International Conference on

Sustainability Engineering and Science

"Engineering without Frontiers"

Professor Paul Jowitt

The Scottish Institute of Sustainable Technology
Heriot Watt University, Edinburgh, UK

Auckland, July 2004

New Zealand Society for Sustainability Engineering and Science
and The International Centre for Sustainability Engineering and Research

New Civil Engineer Jan 2003

ICE news

ice

Edited by Mark Hansford
mark.hansford@construct.emap.com
ICE on the web: www.ice.org.uk

Council puts sustainability top of education curriculum

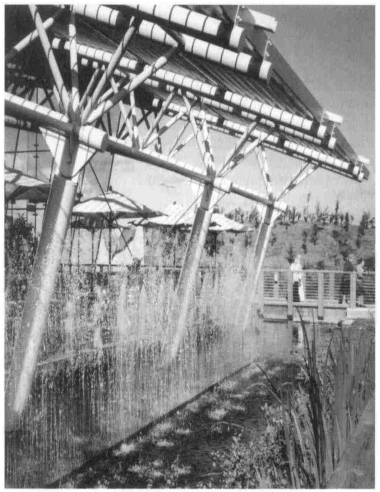
DEGREES IN civil engineering need to put "sustainability at their heart", ICE Council said last month.

In a debate on the role of the Institution in furthering the practice of sustainable construction, Council agreed that civil engineering education needs to be fundamentally overhauled, with a much greater emphasis on sustainability.

"We need to look fundamentally at the training of engineers and the degrees they need for membership of this Institution," said territorial Council member for Glasgow and the West of Scotland Alan Simpson. "This has to be a matter for mature debate."

Mark Dyer, a lecturer at Durham University, added: "Sustainability is at the heart of civil engineering and is the one thing in civil engineering that undergraduates and school leavers can engage with."

Past president Tony Ridley, who instigated the debate through his paper outlining his experiences at last August's World Summit on Sustainable Development, said: "A 21st century engineer is not the one I was educated to be in the 20th century. The ICE has part caught up, but it has a distance to go.



Landmark projects such as the M40 Wheatley service station demonstrate that sustainable development is now "absolutely central" to civil engineering.

"Sustainable development is now absolutely central to civil engineering, and we must organise ourselves accordingly."

In addition to a revamp of engineering education, Ridley called for an immediate audit of the activities of the ICE's engineering boards to ensure that the ICE is fulfilling its role as a centre of knowledge and best practice.

This view was backed by Council member and environment and sustainability board (E&SB) chairman John Ekins. "Civil engineers are still seen by many as uncaring philistines, and we have to get a grip on this. "As chair of the E&SB we have got to get to the point where we don't need an E&SB as it should be at the heart of all boards."

Council agreed that the issues raised should be formalised and returned to Council for further debate. The issue of sustainability in education will be a key theme of the ICE's inaugural annual conference, to be held in Belfast in June.

"Sustainable Development is now absolutely central to Civil Engineering and we must organise ourselves accordingly"

ICE Council 17 December 2002

Why Sustainability?

Codswallop

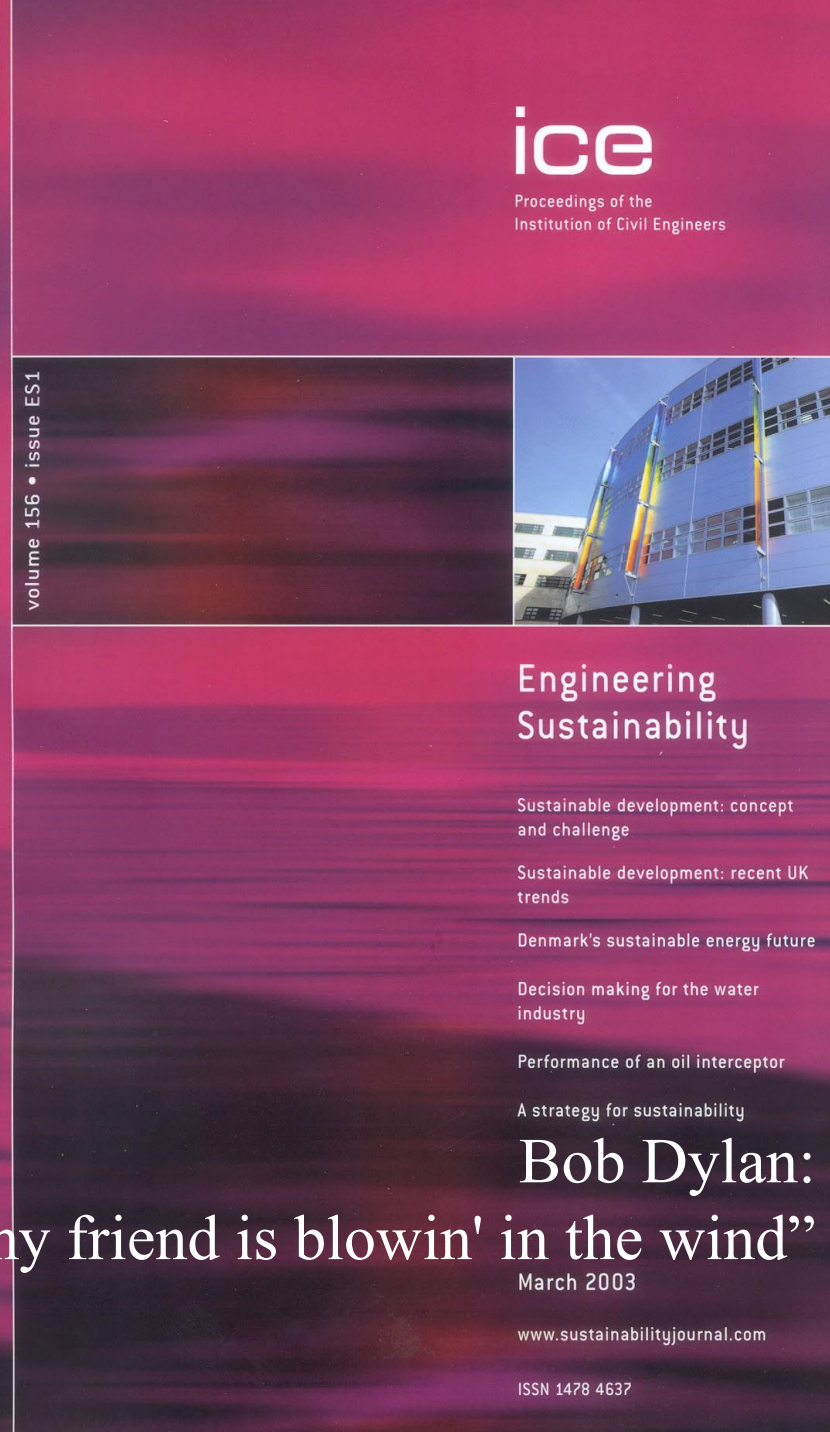
When I looked at the *ICE News* piece in on sustainability (*NCE* 17/24 April) my first impression was of a page of meaningless jargon. This was confirmed by a second look.

I may have missed something in the 10 years since I retired but I do not know what sustainability means or what a civil engineer can do to ensure it.

Does it mean do not build something that costs a lot but is no use – like the Dome? Or does it mean try very hard to scrape up the money when times are hard to build something that is very worthwhile – like Crossrail?

Either way the decision lies outside the field of the civil engineer.

NCE 1st May 2003



"The answer my friend is blowin' in the wind"

Bob Dylan:

Why Sustainability?

We could spend hours debating this…..

But do we really need to?

New Civil Engineer Jan 2003

ICE news

ice

Edited by Mark Hansford
mark.hansford@construct.emap.com
ICE on the web: www.ice.org.uk

Council puts sustainability top of education curriculum

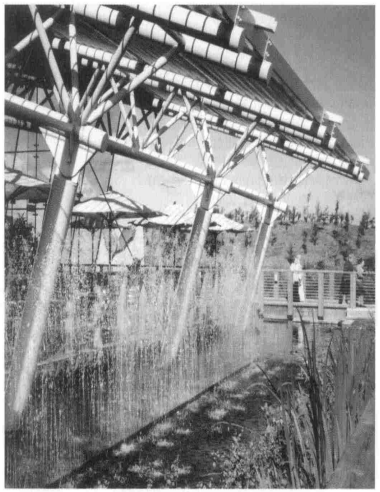
DEGREES IN civil engineering need to put "sustainability at their heart", ICE Council said last month.

In a debate on the role of the Institution in furthering the practice of sustainable construction, Council agreed that civil engineering education needs to be fundamentally overhauled, with a much greater emphasis on sustainability.

"We need to look fundamentally at the training of engineers and the degrees they need for membership of this Institution," said territorial Council member for Glasgow and the West of Scotland Alan Simpson. "This has to be a matter for mature debate."

Mark Dyer, a lecturer at Durham University, added: "Sustainability is at the heart of civil engineering and is the one thing in civil engineering that undergraduates and school leavers can engage with."

Past president Tony Ridley, who instigated the debate through his paper outlining his experiences at last August's World Summit on Sustainable Development, said: "A 21st century engineer is not the one I was educated to be in the 20th century. The ICE has part caught up, but it has a distance to go.



Landmark projects such as the M40 Wheatley service station demonstrate that sustainable development is now "absolutely central" to civil engineering.

"Sustainable development is now absolutely central to civil engineering, and we must organise ourselves accordingly."

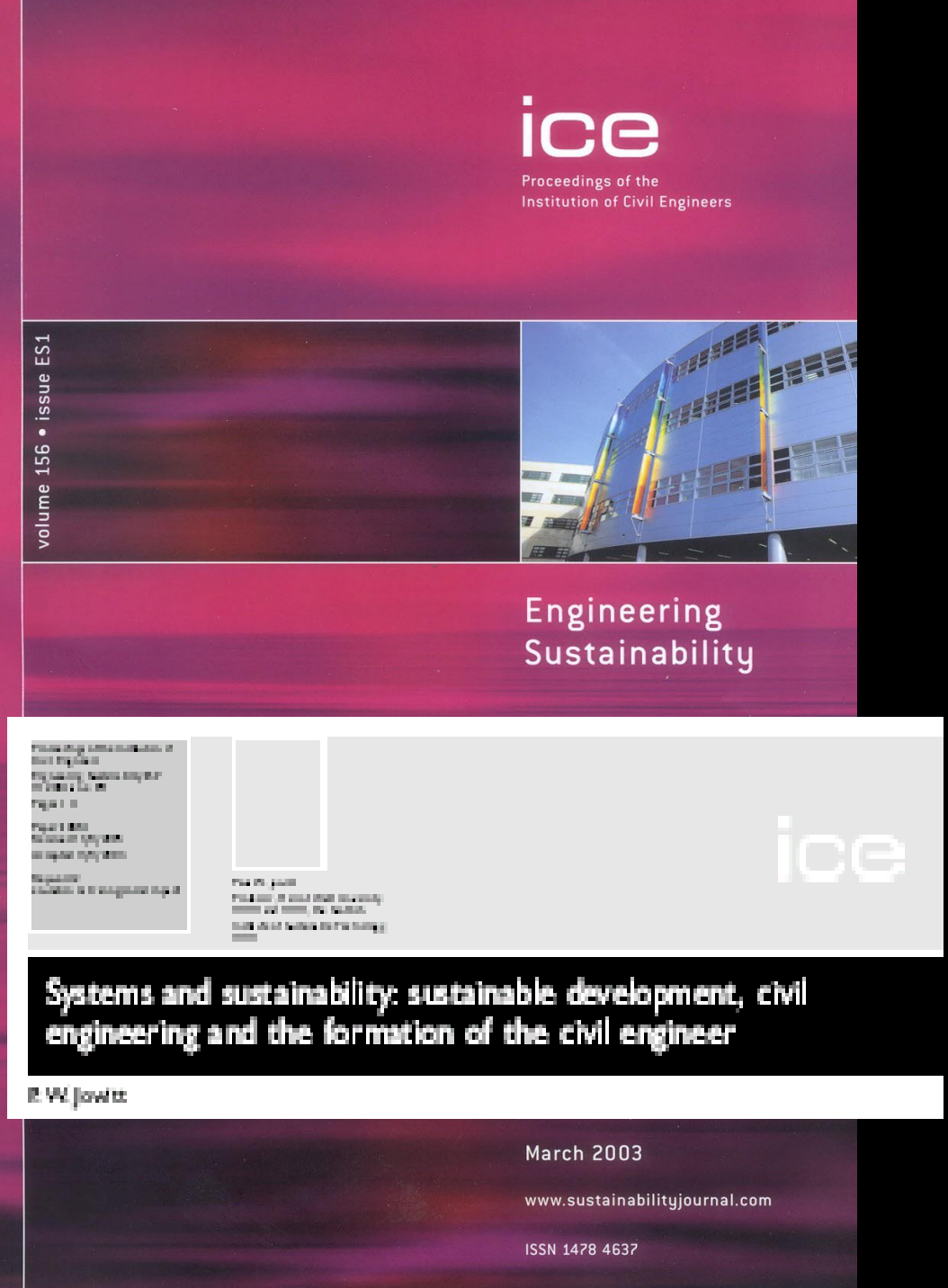
In addition to a revamp of engineering education, Ridley called for an immediate audit of the activities of the ICE's engineering boards to ensure that the ICE is fulfilling its role as a centre of knowledge and best practice.

This view was backed by Council member and environment and sustainability board (E&SB) chairman John Ekins. "Civil engineers are still seen by many as uncaring philistines, and we have to get a grip on this. "As chair of the E&SB we have got to get to the point where we don't need an E&SB as it should be at the heart of all boards."

Council agreed that the issues raised should be formalised and returned to Council for further debate. The issue of sustainability in education will be a key theme of the ICE's inaugural annual conference, to be held in Belfast in June.

ICE Education and Training Task Group

Established by ICE Council in late 2002 to examine the implementation of sustainability principles into education, training and professional development…



ICE Education and Training Task Group

Outcomes summarised in a forthcoming paper in "Engineering Sustainability"

- copies available at the NZSSES IT desk!

Engineering Education, Sustainable Development and the Teaching and Learning Process?

- **Content**:

- **A**wareness/**A**ttitudes
- **S**kills
- **K**nowledge

- **A**wareness/**A**ttitudes
  - An overarching approach to engineering problems in the context of environmental, economic and social issues.
- **S**kills
  - Ability to work with complex/-ill defined problems
  - Team work and communication skills
  - Ability to evaluate the merits and demerits of options
- **K**nowledge
  - Broad and Deep
  - Technical
  - Environmental
  - Social processes
  - Legal
  - Disciplined Body of General Knowledge

Doug Oakervee: "Mandate for Change"

Current ICE President

Doug Oakervee: "Mandate for Change"

"When you understand engineering you see the world differently"

"…we must do everything within our power to care for our Earth and that unique but fragile film of matter that covers its surface, called Life."

"In embracing a culture of caring for earth, its people, flora, fauna and the whole environment, we must involve the younger members.

"They must be involved throughout their careers, have the imagination and energy to resolve the complex challenges in this vital area of engineering…. Engineering in the 21st Century and the engineer's role needs to be rethought.

ICE Presidential Commission

New Civil Engineer

NCE

www.nceplus.co.uk

Magazine of the Institution of Civil Engineers 8 January 2004

Commission to look at role of engineers in meeting UN goals

A PRESIDENTIAL commission is to investigate the role civil engineers have to play in meeting UN international development goals on poverty, education, health and the environment.

Paul Jowitt, professor of civil engineering systems at Heriot-Watt university, will lead the commission. It will ask what society expects of engineers, identify the critical activities needed to meet the UN's goals and suggest what the ICE should do to help meet them.

ICE President Doug Oakervee announced the establishment of a working group to tackle these issues in his presidential address in November. But Council has agreed to upgrade the study to presidential commission status to reflect the importance of the work.

"What makes the scope of this study most challenging is the outward facing international dimension, and in particular, the inclusion of the 'north-south' aspect," said Jowitt.

"Meeting UN goals moves the agenda on to another plane, in which the ICE and its membe have to see themselves as havi a lead role to play international as part of a valued and an impo tant profession," he added.

ICE news

NEW CIVIL ENGINEER 8 JANUARY 2004

from the President
Douglas E Oakervee OBE FREng CEng FICE FHKIE

ice

1 2 JAN 2004

Our ref DEO/CAE
Date 06 January 2004

Institution of Civil Engineers

Professor Paul Jowitt BSc
Department of Civil and Of
Heriot-Watt University
Edinburgh
EH14 4AS

Dear Paul

Re Presidential Commiss

Further to our recent teleph
Presidential Commission th

- What does society
- What are the critic
  Goals?
- How can these am
  RedR, EAP and ou

As you know, the ICE Cou
chairmanship at its Decem

In line with our earlier discu
President of the European
Commission. I entirely agr
so that we can obtain a ba
consider is required of eng

Once having formed the C
in 2004 to confirm the prop
Commission to be put befo

As you know, my intention
Presidential Address in No
year and beyond. I have a
Team for my session in off

Once again, please accept
necessary to achieve the o

I look forward to hearing fu

Yours.
Douglas

Douglas Oakervee

"I am therefore establishing a Presidential Working Group to consider:

1. **What does society expect of an engineer in the 21st century?**
2. **What are the critical activities to address in caring for Earth and meeting the Millennium Development Goals?**
3. **How can these ambitions be integrated with those organisations already involved and especially ADP, RedR, EAP and our Boards?**

Registered Charity No. 210252

New Civil Engineer

NCE

www.nceplus.co.uk

Magazine of the Institution of Civil Engineers 8 January 2004

Commission to look at role of engineers in meeting UN goals

A PRESIDENTIAL commission is to investigate the role civil engineers have to play in meeting UN international development goals on poverty, education, health and the environment.

Paul Jowitt, professor of civil engineering systems at Heriot-Watt university, will lead the commission. It will ask what society expects of engineers, identify the critical activities needed to meet the UN's goals and suggest what the ICE should do to help meet them.

ICE President Doug Oakervee announced the establishment of a working group to tackle these issues in his presidential address in November. But Council has agreed to upgrade the study to presidential commission status to reflect the importance of the work.

"What makes the scope of this study most challenging is the outward facing international dimension, and in particular, the inclusion of the 'north-south' aspect," said Jowitt.

"Meeting UN goals moves the agenda on to another plane, in which the ICE and its membe have to see themselves as havi a lead role to play international as part of a valued and an impo tant profession," he added.

ICE news

NEW CIVIL ENGINEER 8 JANUARY 2004

Outward Facing…..

….. what makes the Scope of this Study most challenging is its outward facing international dimension, and its "North-South" aspect.

"Caring for Earth and meeting the MDGs" move the agenda on to another plane,

"The ICE and its members have to see themselves as having a lead role to play internationally, as part of a valued and an important profession.

Commission - Brief

- Society's expectations of the engineer in the 21st century?
- Engineers' role in caring for earth and meeting the UN MDG's?
- Contribution of the ICE, its Boards and associated organisations – RedR/EAP…?

ICE Presidential Commission

"Engineering without Frontiers"

- Establish the Commission:

- Members
- Special Advisors
- International Advisors

"Engineering without Frontiers" - Commission Members

Paul	**Jowitt**	ICE Council & Executive	Chair
Peter	**Guthrie**	University of Cambridge	Member
Annie	**Hall**	Construction Industry Training Board	Member
Lisa	**Kelvey**	President, European Young Engineers	Member
Bobby	**Lambert**	Director – RedR	Member
Robin	**Nicholson**	Edward Cullinan Architects	Member
Clare	**Short**	Former UK Secretary of State for Intl Devpt	Member
Kate	**Beckmann**	SISTech Ltd	Tech Support
Andrew	**Crudgington**	Institution of Civil Engineers	Tech Support
John	**LaRoche**	Water for Survival (NZ)	Intl Advisor
Tony	**Marjoram**	UNESCO	Intl Advisor
James	**Moody**	Intl Young Professionals Foundation, Aust, TF10.	Intl Advisor
Don	**Roberts**	Engineers Without Borders-USA	Intl Advisor
Bill	**Rourke**	Institution of Engineers (Australia)/WFEO	Intl Advisor
David	**Thom**	WFEO, IPENZ	Intl Advisor
Lee	**Yee-Cheong**	UN TF10, WFEO	Intl Advisor
Tony	**Ridley**	Former ICE President, WFEO	Special Advisor
Haro	**Bedelian**	ICE Vice President	Special Advisor
Peter	**Cameron**	Chair, ICE Appropriate Development Panel	Special Advisor
Graham	**Setterfield**	Chair, ICE Water Board	Special Advisor

OK…
Where shall we start?

1. What exactly are the MDGs??

2. How might they be implemented/achieved?

MILLENNIUM DEVELOPMENT GOALS

ERADICATE EXTREME POVERTY AND HUNGER

TARGET FOR 2015: Halve the proportion of people living on less than a dollar a day and those who suffer from hunger.

ACHIEVE UNIVERSAL PRIMARY EDUCATION

TARGET FOR 2015: Ensure that all boys and girls complete primary school.

PROMOTE GENDER EQUALITY AND EMPOWER WOMEN

TARGETS FOR 2005 AND 2015: Eliminate gender disparities in primary and secondary education preferably by 2005 and at all levels by 2015.

REDUCE CHILD MORTALITY

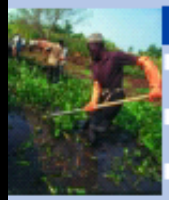
TARGET FOR 2015: Reduce by two thirds the mortality rate among children under five.

IMPROVE MATERNAL HEALTH

TARGET FOR 2015: Reduce by three quarters the ratio of women dying in childbirth.

COMBAT HIV/AIDS, MALARIA AND OTHER DISEASES

TARGET FOR 2015: Halt and begin to reverse the spread of HIV/AIDS and the incidence of malaria and other major diseases.



ENSURE ENVIRONMENTAL SUSTAINABILITY

- Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources.
- By 2015, reduce by half the proportion of people without access to safe drinking water.
- By 2020, achieve significant improvement in the lives of at least 100 million slum dwellers.

DEVELOP A GLOBAL PARTNERSHIP FOR DEVELOPMENT

- Develop further an open trading and financial system that includes a commitment to good governance, development and poverty reduction — nationally and internationally.
- Address the least developed countries' special needs, and the special needs of landlocked and small island developing states.
- Deal comprehensively with developing countries' debt problems.
- Develop decent and productive work for youth.
- In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries.
- In cooperation with the private sector, make available the benefits of new technologies — especially information and communications technologies.

MDGs?

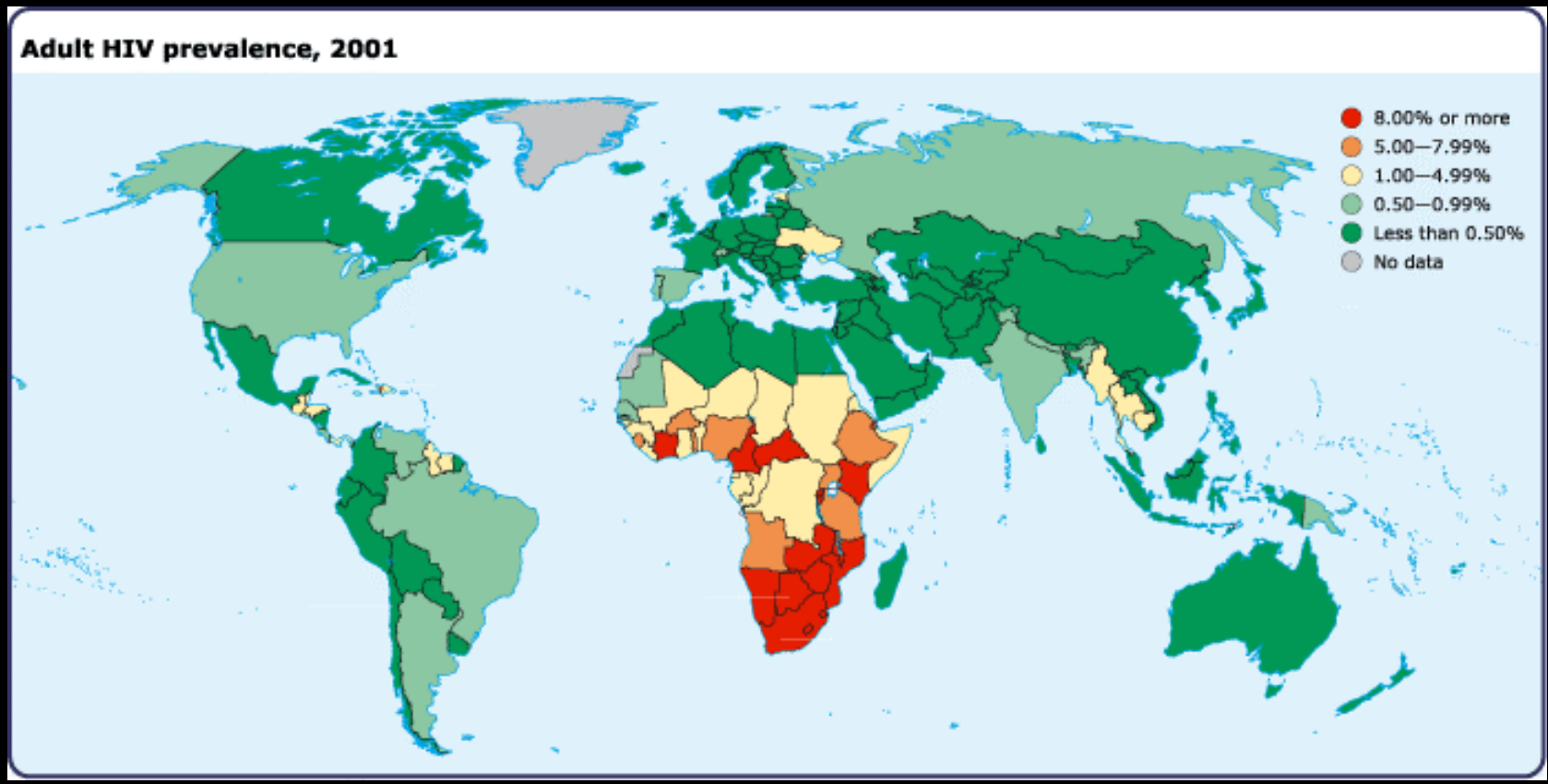
1. < Extreme Poverty
2. > Primary Education
3. > Gender Equality
4. < Child Mortality
5. > Maternal Health
6. < HIV/AIDS
7. > Environmental Sustainability
8. > Develop Global Partnership

- *Water supply comes in as part of 7*
- *Productive work for Youth under 8*
- *Knowledge sharing under 8*

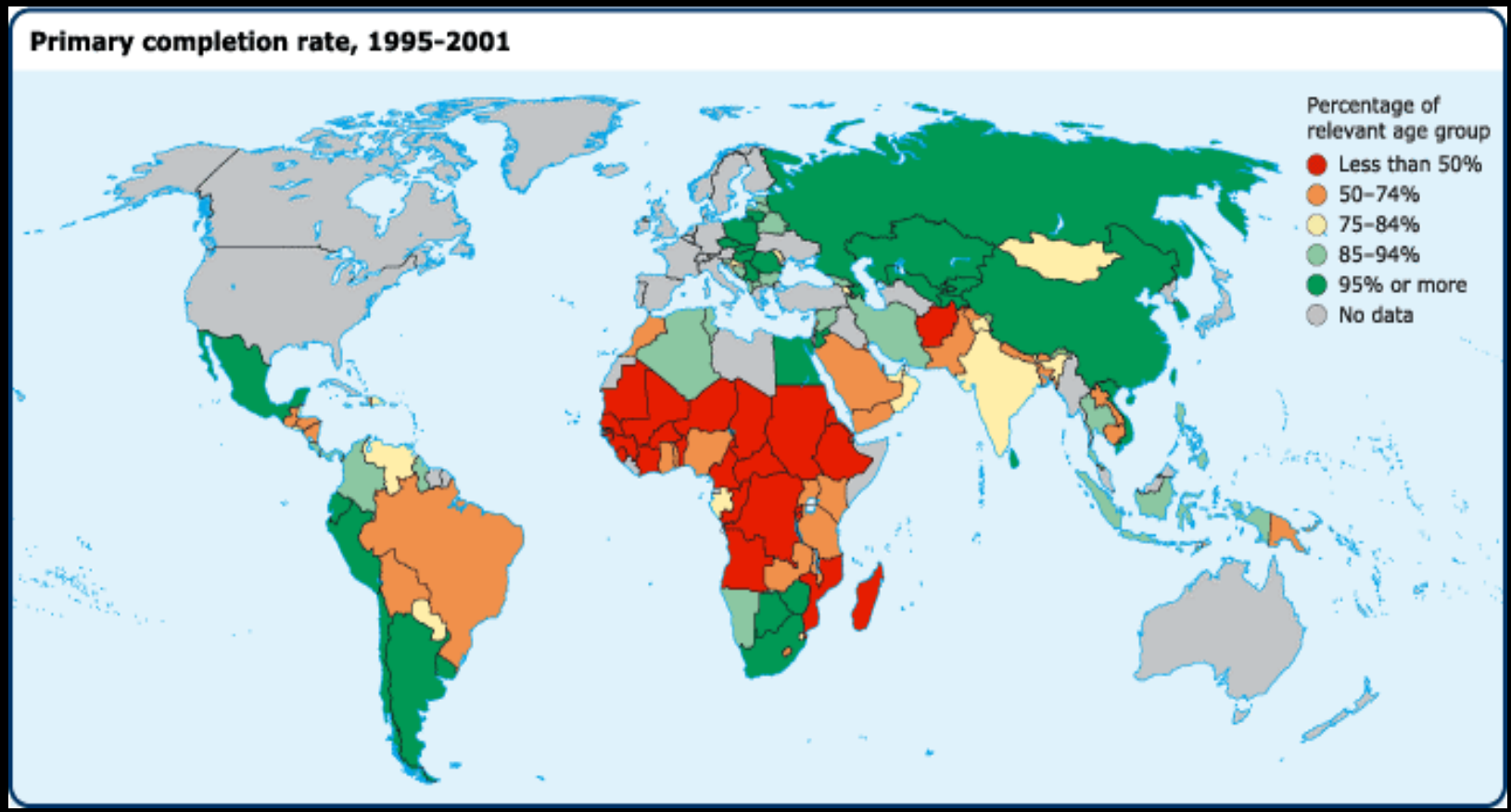
WHY DO THE MILLENNIUM DEVELOPMENT GOALS MATTER?

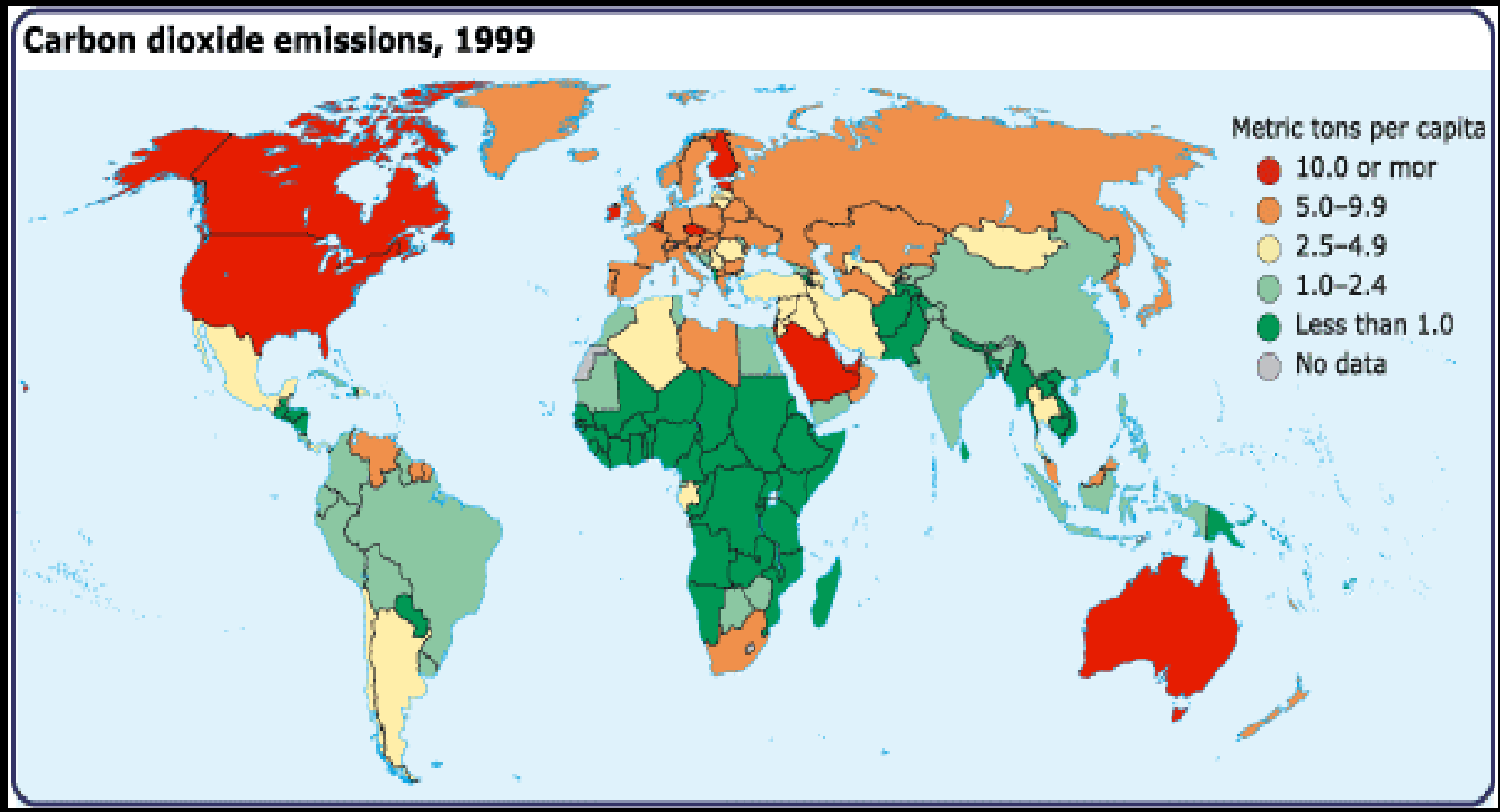
From the Secretary-General's 2003 Report on Implementation of the United Nations Millennium Declaration

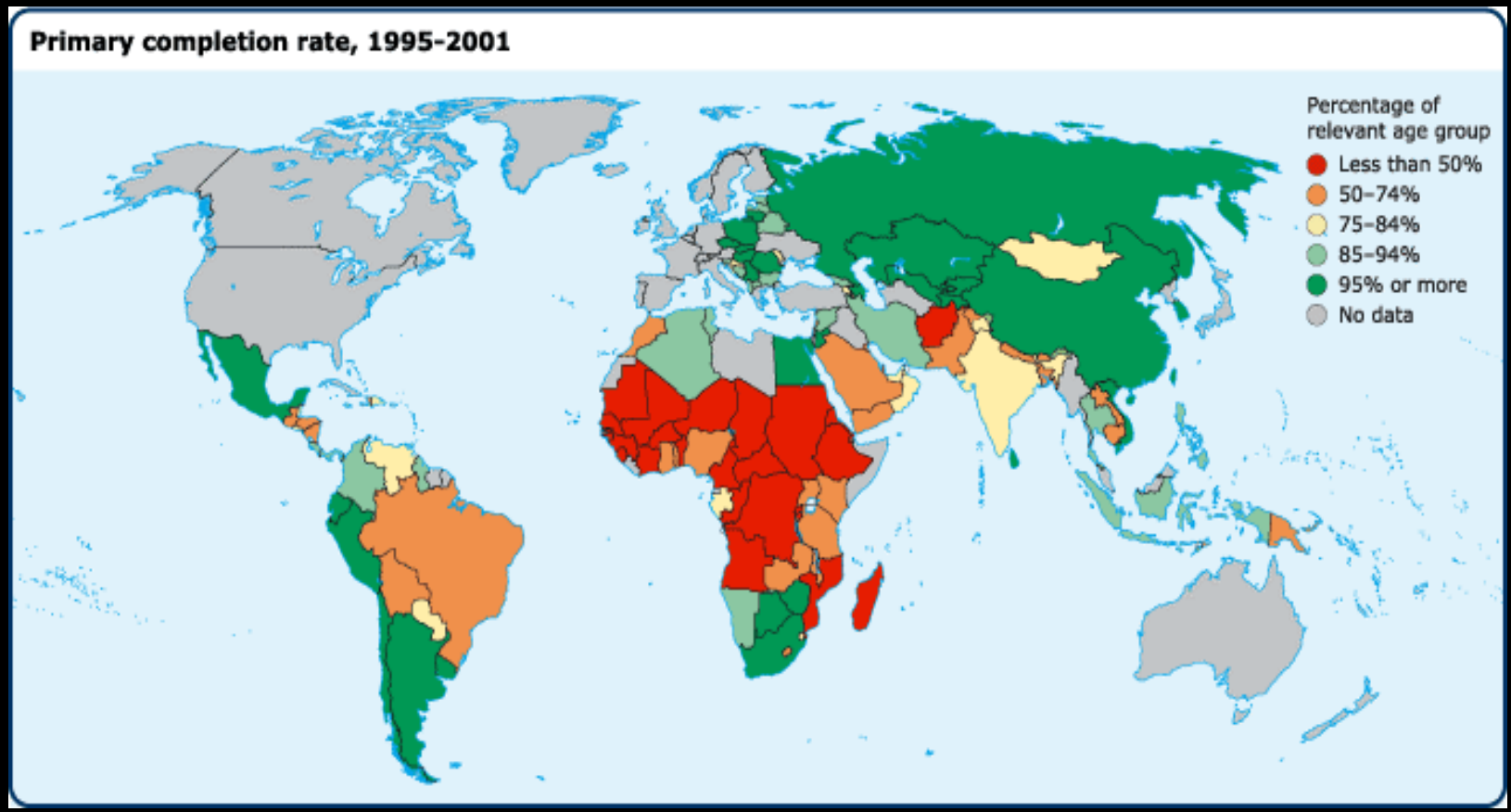
Why do they matter?



AFRICA 2015
For an AIDS-free generation


Primary completion rate, 1995-2001
Percentage of relevant age group
Less than 50%
50–74%
75–84%
85–94%
95% or more
No data


Carbon dioxide emissions, 1999
Metric tons per capita
10.0 or mor
5.0–9.9
2.5–4.9
1.0–2.4
Less than 1.0
No data


Primary completion rate, 1995-2001
Percentage of relevant age group
Less than 50%
50–74%
75–84%
85–94%
95% or more
No data

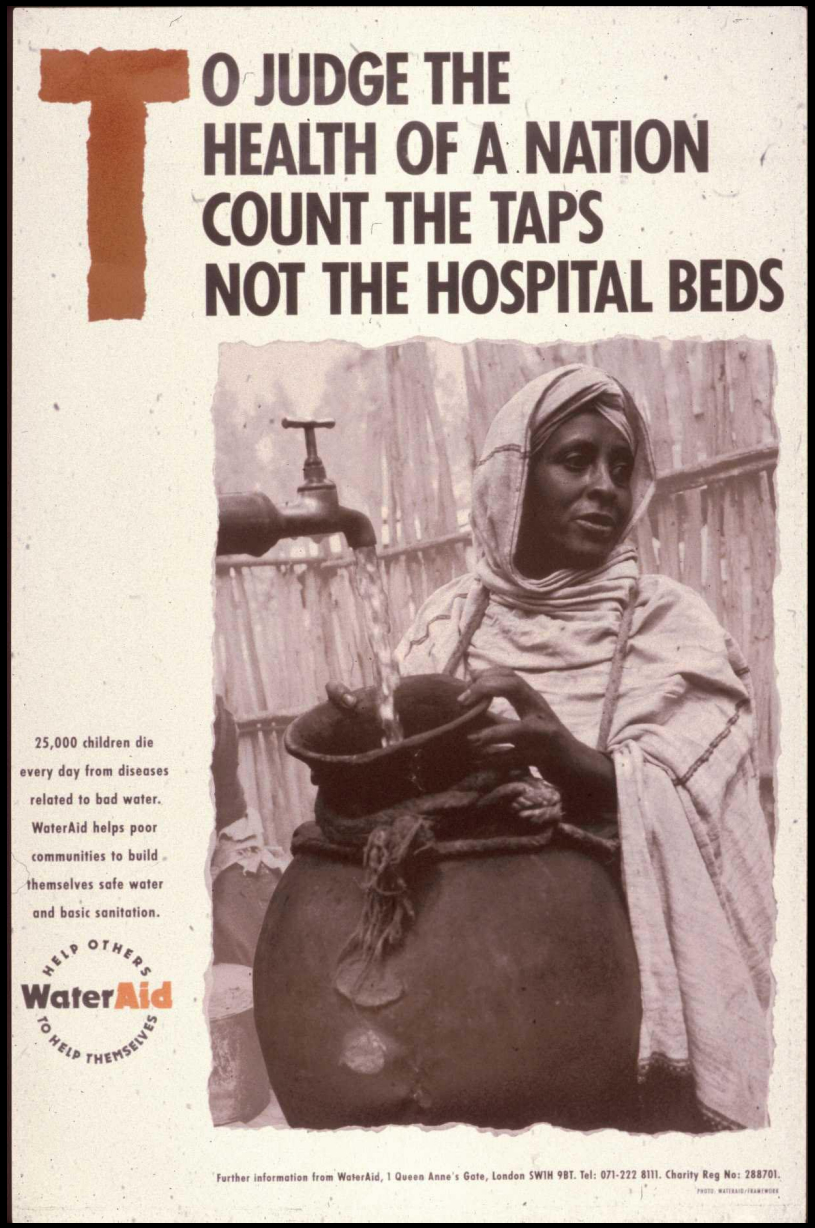
- World population becoming more urbanised – 60% by 2025
- Greatest effect in LDC's
- Currently 5 bn, split 3 bn rural; 2 bn urban
- By 2025, 6.6 bn, split 3 bn rural; 3.5 bn urban
  - Urban growth a combination of endogenous growth and rural migration

David Cook and John Kirke
"Urban Poverty: addressing the scale of the problem"
(Municipal Engineer 156 ME4, 2003)

- 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
- Rebuilding of Trust, Partnership vital
- Land Reform

David Cook and John Kirke
"Urban Poverty: addressing the scale of the problem"
(Municipal Engineer 156 ME4, 2003)

Sustainability at the Wider Scale

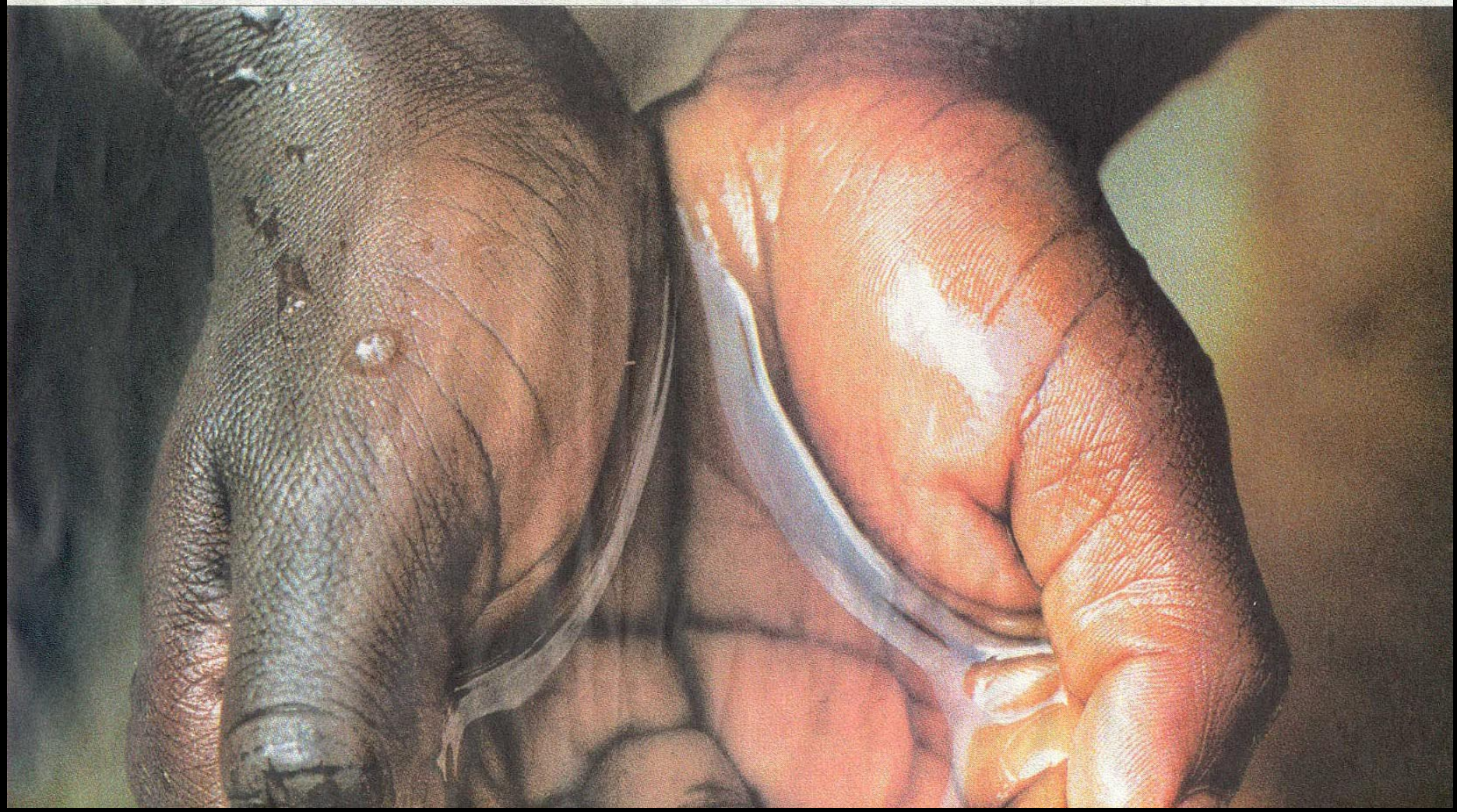


Disparity, Inequity, Environmental Justice

- Within Communities
- Within Countries
- Between Countries
- Across Continents
- Across Lifestyles

  (eg urban vs rural; artisan vs professional)

1.1bn people live without clean water ... **2.4bn** have no proper sanitation ... The UN promised to tackle the problem ... but every **15 seconds** a child dies from a water-related disease ... **This is the full story**



WHY WILL ACHIEVING THE MILLENNIUM DEVELOPMENT GOALS BE SO DIFFICULT?

Paradoxes of Integrated Development?

Paradox 1 "Lofty Goals and Achievable Components"

… China

Paradox 2 "Holism and Key Levers"

… Inexpensive Tampons

Paradox 3 "Top Down vs Bottom Up solutions"

… WTO; Poverty of Exclusion…

Gordon Conway, President, Rockefeller Foundation
Keynote Address, ECOSOC Brainstorming Dialogue Sessions
UN headquarters, New York, 24 March 2003

Do they matter?! – the Economists' View…

Lomborg's "Copenhagen Consensus" - an Economists' "Brains Trust" see www.copenhagenconsensus.com

- 8-strong panel of economists - 3 Nobel prize winners.
- ***"Given US$50 billion to solve the world's biggest problems, where would you spend the money?"***
- 13 opportunities eventually emerged. Top spot went to HIV/AIDS - an estimated $40 of benefit (personal and economic) expected for every $1 invested. Chances of success rated as extremely high.
- Opportunities to reduce malnutrition and malaria and improve water access and sanitation ranked near the top.

(Bjorn Lomborg: author of "The Skeptical Environmentalist")

www.copenhagenconsensus.com

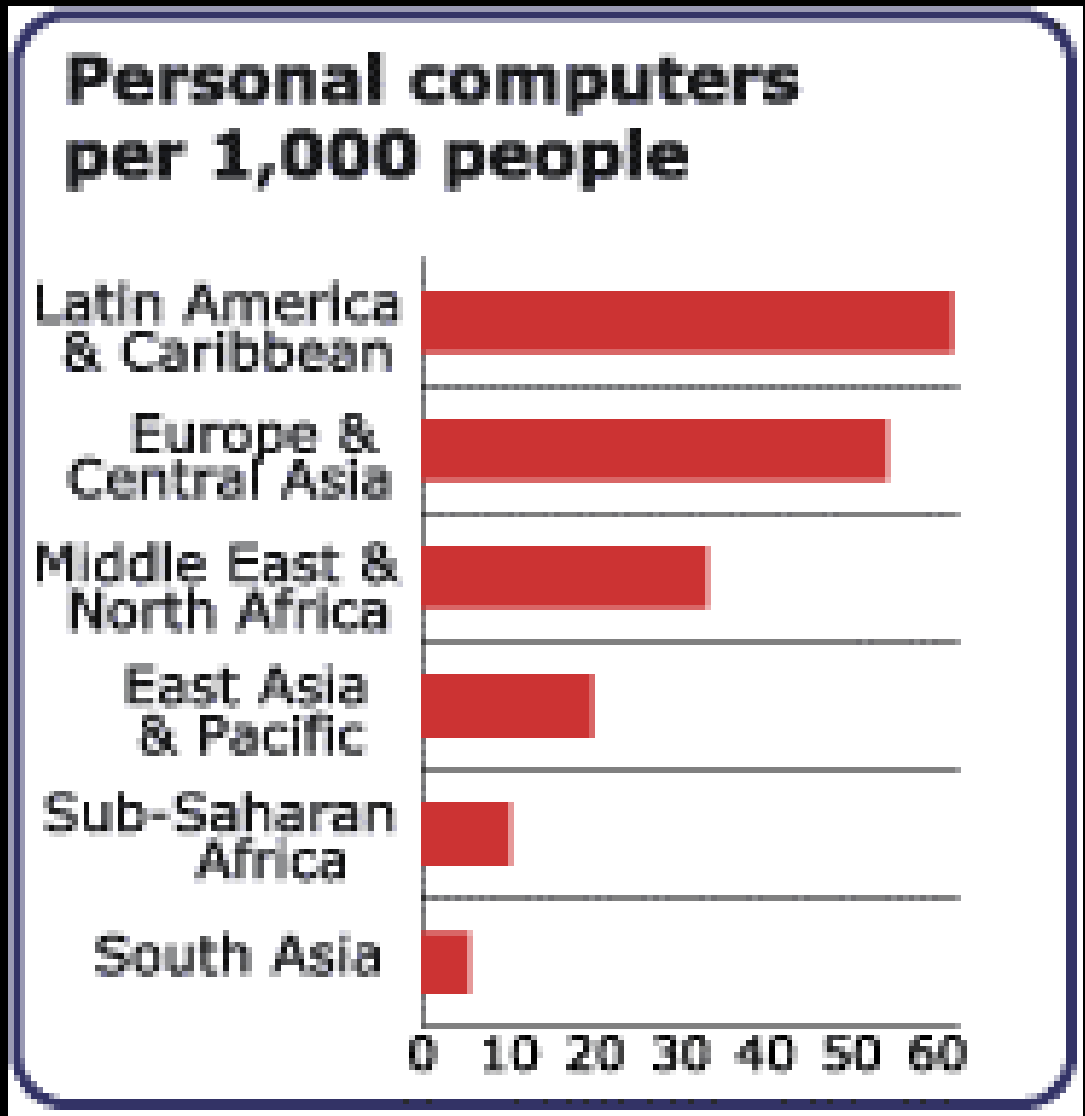
- 4 opportunities rejected by the jury as "bad" investments.
- 3 of them were options to tackle climate change.
- The Kyoto Protocol calculated to require $94 trillion of expenditure for $166 tn of benefits.
- Cost-benefit ratio of $1:$1.77 looked a poor choice compared to the $1:$40 achievable for the same money spent on HIV and AIDS.
- Also far less certain to produce results.
- ***…..but still > 1!***

www.copenhagenconsensus.com

Jury member Thomas Schelling, a US economist who cut his teeth on the Marshall Plan 50 years ago, was even more candid.

"My first thought was to put gender issues at the very top of the list. But then I thought what are the chances of us changing the culture in India or Brazil or wherever?

We've no idea how we even begin to do that. So women's inequality didn't even make it into my top ten."


Personal computers per 1,000 people
Latin America & Caribbean
Europe & Central Asia
Middle East & North Africa
East Asia & Pacific
Sub-Saharan Africa
South Asia
0
10
20
30
40
50
60

But … it's dangerous to be overly influenced by economic theory…

…. Geoffrey Heal (Columbia Business School) on the use of discounted cash flow/NPV methodology….

"Discounting present world GNP over 200 years at 5%, is worth only a few hundred thousand dollars, the price of a good apartment.

"Discounted at 10%, it is equivalent to a used car.

"On such valuations, it is irrational to be concerned about global warming, nuclear waste, species extinction and other long run phenomena. Yet societies are worried about these issues, and are actively considering devoting very substantial resources to them"

MILLENNIUM DEVELOPMENT GOALS

ERADICATE EXTREME POVERTY AND HUNGER

TARGET FOR 2015: Halve the proportion of people living on less than a dollar a day and those who suffer from hunger.

ACHIEVE UNIVERSAL PRIMARY EDUCATION

TARGET FOR 2015: Ensure that all boys and girls complete primary school.

PROMOTE GENDER EQUALITY AND EMPOWER WOMEN

TARGETS FOR 2005 AND 2015: Eliminate gender disparities in primary and secondary education preferably by 2005 and at all levels by 2015.

REDUCE CHILD MORTALITY

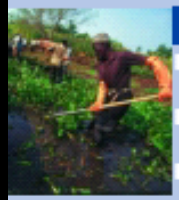
TARGET FOR 2015: Reduce by two thirds the mortality rate among children under five.

IMPROVE MATERNAL HEALTH

TARGET FOR 2015: Reduce by three quarters the ratio of women dying in childbirth.

COMBAT HIV/AIDS, MALARIA AND OTHER DISEASES

TARGET FOR 2015: Halt and begin to reverse the spread of HIV/AIDS and the incidence of malaria and other major diseases.



ENSURE ENVIRONMENTAL SUSTAINABILITY

- Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources.
- By 2015, reduce by half the proportion of people without access to safe drinking water.
- By 2020, achieve significant improvement in the lives of at least 100 million slum dwellers.

DEVELOP A GLOBAL PARTNERSHIP FOR DEVELOPMENT

- Develop further an open trading and financial system that includes a commitment to good governance, development and poverty reduction — nationally and internationally.
- Address the least developed countries' special needs, and the special needs of landlocked and small island developing states.
- Deal comprehensively with developing countries' debt problems.
- Develop decent and productive work for youth.
- In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries.
- In cooperation with the private sector, make available the benefits of new technologies — especially information and communications technologies.

Exactly what is the Engineer's role in achieving the MDGs??

And what is ICE's Role??

Society's Expectations of the engineer in the 21st century?

- Do they have any?
- Are they aware of what the engineer does?
- And if so, are they interested in "infrastructure" or what it achieves?
  - eg "Roads" vs "Access/Mobility"??
  - eg "Power Stations vs "Heat, Light and Energy"

- How can we find out?

"Engineering without Frontiers" - work in progress…

- Two Meetings of the Commission to date
  - 1 The Global Agenda **
  - 2 The "Local" Agenda

- EwF Evidentiary Hearing: The Global Agenda **

  Four Headline Issues

  1. Education, CPD & the Role/Leadership of Youth
  2. Appropriate structures in the Industry – Enablement/Recognition
  3. Appropriate Standards/Knowledge
  4. High Level Issues – Effective Delivery

Key Outcomes so far…

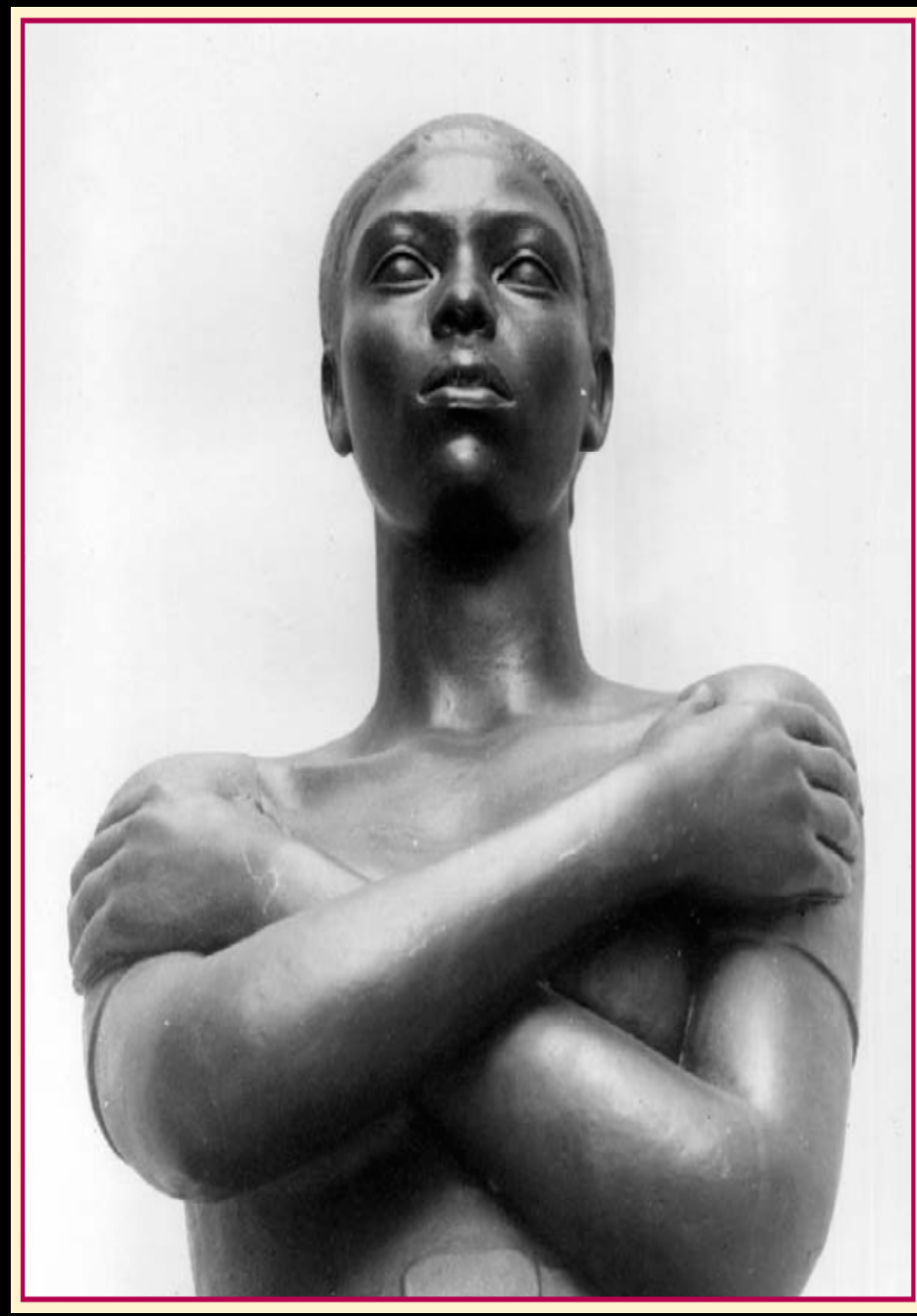
1 The Energy of Youth…

- They want to be involved!
- They have values, commitment, energy..
- Can it be recognised and "captured" without suffocating it?
- Engineering? Can it resonate with/embrace wider personal characteristics. ("red/blue/green/yellow")

Youth?

The Evidence?

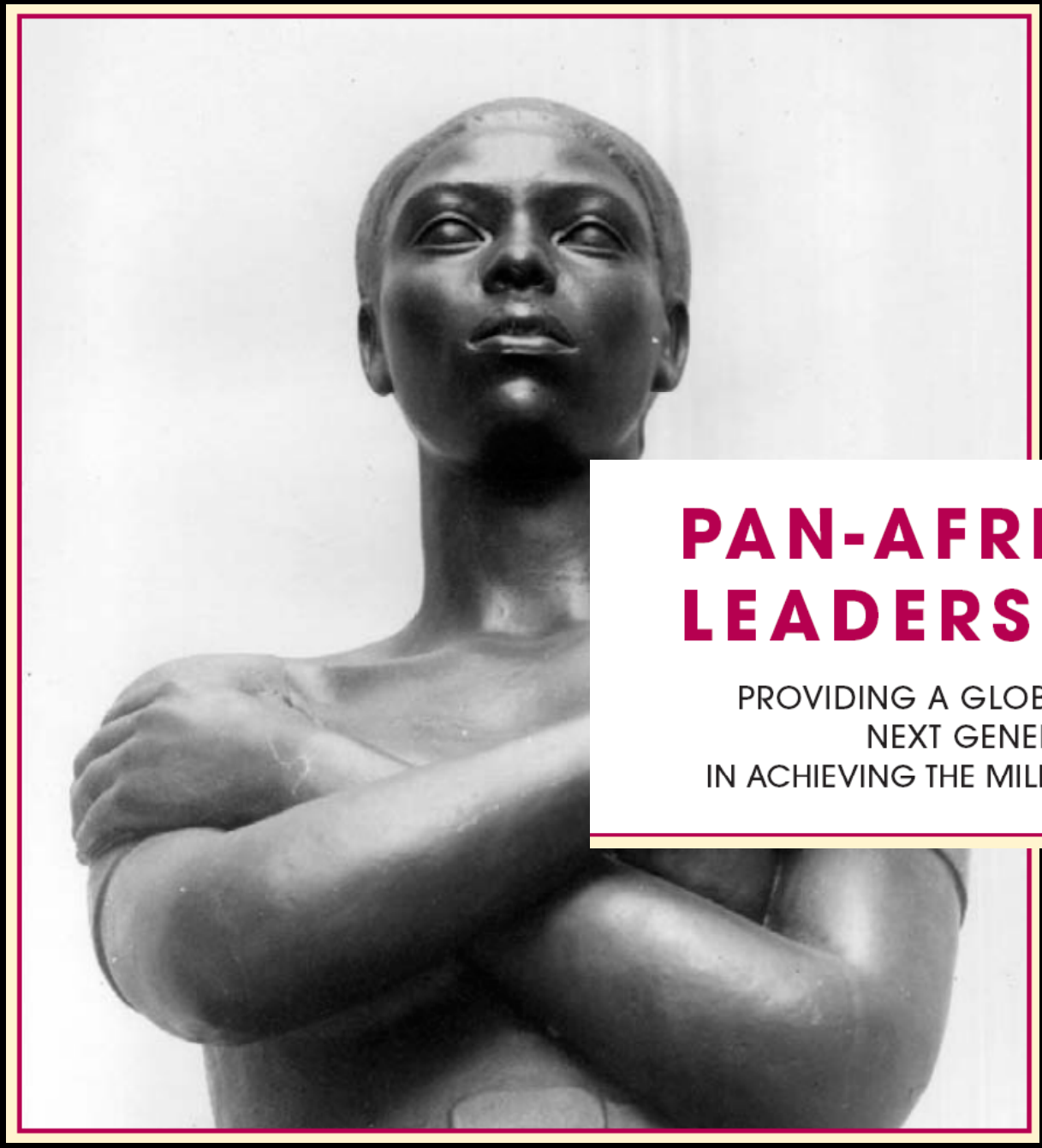
- "Engineers without Borders"
  - Now there's a coincidence …..
- ICE GSNC
- Africa…..



engineers without borders
ingénieurs sans frontières
Canada

Engineers for a
Sustainable World

ESW NATIONAL CONFERENCE 2004 · SOLUTIONS FOR A SHRINKING PLANET ·

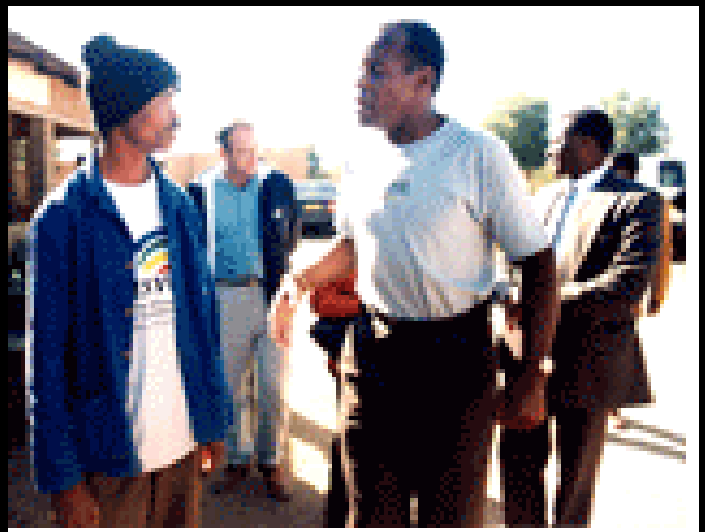


PAN-AFRICAN YOUTH LEADERSHIP SUMMIT

PROVIDING A GLOBAL PLATFORM FOR AFRICA'S
NEXT GENERATION OF LEADERS
IN ACHIEVING THE MILLENNIUM DEVELOPMENT GOALS

Pan African Youth Summit

www.africa2015.org.doc



UNDP Goodwill Ambassador Danny Glover having a discussion with members of a local youth group;

Baaba Maal performing at a function organized to announce his nomination as a UNDP Youth Emissary

Graduates and Students National Committee (GSNC)

2003 to 2004

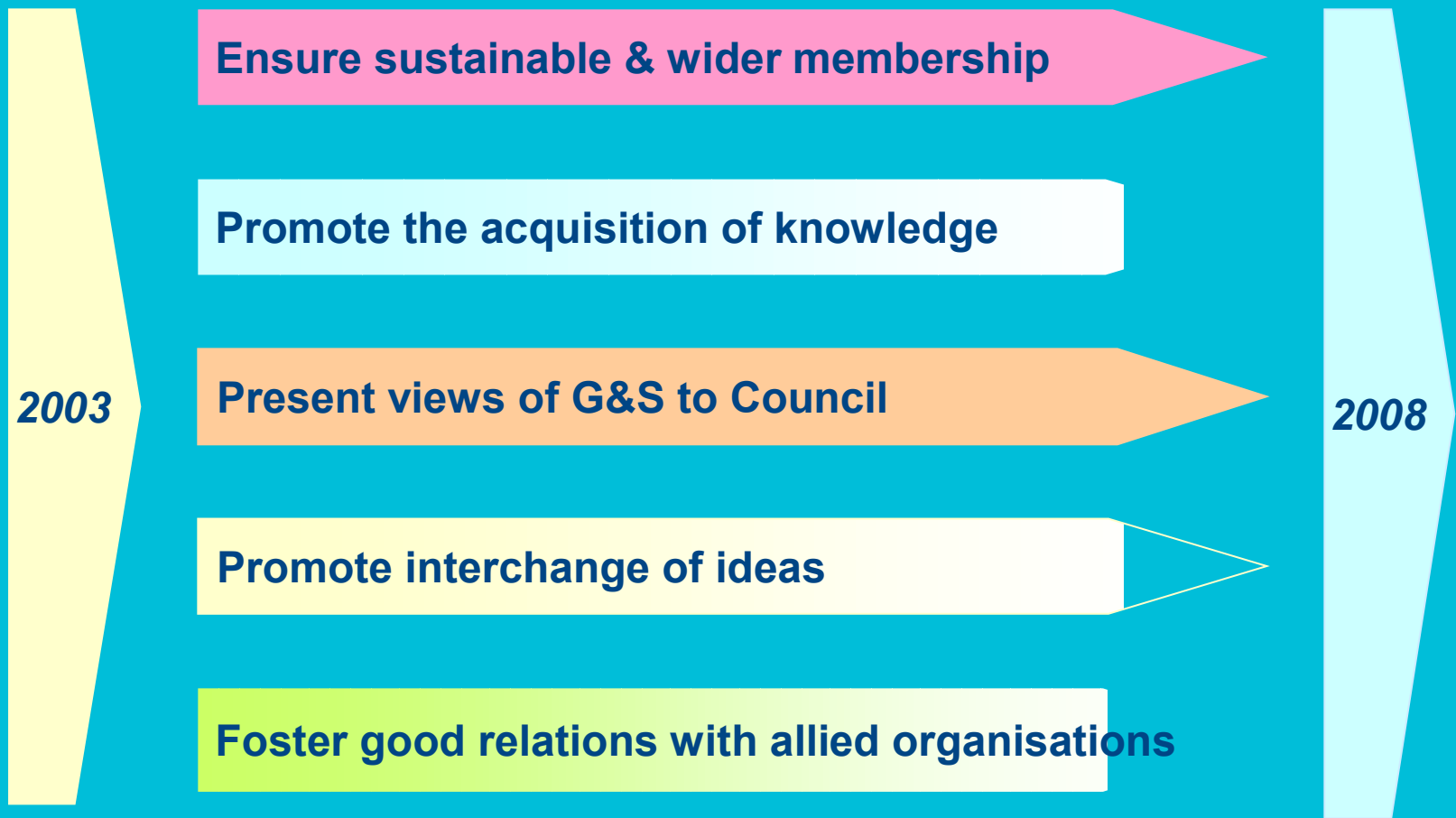
Marcus Rooney
GSNC Chairman

Institution of Civil Engineers

What do G&S Members want?

1. Reputation of the ICE
2. Recognised professional qualification
3. High professional standard for membership
4. Importance of civil engineering in society
5. Raise the profile of civil engineers
6. Encourage young people into civil engineering

GSNC Objectives



Council

- 2 full voting representatives on Council
- 1 Liaison Member of Council
- 1 observer (GSNC Chairman)

Presidential Team

- GSNC Chairman

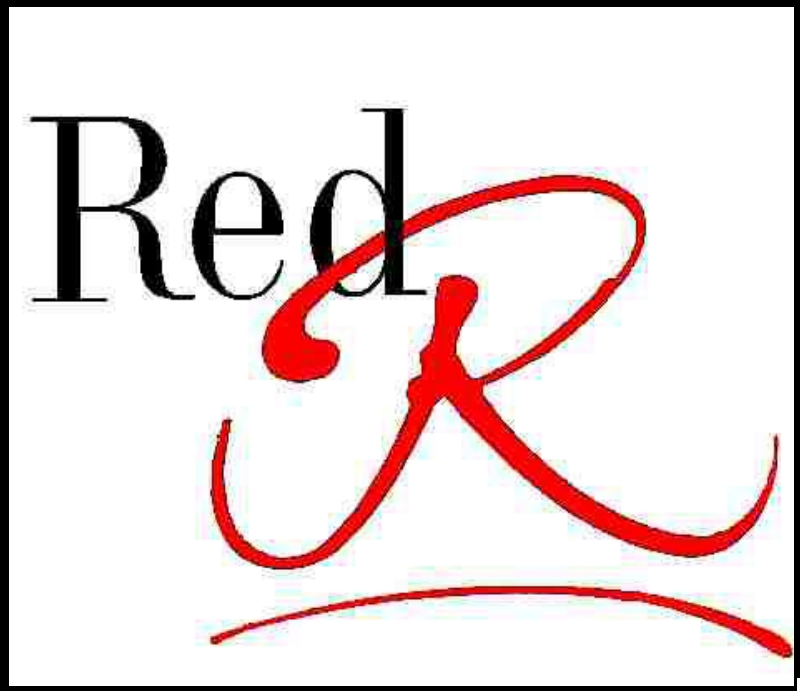
Presidential Commission

- Lisa Kelvey

Key Outcomes so far…

2 Knowledge/Capacity Building

- ICE as a Learned Society
- ICE as a Learning Society
- ICE as a Knowledge Sharing Society
- How to share it…. ??
- Through ICE's International network of members and regional associations…

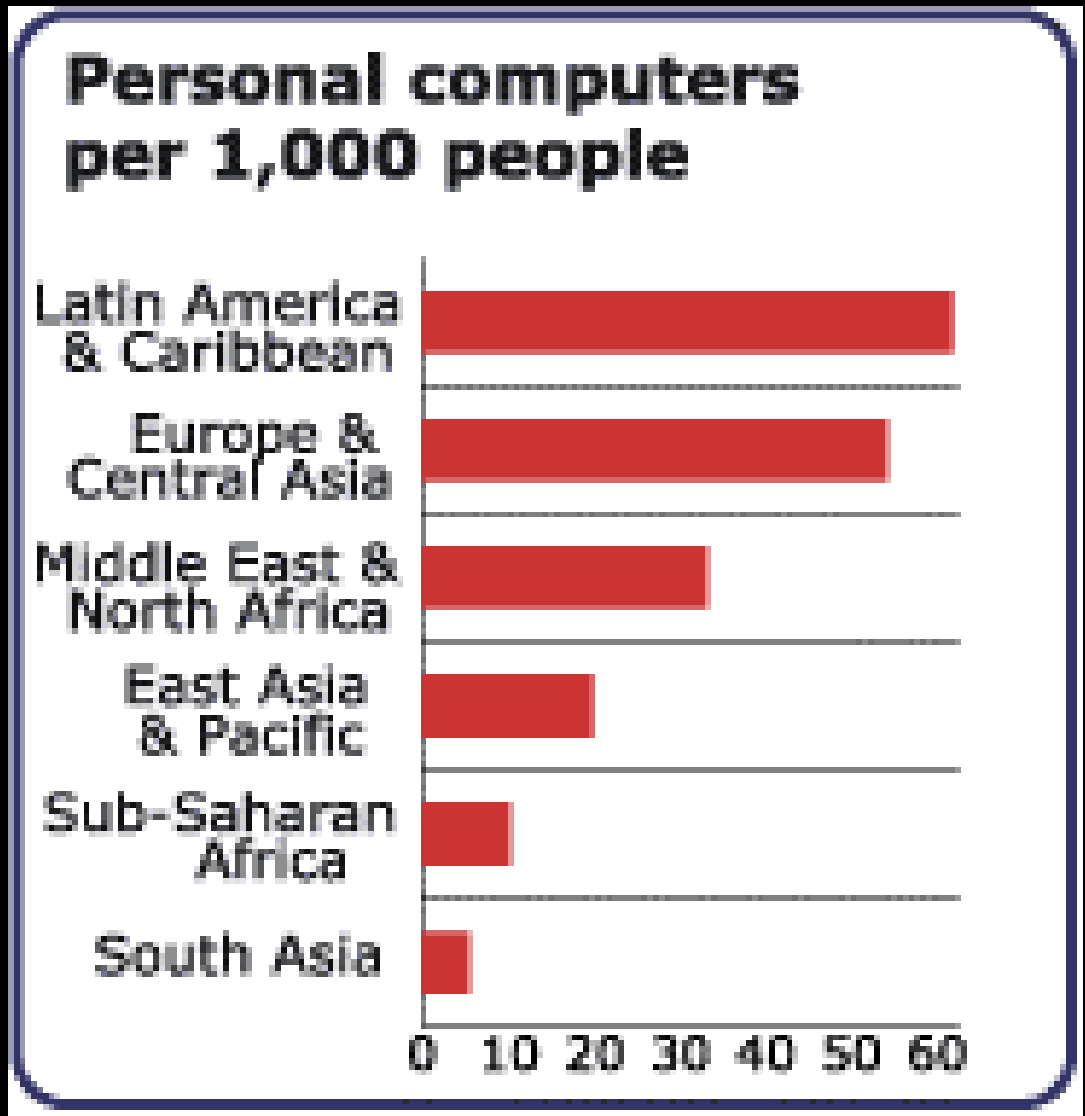


ENGINEERS
AGAINST
POVERTY

In 1979, Peter Guthrie was seconded by his employer, Scott Wilson Kirkpatrick, to work as a engineer in the Vietnamese refugee camps in Malaysia.

Peter saw that while engineers had an important role to play in reducing the human suffering in emergencies, front-line agencies faced great difficulties in identifying and recruiting such staff.

Back in England, after discussions with friends and colleagues, Peter founded "Registered Engineers for Disaster Relief"


Personal computers per 1,000 people
Latin America & Caribbean
Europe & Central Asia
Middle East & North Africa
East Asia & Pacific
Sub-Saharan Africa
South Asia
0
10
20
30
40
50
60

Key Outcomes so far…

3 **Appropriate Standards**

- Appropriate to local circumstances, resources and capacity
- But progressive….

Key Outcomes so far…

4 Transparency

The need for transparency in international development projects –

Avoiding "graft"

The need for <u>Governance</u>

ICE news

Reported by Ruby Kitching
ruby.kitching@construct.emap.com
ICE on the web: www.ice.org.uk

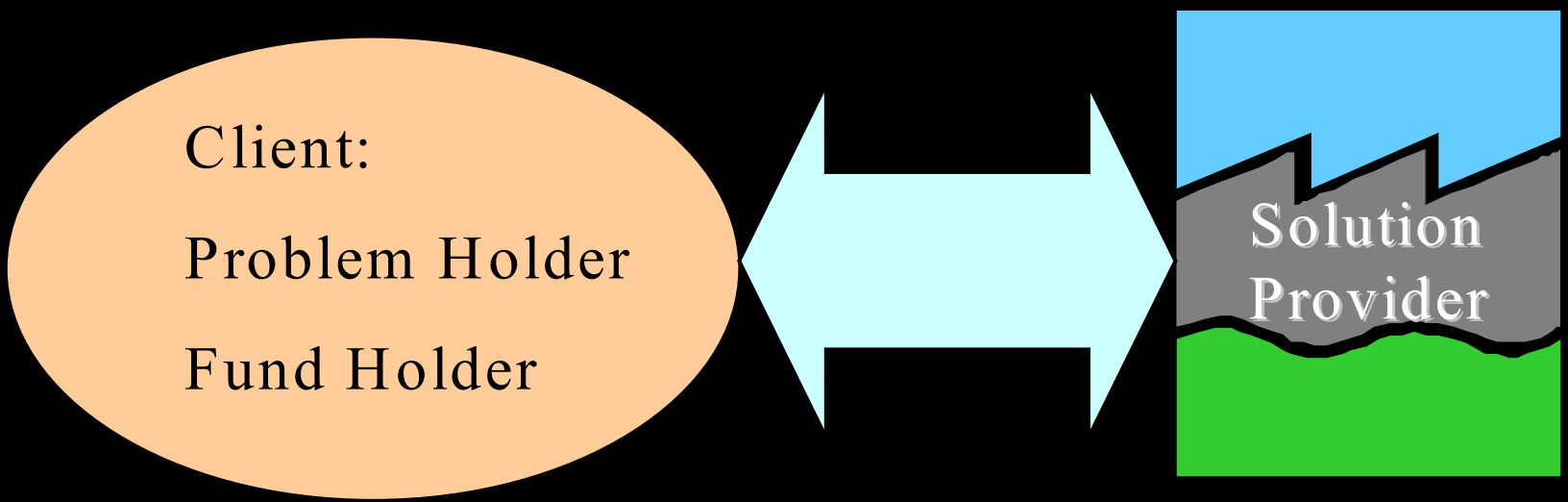
ICE joins talks to stamp out industry corruption

"We want to hammer home is that accepting bribes even on behalf of a company is a criminal offence and individuals could face jail sentences of up to 10 years."

Business Model A:

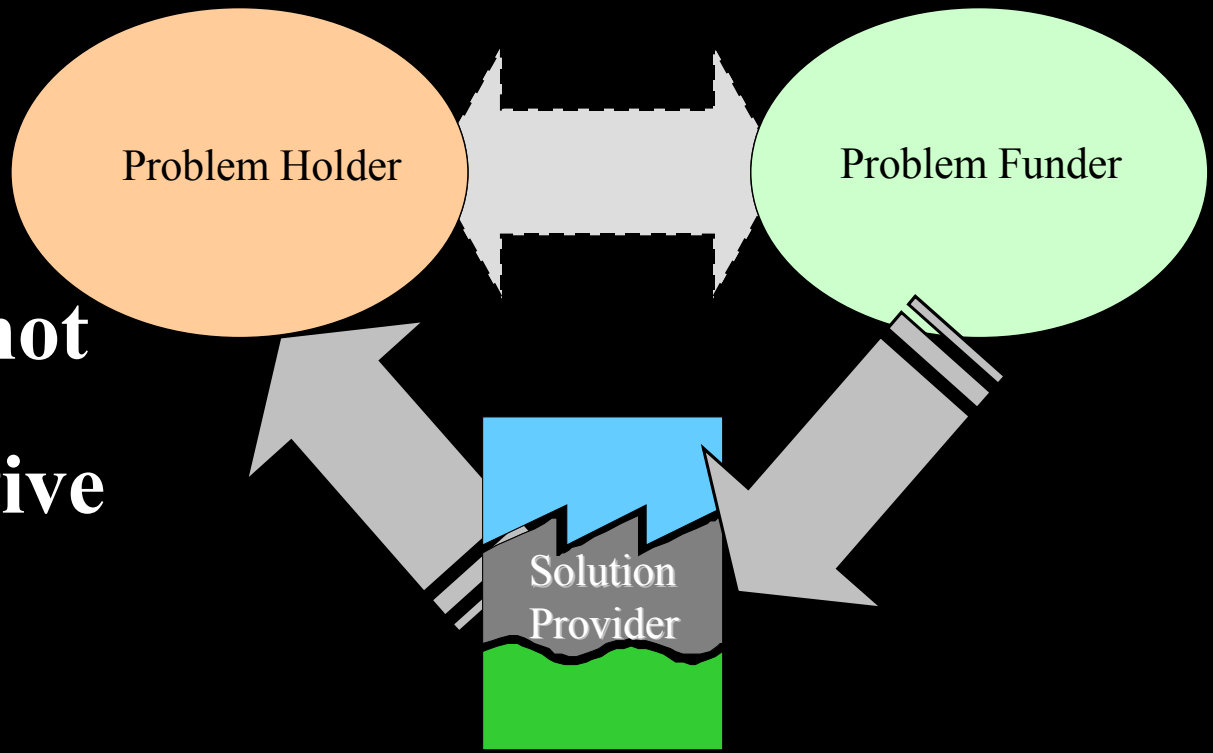
1. **Problem Holder has the Funds**
2. **Solution Provider has the skills**

Not working…..



Business Model B:

1. Problem Holder has the Problem!
2. Solution Funder can will the Funds
3. Solution Provider has the vision and the skills



This Model not always effective either

- **Distrust**
- **Role of the Private Sector in public services….**
- **PSP/PFI/PPP?**

New Model required which recognises the community, the funder, NGO's, the Professions, the Private Sector….

Key Outcomes so far…

5 The MDG's are about Outcomes not Artefacts…..

Delivery, Delivery, Delivery…..

MDGs as an exercise in

"Procurement/Project Management"??

<u>A "Pain and Gain" JV?</u>

“Engineering without Frontiers”

Still very much “Work in Progress”

"Change happens when people who do not usually speak are heard by people who do not usually listen"

- J D O'Brien

(by the way, who is J D O’Brien?)

Thomas Tredgold's 19th c definition of Civil Engineering

Civil Engineering is the art of directing the great sources of Power in Nature for the use and convenience of man;

a 21st c definition of Civil Engineering

Civil Engineering is the art of working with the great sources of Power in Nature for the use and benefit of society

Skegness, England

Hicks Bay, New Zealand

The issues are clear! ….

….So do something!