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OXFORD

B2 Engineering, Sustainability and the Environment

Wei Huang, Michaelmas Term 2021

Lecture 2



Course outline

1. Why?

- Global Issues
- Why Engineering?

2. What?

Brundtland Report
Triple Bottom Line
Stakeholders

3. How?

- Legislation
- Tools
- Metrics

4. When?

- Scenario Analysis
- Structural Change?
- A Sustainable Future





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2. What is Sustainable Development?

- Definition of Sustainable Development**
- Triple bottom line: People, Planet, Profit
(or society, environment, economics)**



Sustainable Development

- The Brundtland Report (also known as *Our Common Future*, *World Commission on Environment & Development*) was published in 1987.
- This report coined and defined the meaning of the term "Sustainable Development"
- It suggests a sustainable development path should be discussed with multilateralism and interdependence of nations.
- Environmental issues are firmly on the political agenda and the environment and development should be regarded as one single issue.



Mark II Engineer: Compliance with regulations is important, but is it sufficient?

Might circumstances arise in which, despite compliance, a project is unacceptable?

Let us consider the Brent Spar example.



Brent Spar – a case study 1

For 19 years Brent Spar, a concrete pillar weighing 14.5 kTonne, was used by Shell/Esso as a storage tank for crude oil, moored on the bed of the North Sea, 250 miles off Aberdeen, Scotland. It was taken out of operation in 1991.



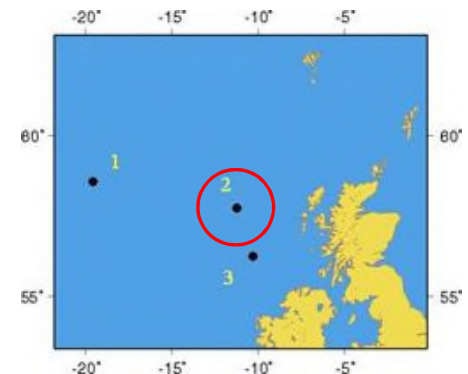


Brent Spar – a case study 2

1992/3 disposal options considered by Shell, with engineering and environment studies. Options considered include.

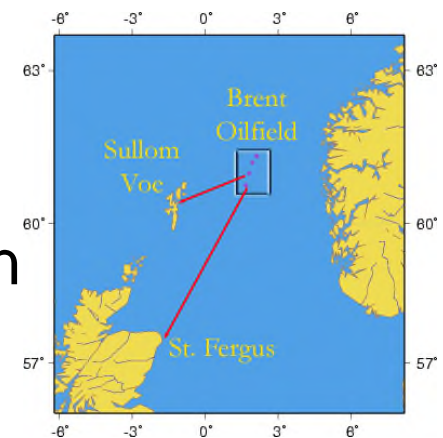
- Deep water disposal

- Shallow water cut-up and on-shore re-cycling/disposal



1994 Independent consultants endorse deep water (Atlantic) disposal. Final draft of “Best Practicable Environmental Option” and impact statement submitted to UK government

1995 – Feb UK government announces intention to approve deep water disposal and notifies relevant EU governments





Brent Spar – a case study 3



Brent Spar, North Sea, 30/4/95. Photo by Greenpeace
Occupation of Brent Spar, to demonstrate against North Sea dumping.

1995 –
30 April Greenpeace activists
(+journalists) occupy Spar
5 May UK Government
issues disposal licence
9 May German Government
lodges protest
23 May Activists removed
from Spar. German boycott of
Shell products begins
10 June Shell begins to tow
Spar to Atlantic disposal site



Brent Spar – a case study 4

What people said:

“Greenpeace learned that the UK government had granted permission for Shell Oil to dump a huge, heavily contaminated oil installation, the 4,000 tonne Brent Spar, into the North Atlantic despite it being loaded with toxic and radioactive sludge.”

"We believe the world's oceans should not be used as the world's dustbin. We believe big industry should take responsibility for its waste" said Greenpeace's Douglas Parr, who argued it should be disposed of on shore.

“...if this platform were to be dumped at sea, with some 400 others at work in the North Sea alone, this would have set a dangerous precedent.”



Brent Spar – a case study 5



E Fauldes
Shell's Decommissioning
Manager

What Shell said:

“The 100 tonnes of sludge (highest estimate) consists of 90 percent sand, and 10 percent stable, heavy oil residues – not dissimilar to bitumen on roads. The very low level radioactivity...is equivalent to that from a group of granite houses in Aberdeen.”

“**Every aspect of UK law and regulation has been followed** to the letter and to the spirit. The Government is entirely satisfied that it [Shell] is also complying with the relevant aspects of international law and conventions.”



Brent Spar – a case study 6

1995 –

15-20 June Chancellor Kohl protests to UK Prime Minister John Major at G7 summit. Opinion in Northern Europe strongly opposed.

Two Shell stations in Germany firebombed, one shot at. Further damage threatened.

20 June John Major confirms Government support for the approved disposal option

20 June Shell aborts operation

7 July Norwegian government grants permission to moor Spar temporarily in Erfjord





Brent Spar – a case study 7

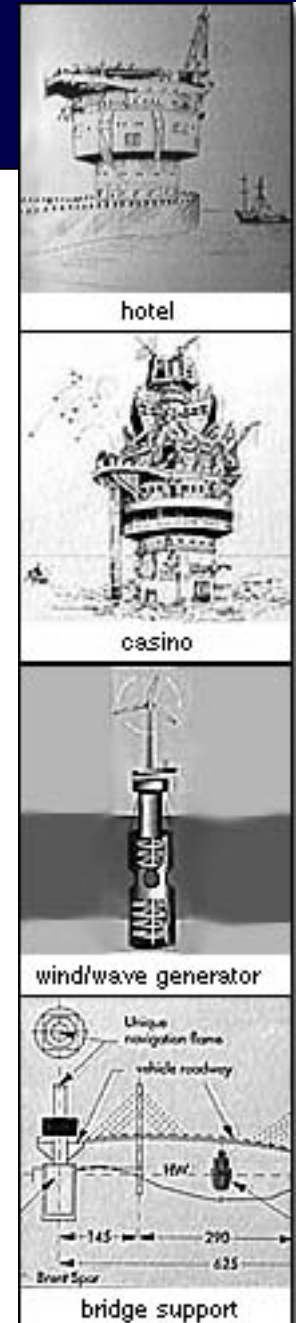
The aftermath

Shell states its commitment to wider consultation so that a new proposal to the UK government “will be informed by the views of many other interested and representative parties.”

“Shell UK has announced radical plans to turn its controversial Brent Spar oil storage terminal into a roll-on roll-off ferry quay.” BBC

"Ocean disposal is an outmoded form of waste management and it has to stop. We sincerely hope that this will set a precedent," said Greenpeace

The cost of disposal rose from £5 million to >£25 million.



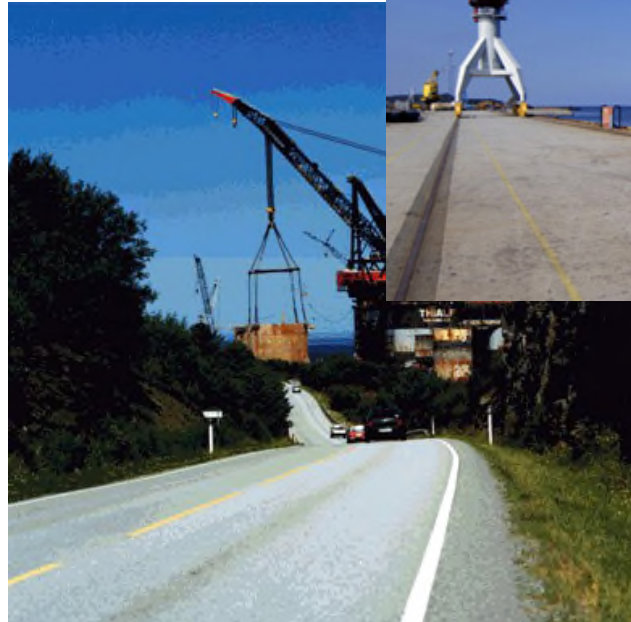


Brent Spar - A final twist

- Destroying old oil platforms in the North Sea has damaging consequences for coral, say two UK scientists. The researchers examined the controversial Brent Spar storage facility when it was being decommissioned and say they found large quantities of healthy coral growing on the structure.
- Marine biologists Niall Bell and Jan Smith work for Cordah Environmental Management Consultants, Aberdeen, UK, who were called in to advise on the disposal of Brent Spar. They believe the quantity and type of coral found on the metal and concrete structure raises serious questions about how best to decommission platforms.
- The 135m-high, 16,000-tonne Brent Spar was chopped up for scrap with some of it being used to build the foundations for a new ferry terminal. When the facility was dismantled, the researchers were sent coral samples from the sides and bottom of the platform. They found large quantities of *Lophelia pertusa*, which is listed under the Convention on International Trade in Endangered Species (Cites).



Brent Spar





Brent Spar

what happened to public opinion?

Some thoughts:

The decision eventually did not turn on who was right or wrong about likely environmental damage.

People refused to believe technical/government experts.

People who had not been consulted didn't see why they should support the forces of "law and order" or the establishment in a dispute with activists.

People were swayed by appealing images of protesters being harried by officials.

People didn't see why Shell should be allowed to "dump" anything at all in any sea.

The relationship between company and regulator was seen as too cosy.

Enough people boycotted/threatened the company, to force a change of direction.



Brent Spar - Summary

- Proposed disposal method complied with regulations and had been environmentally assessed
- Environmental activists were able to mobilise public opinion against Shell, who were seen as 'dumping' pollution in the sea
- Shell and the UK government learnt lessons about the need to consult a wider range of 'stakeholders'



Sustainable Development - Lessons from Brent Spar

- The Brent Spar Case Study has illustrated some important points about Sustainability and the Environment
 - Compliance with regulations *is sometimes not enough*
 - *Optimising financial return* subject to constraints of regulation (the Mark II engine) *may not be satisfactory*
 - There is a need to identify and consult with *a wider range of 'stakeholders'*
 - Not just government and regulators
 - The finally adopted solution represented a compromise between *financial, environmental, and social factors*
 - Perhaps not the ideal compromise, but one that was found acceptable given the history
- Let us see how these observations relate to more general definitions of sustainability



Sustainable Development is...

‘...development which meets the needs of the present without compromising the ability of future generations to meet their own needs.’

‘Our Common Future’ -

World Commission on Environment and Development, 1987

The Brundtland Report

This is a simple definition of an immensely challenging concept. What are the needs of the present, and do we meet them now? Can we reconcile different needs of different people (both in the present and in the future)?



‘Development which meets the needs of the present without compromising the ability of future generations to meet their own needs.’

“Development” is often considered only to be an issue for LDCs (Less Developed Countries – those where living standards are very low).
But Sustainable Development ...

- will affect all nations – those that consume a lot, and those that consume very little,
- may require a fundamental change in how we measure quality of life,
- is a significant change for business – the need to consider **social** and **environmental** consequences, as well as project **economics**
- This leads to the concept of a ‘*triple bottom line*’ (people, planet, profit)
- Shell had probably only considered the last two in the Brent Spar case



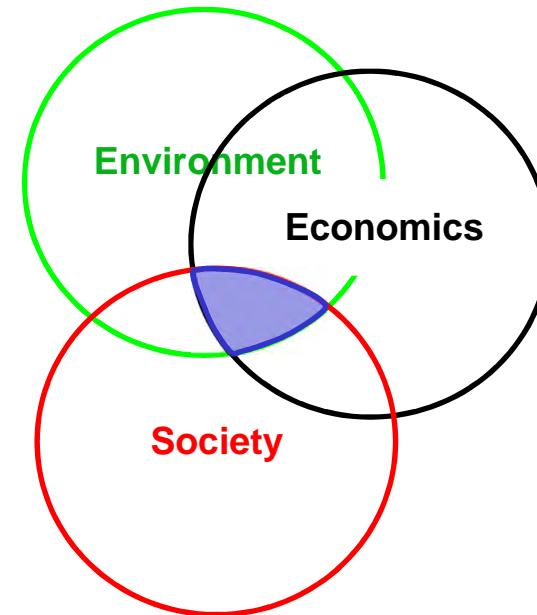
The Triple Bottom Line

Simultaneous pursuit and
balancing of...

Social equity

Environmental quality

Economic prosperity



**Consultation
becomes a key element of
project development**

**Stakeholder analysis seeks to
identify those who should be
consulted**

Stakeholders?

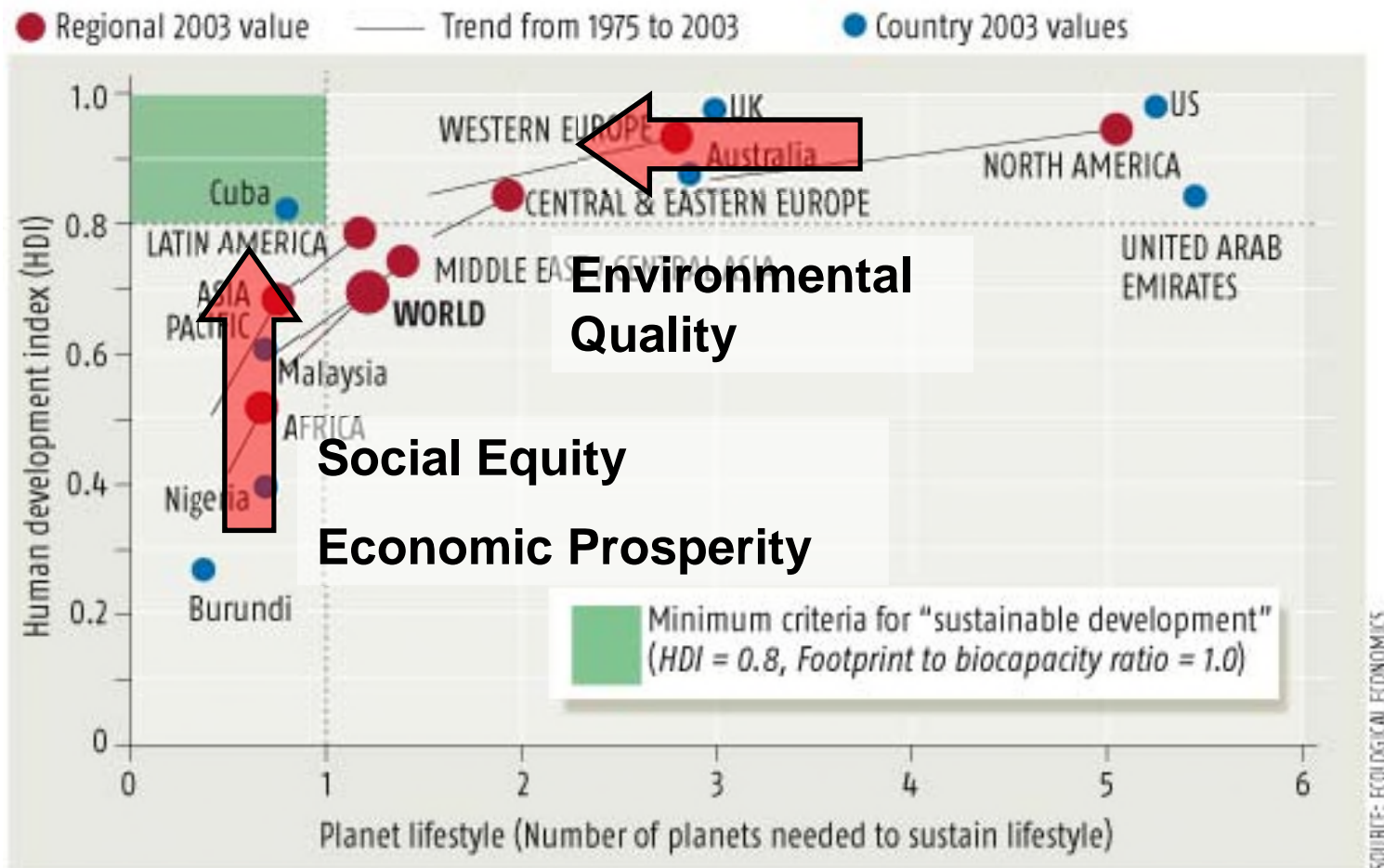
- Shareholders
- Customers
- Employees
- Suppliers
- Neighbours
- Society



Social, economic and environmental balancing

ROAD TO ECOLOGICAL RUIN?

Only Cuba provides a decent standard of living for its people without consuming more than its fair share of resources

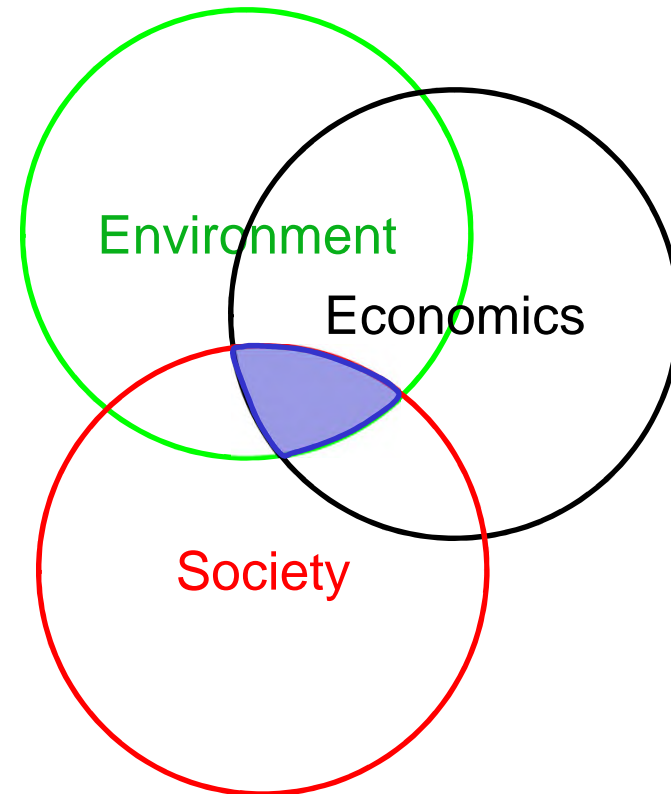




Sustainability and Brent Spar

Where did Shell go wrong?

One answer – they didn't see that they were working in an area where the needs of *environment, economics and society overlap*. No account was taken of stakeholders (society) outside the “official/regulatory” arena.



“Our experts may be able to devise impressive solutions to all sorts of difficult problems, but – as we found to our cost in the past – the technical answer may not always be the most appropriate or acceptable.” Shell



10 Principles for sustainable development

1. Putting people at the centre
2. Taking a long term perspective
3. Taking account of costs and benefits
4. Creating an open and supportive economic system
5. Combating poverty and social exclusion
6. Respecting environmental limits
7. The precautionary principle
8. Using scientific knowledge
9. Transparency, information participation and access to justice
10. Making the polluter pay



The global perspective

- There have been a number of important international conferences in the area of sustainable development
- United Nations Conference on the Human Environment – Stockholm 1972
 - Provided impetus for the Bruntland Report
- Earth Summit – Rio 1992
 - Commission for Sustainable Development (CSD)
 - Established by UN General Assembly to follow up Earth Summit agenda
- World Summit on Sustainable Development (WSSD) – Johannesburg 2002
 - “Rio +10”
- UN Sustainable Development Summit, New York, 2015
 - Transforming our World: The 2030 Agenda for Sustainable Development



1992 Earth Summit in Rio de Janeiro

(UN Conference on Environment and Development UNCED)

Documents produced included

UN Framework Convention on Climate Change:

IPCC reports in 1990, 1995, 2001, 2005 –

‘The balance of evidence suggests a discernible human influence on global climate’.

Biodiversity Convention *(rather weak).*

Agenda 21(with 115 topics, including):

Social and economic dimensions (poverty, health, population...)

Conservation and Management of Resources for Development

Strengthening the Role of Social Groups. Consultation

Means of Implementation (financial, international treaty...)

Local Agenda 21 – Think Globally, Act Locally.



1992 Earth Summit in Rio de Janeiro

(UN Conference on Environment and Development UNCED)

The Rio Declaration, and the provisions of Agenda 21 were based on the acceptance of some basic *principles* such as

- Each state has an inalienable right to develop provided it takes the needs of present and future generations into account (recognition of intergenerational equity),
- The "precautionary approach" (lack of scientific certainty will not prevent cost-effective actions to halt serious environmental damage),
- The "polluter-pays" principle,
- The principle affirming the need for environmental impact assessments before development.



UN sustainable development goals

- Goal 1. End poverty in all its forms everywhere
- Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- Goal 3. Ensure healthy lives and promote well-being for all at all ages
- Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- Goal 5. Achieve gender equality and empower all women and girls
- Goal 6. Ensure availability and sustainable management of water and sanitation for all
- Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all
- Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
- Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation



UN sustainable development goals (2)

- Goal 10. Reduce inequality within and among countries
- Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
- Goal 12. Ensure sustainable consumption and production patterns
- Goal 13. Take urgent action to combat climate change and its impacts*
- Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
- Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
- Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development



Sustainable Engineering

Many of the engineering solutions now being developed as “sustainable” have as characteristics

- that they are developed with customers or communities (eg local sewage treatment, waste disposal)
- that a product sale is replaced by a service or a leased product, with the supplier remaining responsible for recycle or disposal (eg copy machines, cleaning solvents)
- that they are aimed at a much lower consumption of non-renewable resources (some modern houses, biomaterials, wood products from well-managed forests)



Consequences for Engineering

The New Model Engineer and Her Role

Prof R Clift, Trans IChemE Vol 76, Part B, May 1998

Mark I Engineer

classical - 'best' technology using available materials and energy to optimise economic returns.

Mark II Engineer

primary role as meeting human needs, 'best' technology, based on certain science to provide a social benefit as well as a profit. Complies with regulatory constraints.

Mark III Engineer

recognises need for sustainability. Engages with stakeholders.

There will be multi faceted decisions, and a need to trade off monetary & non-monetary benefits.

Engineers may play a role as informed expert in public debate & decisions.



The drive to sustainability

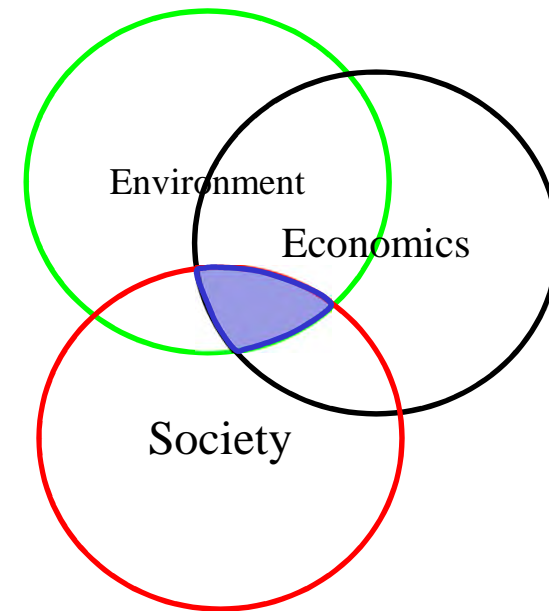
We have seen how engineering projects must take account of environmental constraints (compliance).

Society has also shown that it needs to approve – “the licence to operate”...

...but is there a theme to the demands of society?

How are the needs of society articulated?

How do we know if a project is sustainable?

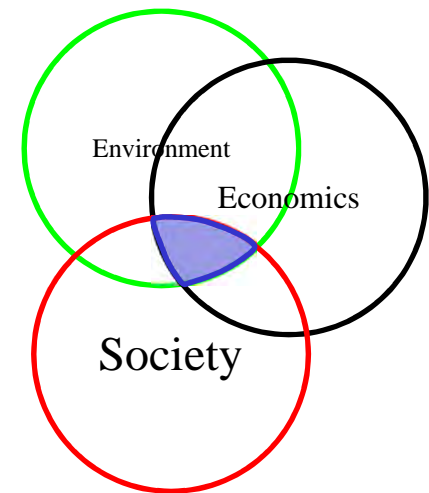




The drive to sustainability: How?

The first approach is by means of **legislation**. Understanding this aspect is the minimum that is needed.

- International accords (RIO, Kyoyto)
 - National Legislation (Acts of Parliament)
 - Regulatory bodies (e.g. Environment Agency)
 - Documentation (Environmental Impact Assessments)
-
- But there is also a clear need to consider
 - wider stakeholders (as seen in the Shell example)
-
- NGOs, Activists, Academics, Greenpeace, FoE





Consequences for Engineering Companies

- Economic factors are still likely to be the main driver in investment decisions
 - Taxation and other Government incentives can help internalise economic externalities (e.g. Renewables Obligation Certificates, Carbon Credits)
- Legislation and Regulation provides constraints to the problem
- Environmental and Societal factors are often incorporated through the need for the organisation to have a good 'public image'
 - Adverse criticism can have economic consequences in terms of reduced sales



References and Suggested Reading

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www.wbcsd.org (World Business Council for Sustainable Development)