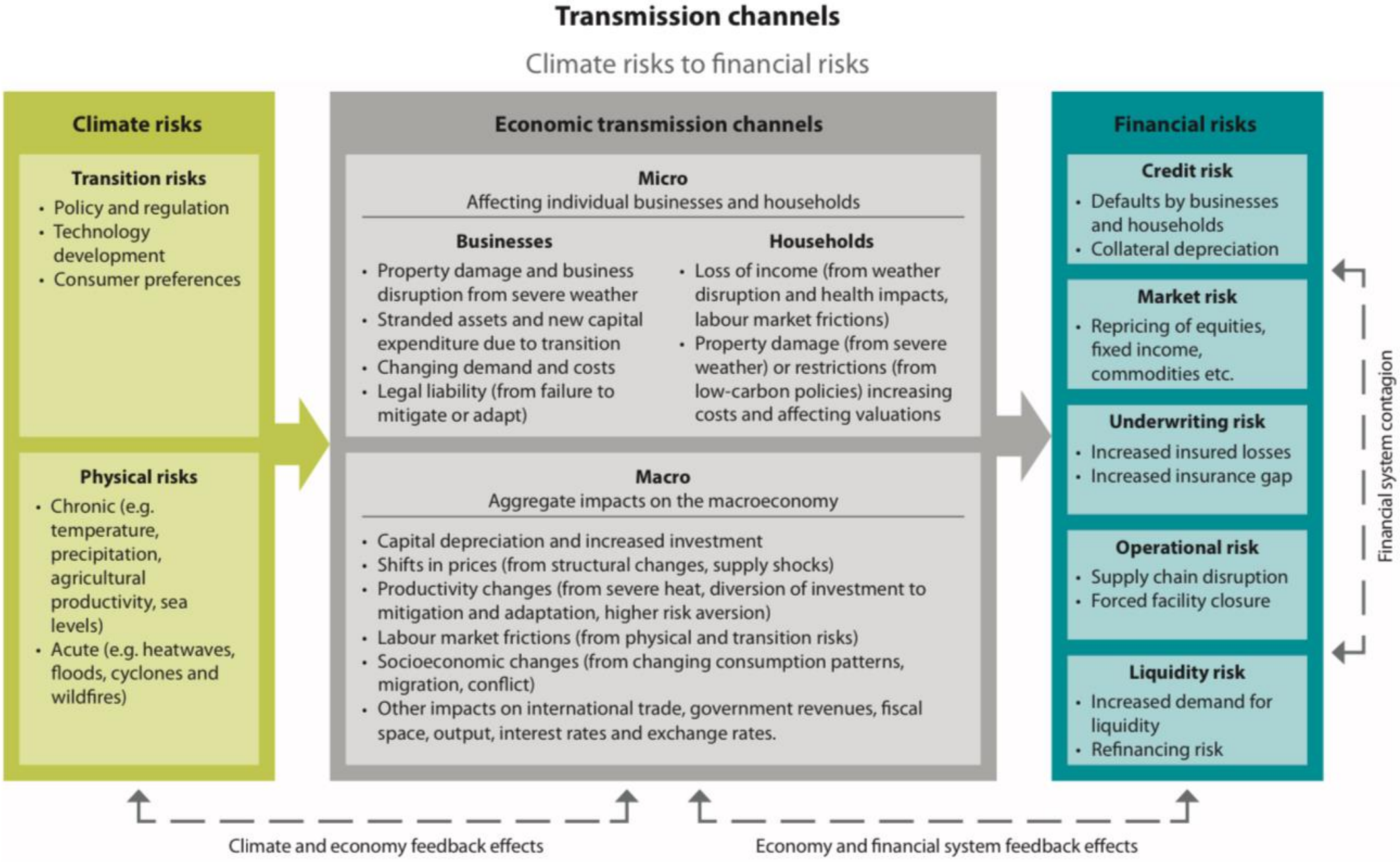
Figure 1

Climate-Related Risks, Opportunities, and Financial Impact



IPCC's Climate Change Cause-Effects Framework





Source: NGFS Sept 2022

Climate Change and Sustainable Finance
Threats and Challenges based on International Experiences

Three Major Threats

- Threat of “Greenwashing”
- Threat of Misallocation of Capital to Ineffective and/or Inefficient Technologies and Projects
- Threat of Information Overload, Misinformation and Digression

Three Major Challenges

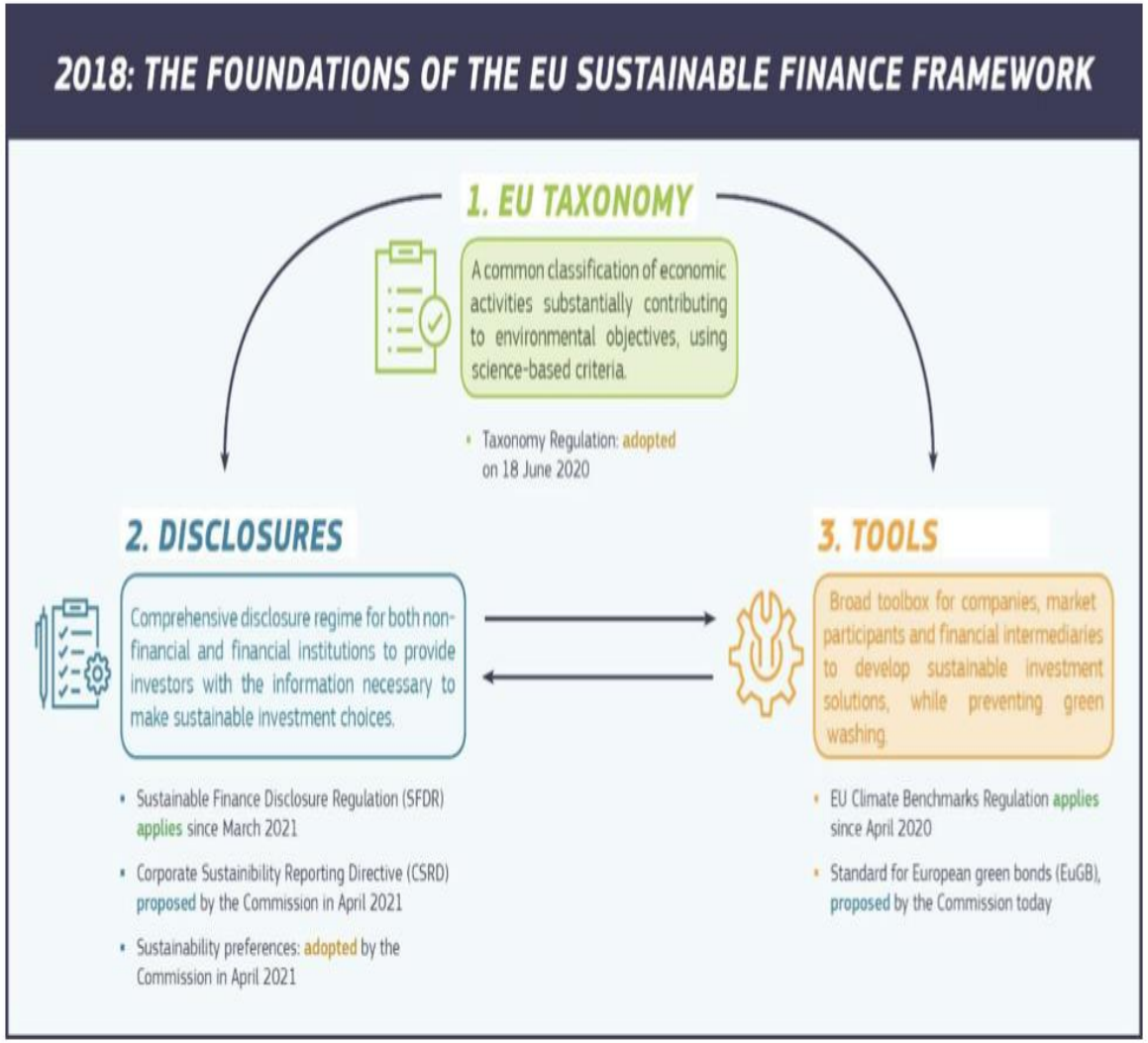
- Challenge of Climate Change Scenario and Risk Analysis and Management
- Challenge of Scope 3 Carbon/Environmental Footprint
- Challenge of Verifying Claims, Monitoring, Tracking and Adaptive Management

1. What is a green investment (taxonomy issue) ?

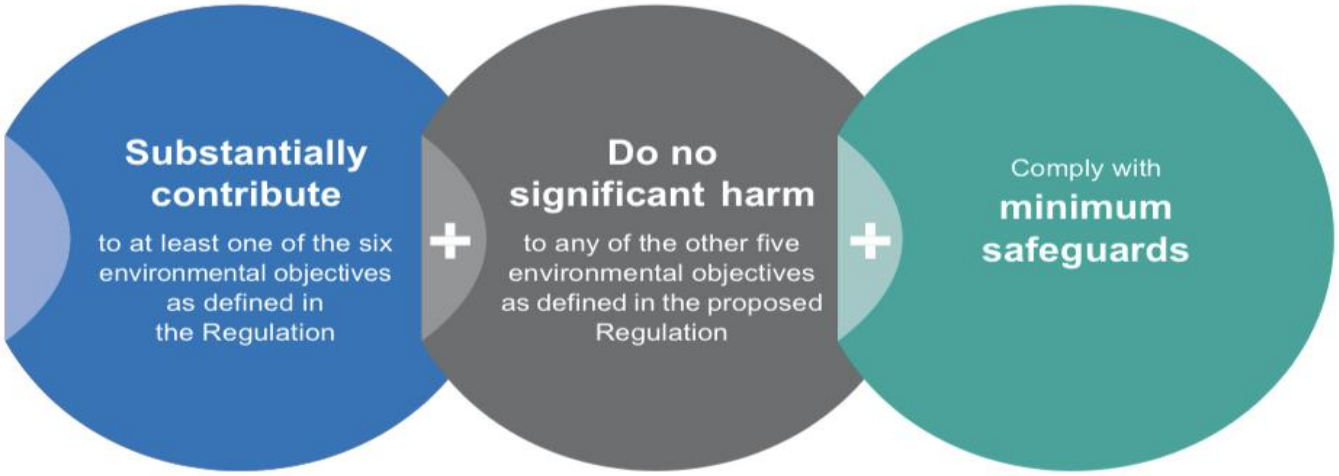
UNEP's First Attempt in 2016 on Taxonomy on Green Investment

Fig.1 Environmental Scope of Green Finance (G20, 2016; UNEP)

EU Sustainable Finance Framework



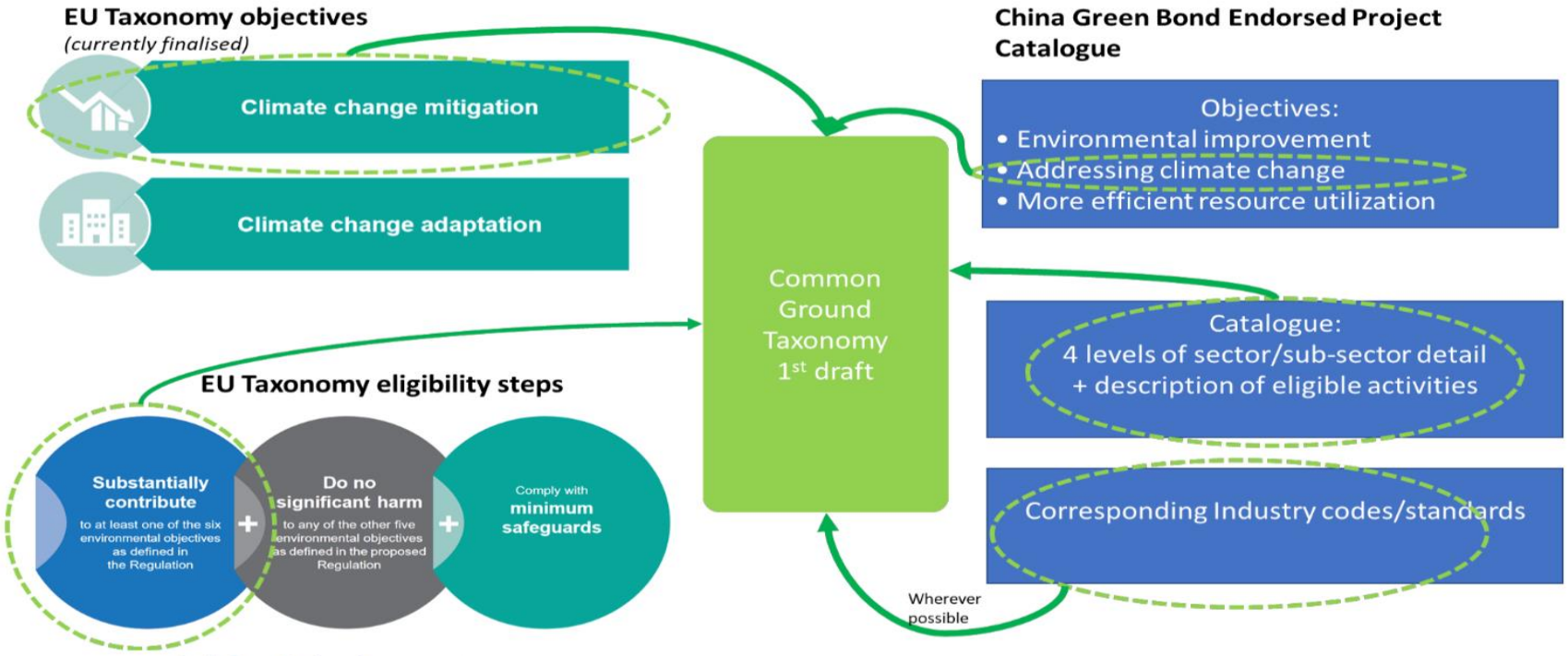
What is a Green investment ?
EU Taxonomy on Sustainable Finance



- Climate change mitigation
- Climate change adaptation
- sustainable and protection of water and marine resources;
- transition to a circular economy
- pollution prevention and control;
- protection and restoration of biodiversity and ecosystems.

Unsettled Isssues

- Fossil gas
- Nuclear



Applying the taxonomy, is gasification technology a *green* or *grey* investment ?

Credit: Enerkem

Enerkem's plant in Edmonton, Alberta, makes ethanol from municipal waste.

This gasification plant is in operation

Trash to treasure

More than a dozen gasification projects seek to turn waste into energy, fuels, and chemicals.

COMPANY	PROJECT LOCATION	COMPLETION DATE	OUTPUT	FEEDSTOCK
Aries Clean Energy	Lebanon, Tennessee	2016	Electricity and biochar	Sludge and woody biomass
	Linden, New Jersey	2020	Electricity and biochar	Sludge
	Lost Hills, California	2021	Electricity and biochar	Agricultural biomass
Enerkem	Edmonton, Alberta	2017	Ethanol	Municipal waste
	Minneapolis	TBD	Ethanol	Municipal waste
	Tarragona, Spain	TBD[a]	Methanol	Household and industrial waste
	China	100 facilities by 2035[b]	Methanol and/or ethanol	Noncompostable, nonrecyclable waste
	Rotterdam, Netherlands	TBD[c]	Methanol	Noncompostable, nonrecyclable waste, including plastics
	Varennes, Quebec	TBD	Methanol and/or ethanol	Noncompostable, nonrecyclable waste and biomass
Envergent Technologies	Undisclosed	TBD[d]	Fuel oil, gasoline, and diesel	Woody biomass
Fulcrum BioEnergy	McCarran, Nevada	2020	Synthetic crude for fuel	Household garbage
	Gary, Indiana	2022	Renewable crude, jet fuel, and diesel	Household garbage
Red Rock Biofuels	Lakeview, Oregon	2020	Naphtha, jet fuel, and diesel	Woody biomass
Sierra Energy	Monterey, California	2018	Electricity and diesel	Municipal waste
Total	Dunkerque, France	2020[e]	Jet fuel and diesel	Woody biomass
Velocys	Immingham, England	mid-2020s[f]	Jet fuel and diesel	Household and office waste
	Natchez, Mississippi	2024	Jet fuel and gasoline	Woody biomass

Sources: Companies. Notes: TBD means to be determined. List is not comprehensive.a In partnership with Suez. b License deal with Sinobioway Group. c In partnership with Air Liquide, Nouryon, Shell, and Port of Rotterdam. d A joint venture between Ensyn and Honeywell UOP. Production via pyrolysis. e In partnership with Avril, Axens, the French Alternative Energies and Atomic Energy Commission (CEA), IFP Energies nouvelles, and Thyssenkrupp Industrial Solutions. f In partnership with British Airways and Shell.

High costs and technology challenges have doomed six gasification projects since 2011.

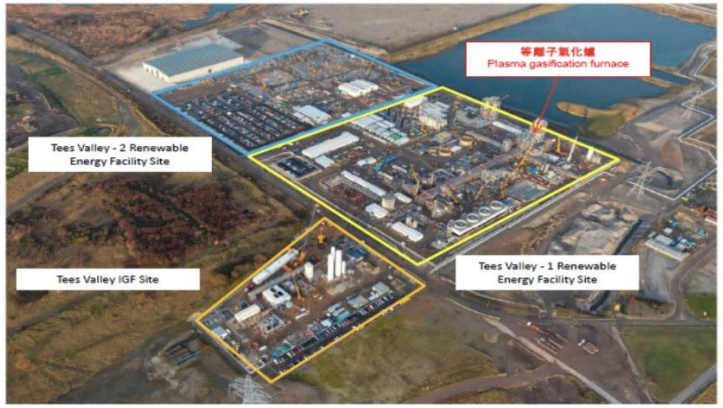
COMPANY	PROJECT LOCATION	YEAR CANCELED	GOAL
Air Products and Chemicals	Teesside, England	2016	Energy from municipal waste
Choren Industrietechnik	Freiberg, Germany	2011	Electricity and diesel from woody biomass
Göteborg Energi	Göteborg, Sweden	2018	Synthetic natural gas from woody biomass
KiOR	Columbus, Mississippi	2014	Gasoline, diesel, and heating oil from woody biomass
Range Fuels	Soperton, Georgia	2011	Methanol from woody biomass
Sundrop Fuels	Alexandria, Louisiana	2017	Gasoline from woody biomass and natural gas

Sources: Companies, C&EN research

Members of the delegation received a briefing on the operation of APP's pilot plasma gasification plant

Government and Legislative Council Joint Visit to UK waste to energy facilities in 2014 including gasification technologies

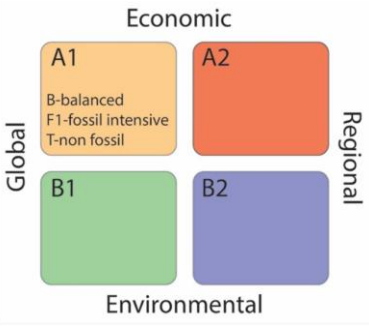
Air Products Tees Valley Site – December 2013

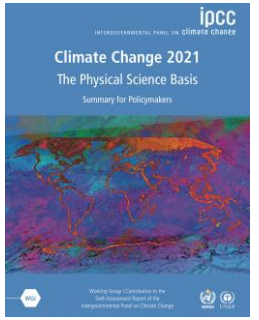


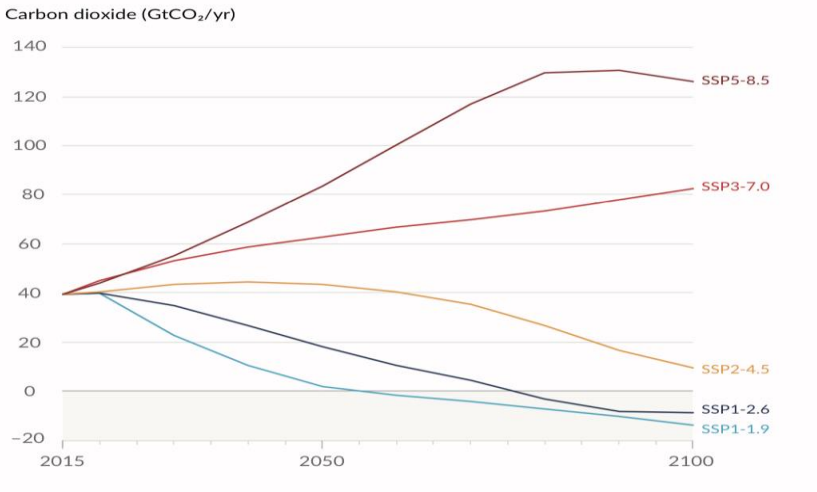
Aerial view of Air Products' waste-to-energy facilities in Teesside

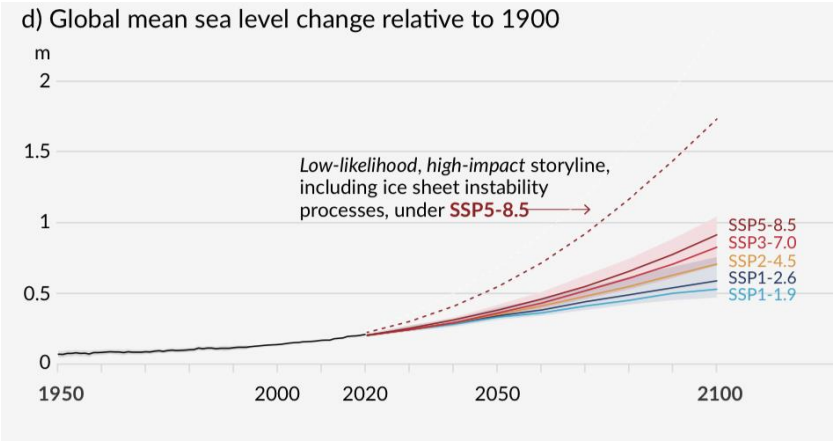
This gasification project was cancelled in 2016

2. Scenario Analysis Issue : IPCC Five Illustrative Socio-economic Pathway Scenarios: What do these scenarios mean to you ?









{Cross-Chapter Box 2.3, 4.3, 4.4, Cross-Section Box TS.1}

	Near term, 2021–2040		Mid-term, 2041–2060		Long term, 2081–2100	
Scenario	Best estimate (°C)	*Very likely* range (°C)	Best estimate (°C)	*Very likely* range (°C)	Best estimate (°C)	*Very likely* range (°C)
SSP1-1.9	1.5	1.2 to 1.7	1.6	1.2 to 2.0	1.4	1.0 to 1.8
SSP1-2.6	1.5	1.2 to 1.8	1.7	1.3 to 2.2	1.8	1.3 to 2.4
SSP2-4.5	1.5	1.2 to 1.8	2.0	1.6 to 2.5	2.7	2.1 to 3.5
SSP3-7.0	1.5	1.2 to 1.8	2.1	1.7 to 2.6	3.6	2.8 to 4.6
SSP5-8.5	1.6	1.3 to 1.9	2.4	1.9 to 3.0	4.4	3.3 to 5.7

SSP5-8.5

- Shared socio economic pathway scenario with radiative force 8.5 Wm^{-2}
- High energy consumption lifestyle
- High fossil fuel usage
- Low cooperation on funds and technologies

Basically **BUSINEES AS USUAL**

SSP1-1.9

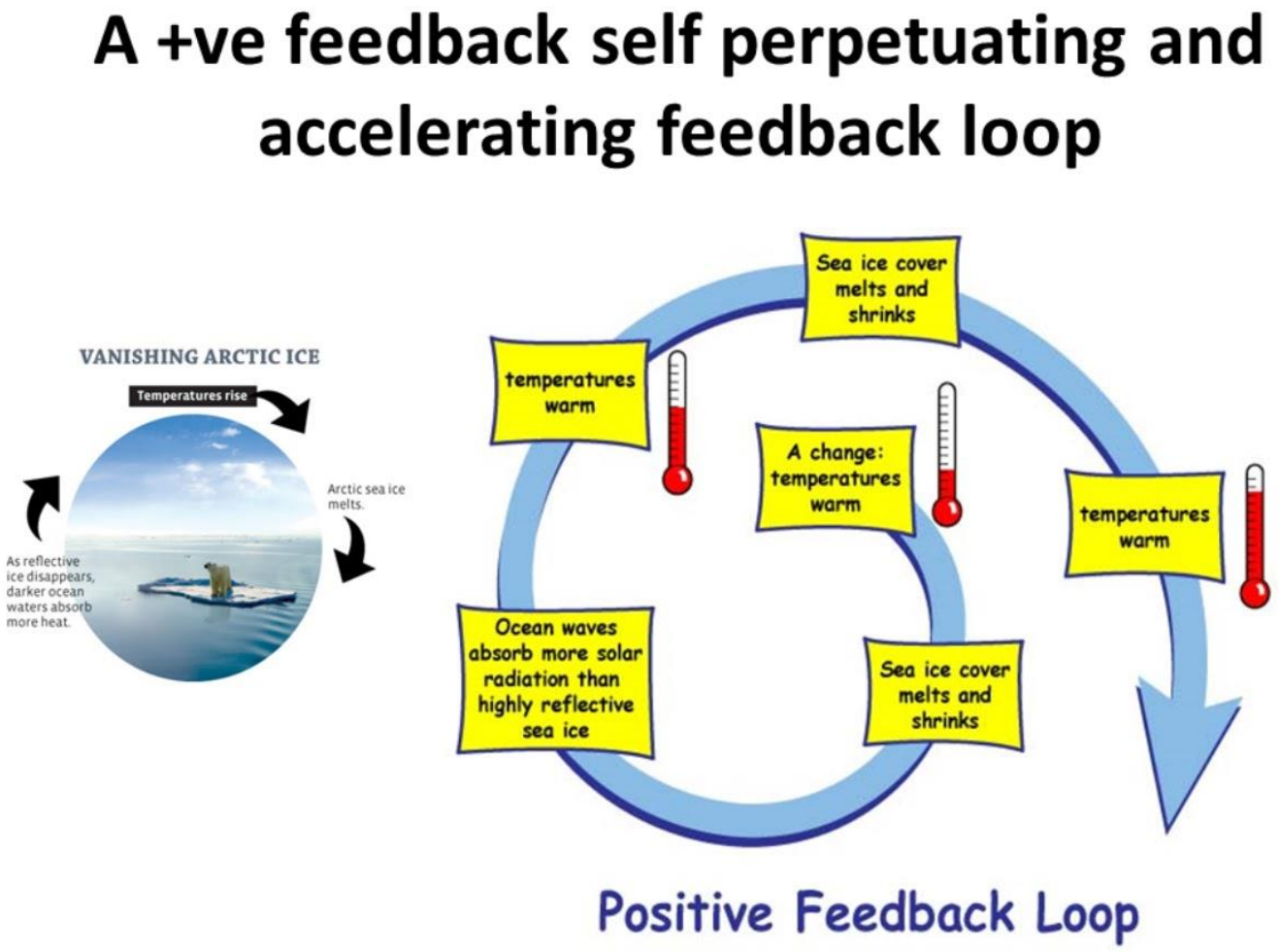
- Shared socio economic pathway scenario with radiative force 1.9 Wm^{-2}
- Very low energy consumption lifestyle
- Near zero fossil fuel usage
- Full cooperation on funds and technologies

DRACONIAN/FUNDAMENTAL SHIFT

Ice Sheet Instability: Climate Feedback Processes and Mechanisms

What is climate feedback ?

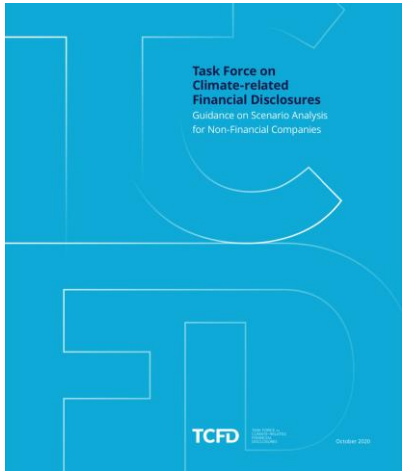
processes that can either amplify or diminish the effects of climate forcings. A feedback that increases an initial warming is called a "positive feedback." A feedback that reduces an initial warming is a "negative feedback."



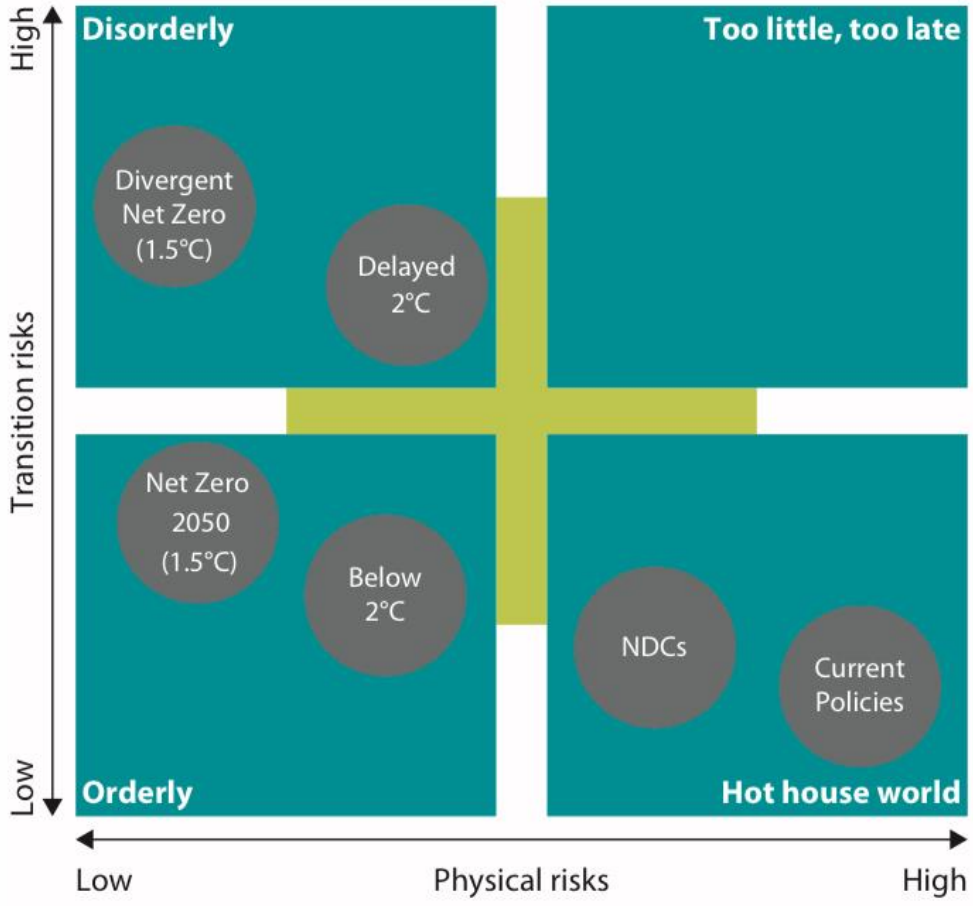
Source: Climate Emergency Institute

"No matter how well we prepare ourselves, when the imagined future becomes the very real present, it never fails to surprise."

– Alan AtKisson, *Believing Cassandra*



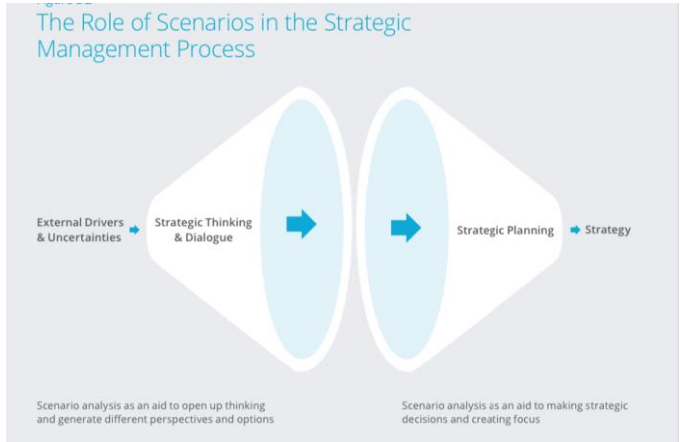
NGFS scenarios framework



STEEP Model of Driving Forces

Social	Technology	Economic
Social/Lifestyle Factors	Basic Research Trends	Macroeconomic Trends
Demographic Patterns	Emerging Technologies	Microeconomic Trends
Health & Education Trends	Technology Diffusion	Regional/National Variations
Civil Stability & Tensions		Financial Capital Trends
		Trade Rules/Protectionism

Environment		Political
Ecosystem Trends	Energy	Policies
Climate/Weather Trends	Waste Disposal	Laws/Regulations
Pollution	Land Use	Court Decisions
Recycling		Political Attitudes



Scenario Analysis for Central Bankers

Scenarios at a glance

Scenarios are characterised by their overall level of physical and transition risk. This is driven by the level of policy ambition, policy timing, coordination and technology levers.

		Physical risk	Transition risk			
Category	**Scenario**	**Policy ambition**	**Policy reaction**	**Technology change**	**Carbon dioxide removal**	**Regional policy variation**
Orderly	Net Zero 2050	1.4°C	Immediate and smooth	Fast change	Medium-high use	Medium variation
	Below 2°C	1.6°C	Immediate and smooth	Moderate change	Medium-high use	Low variation
Disorderly	Divergent Net Zero	1.4°C	Immediate but divergent across sectors	Fast change	Low-medium use	Medium variation
	Delayed Transition	1.6 °C	Delayed	Slow / Fast change	Low-medium use	High variation
Hot house world	Nationally Determined Contributions (NDCs)	2.6°C	NDCs	Slow change	Low-medium use	Medium variation
	Current Policies	3°C +	Non-currente policies	Slow change	Low use	Low variation

Colour coding indicates whether the characteristic makes the scenario more or less severe from a macro-financial risk perspective

- Lower risk
- Moderate risk
- Higher risk

Hong Kong's Recent Scenario Planning for Climate Change Induced Flooding

(*based on medium GHG concentration scenario: Is this adequate ?*)

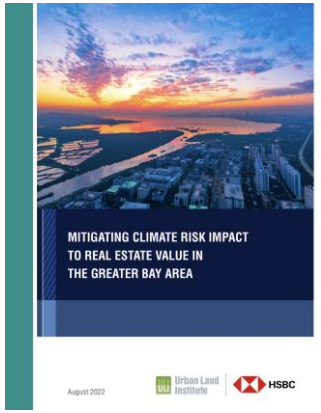
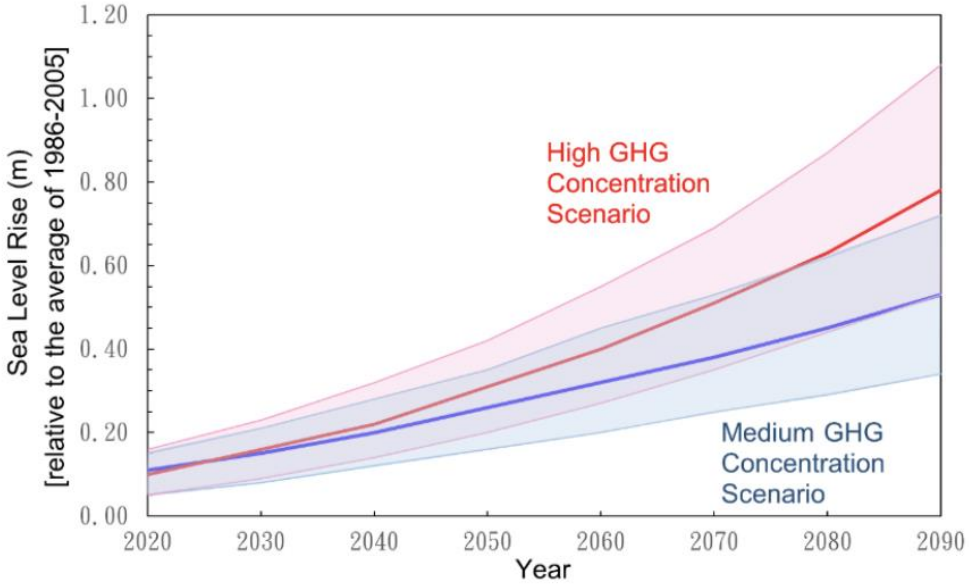
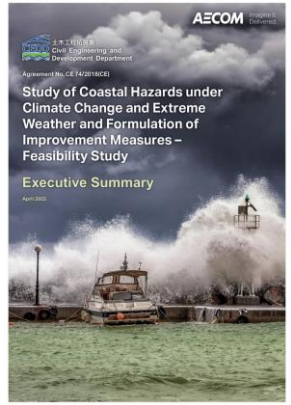


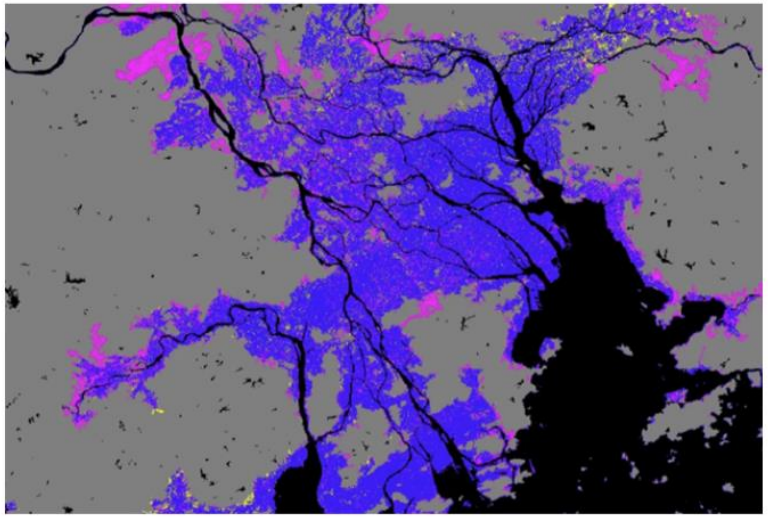
Diagram 2-1: Representation of Climate Change Projections in terms of SLR





Reference: The Fifth Assessment Report of the Intergovernmental Panel on Climate Change

FIGURE 2 Sea-Level Rise Projections for the Pearl River Delta



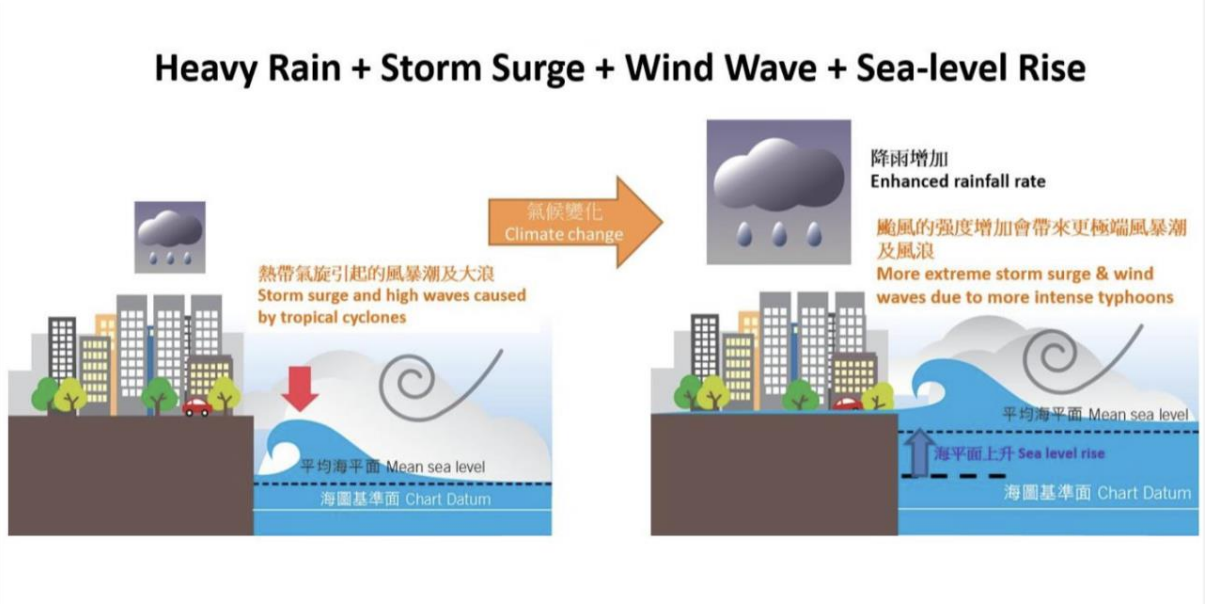
Pearl River Delta, China

Areas below water level according to:

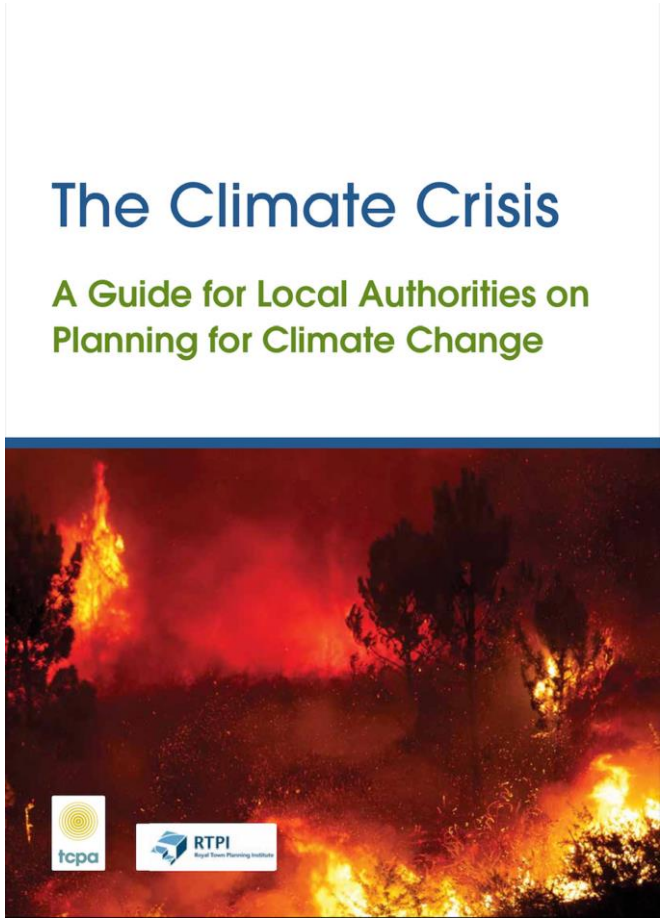
- CoastalDEM only
- SRTM only
- Both
- Current water bodies

Note:
CoastalDEM - a high-accuracy digital elevation model (DEM) for coastal areas
SRTM - uses radar observations to construct DEM

Source: Scott A. Kulp and Benjamin A. Strauss, "New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding," *Nature Communications* 10 (2019).



Climate Scenario Analysis



- "**Reasonable worst-case scenarios** should be drawn up from climate impact data: Local authorities are confronted by a wide range of climate impact data, which is often expressed as probabilistic outcomes depending on future carbon emissions trajectories. This can be bewildering and very hard to communicate to the public. Environment agencies provide advice on the handling of factors such as climate change (flood risk) allowances. Local authorities may wish to consider the development of reasonable worse-case scenarios as a means of considering local climate impacts based on this data. This can be a useful way of understanding the need for new policy responses and engaging communities in a meaningful debate about their future. In practice this means always acting within the science set out by government in, for example, the UK Climate Projections and the latest UK Climate Risk Assessment. It then means that local planning authorities should consider using '**credible maximum climate change scenarios such as 'High++**' when considering particularly vulnerable locations or sensitive development." (The Climate Crisis pg 32)

3. Scope 3 Emission Issue: true and full impacts; not easy, but if there is a will, there is a way !

ISO 14064-1: 2006 — **Mandatory**

- Scope 1 - Direct GHG emissions and removals
- Scope 2 - Energy indirect GHG emissions
- Scope 3 - Other indirect GHG emissions

Optional

ISO 14064-1: 2018 — **Mandatory**

- Scope 1 ➔ Category 1
- Scope 2 ➔ Category 2
- Scope 3 ➔ Categories 3, 4, 5 and 6

Mandatory if significant

Figure 2-1. Overview of GHG Protocol scopes and emissions across the value chain

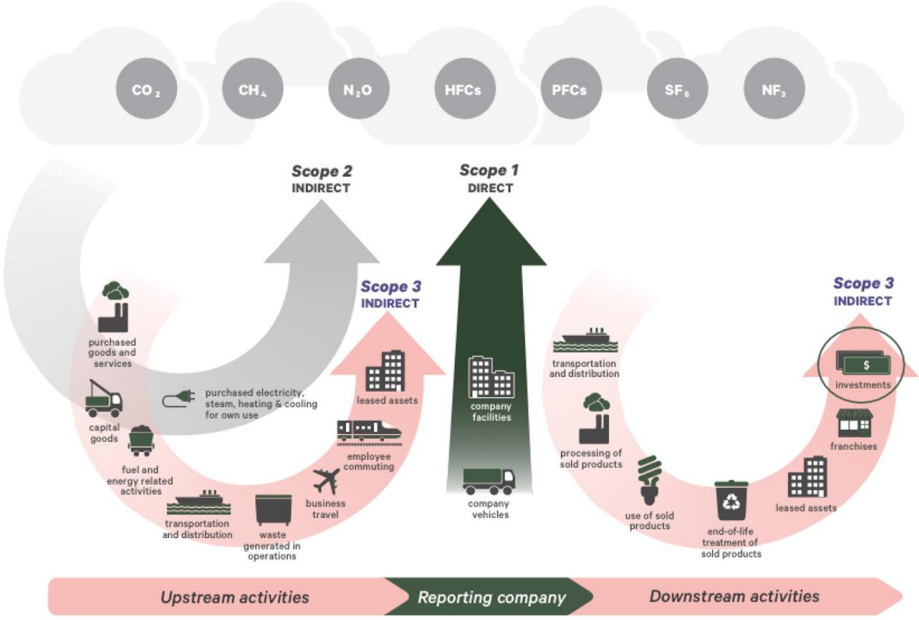


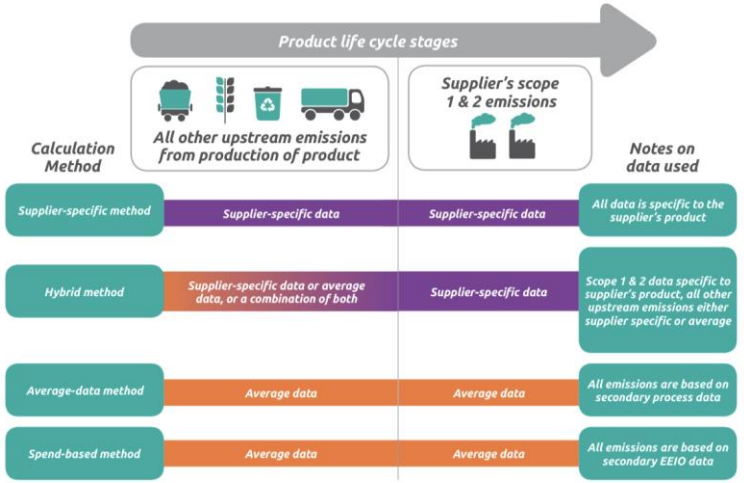
Figure 1-1. Measuring financed emissions as the foundation for other initiati

Source: (PCAF, 2020)

Table [5.3] List of scope 3 categories

Upstream or downstream	Scope 3 category
Upstream scope 3 emissions	1. Purchased goods and services 2. Capital goods 3. Fuel- and energy-related activities (not included in scope 1 or scope 2) 4. Upstream transportation and distribution 5. Waste generated in operations 6. Business travel 7. Employee commuting 8. Upstream leased assets
Downstream scope 3 emissions	9. Downstream transportation and distribution 10. Processing of sold products 11. Use of sold products 12. End-of-life treatment of sold products 13. Downstream leased assets 14. Franchises 15. Investments

Figure [1.1] Different data types used for different calculation methods



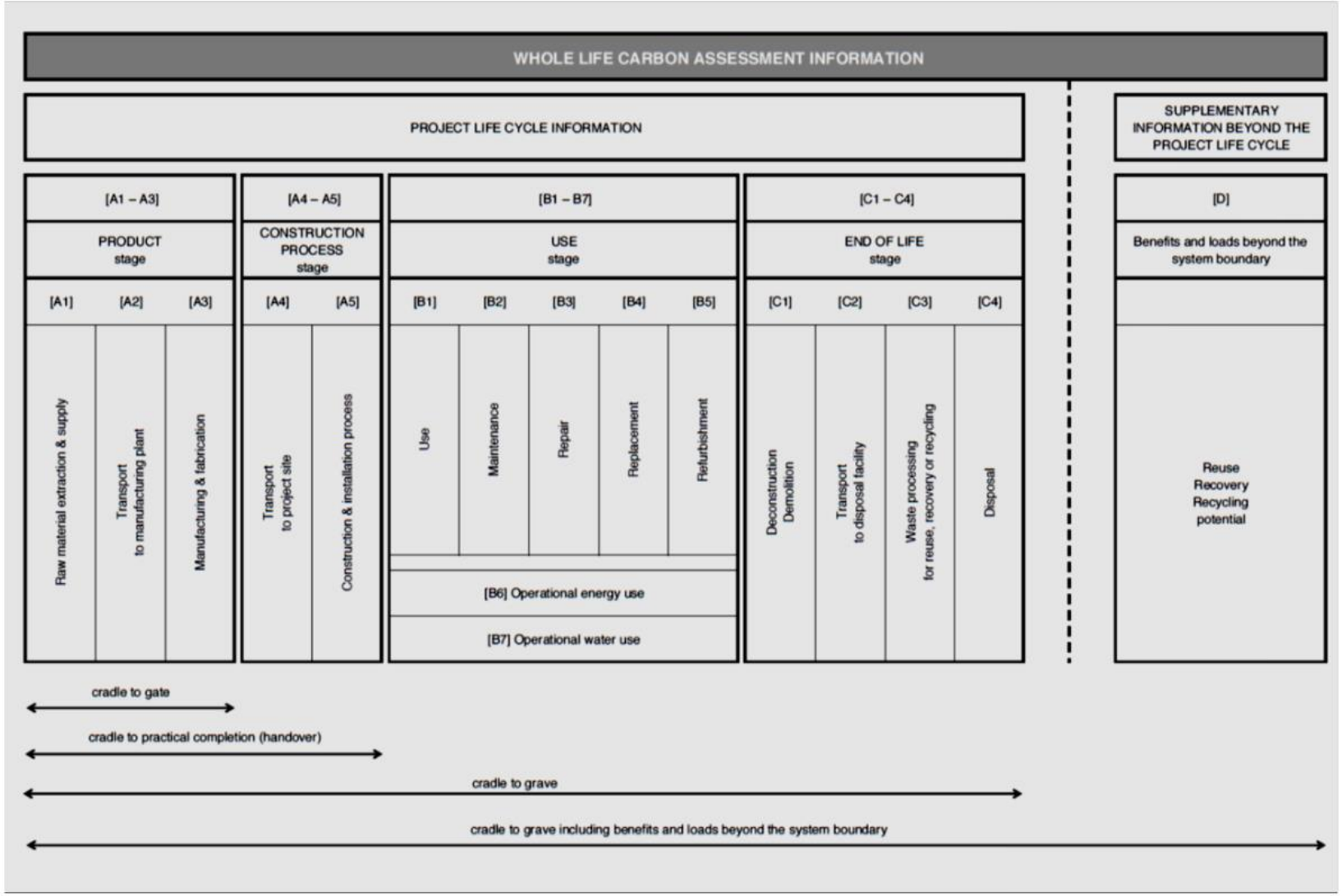
MAYOR OF LONDON

London Plan Guidance

Whole Life-Cycle Carbon Assessments

March 2022

Figure 2.1 Life-cycle modules (BS EN 15978)

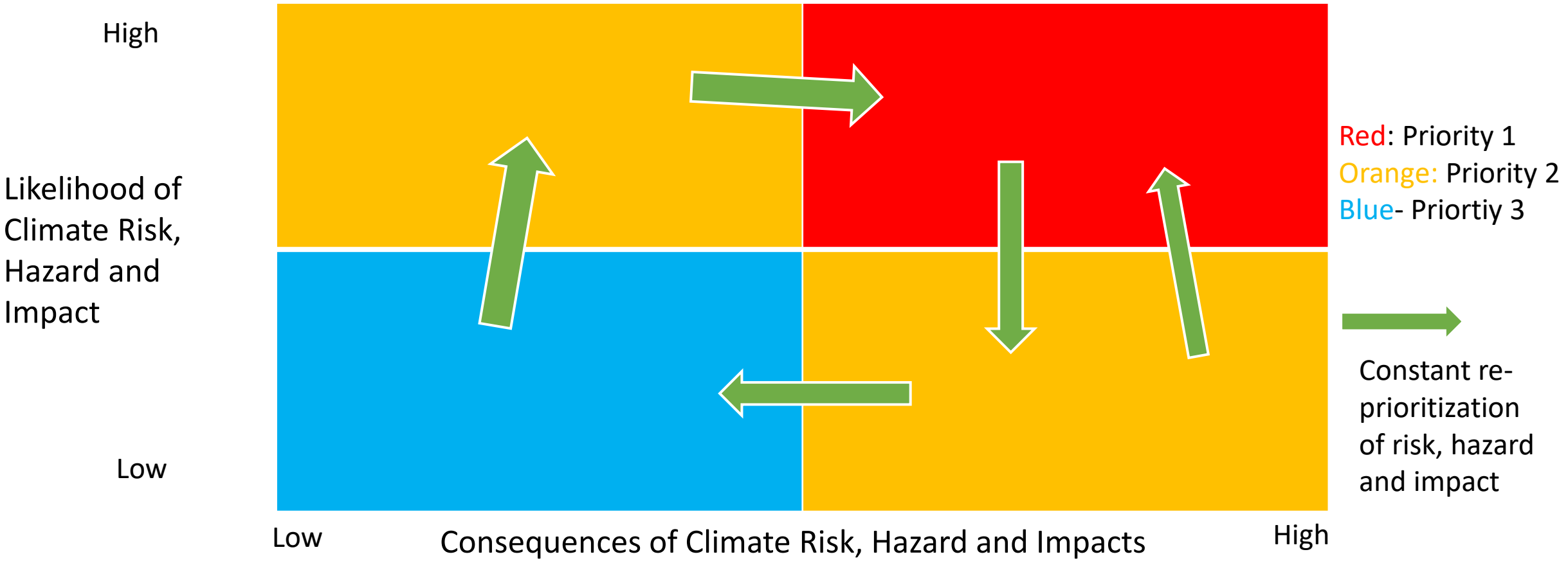


Practical Tip on Managing Risk and Hazard from Personal Experiences over the Past 37 years :

(a) Upfront & Proactive *Screening and Scoping* of Risk and Hazards and Constant Prioritisation and Re-prioritization of risks and hazards

(b) Making Hidden Assumptions Explicit for Flexible and Adaptive Management

(c) Plan for reasonable worst cases, have an emergency plan for worst worst case, but ACT NOW on commonalities and preventive measures



Remarks by UN Secretary General on Closing of UNFCC COP 27 in Egypt

"The world still needs a giant leap on climate ambition"

"The red line we must not cross is the line that takes our planet over the 1.5 degree temperature limit."

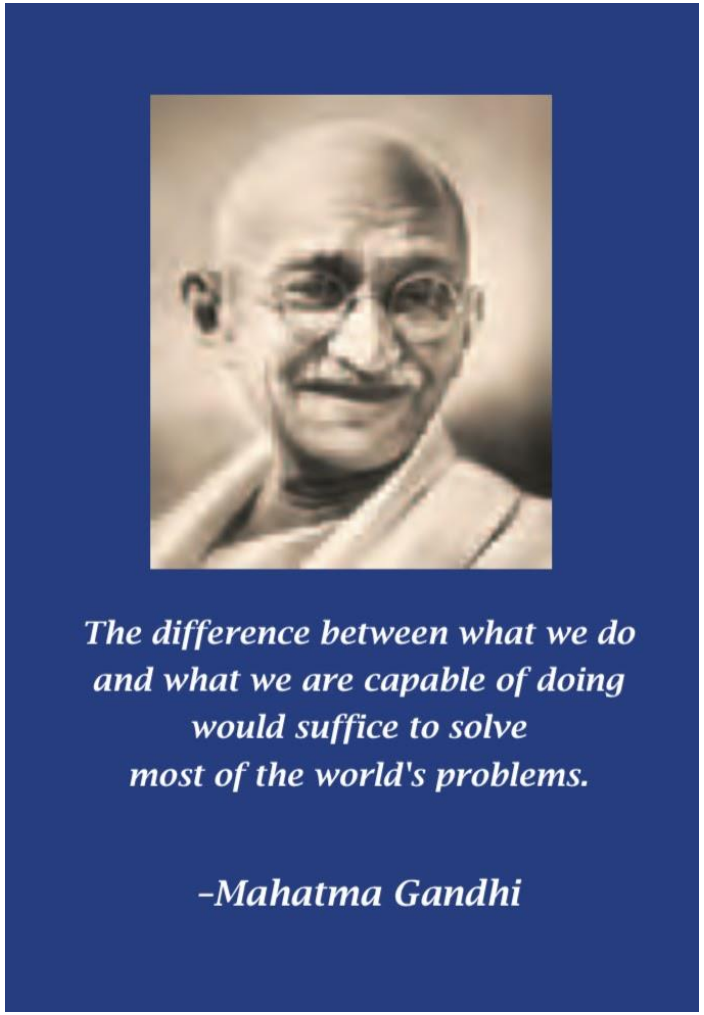
"We can and must win this battle for our lives."

United Nation Secretary-General
Antonio Guterres
20 November 2022

Concluding Remarks

- ✓ Be a proactive and innovative manager to channel and manage funds to deal with climate change

- ✓ Be a climate change leader and enabler for our sustainable world ！




Thank you !