



# Delivering Carbon Critical Design

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## Dealing with Climate Change at a global level

- Energy / resource efficiency
- Decarbonise the energy supply
- Prevent deforestation / change agriculture
- Control population growth

## What can we do as professionals?

- Change the design paradigm
  - Change the way we work and behave
- 

Carbon Critical Design .....

to reduce our consumption of fossil fuels by making carbon a significant, if not the primary design determinant



## So why Carbon?

- What about sustainability?
  - Good proxy
  - Stops worthy debate
- Dependency on carbon leads to business risk
  - Security of energy supply
  - Costs
- Legislation
  - National targets
  - Climate Change Bill
  - 60% / 80% reduction in CO<sub>2</sub> emissions by 2050
- Government policy
  - 1st National Climate Change Strategy published 2000.
  - 2<sup>nd</sup> Strategy (2007-2012) published April 2007.

# The Stern Review – The Economics of Climate Change (2006)

**1% GDP**

Costs of mitigation to stabilise emissions at 550ppm by 2050

**vs**

**5% GDP**

Income losses if we do nothing:  
market impacts only

**20% GDP**

Income loss including non-market impacts, risk and equity

- Delay is dangerous - damage from climate change rise disproportionately with temperature
- Adaptation is crucial to respond to unavoidable climate change
- Probably 10 years before we reach the tipping point

## Carbon Critical Design journey

- Designed on basis of cost for years
  - Thinking about adaptation for half a decade
- Thinking about designing for low carbon operation
  - Design for minimal pumping / no pumping
- Virtually no progress on CCD and mitigation
  - Embedded / embodied
  - Operational



## Changes in behaviours

- Establish roles and responsibilities of those involved
  - who sets the design criteria and objectives?
- Develop skills and share information
- Adopt the use of integrated project teams



## Changing the Design Paradigm

- Confirm the boundary of the design
  - strategic, project specific, component specific
- Understand the desired outcome of the design
- Go back to first principles and generate real options
  - create carbon profiles (direct and indirect usage of carbon) across the life cycle for each option
  - understand and consider the whole life of the building / structure / product / service
- Understand the carbon intensity of the construction / manufacturing phase against carbon usage during operation
- Evaluate the carbon affordability (we may have carbon budgets to work to)



## Carbon Accountancy

- Value of carbon to internalise CO<sub>2</sub> costs
  - Cost of oil plus environmental impact
  - Shadow price of Carbon (€20 to €120 / t)
- Decision support tools
  - Carbon footprinting
  - Whole Life Cost
  - Value engineering
- Standards
  - Discount rates (0.1% Stern, 3.5% Treasury Green Book)
  - Project life span



## Developing the tools - A brief example

Costing carbon into investment  
decisions

## Options Considered for treatment of 52,000 tonnes dry solid per annum

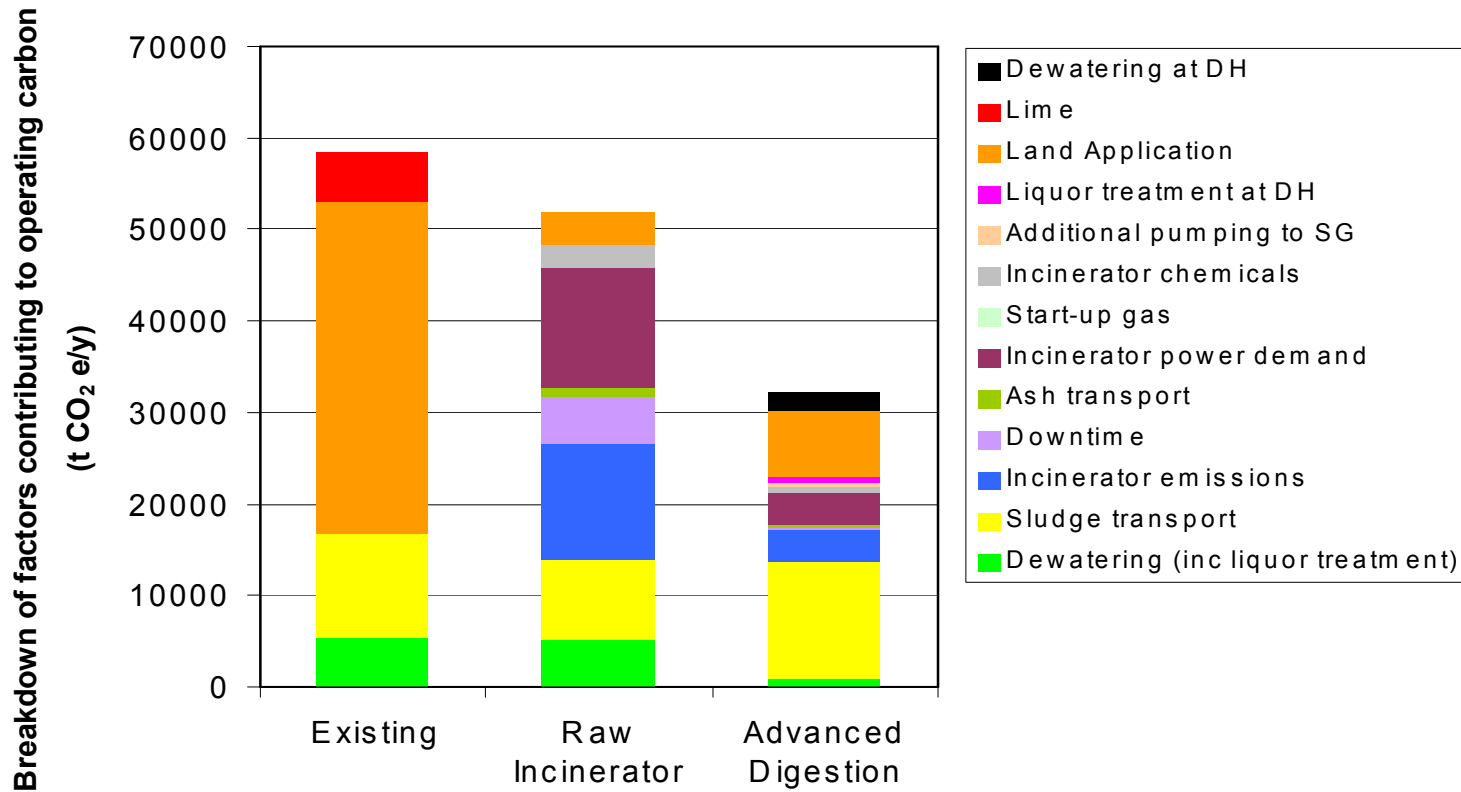
1. Purpose built new incinerator to burn raw sludge
  2. Integrated solution based on advanced anaerobic digestion
- Both options were compared with an existing scenario where all sludge is dewatered raw, limed and recycled to land

## Sludge (Embedded) Carbon Model

- Weights of main construction items (buildings and plant) converted to a carbon dioxide equivalent
- Long term carbon costing based on plant replacements
- Did not include:
  - Staff travelling to/from construction site
  - Fuel / energy use during construction
  - Emissions during construction
  - Waste management



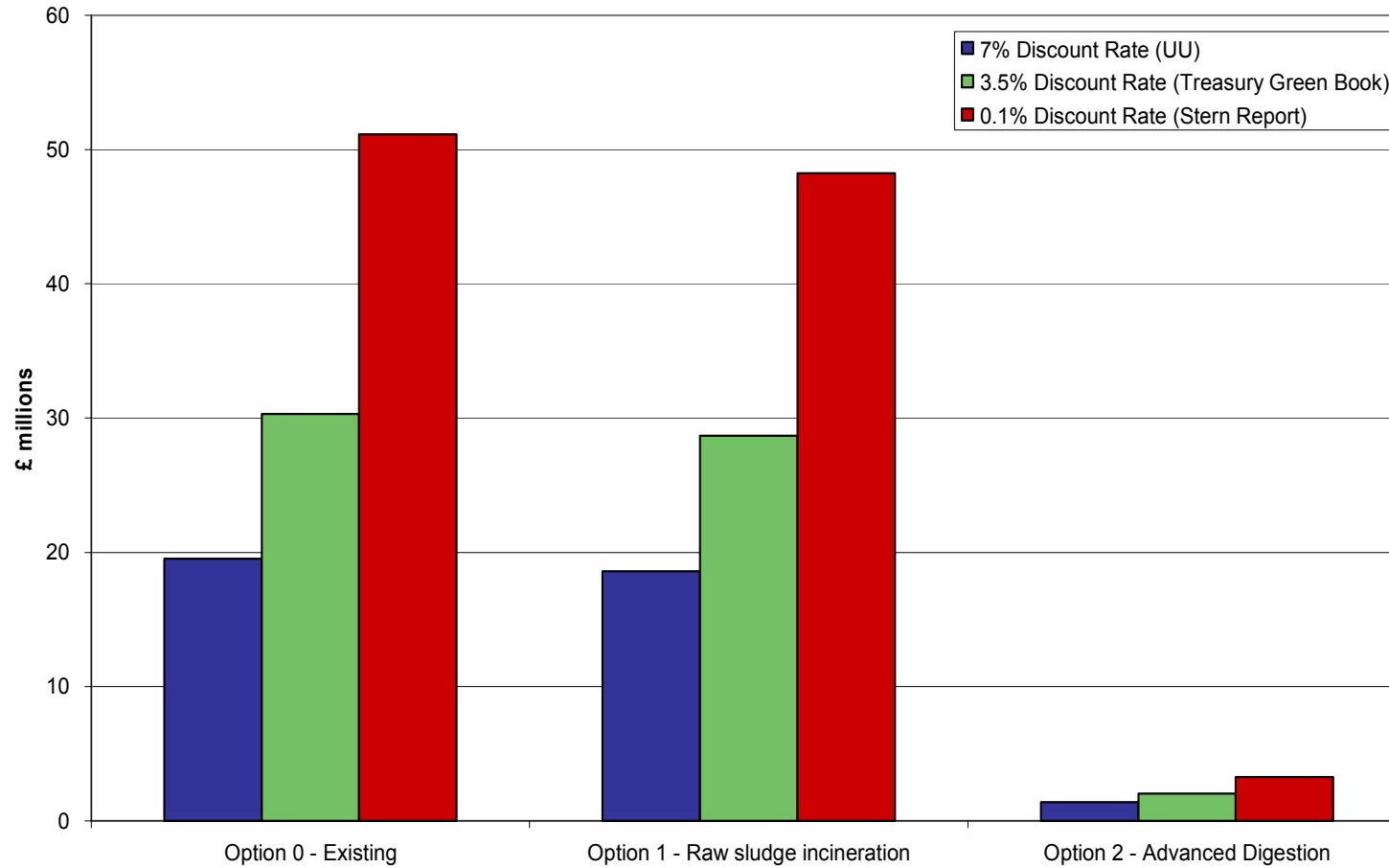
# Carbon footprint of each option



Total Contributing

# Whole-life Carbon costs

Comparison of 30-year net present cost of carbon (£ millions)  
 (shadow price of CO<sub>2</sub>e = £25.4/tonne in 2007, increasing at 2% p.a.)



## Carbon as a strategic decision making tool

- Are we prepared to review strategic investment decisions on the basis of carbon?
  - Can we fully address the whole life cost of carbon?
- At what point would carbon over-ride cost?
  - How much are you prepared to pay for a low carbon design?
- Can we give the appropriate guidance to those managing the capital investment and operational budgets?
  - Acceptable capital premium for long-term low energy consumption?
  - Do you have to change the rules on pay-back periods and discount rates?

## To conclude

- Carbon is the single thread that must be pulled to make a real difference
- Carbon tools are rudimentary but must be used and improved
- Be prepared to make mistakes and share knowledge
- Promote the use of integrated project teams
  
- What will be the catalyst for change?

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