

Environmental Dimension

- What are the responsibilities of engineers with regard to the environmental protection?
 - Should environmental degradation, which is not involving dangers to human health, be a matter of professional ethics or personal ethics?
 - Discuss the “Limiting Growth” and “Unlimited Growth” environmental views
 - Unlimited population and economic growth
Limited growing resources, food and environment
 - How can engineers ensure economic growth is sustainable?
 - Global equilibrium between environment and economic development



Environmental Dimension

1980s and 1990s

- **cost** leadership
- differentiation
- quality & **customers'** satisfaction

21st Century

- **long-term cost** leadership
- differentiation in favour of **green** products and practices All involved parties (including publics)
- quality & **stakeholders'** satisfaction
- **environmental performance** of cities, firms, products or services

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Environmental Issues

Sustainable Development is often defined as:

“meeting the needs of the **present** without compromising the ability of **future generations** to meet their own needs”

*World Commission on Economic Development. (1987).
Our Common Future. England : Oxford University Press.*



How Engineer Can Help

in product design and development

- Determine **Objectives**: Product definition, determine business objectives and constraint
- Evaluate **Alternatives**: Risk analysis and prototyping
- Develop **Product**: Detailed design, code, unit test and integration
- **Planning** the Next Round: Customer evaluation, design planning, implementation, and customer delivery

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Design Consideration

- Select hazardous-free materials
 - Avoid the use of toxic or hazardous materials
 - Avoid ozone-depleting substances ← example: CFC (chlorofluorocarbon) leading to UV increase
 - Select recycled and recyclable materials
- Design for energy efficiency
 - Aim for maximum efficiency ← save energy
- Design for durability ← long working life
 - Identify and eliminate potential weak points
 - Design for easy maintenance and repair ← less waste, less consumption of material and energy
- Design for upgradability ← reduce creation of rubbish
 - Design to allow new modules or functions to be added



Design Consideration

- Design for **remanufacturing** (similar to design for recycle-ability)
 - Parts should be **standardised** and can be **Interchangeable**
- Design for **metal recovery**
 - Increase use of metals
 - Specify use of materials with **recycled content**
- Design for **plastics recovery**
 - Consolidate parts ← **less components, easy disassembled and collection for reuse**
 - Reduce the number of assembly operations



Environmental Laws in Hong Kong

- Water Pollution Control Ordinance (1980)
- Waste Disposal Ordinance (1980)
- Air Pollution Control Ordinance (1983)
- Noise Control Ordinance (1988)
- Environmental Impact Assessment Ordinance (1997)
- Hazardous chemicals control ordinance (2008)
- Product eco-responsibility ordinance (from 7 July 09, plastic shopping bags) ← Polluter pay principle

More details:

https://www.epd.gov.hk/epd/english/laws_regulations/envir_legislation/laws_maincontent_lor.html

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Solar Energy applications in HK



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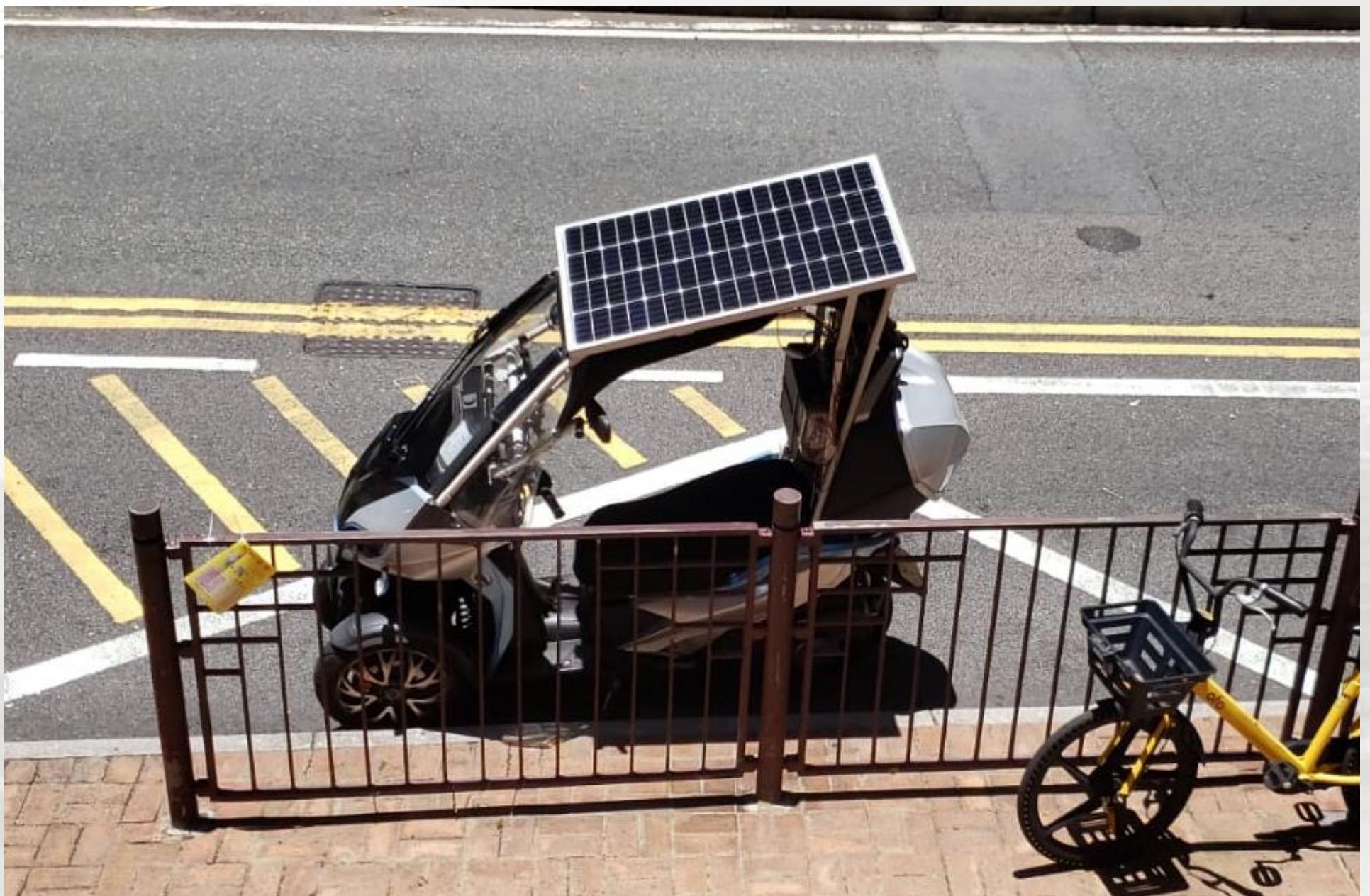
Solar Energy



Source of photo

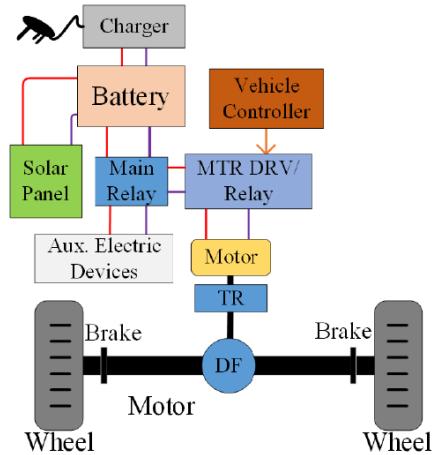
<https://www.polyu.edu.hk/cpa/excel/en/201703/viewpoint/v1/index.html>

Unusual Application: “Innovation and Creativity”

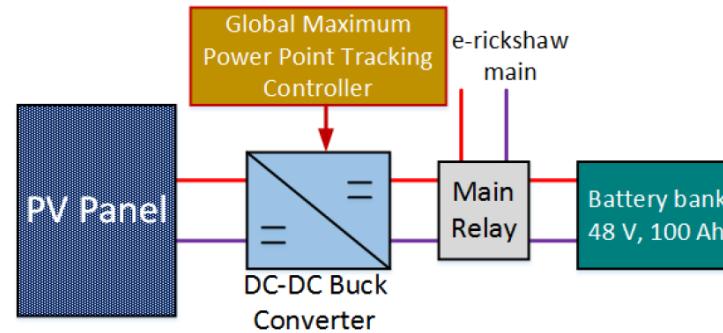


The PV Panel

- Due to solar photovoltaic panel, the load is increased by about **15-22 kg**.
- The max. overall width of motorcycle is **1.1 m**.



Block diagram of solar e-rickshaw



Circuit diagram for the connection of PV panel













https://www.kmb.hk/news_detail.html?id=199&year=2021

Environmental Engineer

- Monitor and improve environmental performance of the Project;
- Responsible for routine site inspections and internal and external audits;
- Conduct training, promotion and complaint handling;
- Provide technical supports to ensure the Project complied with legal and contractual requirements;
- Coordinate with site staff, subcontractors and client's representative for day-to-day activities;
- Monitoring and improve the site environmental performance.
- Prepare meetings, materials and presentations for green building certifications.





Global Warming

What is Global Warming?

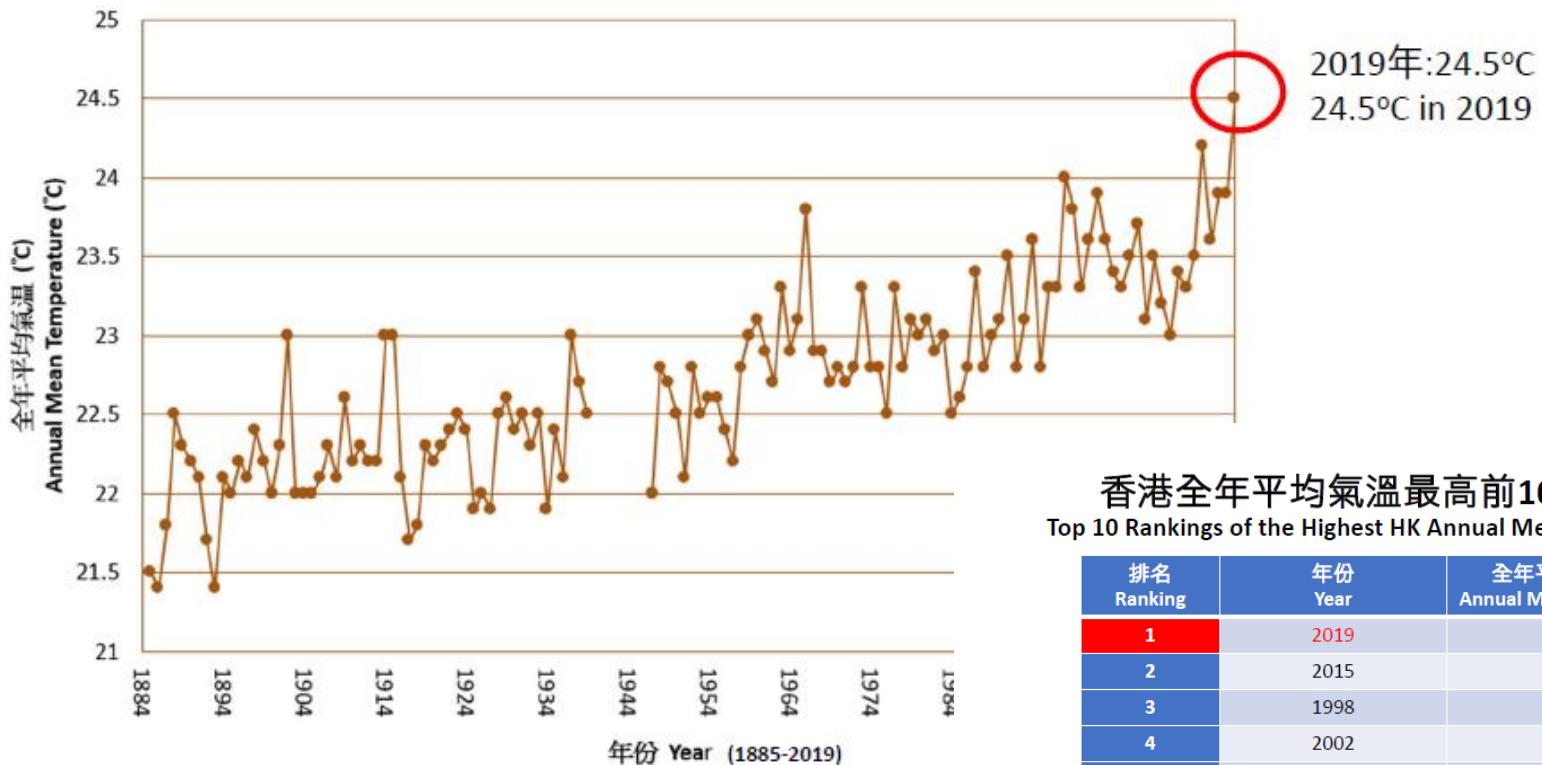


- Warmer atmosphere and oceans*
- Rising sea levels*
- Changing rainfall patterns*
- Expansion of deserts in the subtropics*
- More flooding in coastal areas*
- Melting of polar ice caps*
- Melting of glaciers*
- More extreme weather events*
- Ocean acidification*
- Extinction of animal and plant species*
- Food security threat for humans*

The gradual increase in the Earth's temperature caused by high levels of greenhouse gases in the atmosphere.

香港全年平均氣溫的長期時間序列

Long-term Time Series of Annual Mean Temperature in Hong Kong



香港全年平均氣溫最高前10名紀錄
Top 10 Rankings of the Highest HK Annual Mean Temperature

排名 Ranking	年份 Year	全年平均氣溫 (°C) * Annual Mean Temperature (°C)
1	2019	24.5
2	2015	24.2
3	1998	24.0
4	2002	23.9
4	2017	23.9
4	2018	23.9
7	1966	23.8
7	1999	23.8
9	2007	23.7
10	1994	23.6
10	2001	23.6
10	2003	23.6
10	2016	23.6

*自1884年有記錄以來香港天文台總部記錄 * Recorded at HKO Headquarters since records began in 1884

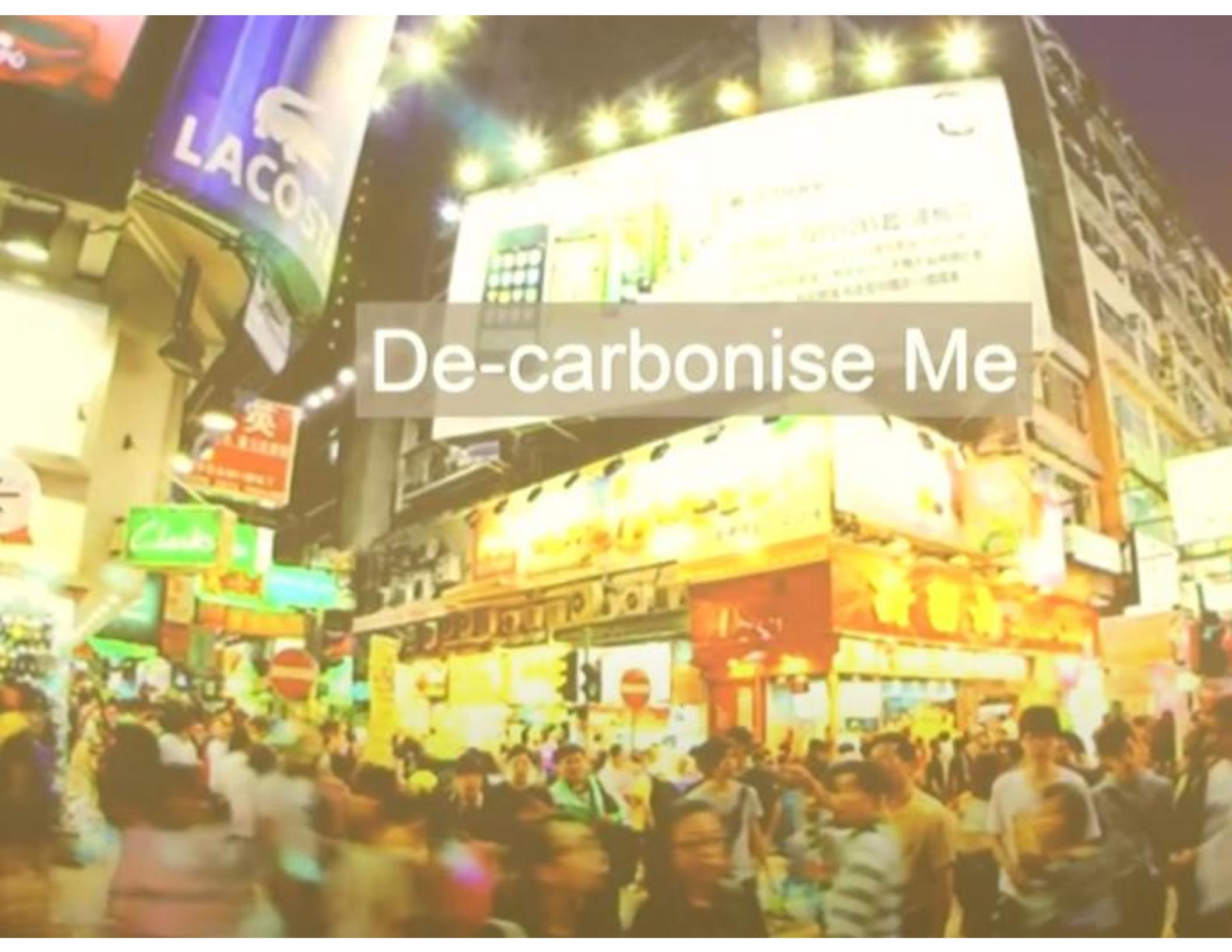


De-carbonise Me



A photograph of a busy urban street at dusk or night. In the foreground, there is heavy traffic on a multi-lane road. To the left, a building features a large digital sign displaying the text "De-carbonise Me". In the background, a range of mountains is visible under a hazy sky.

De-carbonise Me



De-carbonise Me

A blurred night photograph of a city skyline, likely New York City, showing numerous skyscrapers and lights.

Less Bright, More Elegant

Wasteful, Ugly

How to combat climate change?

- Make your voice heard by those in power.
- Eat less meat and dairy.
- Cut back on flying.
- Leave the car at home.
- Reduce your energy use, and bills.
- Respect and protect green spaces
- Invest your money responsibly.
- Cut consumption – and waste.

Enough?

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De-carbonisation

*A matter of re-defining quality of life
and re-orientation of business objectives*

Not just a matter of technical solutions.

- *Human extinction is the ultimate solution to all human-induced climate problems!*

Isn't it?

Engineering for Sustainable Development

Humanity has the ability to make development sustainable - to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.



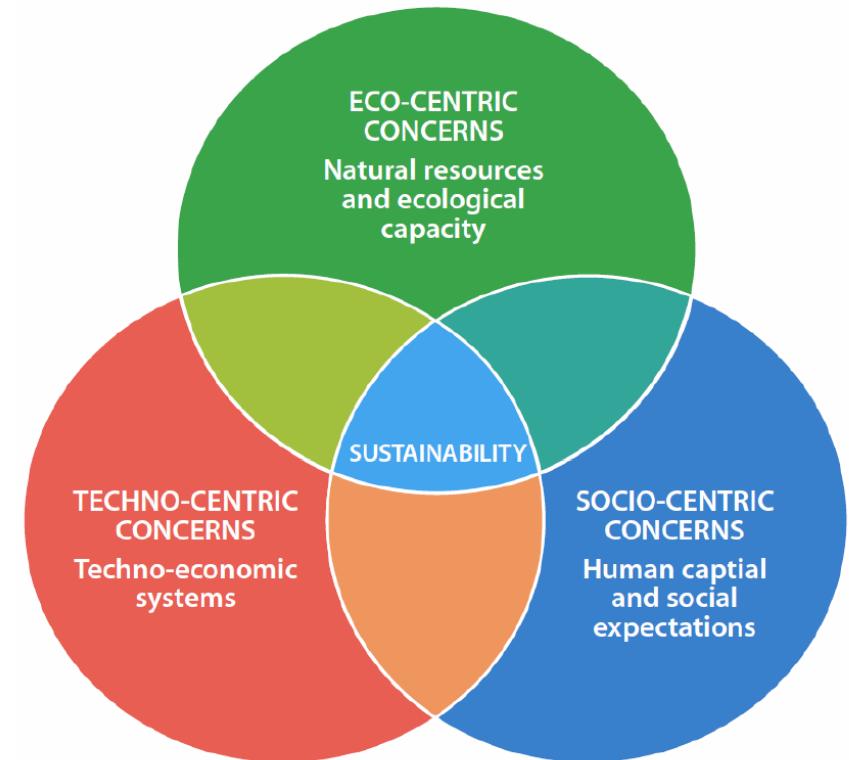
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Why Engineering for Sustainable Development ?

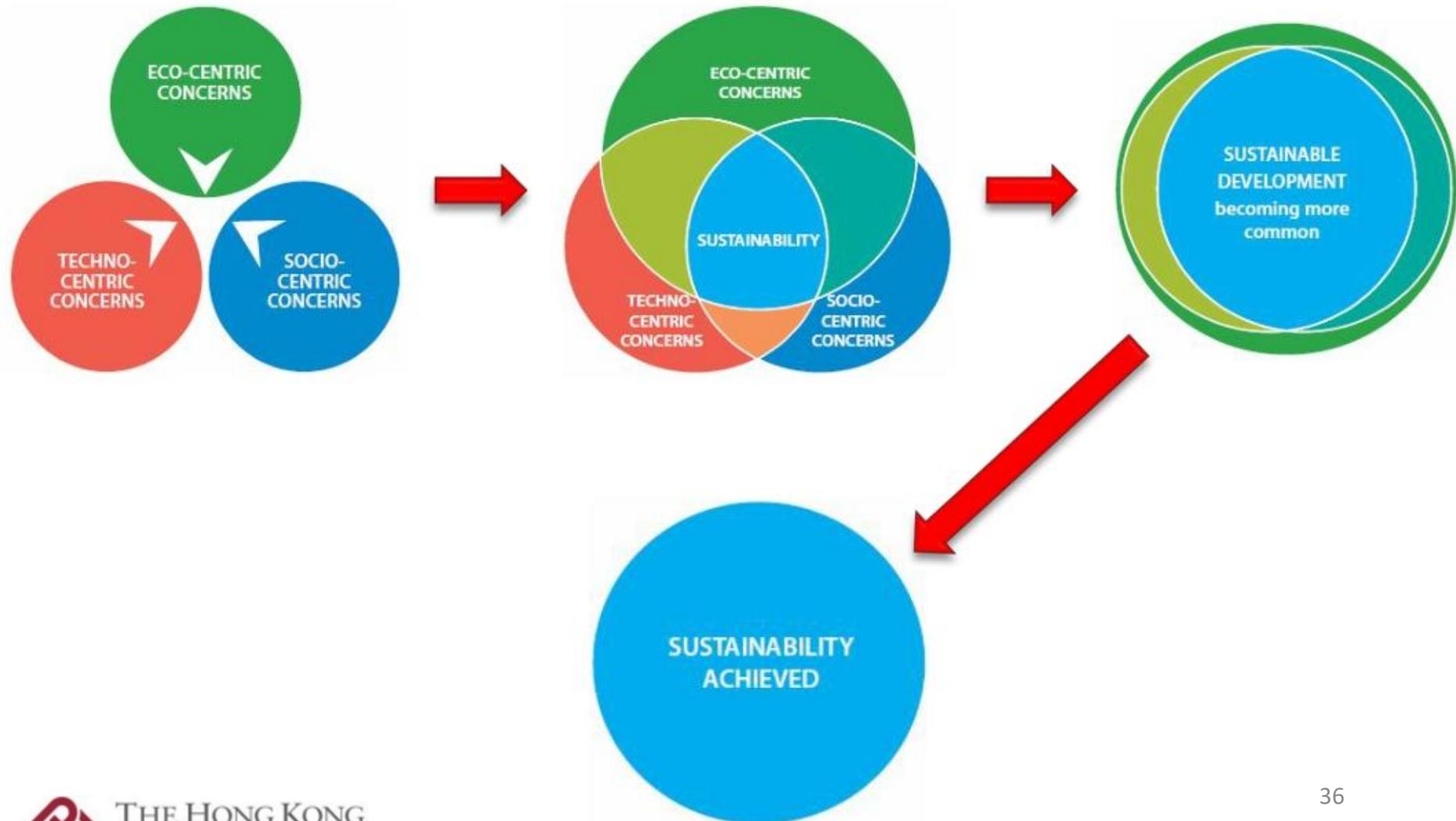
- Since the 1992 United Nations Conference on Environment & Development at Rio de Janeiro, Sustainable development has become an increasingly important issue in local, national and world politics for the engineering professions around the world.
- We are exceeding the capacity of the planet to provide many of the resources we use, while many of the planet's inhabitants cannot meet even their most basic needs.
- The planet is full and we have no new geographical horizons to move to. We need to live within constraints and to ensure more fairness in access to limited resources.

Dimensions of Sustainability

- **TECHNO** Human skills and ingenuity - the skills that engineers must continue to deploy and the economic system within which we deploy them.
- **ECO** The ability of the planet to sustain us - both by providing material and energy resources and by accommodating us and our emissions and wastes.
- **SOCIO** Human expectations and aspirations - the needs of human beings to live worthwhile lives, i.e., a better quality of life for everyone, now and in the future.

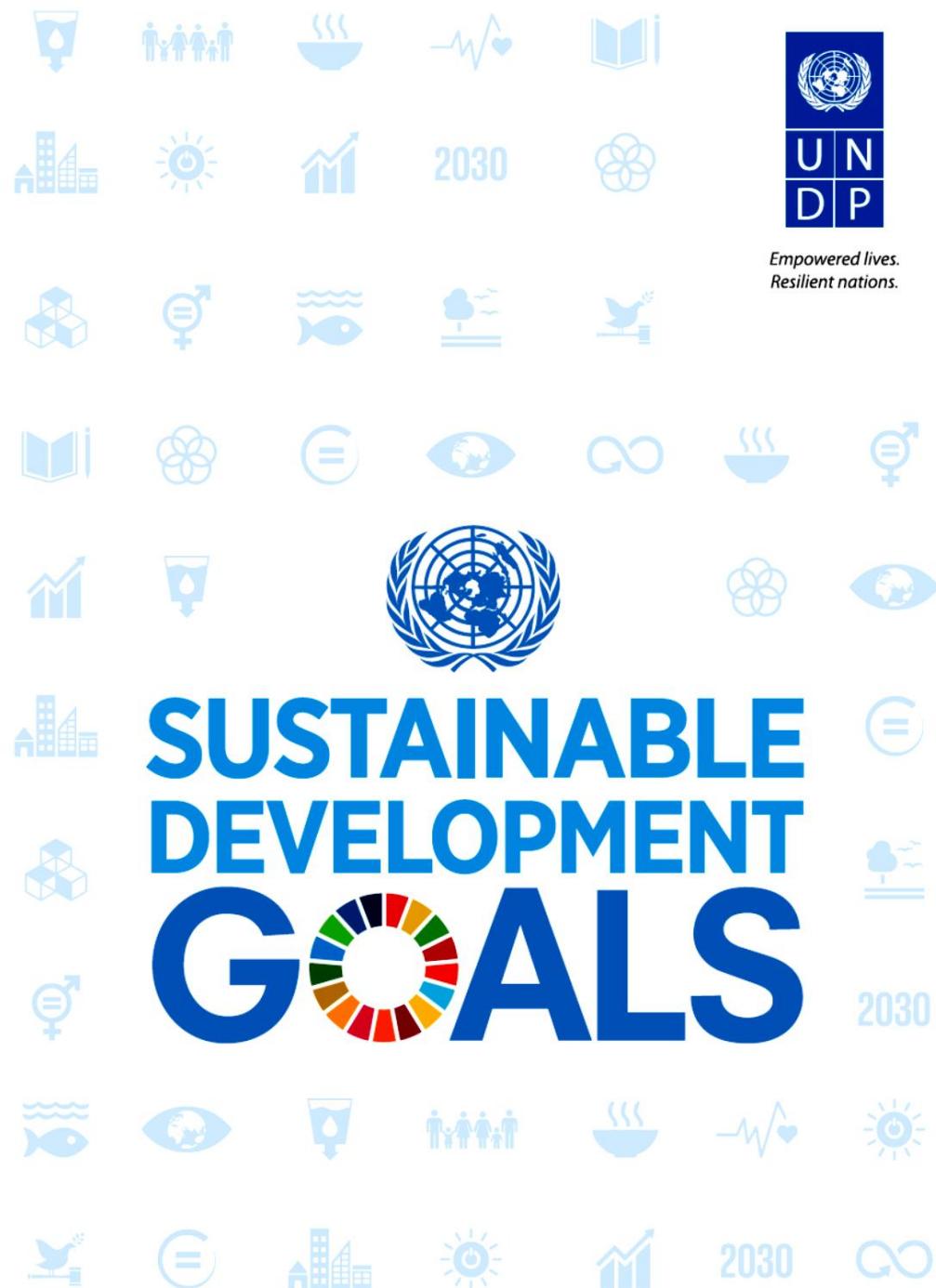


The Process of Sustainability



A Look at the **Sustainable Development Goals** - On September 25th 2015, 193 world leaders commit to 17 Global Goals to achieve 3 extraordinary things in the next 15 years. End extreme poverty. Fight inequality & injustice. Fix climate change. The Global Goals for sustainable development could get these things done. In all countries. For all people.

<https://www.youtube.com/watch?v=5G0ndS3uRdo>



1 NO
POVERTY



2 ZERO
HUNGER



3 GOOD HEALTH
AND WELL-BEING



4 QUALITY
EDUCATION



5 GENDER
EQUALITY



6 CLEAN WATER
AND SANITATION



7 AFFORDABLE AND
CLEAN ENERGY



8 DECENT WORK AND
ECONOMIC GROWTH



9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE



10 REDUCED
INEQUALITIES



11 SUSTAINABLE CITIES
AND COMMUNITIES



12 RESPONSIBLE
CONSUMPTION
AND PRODUCTION



13 CLIMATE
ACTION



14 LIFE BELOW
WATER



15 LIFE
ON LAND



16 PEACE, JUSTICE AND
STRONG INSTITUTIONS



17 PARTNERSHIPS
FOR THE GOALS



Why the Principles of Engineering for Sustainable Development are important?

- ❑ Drive down the adverse environmental and social aspects of engineered products, services and infrastructure
- ❑ Dramatically improve their environmental performance
- ❑ Improve the contribution of engineering products, services and infrastructure to a high quality of life
- ❑ Help society to move towards a significantly more-sustainable lifestyle
- ❑ Ensure products, services and infrastructure meeting these criteria are competitive in their marketplace and, ideally, the most competitive

The Principles of Engineering for Sustainable Development

- ❑ Look beyond your own locality and the immediate future
- ❑ Innovate and be creative
- ❑ Seek a balanced solution
- ❑ Seek engagement from all stakeholders
- ❑ Make sure you know the needs and wants
- ❑ Plan and manage effectively
- ❑ Give sustainability the benefit of any doubt
- ❑ If polluters must pollute... then they must pay as well
- ❑ Adopt a holistic, 'cradle-to-grave' approach ← from birth to death
- ❑ Do things right, having decided on the right thing to do
- ❑ Beware cost reductions that masquerade as value engineering
- ❑ Practice what you preach

Examples of Sustainability Issues in Engineering

- Civil Engineering - *Jubilee River*
- Chemical & Manufacturing Engineering - *laundry cleaning products*
- Walking the talk : embedding sustainable development into an organization - *Glasgow University*
- Product design in Electrical & Electronic Engineering - *mobile phones*
- Civil Engineering & Building - *Mossley Mill regeneration in Northern Ireland*
- Balancing positive and negative impacts - *the case of catalytic converters*
- The energy challenge

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References:

1. Sustainable Development Goals: Leaving No One Behind – Examples from Papua New Guinea

<https://www.youtube.com/watch?v=3VbLlz9SaaY>

2. How Singapore fixed its big trash problem

<https://www.youtube.com/watch?v=r-q5V6LDxEY>

3. Hong Kong's Long-term decarbonization strategy by Prof. Lam Chiu-ying

<https://www.youtube.com/watch?v=mi7PY5Q61SY>