# UNFCC Bonn

## Adapting Infrastructure to the Impacts of Climate Change

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|---|---|
| 1. Welcome and introductions | Don Lemmen |
| 2. Framework for Adapting Sustainable Infrastructure to a Changing Climate | Darrel Danyluk |
| 3. Sustainability and Infrastructure | Paul Jowitt |
| 4. Implementation of the Protocol | Darrel Danyluk |
| 5. Questions and Discussions | Darrel/Paul |
| 6. Closing Remarks | Darrel Danyluk |

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# Sustainability and Infrastructure

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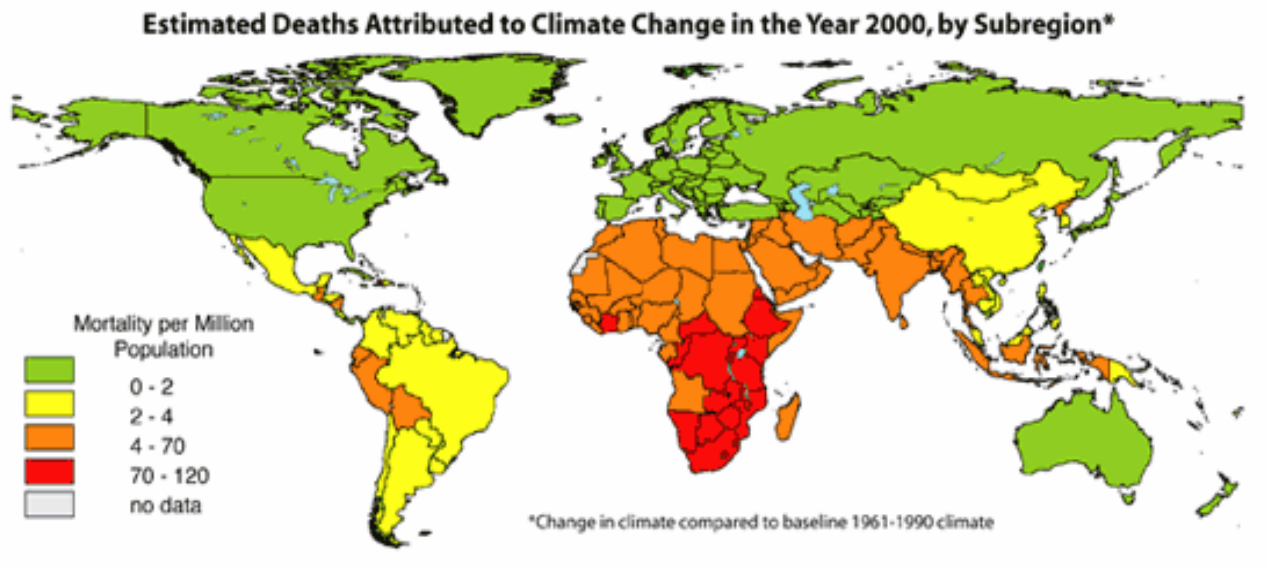
# “Climate Change is Real”

Statement by 11 National Science Academies (June 2005):

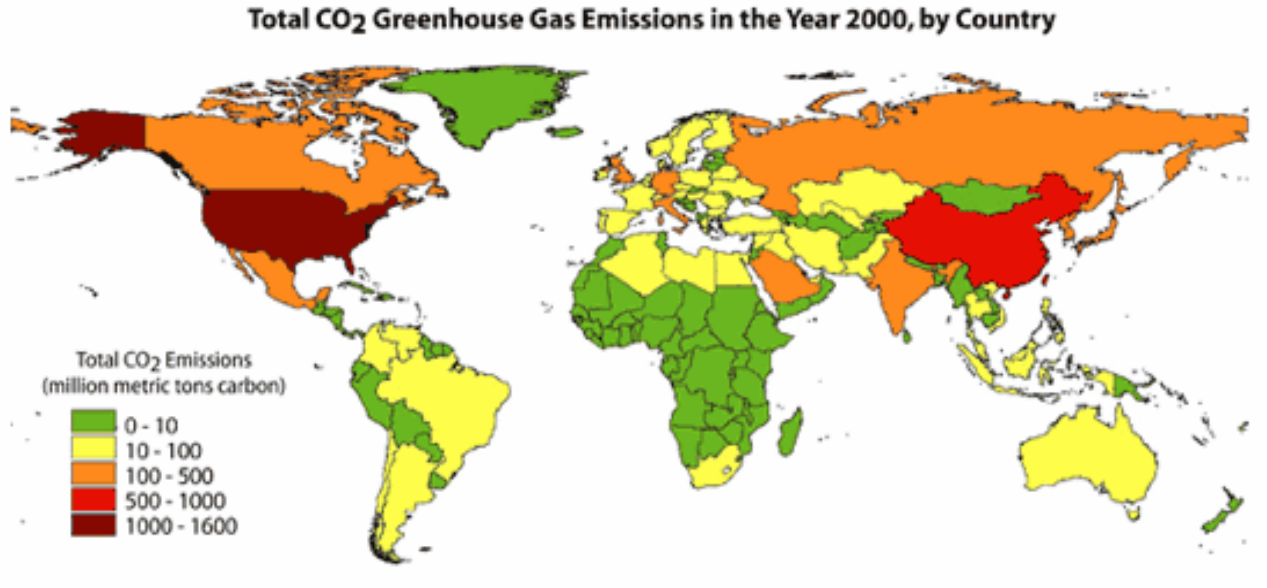
”Developing nations that lack the infrastructure or resources to respond to the impacts of climate change will be particularly affected…”

# The North South Divide

**Deaths caused by Climate Change in 2000**




**GHG Emissions in 2000**

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# “Climate Change is Real”

“The task of devising and implementing strategies to adapt to the consequences of climate change will require worldwide collaborative inputs from a wide range of experts, including physical and natural scientists, **engineers**, social scientists, medical scientists, those in the humanities, business leaders and economists.”

”G8 nations have been responsible for much of the past greenhouse gas emissions.”

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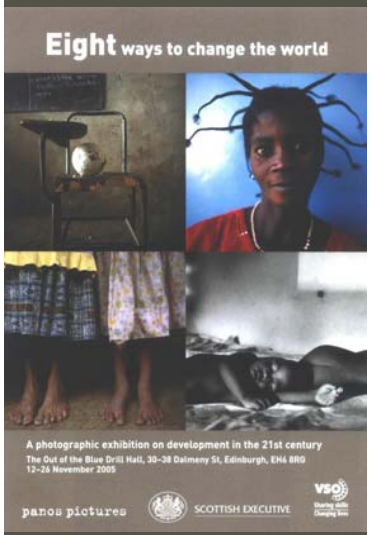


# Infrastructure and the UN MDGs

"The key to sustainable development in Africa is the creation of infrastructure.

Part of this is a purely physical matter: **a question of civil engineering.**

The business and finance communities in African nations identify the lack of good roads, railways, air and water transport facilities, energy and water supplies, and telecommunications networks as the main obstacles to economic growth."

*Sir David King*
*Former UK Chief Scientific Advisor*

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# Time's Winged Chariots

**UK carbon emissions 50 times those of Bangladesh, where 6million people will be at risk from a 0.5m rise in sea level, coupled with increased malaria risk…**

# Population and Urbanisation

- World population becoming more urbanised – 60% by 2025
- Greatest effect in Lesser Developed Countries
- In 2003, world population was ~5 bn,

  - split 3 bn rural; 2 bn urban
- By 2025, 6.6 bn

  - 3 bn rural; 3.5 bn urban
- Urban growth a combination of endogenous growth and rural migration
- Most will be accommodated in urban slums

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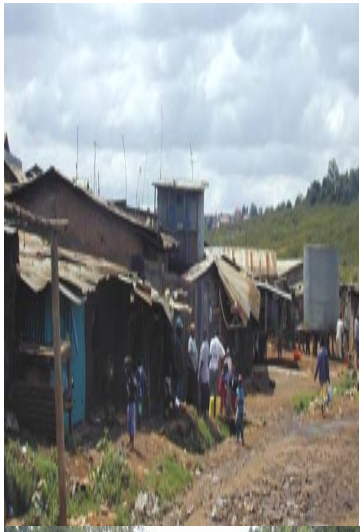


# The shadows of poverty…

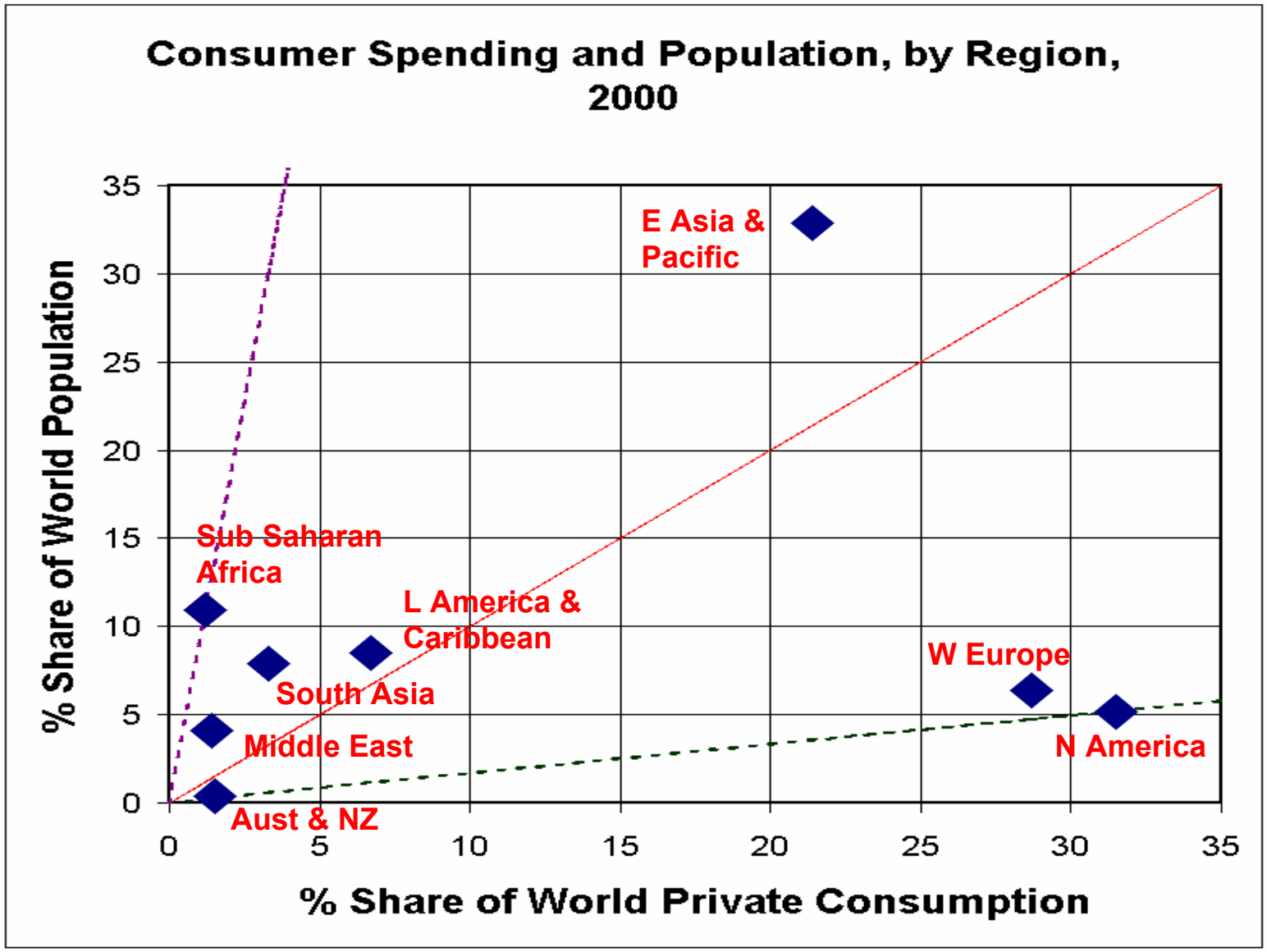
Result:

- Increased Poverty, both absolute and relative
- Much of population outwith the official economy, with consequent loss of taxation, contribution to costs of infrastructure provision, but offset by lack of legal rights of ownership and service provision….
- Marginalised, Lack of Trust in institutions
- Need to Rebuild Trust, Partnerships vital
- Need Land Reform

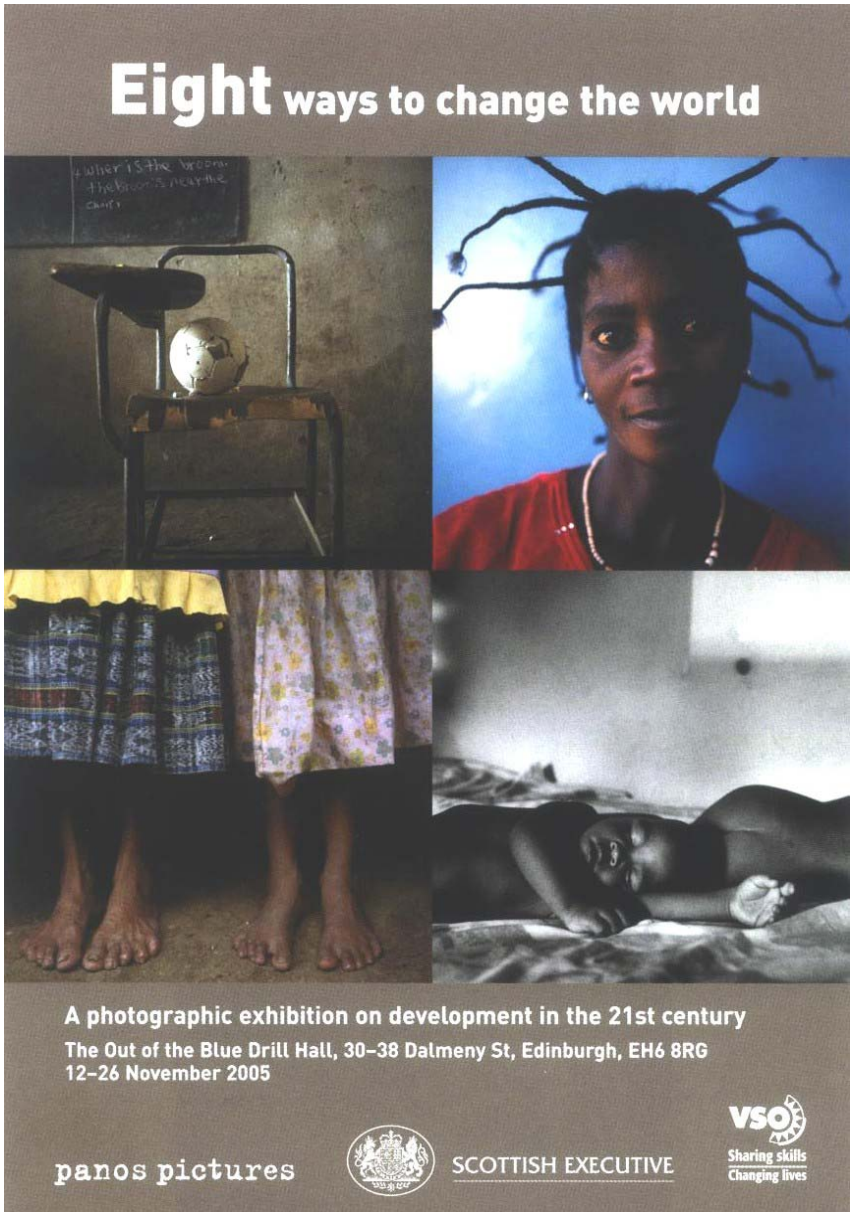
# Distribution of World Spend

Kibera

Edinburgh



# Infrastructure and the UN MDGs




6 of the 8 MDGs directly concerned with the human condition – health, economic and social well-being and the capacity to play a full and useful role in the world.

All of the MDGs depend critically on the delivery of the underpinning infrastructure upon which civilisation depends.

<u>And not just infrastructure, but infrastructure that delivers real, pro-poor outcomes</u>

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# Making Poverty History

**The MDGs need the delivery of effective Infrastructure**

**- and the vision, the capacity, the skills and the engineering partnerships to deliver it**


# Seven Structural Pressures which compromise our ability/capacity to find equitable solutions…

- Land – not much of it
- Demography – more people at both ends of the age range
- Fossil Fuels – demand rising, resources falling
- Dietary change – richer diets with bigger ecological footprints
- Climate Change – impacts on natural resources, human health
- Water – too much, too little, source of conflict
- Urbanisation – >50% now live in urban environments rather than rural/agricultural areas

# Criticality and Vulnerability of Civil Infrastructure

… Safety, Security and Sustainability …

| Cyclones | Floods/Monsoons | Droughts | Landslides |
|---|---|---|---|
| Burma | Bangladesh | Somalia | Philippines |

# Criticality and Vulnerability of Civil Infrastructure

… Safety, Security and Sustainability …

| Hurricanes | Floods | Droughts | Landslides |
|---|---|---|---|
| New Orleans | England | Spain | Hong Kong |


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# Experiences of Flooding

Scotland

Bangladesh

# Experiences of Coastal Flooding

England

Tuvalu

# Experiences of Coastal Flooding

The Netherlands

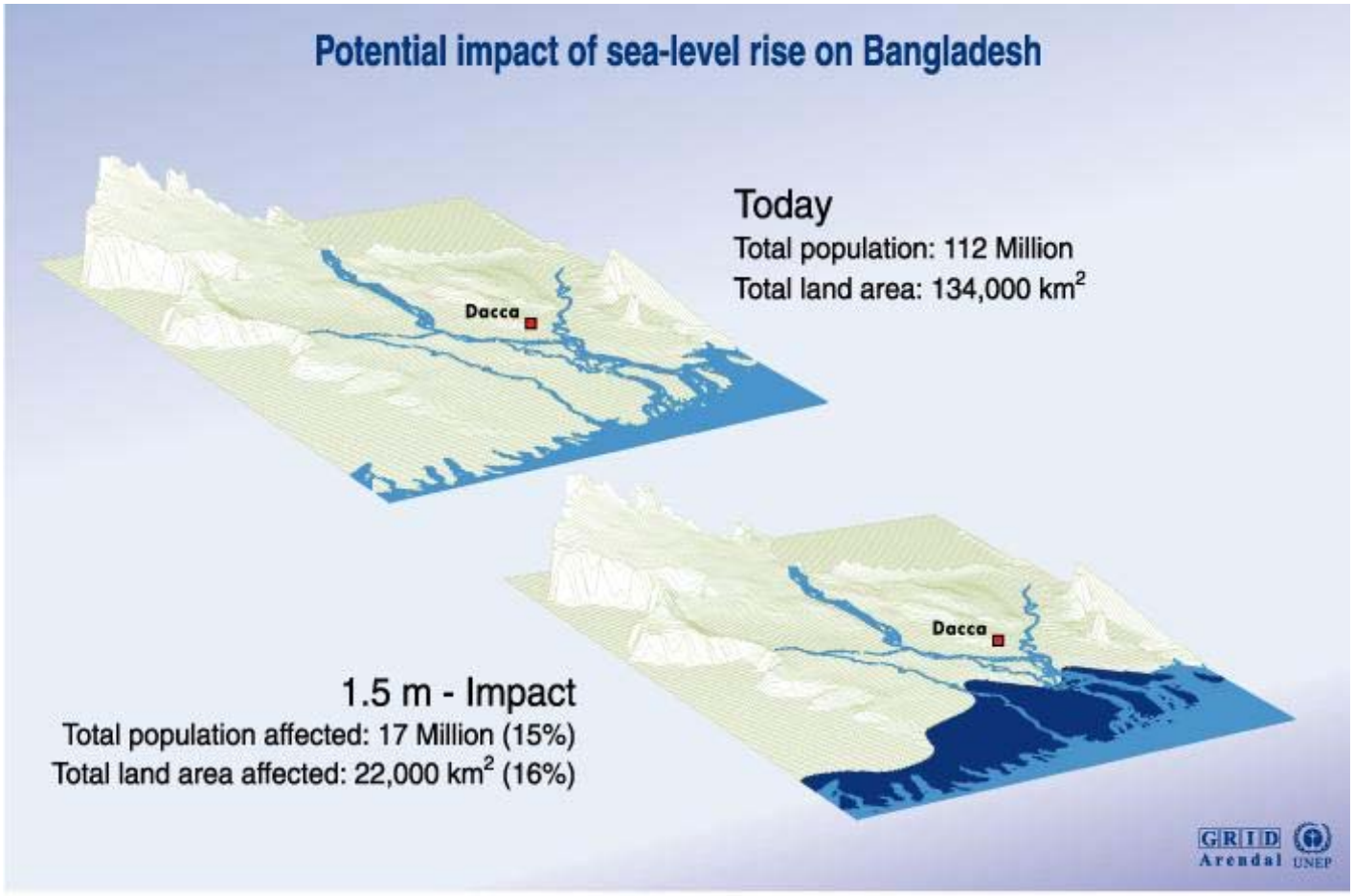
Kiribati

# Flood Defences



The Netherlands

# Flood Impacts




Source : UNEP/GRID Geneva; University of Dacca; JRO Munich; The World Bank; World Resources Institute, Washington D.C.

Bangladesh

# The Psychology of Climate Change

The discrepancies between the points of view of citizens, administrators, scientists/engineers….

1. The public - and the public dichotomy between personal lifestyles and expectations of others
2. Politicians - what they say and what they do
3. But who can deliver sustainable infrastructure?

   … Politicians, economists, scientists, engineers?

   … The finance, the framework, the knowledge…

   … and the practical implementation

Perceptions of risk?

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# Five Questions

Q1 The biggest threat to global society is:

Food Security? ***Blue***

Global Terrorism? ***Yellow***

Access to Fresh Water? ***Red***

# Five Questions

Q2 Population growth is a bigger threat than Climate Change?

Yes? ***Blue***

No? ***Yellow***

# Five Questions

Q3 Carbon offsetting to compensate for $CO_2$ emissions is a guilt trip…?

Yes? ***Blue***

No? ***Yellow***

# Five Questions

Q4 Bio-fuels are not so much the answer but the source of a whole new set of problems…

Yes? ***Blue***

No? ***Yellow***

# Five Questions

Q5 The best response to sea-level rise and climate change is:

Move north or move to higher ground? ***Blue***

Build massive defences at whatever the cost? ***Yellow***

Tell society that the effects of climate change are “locked in” and they are at real risk and they had better get ready for the consequences… ? ***Red***

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# Three Engineering Challenges

1. **Adaptation** – engineering the built environment to cope with the direct impacts of climate change including extremes of temperature, higher sea levels and more frequent fluvial, pluvial and coastal flooding
2. **Mitigation** – reducing the impact of energy generation, transport and the construction and operation of buildings and infrastructure
3. **Secondary impacts** – understanding and dealing with the downstream impacts of climate change, for example the impact of mass migration and changing demands for water and sanitation on infrastructure networks

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# Mitigation:

- The infrastructure that engineers provide is implicated in three of the largest sources of green house gas emissions
  - **Energy Generation**
  - **Transport**
  - **Construction**

- Engineering must deliver massive demand reduction, alongside cleaner technologies.
- A zero carbon goal should be established together with a roadmap for its delivery in a defined timeframe, and covering:

# Mitigation:

- **Example – efficiency of transportation systems – small steps, big gains…**

- **Effective traffic signalisation in Calgary**
  - 7 junctions
  - 15t less CO2, 12% less NOx, 12% less volatile organic emissions
  - $1m fuel savings
  - 250k travel time hours per year saved

  - Year on year…

# Secondary Impacts of Climate Change

- Some of the greatest challenges that climate change will cause will be its downstream effects.

- Changing disease patterns, increased poverty, and mass migration are all exacerbated by climate change.

- The impacts of climate change vary greatly, but generally, climate change is superimposed on existing vulnerabilities.

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# Civil Engineering for the 21st Century?

| Areas | Engineering Need |
|---|---|
| **Civil Contingency/Disaster Prevention** | **Infrastructure Vulnerability to Hazard; Infrastructure Resilience and Emergency Response**<br><br>- Civil contingency – the engineer's role<br>- Sustainable Infrastructure Development;<br>- Developing Sustainable Communities |
| **International Development** | **Delivering the underpinning infrastructure to achieve the UN MDGs**<br><br>- Sustainable Infrastructure Development<br>- Developing Sustainable Communities<br>- Public Procurement, Waste Management Infrastructure etc |

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# *Can we engineer a difference?*

Let us build wisely,

let us build surely,

let us build faithfully,

let us build for the years that are to come,

and so establish here below what we hope to find above-

a house of many mansions, where there shall be room for all.

Winston Churchill

Dundee, May 4th,1908.