CAST International Forum on Engineering Capacity
November 2018

Capacity Building for sustainable development through the International Engineering Alliance Accords

Em Prof Elizabeth Taylor AO

Deputy Chair Washington Accord

Chair Accreditation Board Engineers Australia

INTERNATIONAL ENGINEERING ALLIANCE

Sustainable Development

A fragile environment

An interdependent world

An aspiration to leave no one behind

Engineering Capacity Building

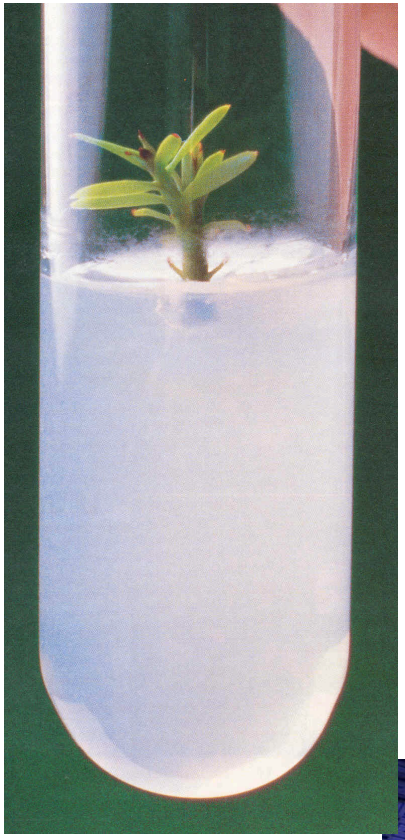
The International Engineering Alliance Accords

Establishing a global engineering education standard that drives sustainability

Facilitating engineering mobility – creating networks, sharing ideas

Building engineering capacity for sustainable development

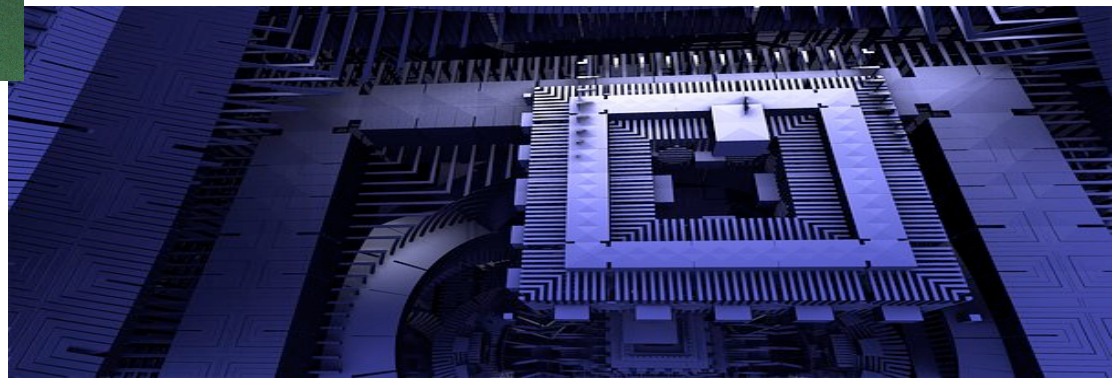
Working together to create a shared and better future



Engineering appears to be on the cusp of a new golden age.

The physical, digital and biological are blurring.

A melting pot of technologies and cyber-physical systems offer great potential and challenge.

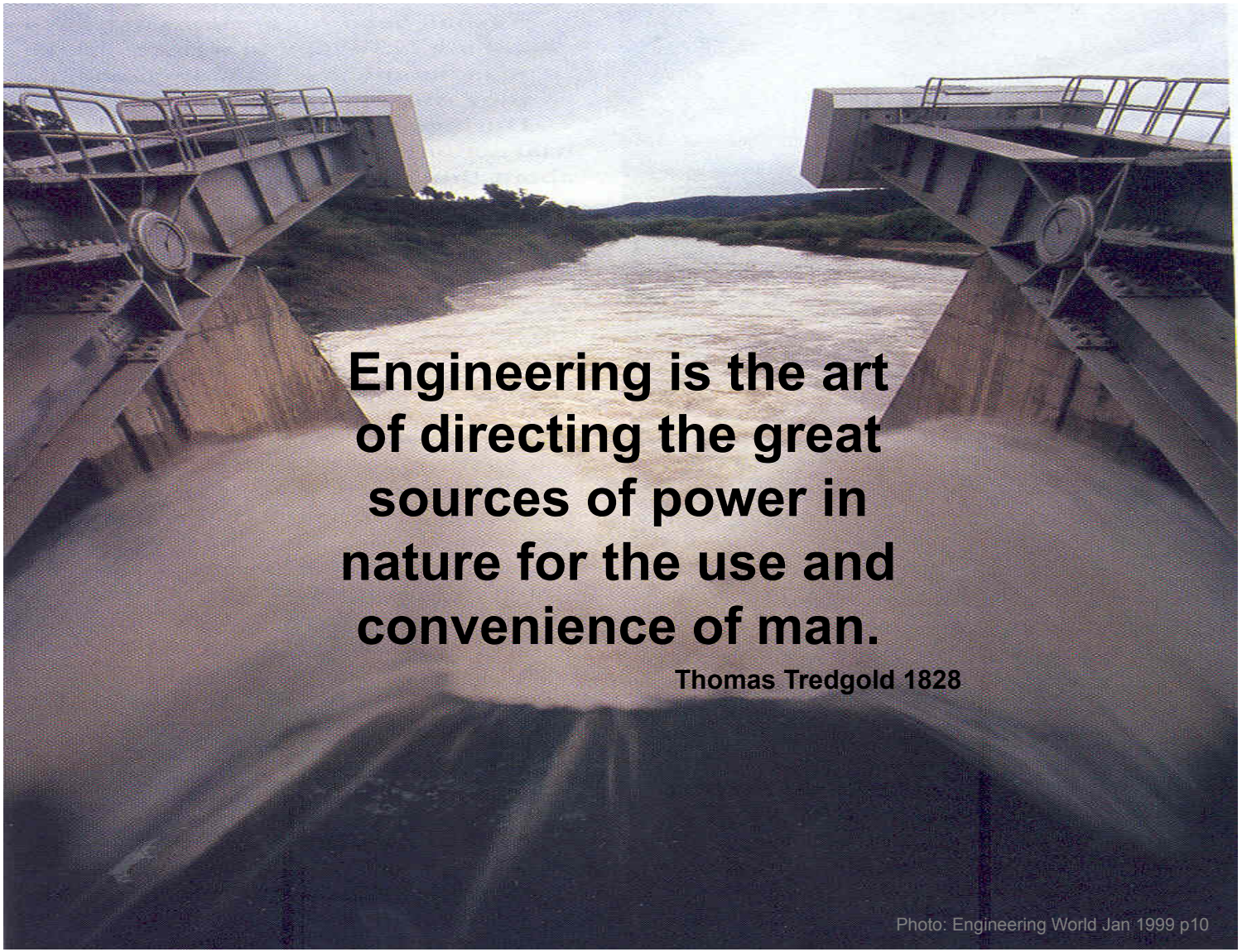


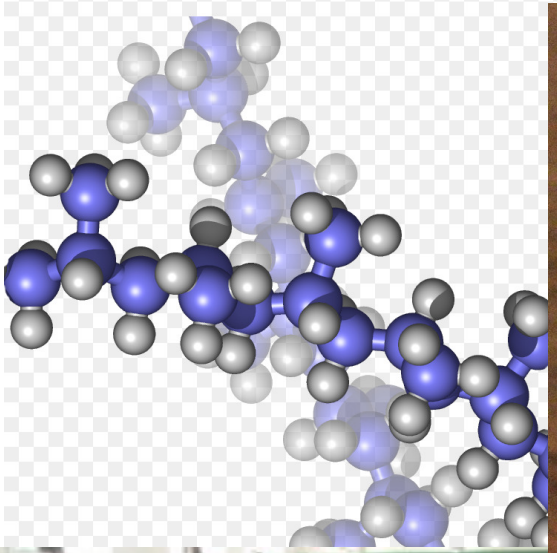
As with each Industrial Revolution, the benefits of this Fourth Industrial Revolution are being extolled:

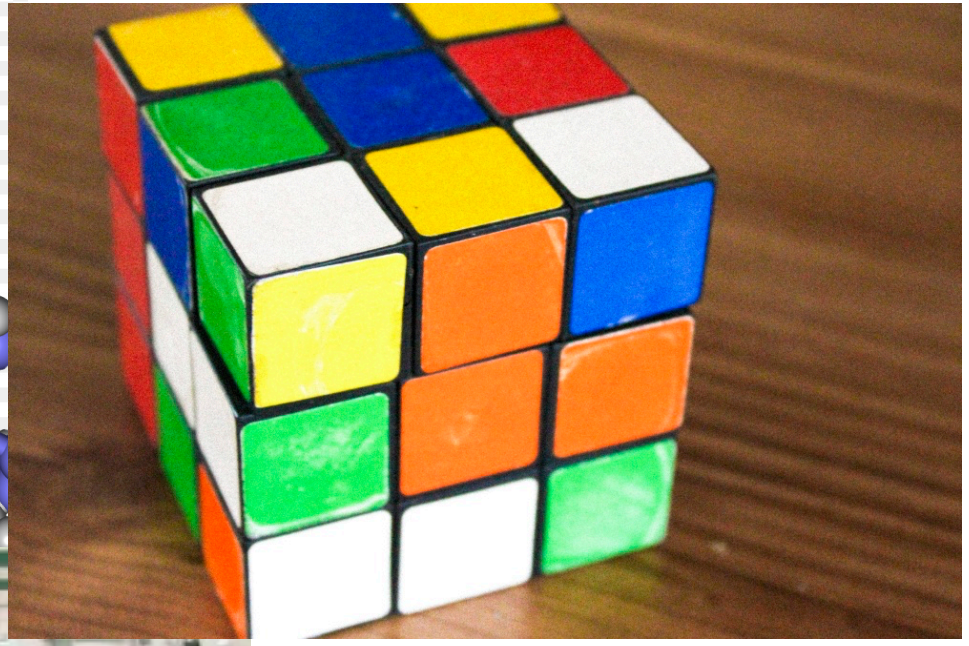
- Big data analytics capacity
- Data encryption depth
- Modelling power – climate, economic, biological systems

Within engineering circles discussion of the challenges generally revolve around accommodating emerging technologies:

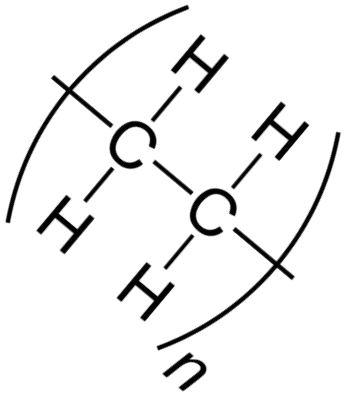
- Applied anthropomorphism in AI evolution
- Cyber Security and Privacy
- Genetic engineering/modification/manipulation


Engineering is the art of directing the great sources of power in nature for the use and convenience of man.
Thomas Tredgold 1828
Photo: Engineering World Jan 1999 p10



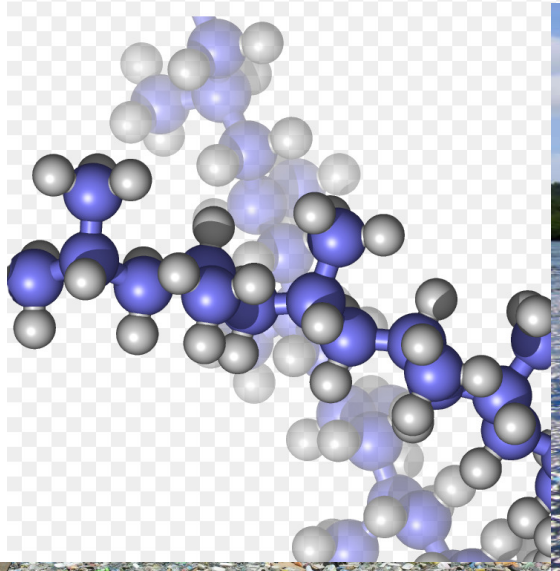


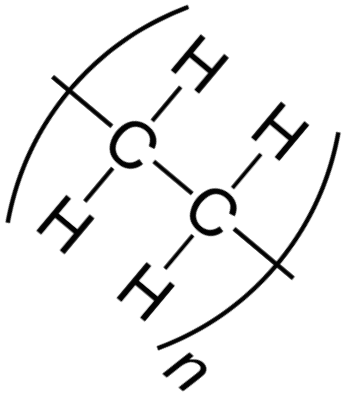
The story of plastic



We are the priests of material development, of the work which enables other men to enjoy the fruits of the great sources of power in Nature, and of the power of mind over matter. We are the priests of the new epoch – without superstitions.

George Morison, 1895
ASCE Presidential Address,

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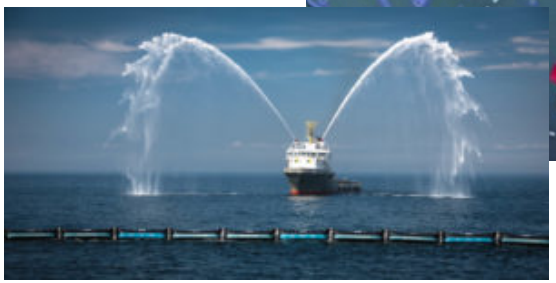
The more engineers create, the more they are required to create to control the ever emerging negatives that arise from their original actions.

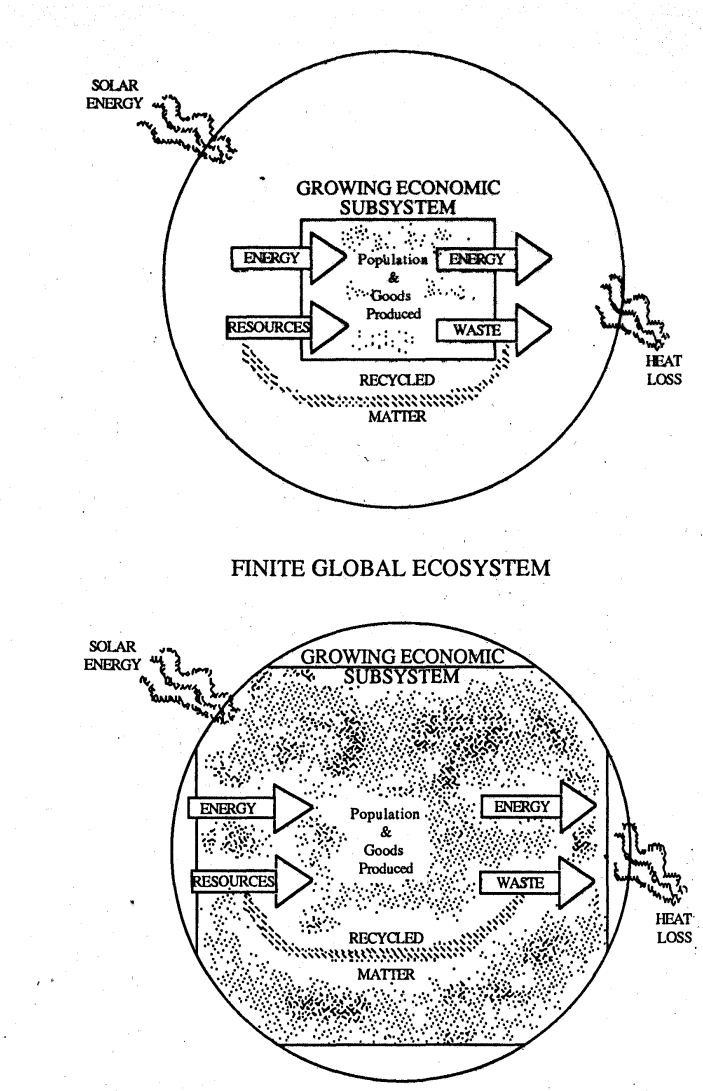


The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all.

They address the global challenges we face:

poverty,
inequality,
climate,
environmental degradation,
prosperity, and
peace and justice.

The Goals interconnect and in order to leave no one behind, it ís important that we achieve each Goal and target by 2030.



Robert Goodland & Herman Daly
Environment Department
World Bank 1991

Achieving Sustainable Development will require very different engineering capability to that which has underpinned progress to date.

Building engineering capability for sustainable development will require:

rethinking engineering capability

innovative educational models


The capacity of engineers to deal with complexity, environmental fragility and global interdependence will be crucial in determining what future we have

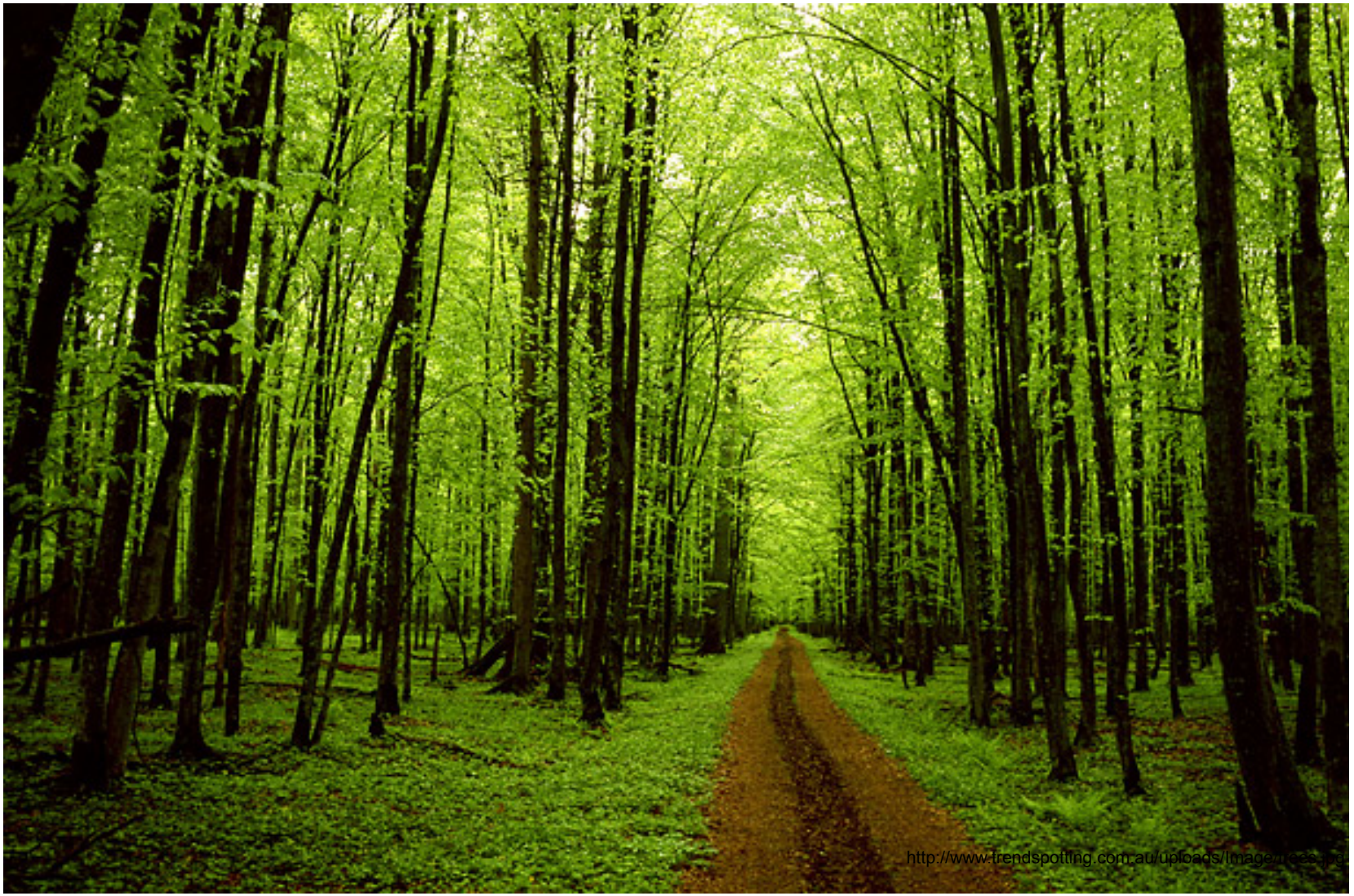
Accords:
Establishing a global engineering education standard that drives sustainability

E Taylor: data as at Oct 2018

2015 IEA/ENAEE publication: “Best practice in Accreditation”

Federation of Engineering Institutions in Asia and the Pacific (FEIAP) has developed an accreditation development pathway that facilitates IEA Accord signatory status.

World Federation of Engineering Organisations (WFEO), in partnership with IEA, established a project in June 2018 to address the needs of its members in the developing world, based on IEA standards.


http://www.trendspotting.com.au/uploads/Image/tree.jpg

Characteristic	**Professional Engineer**
Comprehend and apply universal knowledge:	**EC1:** Comprehend and apply advanced knowledge of the widely-applied principles underpinning good practice
Comprehend and apply local knowledge:	**EC2:** Comprehend and apply advanced knowledge of the widely-applied principles underpinning good practice specific to the jurisdiction in which he/she practices.
Problem analysis:	**EC3:** Define, investigate and analyse complex problems
Design and development of solutions:	**EC4:** Design or develop solutions to complex problems
Evaluation:	**EC5:** Evaluate the outcomes and impacts of complex activities
Protection of society:	**EC6:** Recognise the reasonably foreseeable social, cultural and environmental effects of complex activities generally, and have regard to the need for sustainability; recognise that the protection of society is the highest priority
Legal and regulatory:	**EC7:** Meet all legal and regulatory requirements and protect public health and safety in the course of his or her activities
Ethics:	**EC8:** Conduct his or her activities ethically
Manage engineering activities:	**EC9:** Manage part or all of one or more complex activities
Communication:	**EC10:** Communicate clearly with others in the course of his or her activities
Lifelong learning:	**EC11:** Undertake CPD activities sufficient to maintain and extend his or her competence
Judgement:	**EC11:** Recognize complexity and assess alternatives in light of competing requirements and incomplete knowledge. Exercise sound judgement in the course of his or her complex activities
Responsibility for decisions:	**EC12:** Be responsible for making decisions on part or all of complex activities

Washington Accord programme provides:

WK1: A systematic, theory-based understanding of the **natural sciences** applicable to the discipline
WK2: Conceptually-based **mathematics**, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline
WK3: A systematic, theory-based formulation of **engineering fundamentals** required in the engineering discipline
WK4: Engineering **specialist knowledge** that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5: Knowledge that supports **engineering design** in a practice area
WK6: Knowledge of **engineering practice** (technology) in the practice areas in the engineering discipline
WK7: Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability
WK8: Engagement with selected knowledge in the **research literature** of the discipline

A programme that builds this type of knowledge and develops the attributes listed below is typically achieved in 4 to 5 years of study, depending on the level of students at entry.

Accords:
Facilitating engineering mobility – creating networks, sharing ideas

MUTUAL RECOGNITION OF SUBSTANTIAL EQUIVALENCE

"The signatories have exchanged information on, and have examined, their respective processes, policies and procedures for granting accreditation to engineering academic programs and have concluded that ***these are comparable****.*

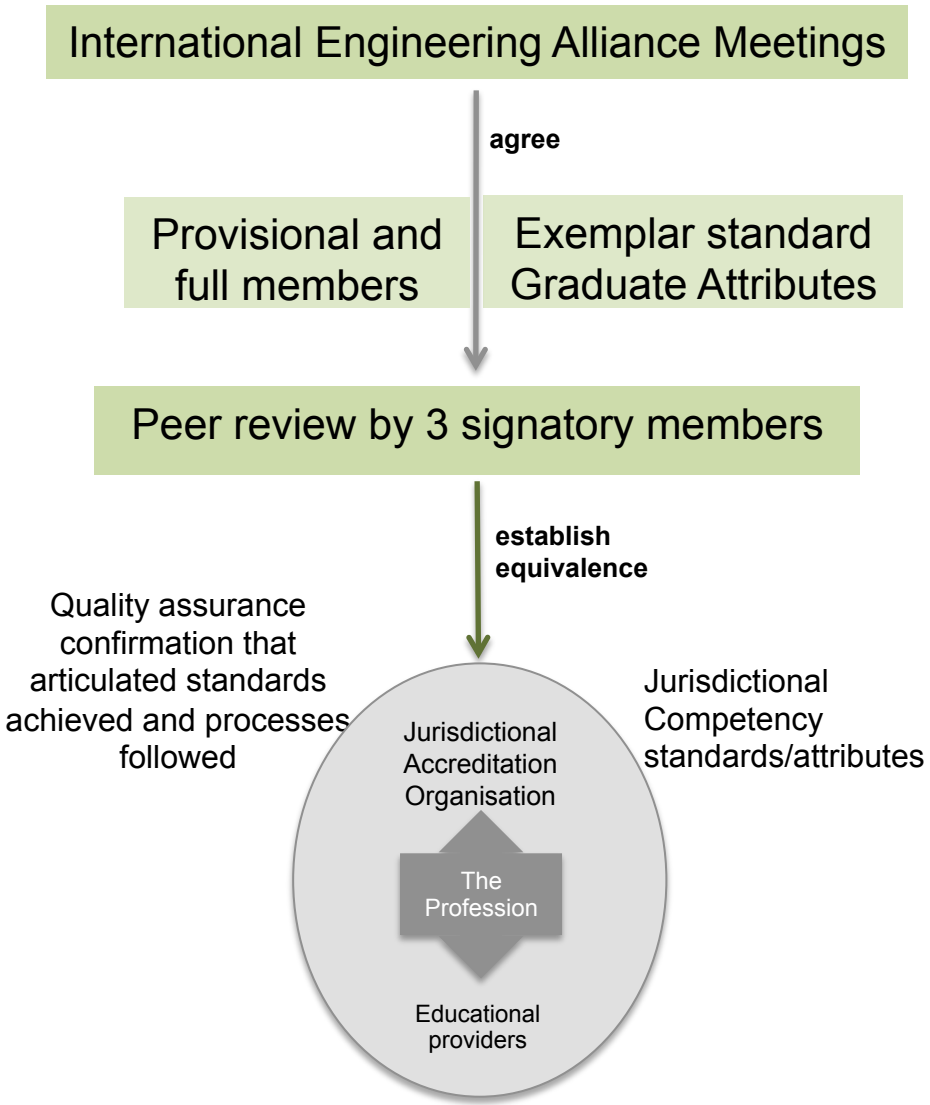
"Through the Washington Accord…. The signatories recognise the substantial equivalence of such programmes in satisfying the academic requirements for the practice of engineering at the professional level."

p4 Accord Rules and Procedures 13 June 2014

The Accords validate jurisdictional accreditation systems, embedding the diversity arising from cultural and jurisdictional imperatives.

The Accords then are a living compact made by each signatory that they will approach deliberations with **confidence**:

- ✧ we can gain insight from our different cultural, socio-political and legal environments.
- ✧ we can find common ground and build a strong network from our collective understanding.
- ✧ we can negotiate, learn and transform in good faith as we create the terms of our engagement.



Note: Simplified diagram indicative only

It is hard work

It requires continuous maintenance and nurturing and close interaction

It can be easy to slip into actions derived from unintended, subtle claims about ‘our way’ superiority

To misunderstand across our language nuances in our haste to make things happen

To deploy ‘short-cut’ metrics, pro-formas, standards and other tools that draw us away from the uncertainty and energy of continuous relationship building and close interaction

http://www.blog.thefortuneinstitute.com/wp-content/uploads/2010/07/tree_life.jpg

There are a number of reasons why mutual recognition of substantial equivalence, although a hard route, adds significant value to accreditation and enhances international practice.

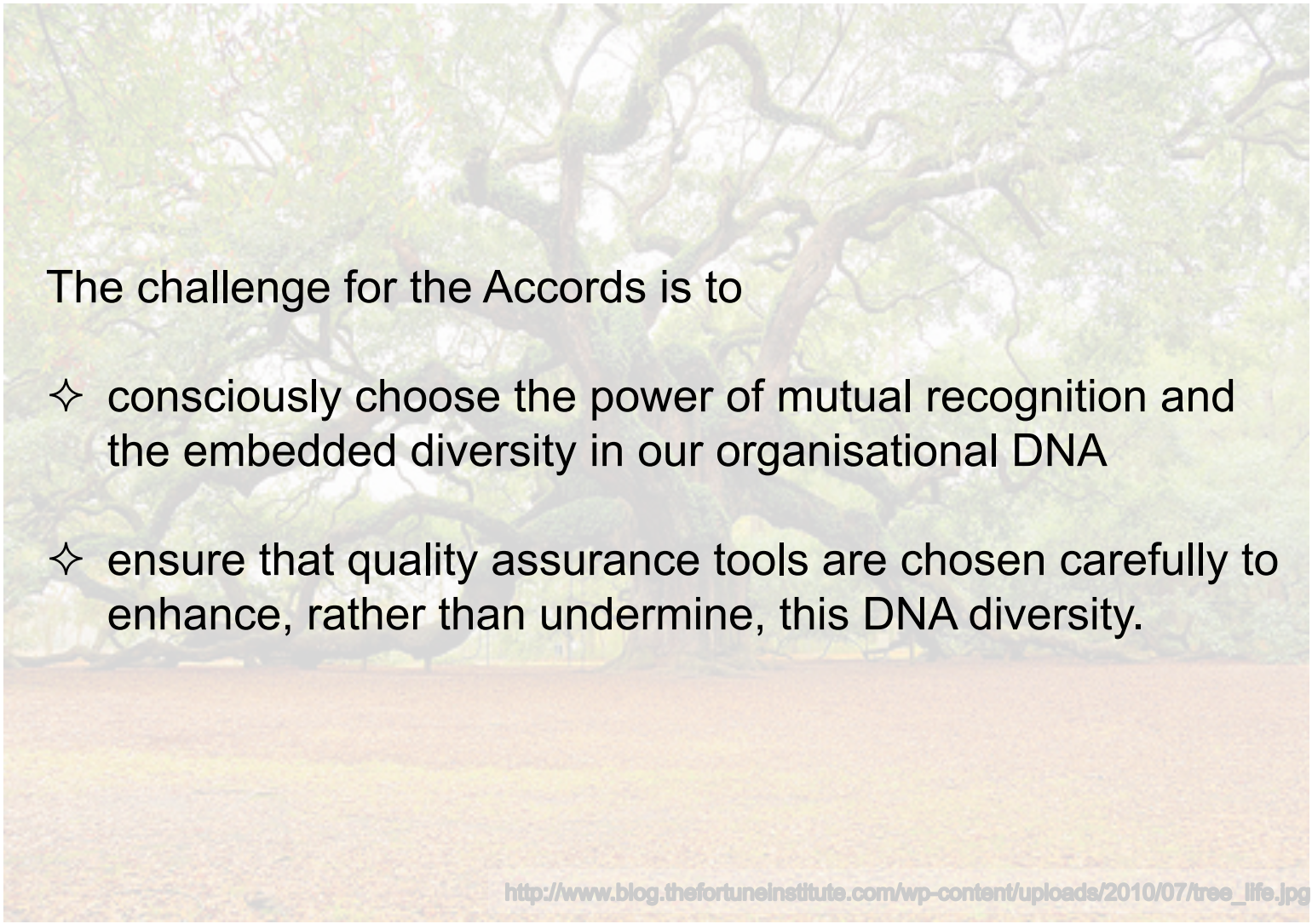
Sociological, anthropological and ecosystem studies suggest that diversity in our systems drives innovation and capacity to meet complexity, disruption and change.

Whenever a system is captured by one culture, by one world view, or one intellectual tradition and iterates to one metric (standard) of success, its capacity for intellectual flexibility and agility is significantly reduced.

http://www.blog.thefortuneinstitute.com/wp-content/uploads/2010/07/tree_life.jpg

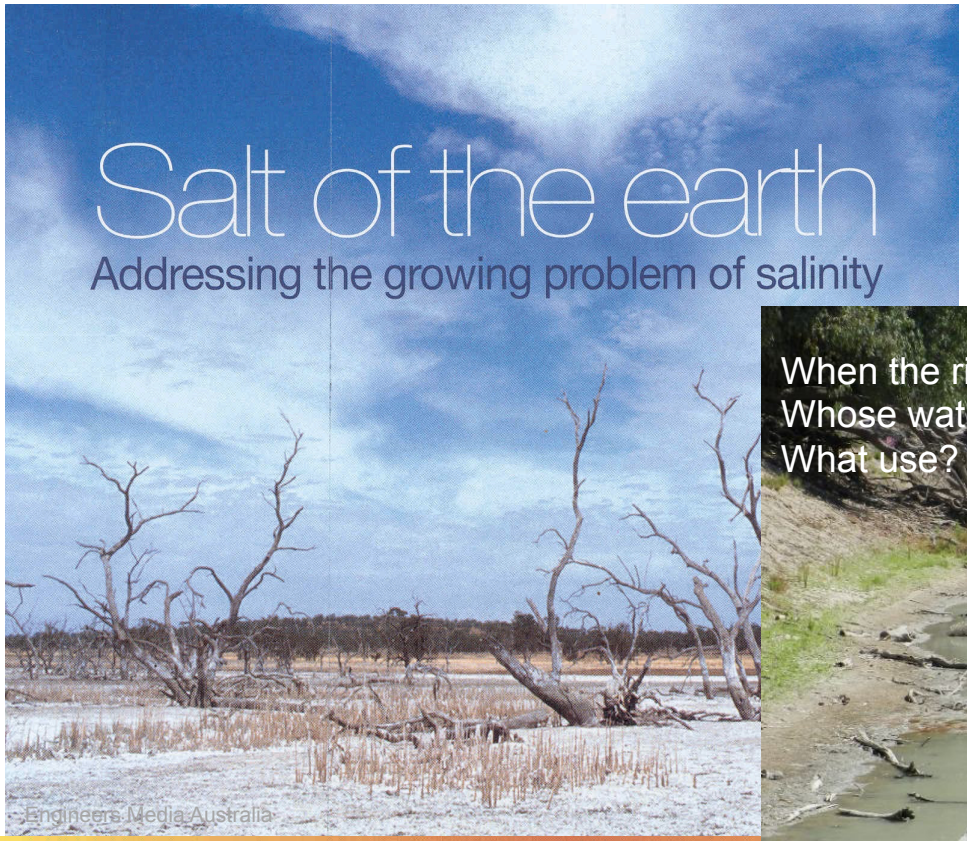
The challenge for the Accords is to

- consciously choose the power of mutual recognition and the embedded diversity in our organisational DNA
- ensure that quality assurance tools are chosen carefully to enhance, rather than undermine, this DNA diversity.



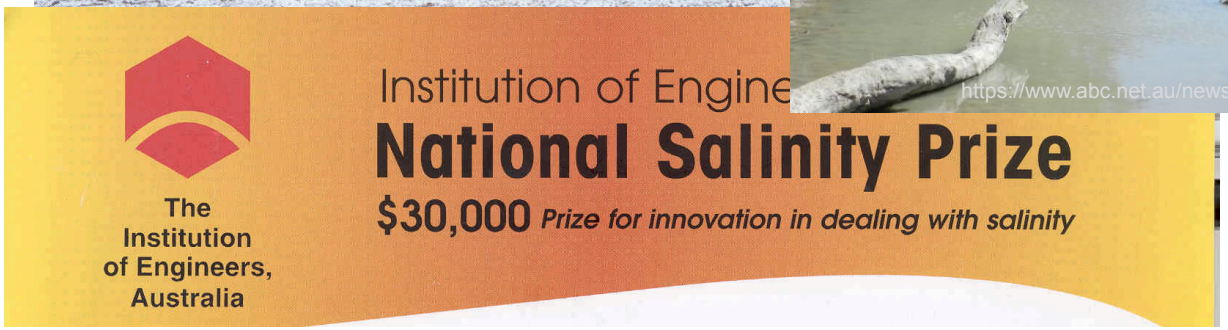
The story of the Snowy Mountains Irrigation System Australia

built during the1950s


Salt of the earth
Addressing the growing problem of salinity
Engineers Media Australia

50 years on……..


When the rivers run dry….
Whose water?
What use?
https://www.abc.net.au/news/2015-06-30/low-flows-on-the-darling-river/6584276


The Institution of Engineers, Australia
Institution of Engine
National Salinity Prize
$30,000 Prize for innovation in dealing with salinity

China: Dujiangyan Irrigation System built 256 BC

http://history.cultural-china.com/en/54History2795.html

Accords:
Building engineering capacity for sustainable development

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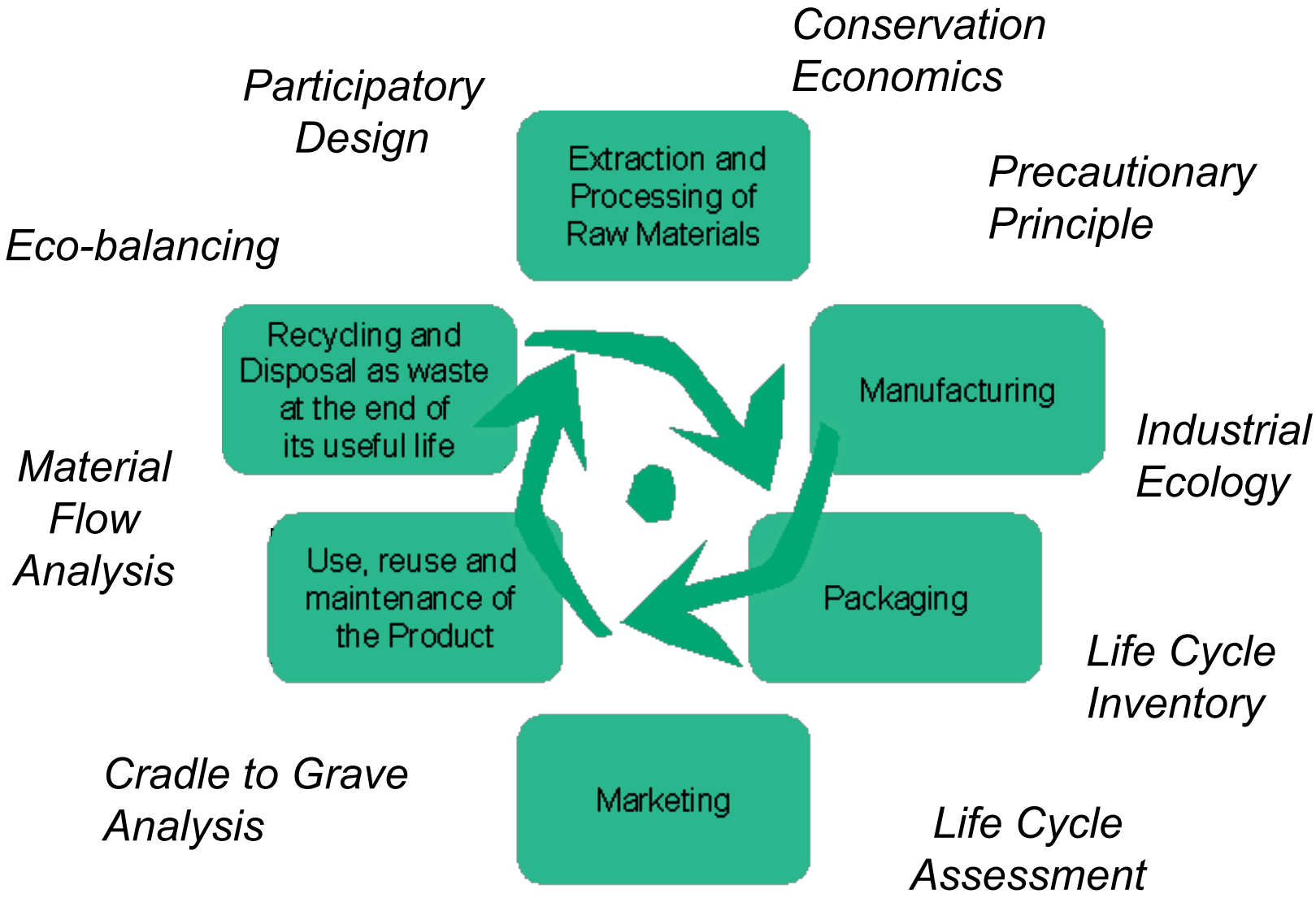
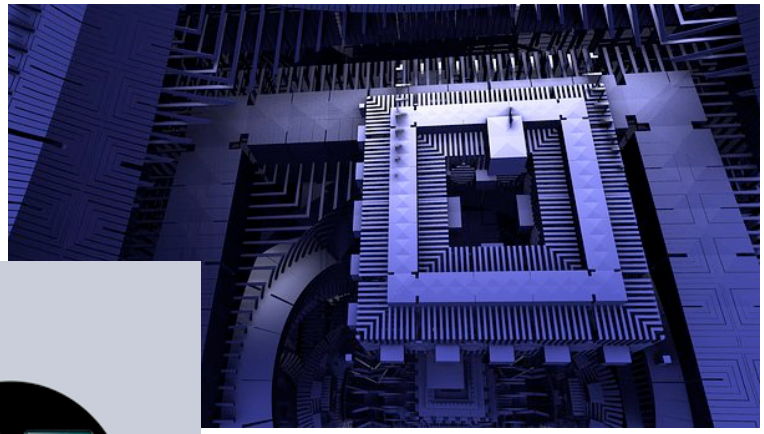
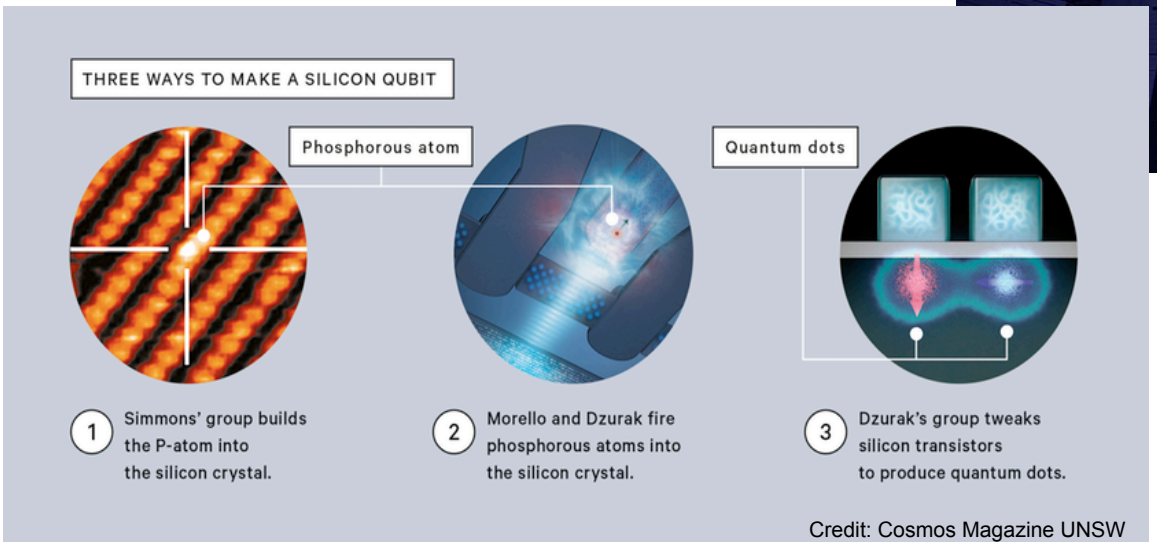

Conservation Economics
Participatory Design
Extraction and Processing of Raw Materials
Precautionary Principle
Eco-balancing
Recycling and Disposal as waste at the end of its useful life
Manufacturing
Industrial Ecology
Material Flow Analysis
Use, reuse and maintenance of the Product
Packaging
Life Cycle Inventory
Cradle to Grave Analysis
Marketing
Life Cycle Assessment

What will be the story of quantum computing?





Credit: Cosmos Magazine UNSW

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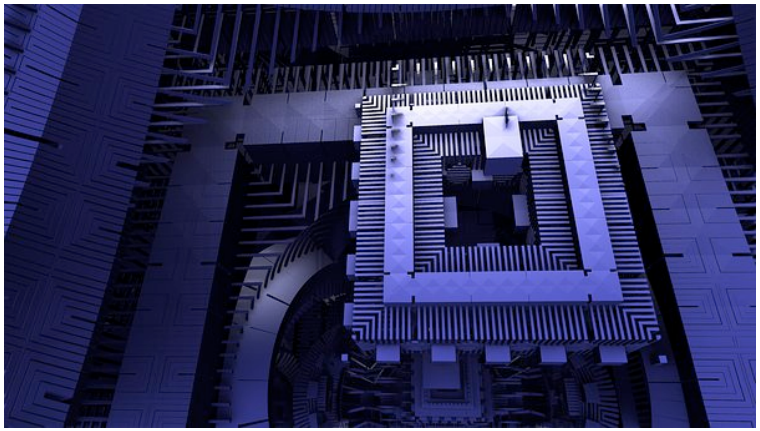

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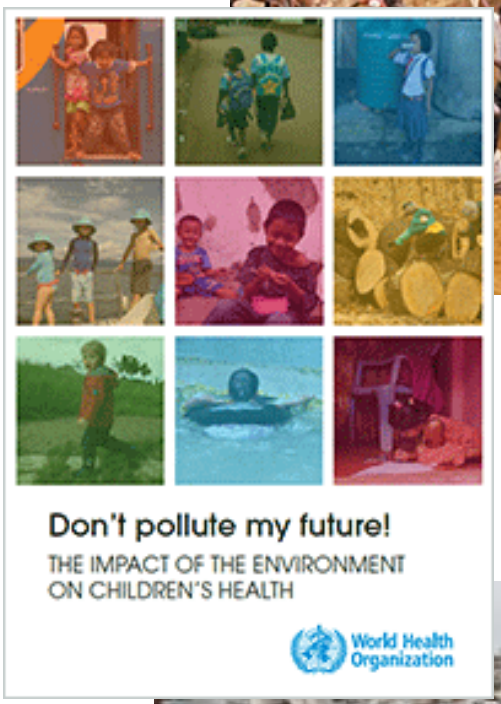
Don't pollute my future!
THE IMPACT OF THE ENVIRONMENT
ON CHILDREN'S HEALTH
World Health Organization


1 NO POVERTY
15 LIFE ON LAND
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
3 GOOD HEALTH AND WELL-BEING
14 LIFE BELOW WATER

Working together to create a shared and better future

The Earth Charter

We stand at a critical moment in Earth's history, a time when humanity must choose its future. As the world becomes increasingly interdependent and fragile, the future at once holds great peril and great promise. To move forward we must recognize that in the midst of a magnificent diversity of cultures and life forms we are one human family and one Earth community with a common destiny.

http://earthcharter.org/discover/the-earth-charter/

International Engineering Alliance Accords
Capacity Building for Sustainable Development

Establishing a global engineering education standard **that drives sustainability**

Facilitating engineering mobility – **creating networks, sharing ideas**

Building engineering capacity **for sustainable development**

Working together to create a shared and better future

17 PARTNERSHIPS FOR THE GOALS