



Sustainability – a task for engineers

Report from the
Presidential Task Committee on Sustainability
Chair - Gerry Te Kapa Coates
IPENZ President 2003-2004

Members of the Committee

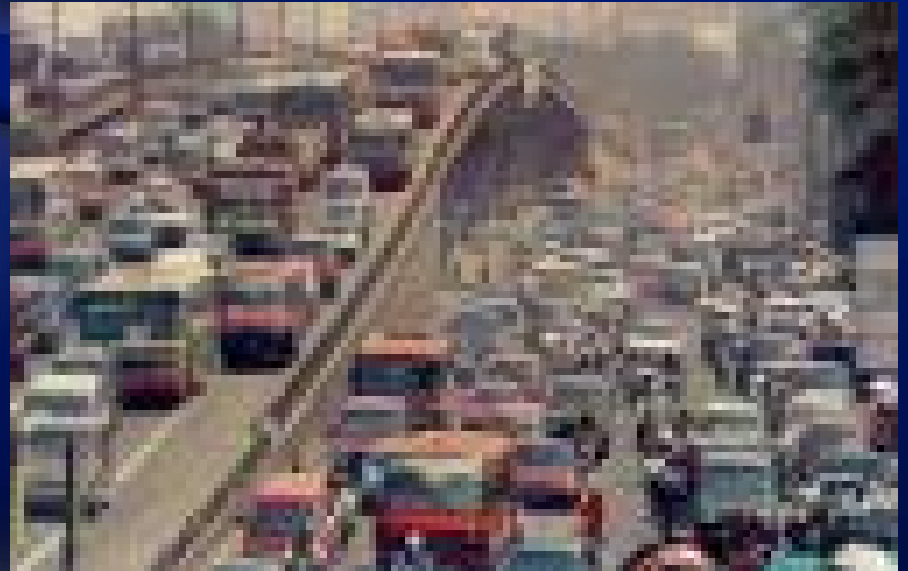


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Sustainability

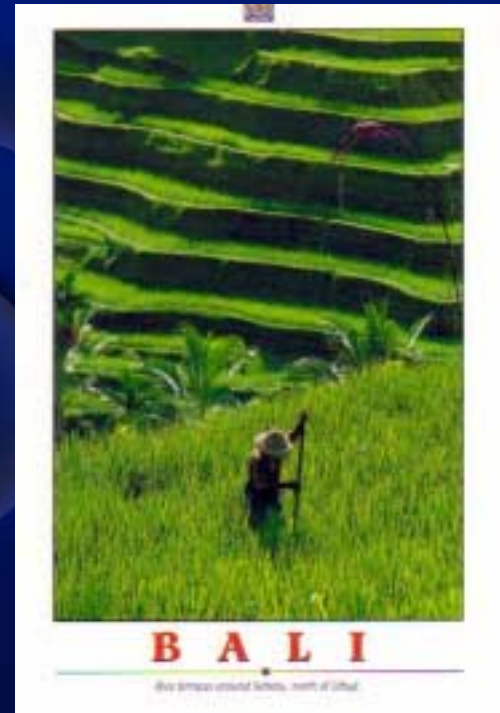
– What is it?

- Many definitions
- Long term survival of humanity
- Over what time scale?
- Assumptions?
- Paradigm shifts in thinking needed

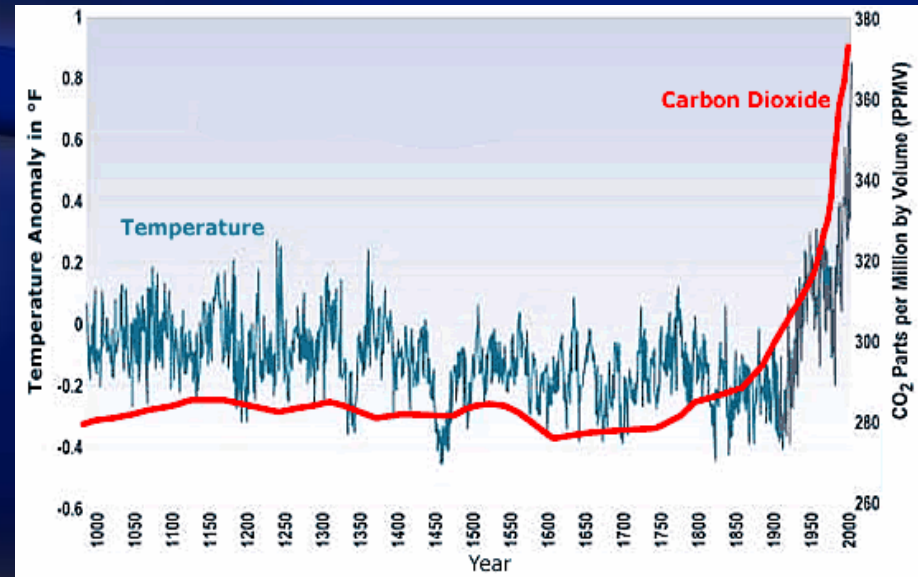


Sustainability Principles

- Principle 1:
 - Maintaining the viability of the planet
- Principle 2:
 - Providing for equity within and between generations
- Principle 3:
 - Solving problems holistically



Sustainability & Engineering



- Managing changes in the environment
- Equity and safety of engineering activities – quality of life
- Problem solving – holistically
- Past problems – remediation

Engineers – What can we do?



- Sustainable Resources and Production
- Sustainable Energy
- Sustainable Transportation
- Sustainable Water
- Sustainable Solid Waste

Sustainable Resources and Production



**Dr Carol Boyle, International Centre for Sustainability
Engineering and Research, University of Auckland**

Sustainability of Resources and Products

- The use and waste of resources is increasing significantly
- For every kilogram of product, kilograms of material are moved, energy is consumed and pollution contaminates soil, water and air
- For example, a 10 gm gold ring requires the shifting of over 5 tonnes of material
- A 24 kg computer requires 22 kg of chemicals, 1500 kg of water and 240 kg of fossil fuels

Sustainability of resources

- Effects on resources from use
 - Contamination
 - Degradation
 - Dispersion
 - Consumption
 - Loss
- Sustainable management of resources can include recycling and reuse but the overall system has to be evaluated to determine the sustainability of the system over time

Sustaining resources

- The risk of using a resource can be assessed from assessing the type of the resource and the potential effects from its use
- The short, medium and long term risk to the environment, society and business needs to be defined
- Such a risk then indicates the risk to sustainability of that system

Engineers and resources

- In order to achieve sustainability, it is thought we will have to reduce our resource consumption by a factor of 10-50 fold
- This will require more than simple cleaner production, recycling or reuse
- It will need rethinking of the technologies and products we produce and the services they provide

Engineers and resources

- Engineers need to take responsibility for the technologies and products they design and produce
- They also have to clearly understand the risks faced by society and the environment from over-consumption of resources
- Engineers need to lead the way in sustainable use of the planet's resources

Sustainable Energy



Ian Shearer, Energy Information Services Ltd

Sustainable Energy essential for Sustainable Development

- Sustainable use of planetary energy resources must support the wellbeing of all present and future inhabitants.
- Sudden global warming “could result in catastrophic breakdown in international security” and nations fighting “wars over food, water & energy.” (US Pentagon Report)

Where to from here?

- Climate change is inevitable and has begun. We must stop further damage.
- There will be costs involved in moving towards less dependence on fossil fuels. But there may be a much bigger price to pay if we don't!
- The mix of energy sources needs change.
- Sustainable energy sources must account for 75% of all energy use by 2050.

NZ in Focus

- **Around 29% of consumer energy is from renewable sources.**
- **Govt. targets are 20% improvement in efficiency and 30PJ/year more renewable energy by 2012.**
- **Climate Change goal is “significant GHG reductions on ‘business as usual’ ... by 2012”**

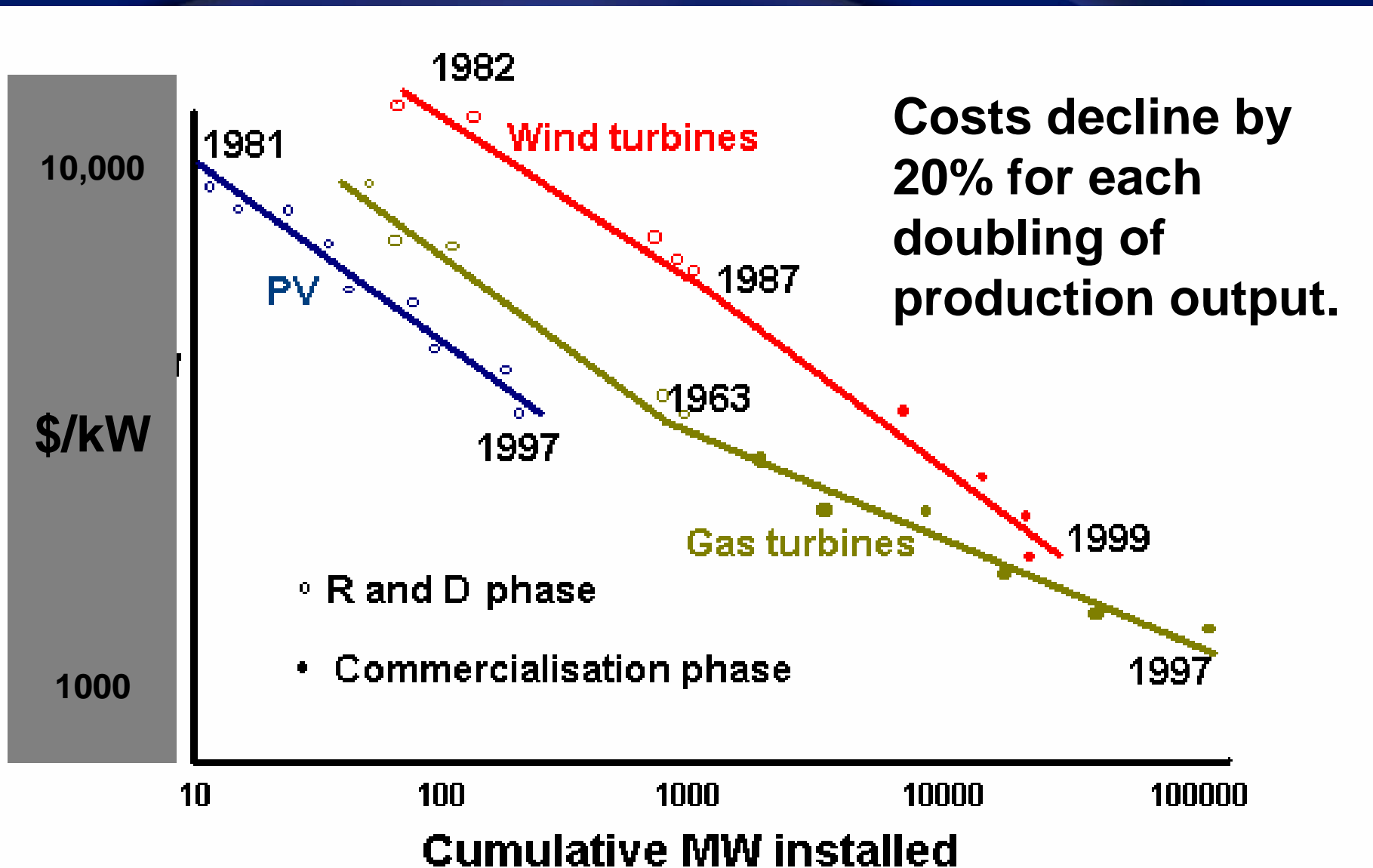
Could We Do More?

- **The Australian 2% mandatory renewable electricity target requires energy retailers to purchase 2% more renewable energy each year.**
- **This includes solar water heaters**
- **Their target is 34 PJ/year (9,500 GWh/y) by new renewable sources by 2010!**

Sustainable Energy Business Opportunities

- Hydro, geothermal, wind & solar water heating are mature energy technologies. These only need a level playing field to support their use.
- Bioenergy, wave, ocean currents, & solar PV are emerging technologies with huge potential for use in NZ. These need more R&D support.
- Kyoto should provide NZ with many international business opportunities.
- NZ industry can benefit from global trends towards sustainable energy sources and distributed generation technologies.

Technology costs continue to decline



Can Engineers Help?

- **There are excellent sustainable energy resources in New Zealand.**
- **Engineers, as technocratic members of society, must help our nation choose the sustainable energy future we wish our children to live in.**



The goal of a sustainable economy necessitates that sustainable energy sources must become dominant.

Engineers must become leaders in moving New Zealand to become the first nation to be both nuclear AND fossil fuel free!

Windflow Turbine



Solar Electric System



Wave Energy



Sustainable Transportation



Andrew Macbeth - MWH New Zealand Ltd

NZ Aspects of ST

- 30% of motor vehicle trips < 2 km; 60% < 5 km
- Transportation produces
 - 40% of NZ's CO₂ emissions
 - 15% of Greenhouse Gases
 - Fastest growing source of GHG emissions
- Policy framework
 - Transfund and Transit to achieve an:
*“integrated, safe, responsive and **sustainable** land transport system”*



Overseas Perspectives

- WA - Govt establishing code of practice for sustainability
- Europe - travel plans; car sharing; congestion pricing
- USA - Hunter Lovins et al
- Canada -
 - Assn Prof Engineers & Geoscientists BC
 - Centre for Sustainable Transportation
 - Victoria Transport Policy Institute
- WHO - worldwide traffic collisions epidemic



Implications for NZ Engineers

- Can't build our way out of congestion
- Need to move beyond “predict and provide”
- No longer “business as usual”
- Work with communities & be part of the solution



So many things to do...

- Accommodate pedestrians and cyclists in routine road design
- Reduce speeds in urban areas
- Support public transport



So many (more) things to do...

- Control urban sprawl; limit parking
- Walking school buses
- Congestion pricing; HOV lanes; travel plans; etc.

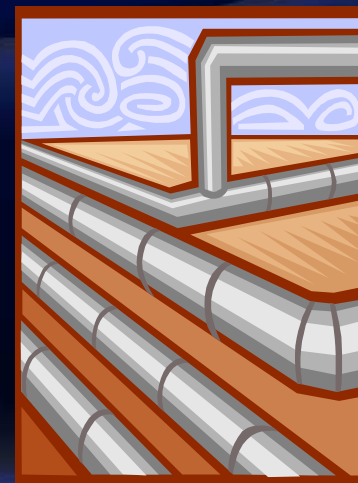


Conclusions

- Transportation is increasingly unsustainable
 - fuel, emissions, pollution
 - land use
 - congestion and economics
 - collisions, safety and health
- We need to work at many levels
 - transportation policy, planning and funding
 - land use planning
 - traffic engineering practice
 - day-to-day road maintenance operations
- Engineering community must lead and be seen to lead the way to sustainability



Sustainable Water Resources



Water Engineering Thinking

- Traditional approaches under question
(e.g. costs to upgrade and expand, potable water for toilet flushing)
- Process-Thinking to reflect WATER CYCLE
(integrated, localised, dynamic process)
 - Stormwater
 - Wastewater
 - Water Supply

NZ Water Policy Framework

- “Legislative framework...outdated and conflicting” (Parliamentary Commissioner for the Environment, 2001)



- Significant Local Government responsibility, ownership, management of water resources

e.g. “To implement sustainable, integrated water supply, stormwater and wastewater services that are in harmony with the natural water cycle” (NSCC Strategic Plan)

Sustainable Water Systems

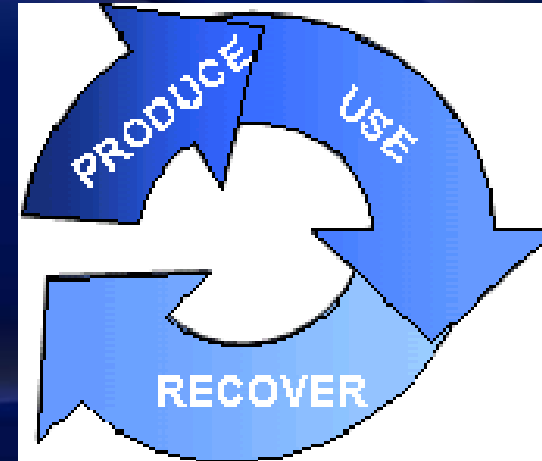
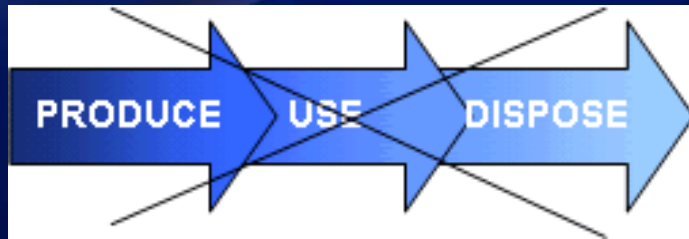
- *Priority:* Reflect Sustainability Principles (e.g. integration, ecological integrity, full cost, efficiency, community involvement)
- *Priority:* Managing demand and efficient use
- *Priority:* Low-impact, water-sensitive designs



So many things to do...

- Participate at the decision-making level
- Use Local Government influence
- Seek out more sustainable water technologies; make them competitive; “on the shelf”
- Future technologies — reuse waters, GIS, real-time modelling, integrated software models, new materials, smaller pipes, improved maintenance

Sustainability and Solid Waste



Nadine Wakim – Maunsell Ltd

NZ Waste Policy Framework

- Local Government Amendment Act 1996



- NZ Waste Strategy 2002 –
“Towards zero waste and a sustainable NZ”

- Ministry for the Environment –
leading central government role

- Important influence of industry

- Community participation

Changing Engineering Roles

➤ Traditionally:

- waste collection and disposal



➤ Recent focus:

- waste hierarchy and minimisation



➤ Sustainability future roles?

- waste minimisation; manage material flows; engineer products and processes

Priorities

- Consumerism – learn to consume; learn to live sustainably.

“A mark of how civilised a population is: what they start worrying about when their ordinary needs are met. An advanced civilisation might start being concerned about spiritual or philosophical questions. We go shopping.” (Anholt, 2003)

Priorities

- **Beyond Recycling** – avoidance, service vs. product, product redesign, closing the loop, lifecycle assessments (LCA), material/energy efficiencies.
- **Multi-disciplinary Action** - all sectors and communities, marketing, educators, designers, scientists, economists, engineers, developers, business sectors, community participation.



So many things to do...

- Establish targets. Monitor progress.
- Establish product and/or service preferences
- Support, promote & use sustainable technologies
- Incentivise contracts and pricing; landfill bans, levies, polluter pays, Extended Producer Responsibility (EPR)....
- Quantify real costs for production & disposal