Challenges to Implementation of Sustainable Construction Practices:

By

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Climate Change and Global Disasters: Developing Sustainable Infrastructure to Achieve Growth Amidst Declining Economic Resources

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CONSIDERATIONS…

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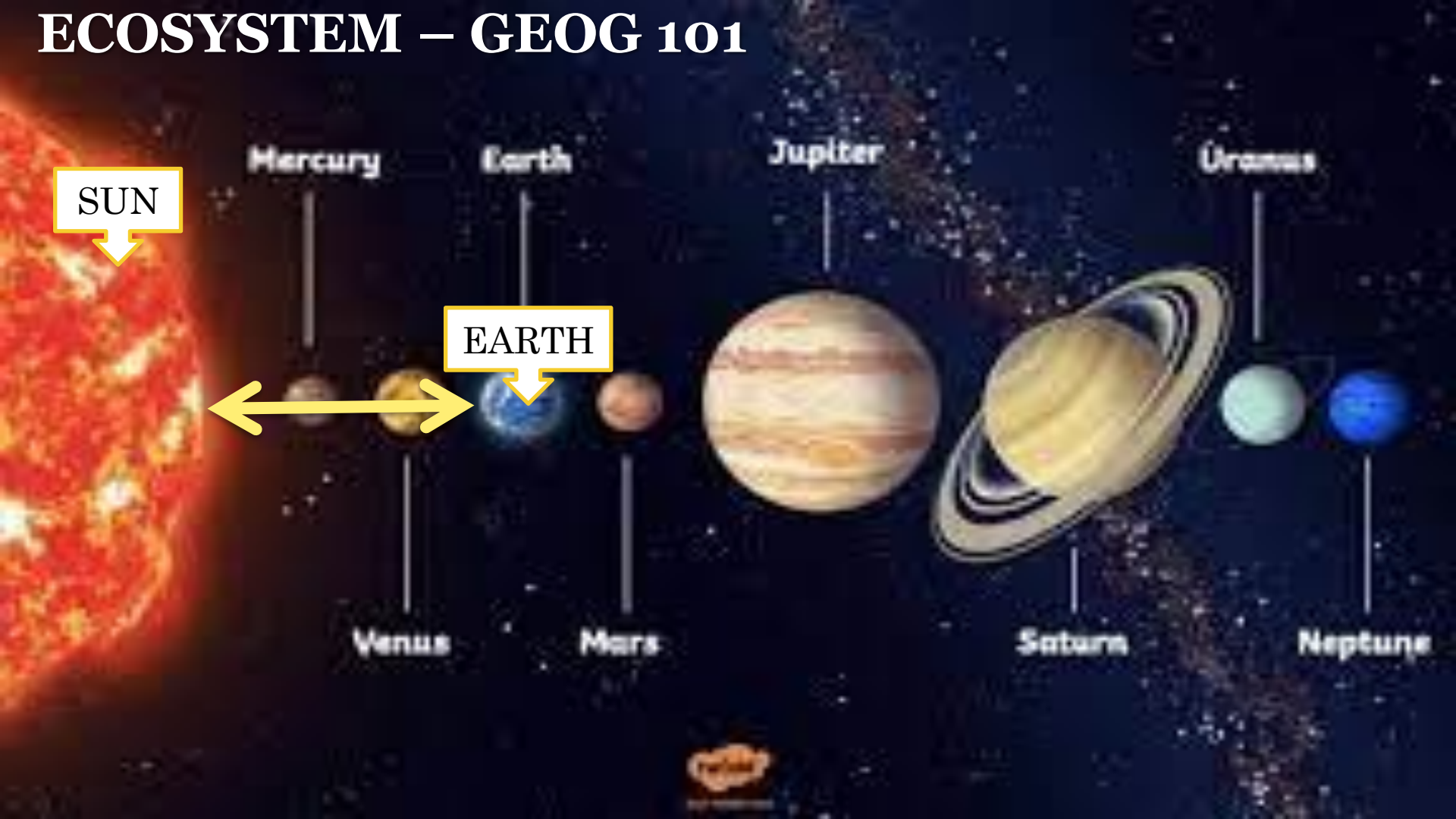
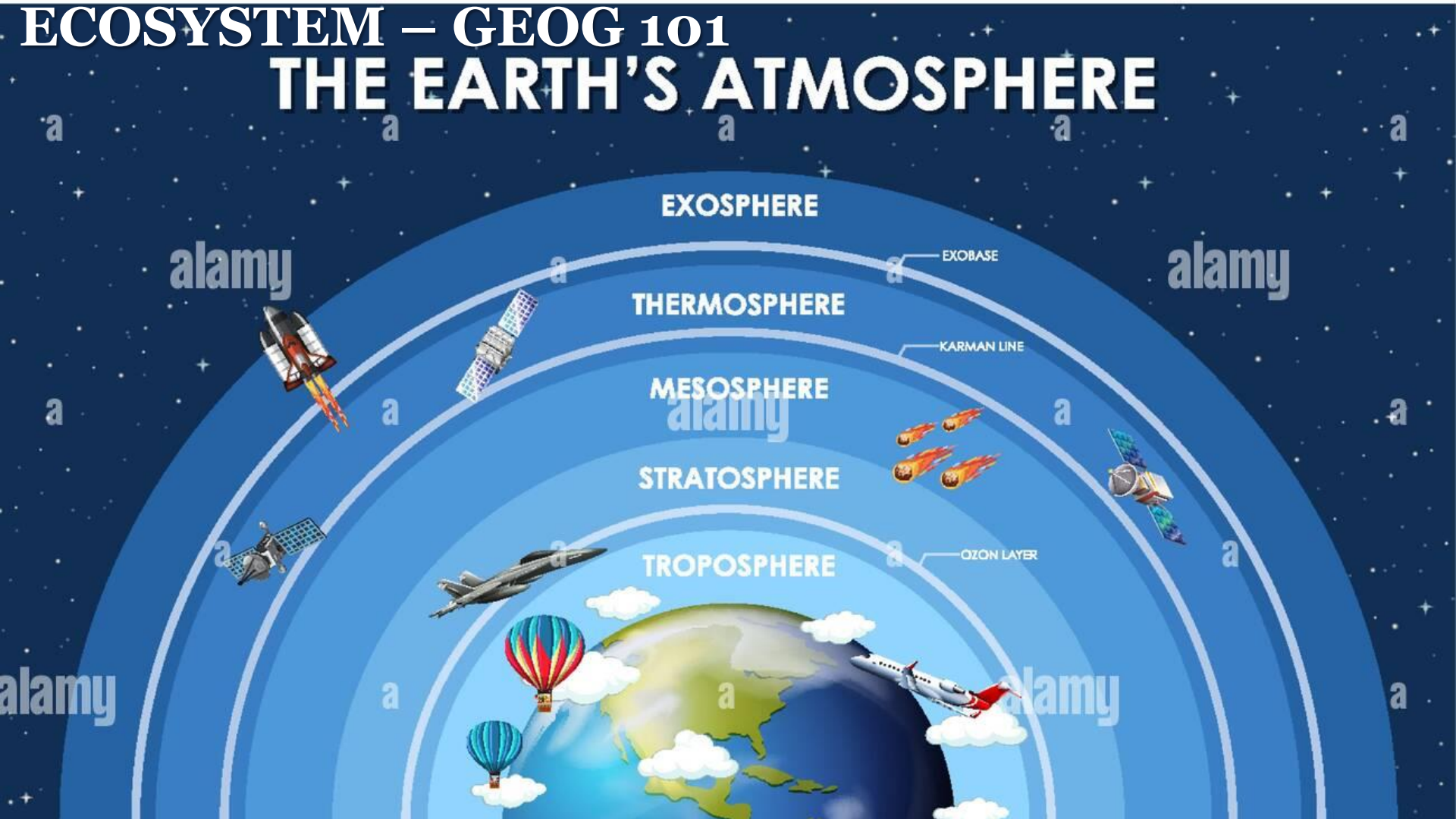
Developing ‘Sustainable Infrastructure’ to Achieve Growth

CLIMATE CHANGE: AN INTRODUCTION

ECOSYSTEM – GEOG 101



ECOSYSTEM – GEOG 101



ECOSYSTEM – WEATHER & CLIMATE

- Sun – emits heat
- Earth's atmosphere mixture of gases:
  - 78% nitrogen + 21% oxygen + 0.934% argon and
  - 0.036% of trace gases [gives earth ability to trap heat]
- Water in its liquid, solid, gaseous form
- Earth's shape, orientation (tilt) & movement (orbit around the sun)
- WEATHER….CLIMATE…NATURAL

WHAT IS CLIMATE CHANGE?

- Climate change is a long-term change in the statistical distribution of weather patterns over periods ranging from decades to millions of years.
- Intergovernmental Panel on Climate Change (IPCC) – 195 member states, est. 1988
- Provide a comprehensive summary of what is known about the drivers of climate change, its impacts and future risks, and how adaptation and mitigation can reduce those risks.

THE FACTS….IPCC CODE RED

- Report prepared by 234 scientists from 66 countries indicating that:
- Human influence warms climate at unprecedented rate in the last 2,000 years.
- *Human-induced climate change* is already affecting many weather and climate globally.
- Greenhouse gases (GHG) responsible for global heating in excess of 1.5°C and to exceed 2.0°C this century. Totally Catastrophic!!

THE FACTS….IPCC CODE RED

- The Report further indicates that:
- Mean Sea Level is increasing globally.
- Some changes will remain ‘irreversible’ for centuries to millennia e.g. continued sea level rise.
- There is still time to limit climate change.
  - Reductions in emissions of CO_2 and greenhouse gases would make air quality better and stabilize global temperatures in 20-30 years

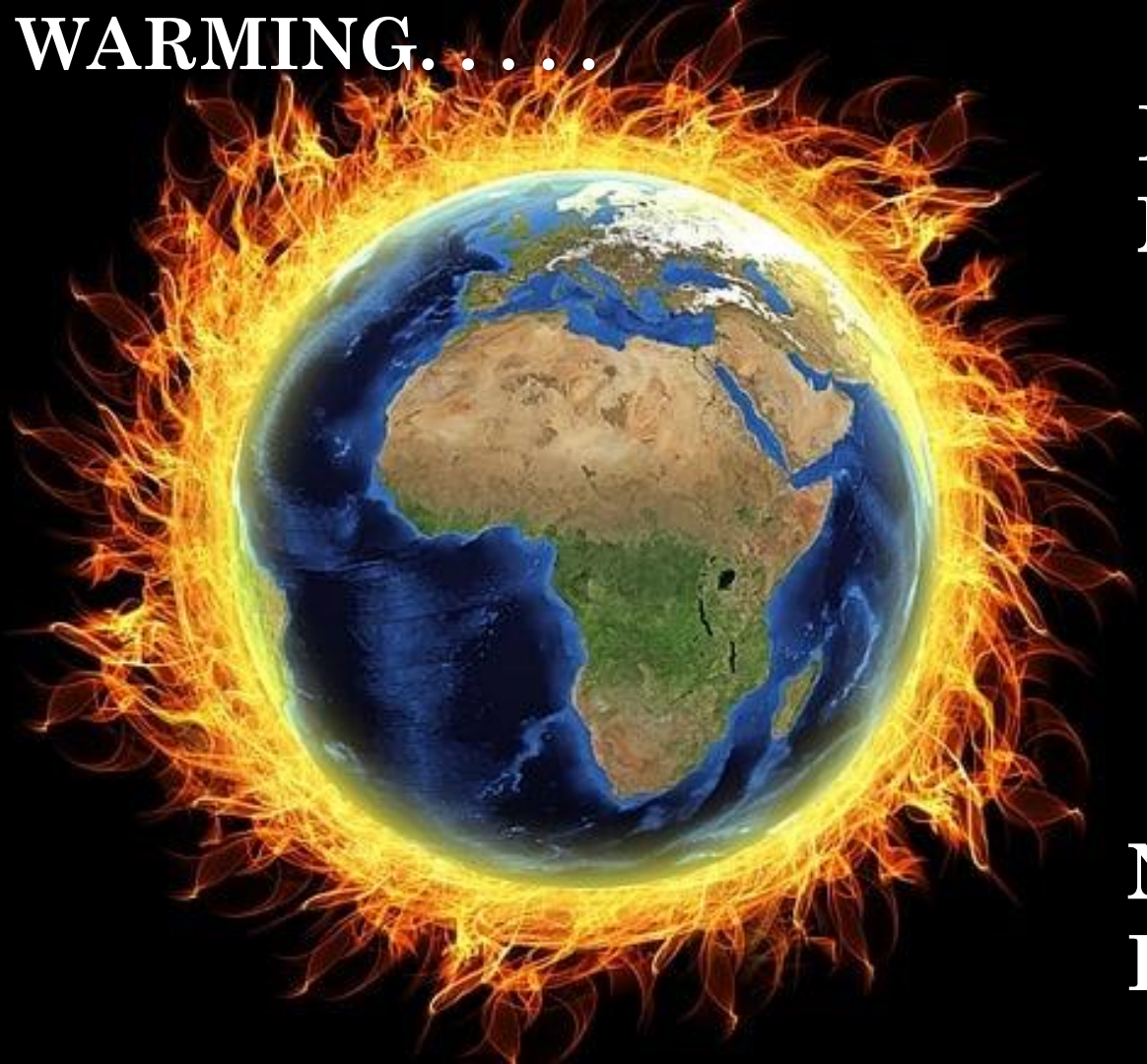
CLIMATE APOCALYPSE: MYTH OR FACT?

- Is Earth headed towards an apocalypse?
- Will climate change lead to the global collapse of human civilisation and human extinction?
- **If Climatologists' warnings is to be believed….**
  - Some parts of the Earth will be rendered uninhabitable
- **Two** ways to think about this:
  - Hope that catastrophe is preventable, and feel ever more frustrated or enraged by the world's inaction, or
  - Accept that disaster is coming, and begin to rethink what it means to have hope.

POINTS TO NOTE ON CLIMATE CHANGE

- **Firstly**, changing global temperature has always occurred – hence not a new phenomenon!
- **Secondly**, focus on temperature change today is viewed from the effects of human actions – referred to as global warming
- **Thirdly**, there is clear consensus that the major causes behind the warming up of the planet are human.
- Is global warming really real? Or simply a myth?

GLOBAL WARMING. . . . .



FACT?
MYTH?

NOW?
FUTURE?

IS GLOBAL WARMING REALLY REAL?

YES! YES! YES! YES! YES!

- Rise in Sea Level
- Rise in Earth's Average Temperature
- Rise in Ocean Temperature
- Shrinking Glaciers
- Ocean Acidification

IS GLOBAL WARMING REALLY REAL?

NO! NO! NO! NO! NO!

- No significant and prolonged temperature changes since 1997
- Not enough historical data available
- Arctic ice increased by 50% since 2012
- Climate models used are proven to be unreliable
- Early predictions about the effects of warming have been proven wrong
  - For example….

IS GLOBAL WARMING REALLY REAL?

- Arctic ice would be gone by 2013 (Al Gore). But, on the contrary, Arctic ice is up by 50% since 2012.
- "*In a decade, urban dwellers will have to wear gas masks to survive air pollution…by 1985 air pollution will have reduced the amount of sunlight reaching earth by one half….*" (Life, 1970).

DEVELOPING TOWARDS DESTRUCTION?

- Societal development and population growth leads to overexploitation of the earth resources
- Industrialisation responsible for global warming.
- Solution? We need to approach zero net emissions, globally, in the *next* three decades, by:
  - Shutting down energy and transportation infrastructure, and completely retool the economy!
  - Acceptance of high taxes required for the extreme measures needed to combat global warming.


CONSTRUCTION AND
CLIMATE CHANGE

CRITICAL ROLE OF INFRASTRUCTURE DEVELOPMENT

- *"We cannot **address** climate change without thinking about buildings."* — Bryn Davidson
- Infrastructure developments: results in resource depletion and environmental destruction.
- For instance, increase use of materials like metals, plastic, oil, and rubber – have had drastic impacts on the environment.
- What does climate change mean for the construction industry?

THE CI@CORE OF CC DEBATE

- Climate change is having a significant impact on businesses, society, and individuals.
- The construction sector's GHG emissions account for ≈40% of global emissions (WBCSD, 2018).
- Major contributors are: materials used, heating, cooling, and lighting of constructed facilities.
- The construction sector is highly carbon intensive hence always in the spotlight of climate change debates.

CONSTRUCTION AND CLIMATE CHANGE

- Fossil fuels use in managing microclimates release carbon which contribute to global warming.
- Hence the campaign for renewable energies – fossil fuels are non-renewable and so not sustainable.
- Construction contributes 39% of carbon emissions globally i.e. 28% from energy consumption, 11% from materials (known as Embodied Carbon).
- Energy consumption comes from managing microclimates in facilities.

CONSTRUCTION AND CLIMATE CHANGE

- Embodied carbon is generated within the construction materials and products supply chain.
- To reduce embodied carbon, energy grids need to be de-carbonized to limit impacts on global warming.
- CI is moving towards Net Zero Carbon buildings (NZCB) i.e. buildings whose GHG sum up to zero, through their life-cycle.

CONSTRUCTION AND CLIMATE CHANGE

- Next step is constructing net-positive or energy-positive facilities (NPF or EPF) i.e. Green Buildings
- EPF produces more energy than it consumes through its life cycle to make up for the energy used to construct it.
- Accounting for factors that promotes NZCB and EPF is the foundation of sustainable building practices.
- The more green buildings and eco-design become mainstream, the more harmful practices are reduced.

IMPACT OF CLIMATE CHANGE TO CI

- Four concerns for the construction industry:
  - Workers' Health and Safety
  - Weather-related delays
  - Construction materials design and manufacturing
  - Insurance costs

IMPACT OF CLIMATE CHANGE TO CI

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  - **Workers' Health and Safety**
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- **Exposure to excessively/changing weather conditions.**
- **Endangers health and safety.**
- **Affects creativity and productivity**
- **Results in increased healthcare compensation.**
- **Delays in project delivery and high construction costs.**

IMPACT OF CLIMATE CHANGE TO CI

- Four concerns for the construction industry:
  - Workers' Health and Safety
  - **Weather-related delays**
  - Construction materials design and manufacturing
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- **Unpredictability of weather conditions.**
- **Unplanned disruptions to supply chain processes.**
- **Excessive claims from supply chain partners.**
- **Delays in project delivery and high construction costs.**

IMPACT OF CLIMATE CHANGE TO CI

- Four concerns for the construction industry:
  - Workers' Health and Safety
  - Weather-related delays
  - **Construction materials design and manufacturing**
    - **Discarding traditional construction materials and methods.**
    - **Paying more attention to R & D in materials management.**
    - **Retraining of workforce in harnessing newer materials and techniques.**
    - **Delays in project delivery and high construction costs.**
  - Insurance costs

IMPACT OF CLIMATE CHANGE TO CI

- Four concerns for the construction industry:
  - Workers' Health and Safety
  - Weather-related delays
  - Construction materials design and manufacturing
  - **Insurance costs**
    - **Increasing litigious disputations and frequent works disruption.**
    - **Complication in the management of insurance claims .**
    - **Excessive claims from supply chain partners.**
    - **Delays in project delivery and high construction costs.**

IMPACT OF CLIMATE CHANGE TO CI

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PRINCIPLES OF SUSTAINABLE CONSTRUCTION

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- Fundamental Goals of sustainable construction:
  1. Reduce or prevent the depletion of resources
  2. Prevent the degradation of the environment
  3. Create welcoming, safe and productive environments
- The principles of sustainable construction must be considered from the very earliest stages of a facility's life cycle.

PRINCIPLES OF SUSTAINABLE CONSTRUCTION

- The PoSC provide means to contributing to a greener built environment while reducing overall carbon footprint.
- Seven (7) Principles of Sustainable Construction are:

Resources Reduce resource consumption	**Reuse** Reuse resources	**Recycle** Use of recycle resource	**Nature** Protection of nature	**Toxics** Elimination of toxics	**Economics** Application of life cycle costing	**Quality** Focus on quality

PRINCIPLES OF SUSTAINABLE CONSTRUCTION

- Why?
- Education!
- **Education**
- "A reasonable understanding of building science is the most important attribute of a green builder" Alex Wilson

PRINCIPLES OF SUSTAINABLE CONSTRUCTION

- Areas of focus of the Seven (7) PoSC:
  - Sustainable design
  - Durability
  - Energy efficiency
  - Waste reduction
  - Indoor air quality
  - Water conservation
  - Sustainable building materials

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- **Site selection and ecosystem are key.**
- **Consider PoSC during earliest stages of design.**
- **Size is a main determinant of green design – priority!**
- **Stick to basic shapes in design concepts.**
- **Solar orientation is a CSF for cooler climates**
- **Ensure sustainability assessments e.g. BREEAM.**

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- **Facilities ≤ 10 years old that are redesign/demolish are not green.**
- **Durability of materials are tested by a facility's age.**
- **Durable facilities are economical and environmentally friendly**
- **Durability dictates cost of maintenance and operation.**

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- **Leads to lower cost, GHG emission, contributes less to climate change.**
- **Use of eco-friendly energy methods, technology & materials.**
- **3 aspects to consider – insulation, air quality and microclimate.**
- **SAP assessment – standard procedure for assessing energy within a building**

PRINCIPLES OF SUSTAINABLE CONSTRUCTION

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- **Adaptable facilities reduces incidences of demolition.**
- **Consider environmental impact of materials used.**
- **Engage best practices e.g. Team-working and ethical material sourcing.**
- **Engage the 3Rs – renewable, reuse, recycle.**

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- **Effected by indoor pollution and defective construction.**
- **Affects indoor environment and health of occupants.**
- **Strict regulations on heating and ventilating systems.**
- **Minimize use of products that off-gas.**

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- **Pollution and climate change hugely affects freshwater.**
- **Incorporate sustainable water design early in facility life cycle.**
- **Undertake regular leak detection tests.**
- **Use of pressure valves, durable service pipes and sub-metering devices.**
- **Reuse and recycle where/when appropriate**

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  - **Sustainable building materials**

- **Natural materials are not infinite.**
- **Use material that are renewable and zero impact on environment.**
- **Ethical material sourcing and optimized selection e.g.**
- **Fly-ash partially substituting portland cement in concrete, using bamboo instead of wood species**

BENEFITS OF SUSTAINABLE CONSTRUCTION

- Cost Reduction – Green building costs less compared to regular ones
- Increased Productivity – Environmentally friendly workspaces impacts positively on workers.
- Waste Minimization – Use of renewable materials lower impact on the environmental.
- Efficient use of Materials – Manages water and energy in a more effective and environmentally friendly manner.

BENEFITS OF SUSTAINABLE CONSTRUCTION

- Environmental Protection – Recycling and use of energy-efficient solutions protects against pollution and waste.
- Noise Avoidance – Using distance augmentation, planting trees as absorbents, and noise barriers
- Better Quality of Life – Due to safer materials, better surroundings and effective noise protection.
- Emerging New Market – Creating new possibilities and unlocking markets.


SUSTAINABLE
INFRASTRUCTURE

SUSTAINABLE INFRASTRUCTURE

GOING
GREEN

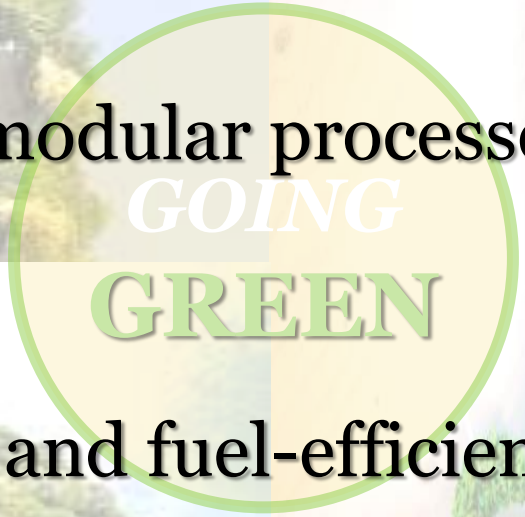
SUSTAINABLE INFRASTRUCTURE

- Consideration in meeting climate-change challenge:
  - changes to how we design, build, and operate infrastructure.
  - A new approach to public–private collaboration.
  - Capital sustainability will play a critical role in achieving SDGs.
  - Rethink cultures, technologies, business models and agendas
  - Appropriate leadership and followership

SUSTAINABLE INFRASTRUCTURE

Some emerging green building trends :

1. Green Materials
2. Prefabricated and modular processes
3. Zero net buildings
4. Waste recycling
5. Use of eco-friendly and fuel-efficient equipment:



SUSTAINABLE INFRASTRUCTURE – CHALLENGES

- Need for significant cultural and behavioural change
- Engaging markets from an outcome perspective
- Levering data in understanding existing systems
- Making sustainable infrastructure more socially acceptable

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- **Put carbon & environment at the fore front of our thinking.**
- **Cultural shift to a “future first” approach**
- **Mindset shift to embrace “whole of life” thinking**

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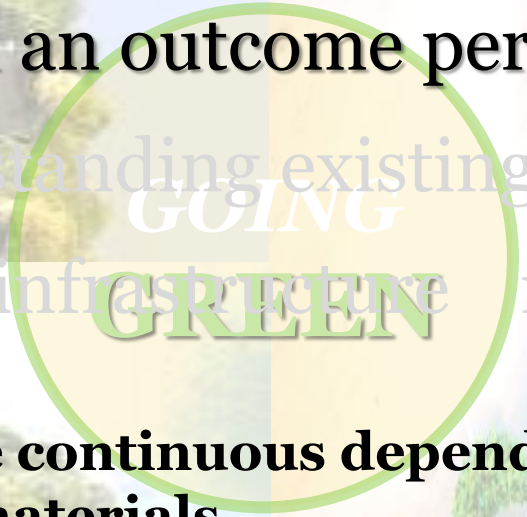

- **Discourage continuous dependence on carbon intensive materials .**
- **Establish model for incentivising markets to bring innovation to bear.**

SUSTAINABLE INFRASTRUCTURE – CHALLENGES

- Need for significant cultural and behavioural change
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- **Using evidence approaches to enhance sustainable decisions – Big data can help.**
- **Deploying data to identify opportunities to minimize sustainability and resilience.**

SUSTAINABLE INFRASTRUCTURE – CHALLENGES

- Need for significant cultural and behavioural change
- Engaging markets from an outcome perspective
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  - **Prioritising nature-based solutions over grey alternatives.**
  - **Demonstrating long-term benefits of public amenities, green spaces, and air quality.**

SUSTAINABLE INFRASTRUCTURE – CHALLENGES

- Other challenges/problems:
  - Lack of understanding of ecological impact of construction activities
  - Lack of early rapid environmental assessment
  - Use of hazardous materials
  - Special interests who do not prioritise sustainable construction
  - Disregard for the local population
  - Poor planning by project managers

CONSTRUCTION INDUSTRY: CALL TO ACTION

SUSTAINABLE INFRASTRUCTURE – WAY FORWARD

Decarbonization would require that the CI:

- Support the move to platform approaches i.e. adopting manufacturing principles.
- Act as carbon-efficient leaders.
- Consider whole-life (not operational) carbon measurement and reporting as a priority.
- Adopt systems that increase off-site manufacturing and on-site, modular assembly e.g. Design for Manufacture and Assembly (DFMA) approaches

SUSTAINABLE INFRASTRUCTURE – WAY FORWARD

Decarbonization would require that the CI:

- Up scale it's ability to retrofit existing facilities, rather then build new ones, to improve energy efficiency and their resilience.
- Stakeholders together must identify and co-create the appropriate lowest-carbon, most resilient infrastructure solution.

WHAT SHOULD BE DONE? – GOV'T

- Build the capability to model climate risk and assess the economics of climate change.
- Devote a portion of the vast resources deployed for economic recovery to climate-change resiliency and mitigation.
- Seize the opportunity to reconsider existing subsidy regimes that accelerate climate change.

WHAT SHOULD BE DONE? – GOV'T

- Reinforce national and international *alignment and collaboration* on sustainability,
- Create the right incentives for companies that choose to build in a sustainable way.
- Legislate and create mandates that require firms to build in a sustainable way and offer tax incentives or exemptions for construction firms that use sustainable practices.

WHAT SHOULD BE DONE? – COMPANIES

- Decarbonize by prioritizing the retirement of economically marginal, carbon-intensive assets.
- Take a systematic and through-the-cycle approach to building resilience.
- In the wake of the pandemic, it is expedient and economical to continue these practices.

WHAT SHOULD BE DONE? – COMPANIES

New Innovations that Industry needs to leverage on:

- Subscribe to LEED, BREEAM
- Adopt prefabrication – it is eco-friendly, promotes recycling/reusing, more accurate.
- Adopt BIM technologies – can help model energy consumption towards selecting energy-efficient solutions.
- Leverage on BIG DATA Analytics – paves the way for generating intelligence for SMART decisions

THE WORLD STAGE. . . .

- If our own apocalypse is a three-act film, then the last 200 years of environmental harms have been the setup, the exposition.
- We are now at the moment of confrontation. We all, as the lead characters, must confront the reality of what is around us.
- If not, the third act, the resolution, may not be the ending we hope for.

SO WHAT DO WE DO?

- First of all, even if we can no longer hope to be saved from two degrees of warming, there's still a strong practical and ethical case for reducing carbon emissions.
- In the long run, it probably makes no difference how badly we overshoot two degrees; once the point of no return is passed, the world will become self-transforming.

SO WHAT DO WE DO?

- In the shorter term, however, half measures are better than no measures.
- Halfway cutting our emissions would make the immediate effects of warming somewhat less severe, and it would somewhat postpone the point of no return.
- In any case, collective action is worth pursuing

SO WHAT DO WE DO?

- So how do we do what we should do to implement Sustainable Construction?
- Well your guess is as good as mine . . . . .

Decarbonize and build for resilience

GO GREEN!


Thank You.