German Rector's Conference

International Engineering Conference

"Attracting more students and educating well-trained engineers: sensible ways to advance the field of engineering education"

Berlin, 29–30 October 2012

Keynote presentation, Monday 29 October:

"Engineering Education: the Need for Transformation and Innovation"

"Engineering for development, and the development of engineering"

Tony Marjoram, PhD, FIEAust, CPEng

Head of Engineering, UNESCO, 2001 - June 2011

Introductory remarks

Thank - Engineers Australia, EWB Australia, SKM, AusAID and partners
Acknowledge – traditional owners of this land, past and present

Important event, reflects increasing interest engineers in development

Highly commended initiative – we need to continue and develop

Eg - IEEE Global Humanitarian Technology Conference in Seattle
Examined – housing, energy, health, ag, emp, watsan, transp/comms
Identified - need for better data, information, application, networking
IEEE grand challenge – electricity for all

BUT - we also need to remember that technological change and innovation are technical AND social processes

Background - how I got into this …

UMIST Manchester - Mech Eng 1969-72

Small is Beautiful (1973), Silent Spring (1962), AT magazine (1973), Whole Earth Cat (1968-72), Undercurrents (1972-84), ITDG (1966)

Year off – overland to India

Manchester University - science policy, 1974-80

University of the South Pacific, 1980-87, rural/development studies

International Development Technologies Centre, Melbourne Uni, 1987

Community Aid Abroad (CAA – became part of Oxfam in 1995)

international and Aboriginal projects, information, local groups

Joined UNESCO 1993 …

Introductory remarks

Speak on:

- Pressing issues and challenges facing the world
- Role of engineering and technology in development
- Past experience, success achieved and lessons learnt
- What can we do, what do we need to do?

With reference to the findings of the UNESCO Report -
"Engineering: Issues, Challenges and Opportunities for Development"
First ever international report on engineering …

- first to link engineering to development issues and challenges
- to put engineering on the development agenda

My work last 10 years - keeping engineering on the UNESCO agenda

Pressing issues and challenges facing the world

39% world population do not have safe water – 2.6 billion people

35% do not have improved sanitation - 2.3 billion people

24% do not have electricity – 1.6 billion people

20% live in poverty (<1$/day, 70% women) – 1.3 billion people

15% lack adequate housing/live in slums – over 1.0 billion people

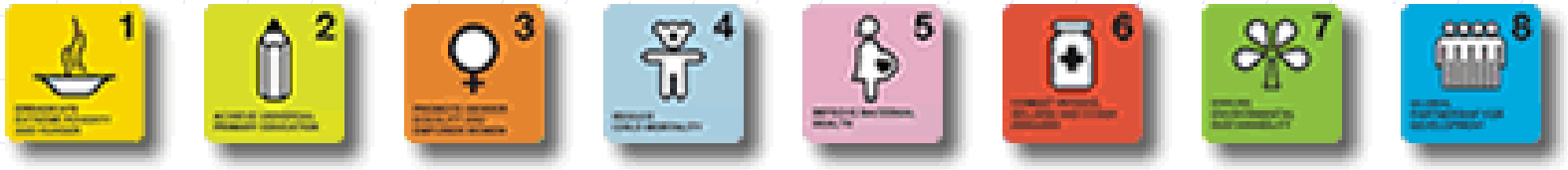
15% lack any ICT connection – over 1.0 billion people

13% go hungry every day - 852 million people

Life expectancy - poor countries: 52 years; rich countries: 78 years

These are engineering problems with engineering solutions!

UN Millennium Development Goals (MDGs):



8 MDGs, 18 quantifiable targets measured by 48 indicators

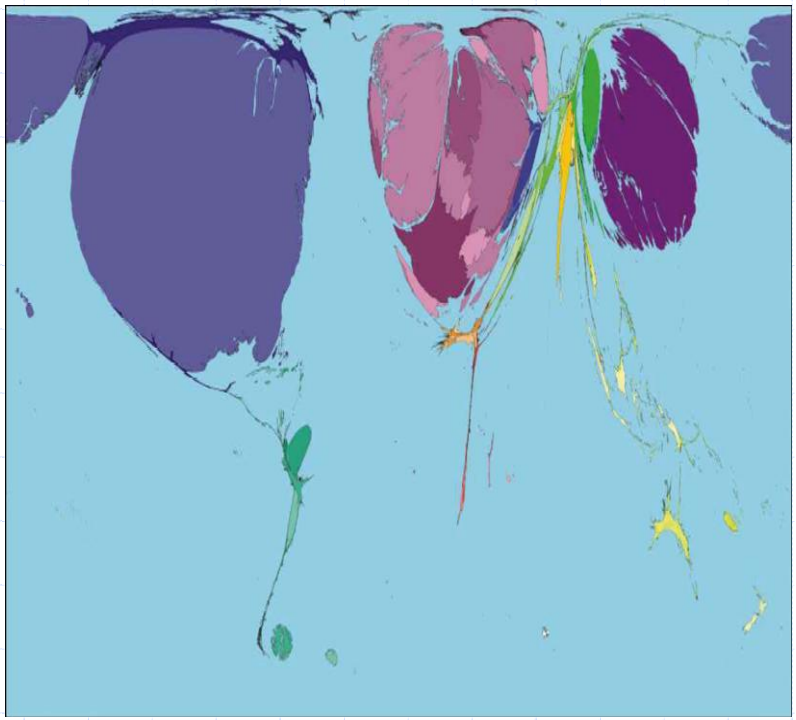
1. Eradication of extreme poverty and hunger
2. Achievement of universal primary education
3. Promotion of gender equality and empower women
4. Reduction of child mortality
5. Improvement of maternal health
6. Combating HIV/AIDS, malaria and other diseases
7. Ensuring environmental sustainability
8. Development of global partnership for development

   (MDG8, target 18 mentions knowledge, science and technology and ICTs)

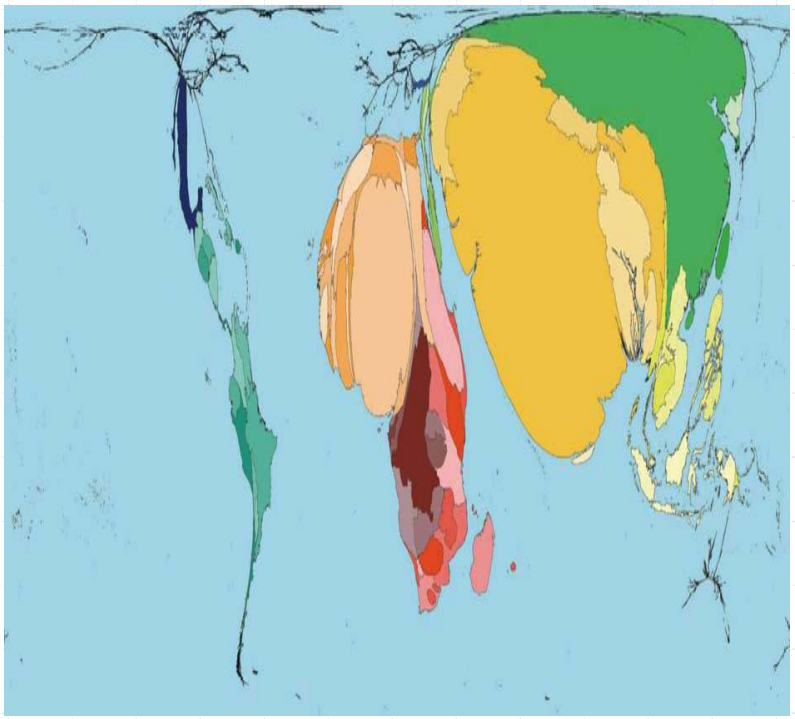
The world of knowledge and poverty:

Map re-sized according to variable:

IP royalties (knowledge)

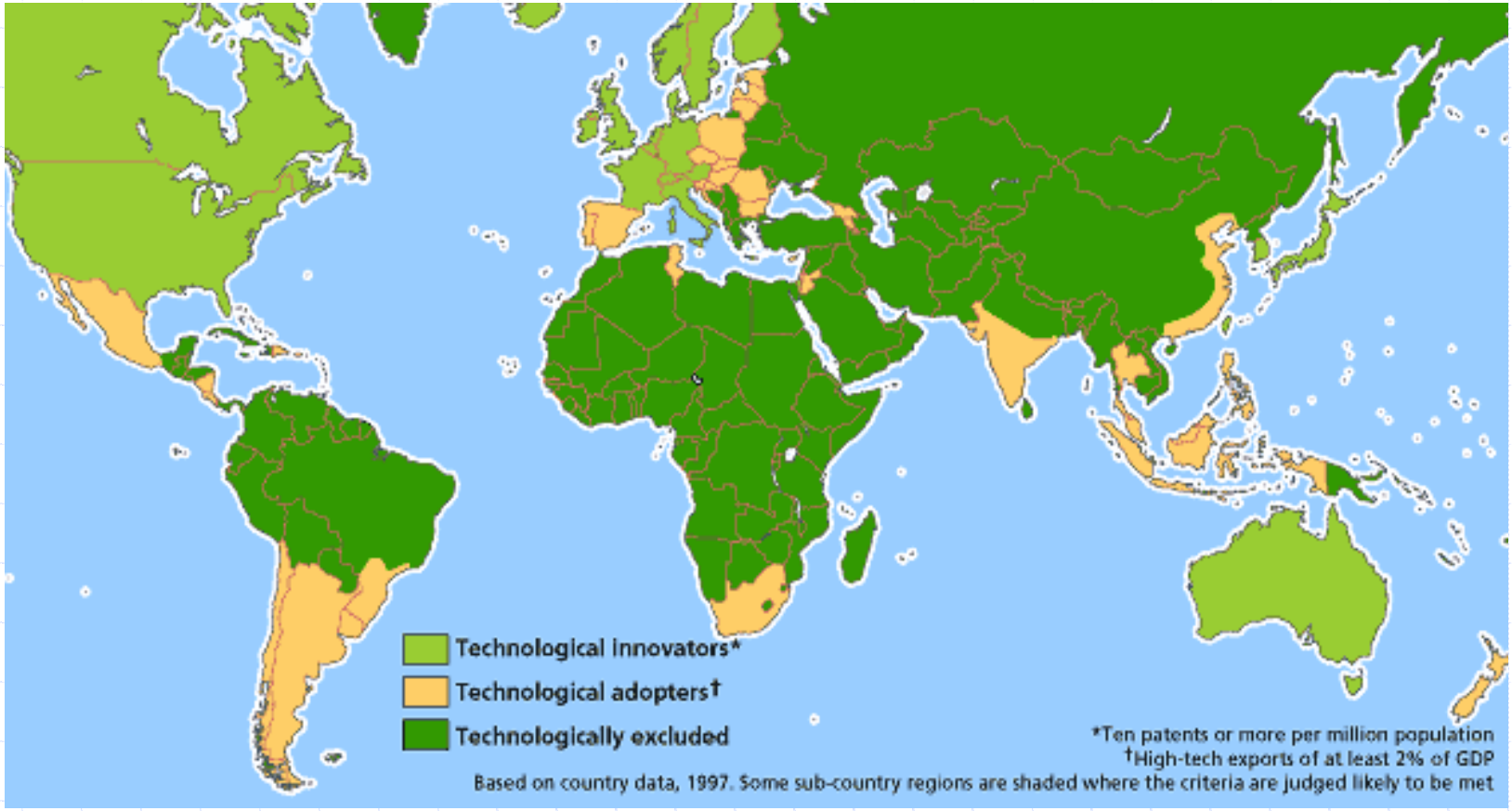


Poverty (<$1/day)



www.worldmapper.org

A new map of the world - Jeffrey Sachs
Technology innovators, adopters, excluded



Jeff Sachs, Economist 22/6/2000

Engineering, technology and development

Engineering and technology are vital in addressing human, social and economic development (eg Stone, Iron, Information Ages)

BUT

millions of people continue to live in poverty,

despite various initiatives and actives on science and technology for development over the last 50 years (mentioned below)

Why is this? Why have these activities often achieved mixed results, and sometimes failed (limited success)?

Due to a mixture of general factors and specific factors relating to engineering and technology (external and internal factors)

Engineering, innovation and development

Engineering applications and innovation:

Not just hi-tech

Innovation - includes introduction of technology that is new to the user and user-group

for example – new water pump for African farmers:

‘Ujeli’ stove + thermo-electric generator, Nepal

DaimlerChrysler-UNESCO Mondialogo Engineering Award

Other areas of humanitarian technology include:

Biogas, photovoltaic solar home systems, water tanks, improved toilets (pee and poo – *fecal matter*), improved cooking stoves (fuel efficient, smokeless), biofuels (biodiesel, ethanol), biomass gasifiers, building materials …

Political economy of technology and development

Engineering applications and technology depend on knowledge, resources and funding

Application of engineering/technology in development depends on:

- awareness of the role of engineering/technology in development policy and implementation
  - by policy-makers and decision-takers
    - (external factors to engineering)
- internal factors in engineering:
  - information and advocacy of engineering in development

Engineering often overlooked or under-represented in S&T policy

Past experience, words and actions

Various initiatives and activities on engineering, science and technology for development over the last 50 years, including:

Increasing postwar interest in 1960/70s in development, S&T, appropriate technology and "AT movement" - ITDG, VITA … 1973 - "Small is Beautiful: Economics as if People Mattered", Schumacher

Sussex Manifesto: Science and Technology to Developing Countries during the Second Development Decade (1970) … other 1970s …

1970s UNESCO Conferences Application Science Technology to Development - CASTASIA, CASTAFRICA, CASTLAC, CASTARAB

UN Conference on Science Technology for Development (UNCSTD) 1979 - tec transfer, access to S&T, G77, NIEO … heady years …

Heading for … decline

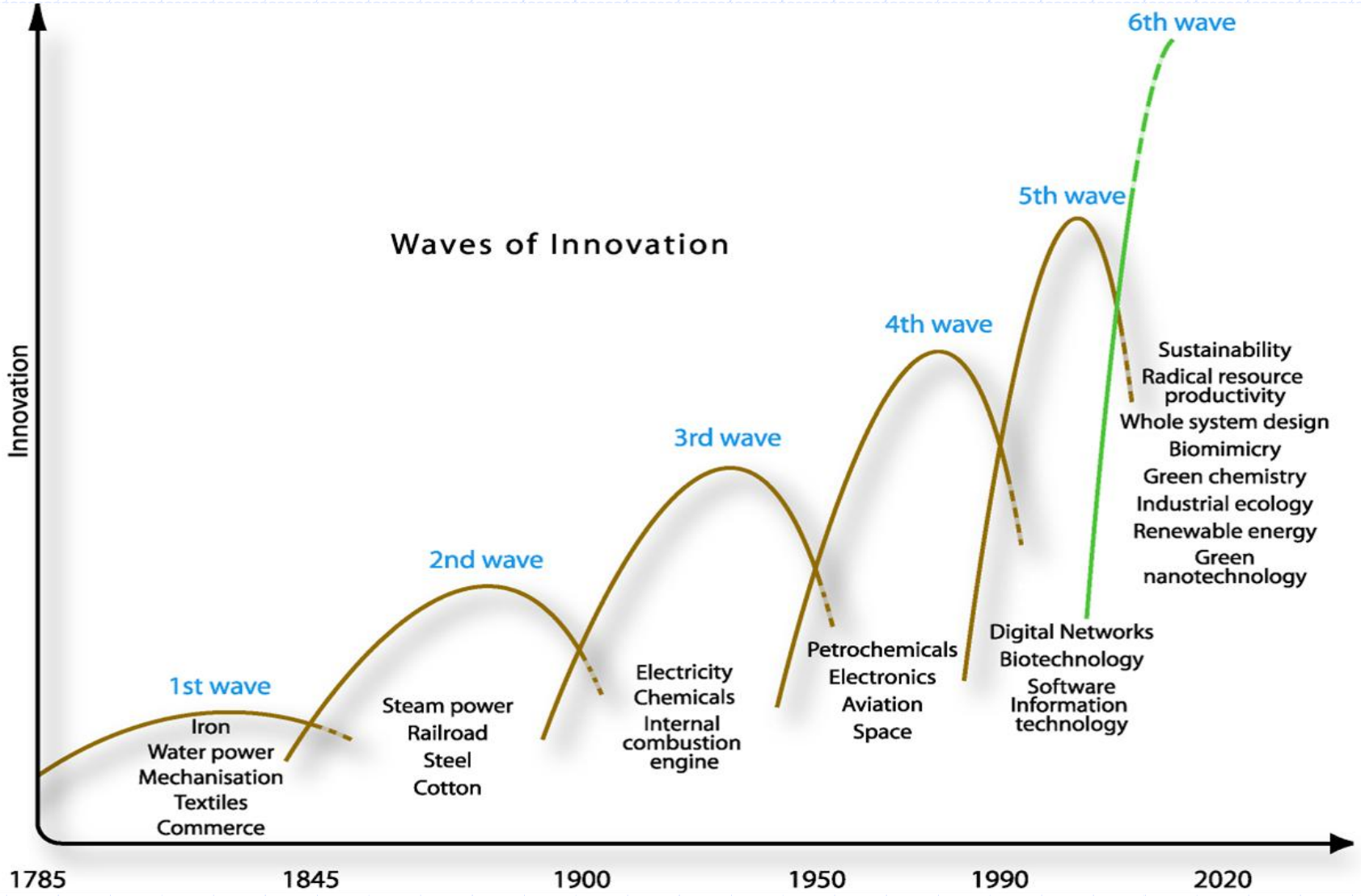
Interest in S&T and development declined in the 1980s and 1990s

Reagan, Thatcher, monetarism, structural adjustment, cuts in aid, US/UK withdrawal from UNESCO in 1984 (rejoin in 2003, 1997)

Renewed interest in S&T and development in the 'noughties' eg
"Small is Working: Technology for Poverty Reduction", 2004
UNESCO video/booklet - 30 year anniversary Small is Beautiful
AT was not dead, as claimed by Paul Polak, but resting …

But – interest still focused on S&T, S&T policy
Little focus on engineering - still equated with infrastructure

Waves of interest - Kondratiev waves - 30/40 years, generational?


Waves of Innovation
Innovation
1st wave
Iron
Water power
Mechanisation
Textiles
Commerce
2nd wave
Steam power
Railroad
Steel
Cotton
3rd wave
Electricity
Chemicals
Internal combustion engine
4th wave
Petrochemicals
Electronics
Aviation
Space
5th wave
Digital Networks
Biotechnology
Software
Information technology
6th wave
Sustainability
Radical resource productivity
Whole system design
Biomimicry
Green chemistry
Industrial ecology
Renewable energy
Green nanotechnology
1785
1845
1900
1950
1990
2020

Let’s ride the new wave of EST for development

Success achieved and lessons learnt?

1970s UNESCO Ministerial conferences application of S&T to development - CASTASIA, CASTLAC, CASTARAB, CASTAFRICA, 1970 Sussex Manifesto S&T4D, UNCSTD 1979, etc

These activities achieved varied/limited success - why?

- Mixture of reasons relating to political will, bureaucracy - putting words into action, resources, implementation
- Lack political commitment, political economy of knowledge/power – eg UNCSTD (politics and science, NIEO)
- Poor understanding of engineering, S&T and development

Lessons learnt? – need continuous advocacy EST for development

2010 Sussex Manifesto "Innovation, Sustainability, Development"

Success factors - general factors

Success? – at macro/thematic level, programme level, project level

Need for evidence, information, advocacy, commitment, resources, and … leadership

- Driven by the engineering and technology community

Policy useful, but policy alone not enough

- Need commitment, resources and implementation

Focused on what communities?

- engineering and technology, policy and planning, development specialists (and economists), government and private sectors, NGOs, international and intergovernmental organisations

Persuading policy makers about engineering

Shift going to work, Katse Dam, SAICE

Success factors - specifics

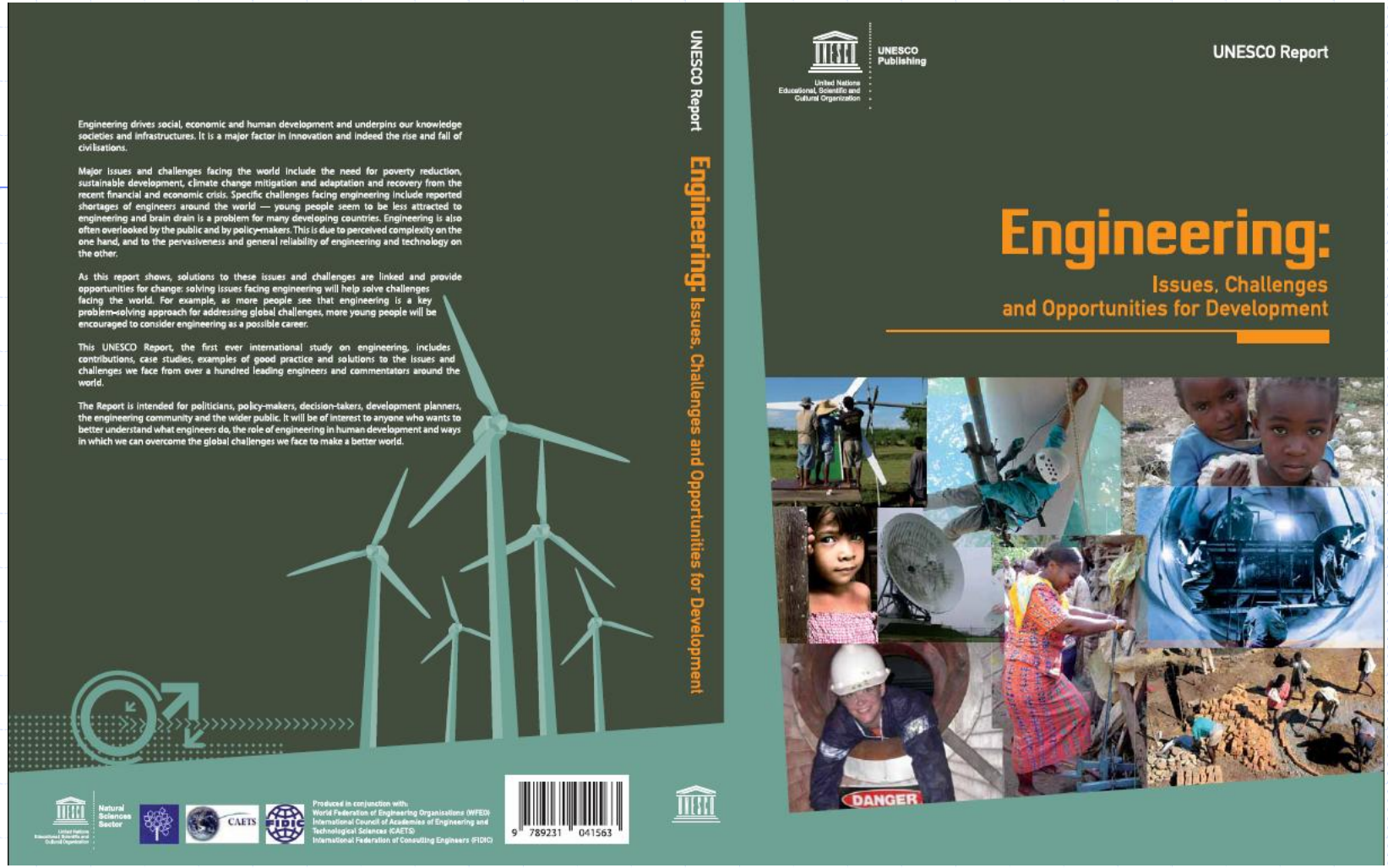
Lessons learnt and what works in engineering and technology for development:

Project technologies need to be appropriate to local social and economic needs and conditions:

- complement and build upon local technologies, affordable, maintainable, rather than tec-fixes to perceived problems
  - eg: water tanks, toilets, cooking stoves, biogas, PV …

Projects in developing countries - need to engage and involve local community and engineers

- outside aid contractors often do not do this, eg: biogas, PV …
- NGOs may also overlook – developmental tourism?



ISBN 978-92-3-104156-3, 215 x 280mm, 400 pages, 26.00 Euro

On-line version - search "UNESCO Engineering Report"

UNESCO Engineering Report

Produced by UNESCO in conjunction with the three main international engineering organisations:

World Federation of Engineering Organisations (WFEO)

International Council Academies of Engineering and Technological Sciences (CAETS)

International Federation of Consulting Engineers (FIDIC)

Eight sections/chapters, 400 pages (started as 250), with 120 contributors from 40 countries

Introduction and soft launch at WEC2008, publication and hard launch October 2010

The first ever international report on engineering

UNESCO Engineering Report

The Report is intended as a platform to:

identify issues, challenges and opportunities for engineering for development, esp poverty, SD, climate change and MDGs

promote better public understanding of engineering and its role in society

highlight ways of making engineering and engineering education more attractive to young people, esp women

The report is for decision-makers, engineering community and public to better understand and address these issues and challenges.

Poverty and sustainable development relate particularly to:

access to knowledge and technology to address basic needs

– which relates particularly to engineering

Word cloud – engineering and development agenda

Emerging issues and challenges

Particular emerging issues and challenges include:

- climate change mitigation and adaptation, urgent need to move to a low-carbon future,
- consequences of the global financial crisis,
- calls for increased investment in infrastructure, engineering capacity and associated research and development

At the same time, many countries are concerned about:

- the apparent decline of interest and enrolment of young people, esp young women, in engineering, science and technology
- the effect this will have on capacity and development
- these issues are compounded in developing countries by the brain-drain of engineers (to Europe and North America)

Main findings of the Report, need to:

Promote engineering as driver of social and economic development
– get engineering on the development agenda

Develop public and policy awareness and understanding of engineering and innovation

Develop information on engineering, highlighting the need for
- better statistics and indicators on engineering

Promote change in engineering education, curricula and teaching
- to emphasise relevance and problem-solving

More effectively apply engineering and innovation to global issues
- such as poverty reduction, SD and climate change

Develop a greener/sustainable engineering and technology
- the next wave of innovation

The Report shows that:

Many of these issues, challenges and opportunities are connected as possible solutions

For example:

when young people, the public and policy-makers see that engineering, innovation and technology is part of the solution to global issues,

their attention and interest is raised and they are attracted to engineering

The Report was a response to the need for the engineering community to engage with these audiences in promoting such an agenda for engineering – and for the world

Engineers and development - what can we do?

Program activity

Develop and support national and international engineering for development programme activities and initiatives

Partnerships

Seek partnership:

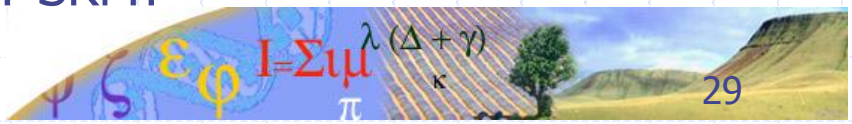
with local, national and international engineering organisations (such as Engineers Australia) and companies (such as SKM, BHP)

with various branches of engineering, NGOs such as EWBs around the world and global organisations such as WFEO

Sponsorship and funding

Seek public and private sponsorship and funding – companies keen to support, eg continue Mondialogo Engineering Award

Possible partners/sponsor? BHP? SKM?



What can EWBs do?

EWBs – becoming the largest international engineering group?

Particular responsibility to:

develop, promote and support program activity, partnerships, sponsorship and funding on engineering and technology

for the benefit of humanity

This will stimulate other engineering organisations, related national, international and intergovernmental organisations, the public and private sectors to do more in this important area

I look forward to the outcome of this conference and continuing to work in this vital area of endeavour

Let's get moving!