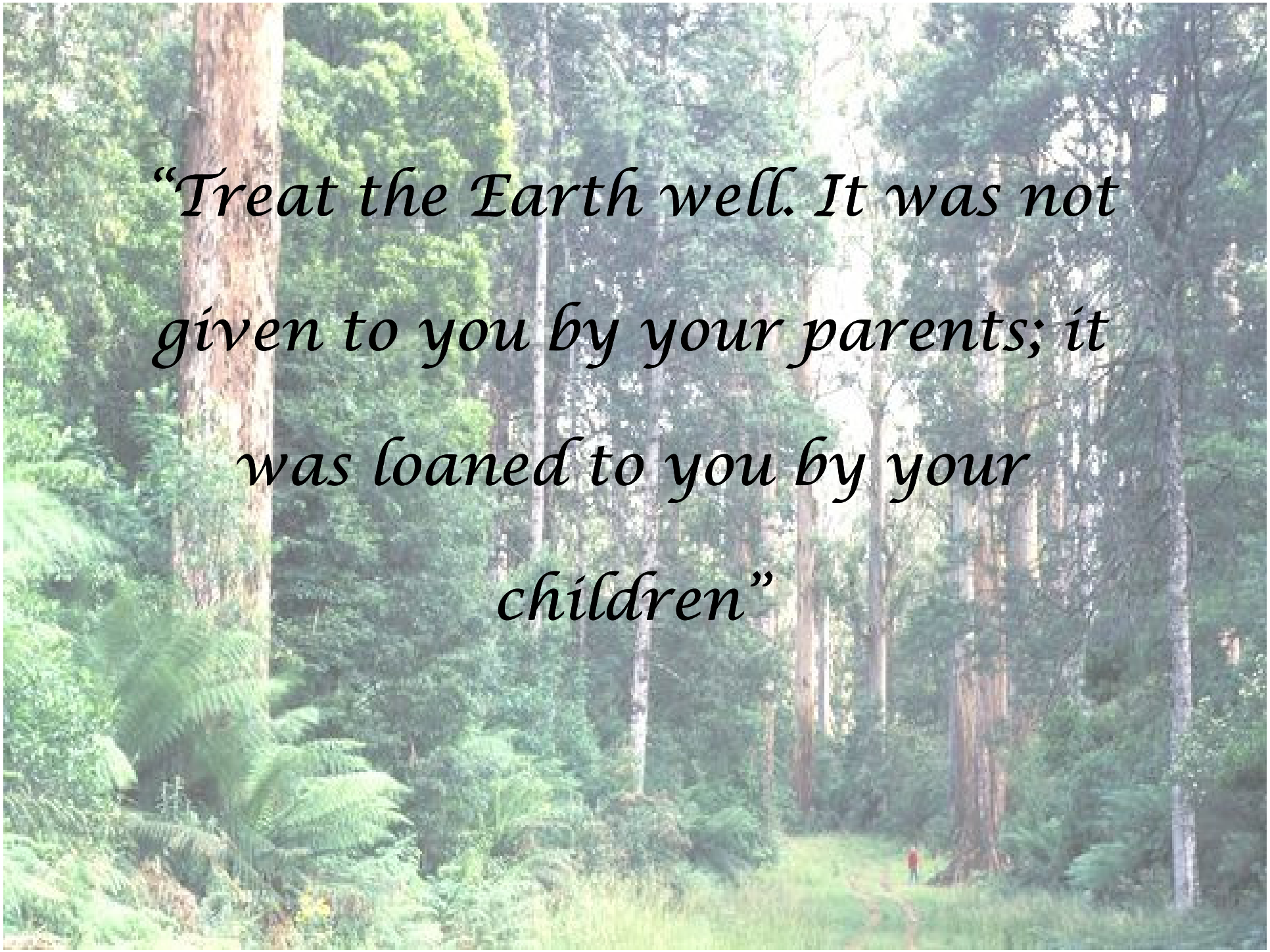
"Treat the Earth well. It was not given to you by your parents; it was loaned to you by your children"


Presented by:
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Master Environmental Planning
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sustainable futures
CERTCON

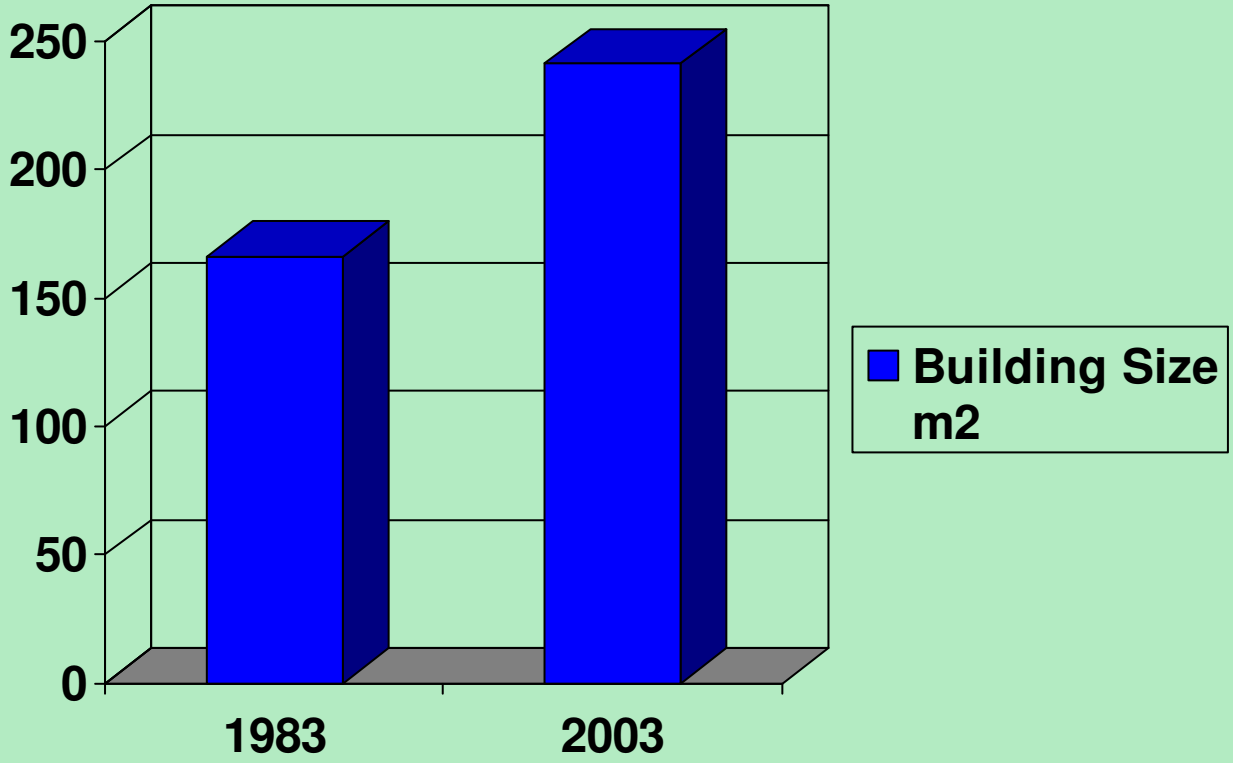
The Ultimate in Sustainable Construction

Embodied Energy

One measure of the sustainability of building materials is the embodied energy needed to produce the products.

Embodied energy represents 20 to 50 times the annual operation energy of most Australian buildings, requiring approximately 18 million trees grown to maturity to offset the embodied greenhouse impacts of one year's construction.

Increased Building Size



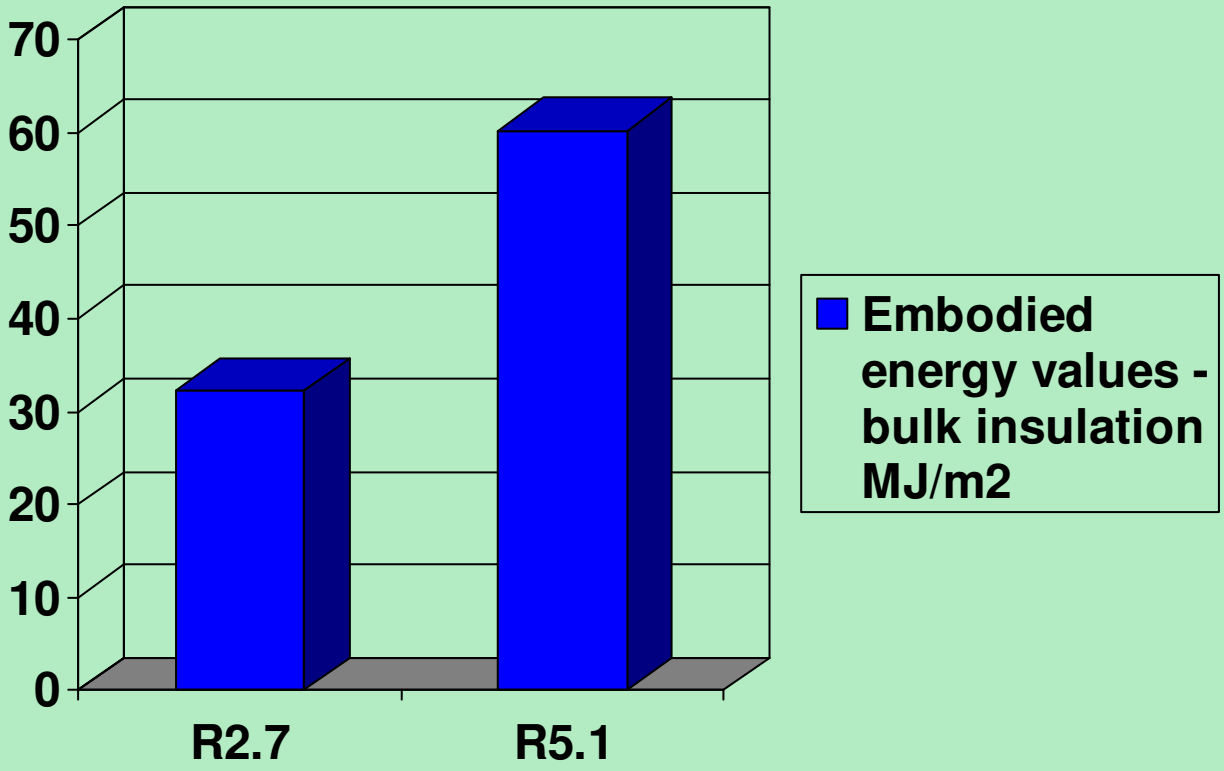
Unintended Consequences

As the energy efficiency of buildings increases so does the ratio of embodied energy. This may be demonstrated with the BCA amendments, where existing insulation had an embodied energy of 32.2 MJ/m2.

Unintended Consequences

The 2010 amendments have increased the embodied energy to 60.2 MJ/m2. This increase represents an additional 6748 MJ (1.4 tonnes of CO2 emissions) of embodied energy for the average house, meaning the energy payback period is 2.5 years

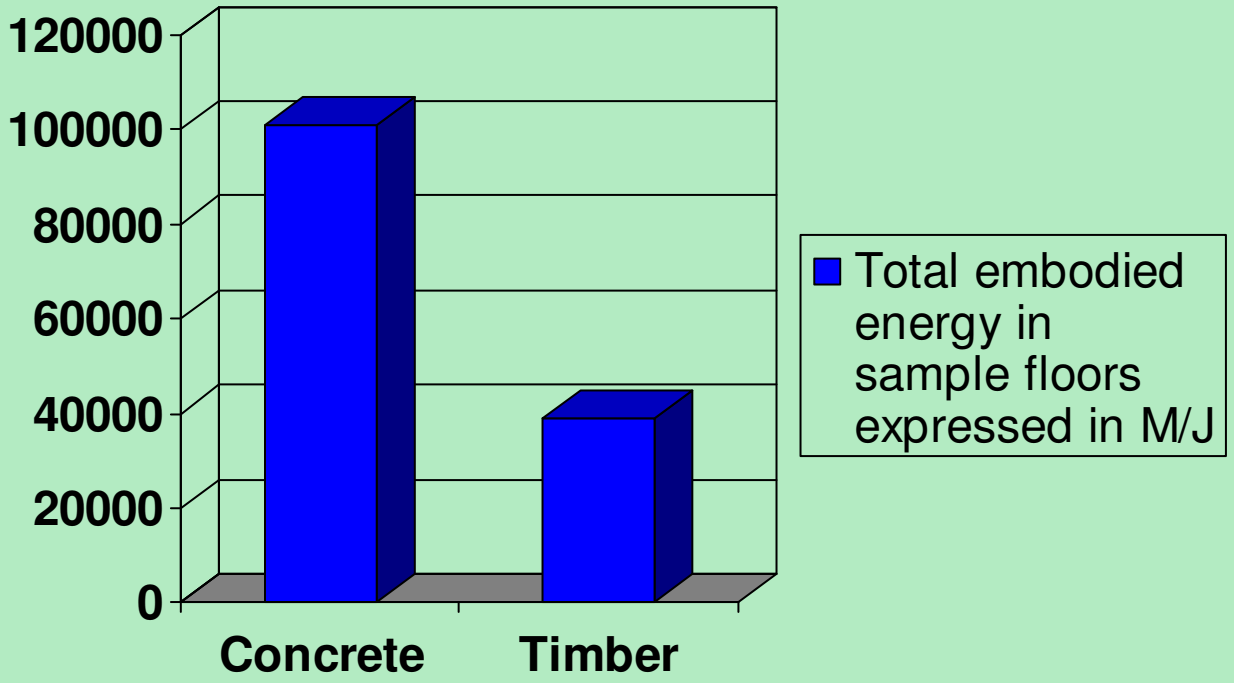
Unintended Consequences



Embodied Energy

Product	Embodied Energy
Reinforced Concrete 25 MPa	2.12 (MJ/kg)
Concrete Block	0.81 (MJ/kg) or 9.23 MJ per Block
Cement	4.6 (MJ/kg)
Single Face Brick	8.21 (MJ/kg) or 23 MJ per Brick
Sawn softwood	7.4 (MJ/kg)
Sawn Hardwood	7.8 (MJ/kg)
LVL Timber	9.5 (MJ/kg)
Plywood	15 (MJ/kg)
Structural Steel (Bar and Rod)	36.4 (MJ/kg)
Aluminium	155 (MJ/kg)

Concrete/Timber Flooring Comparison



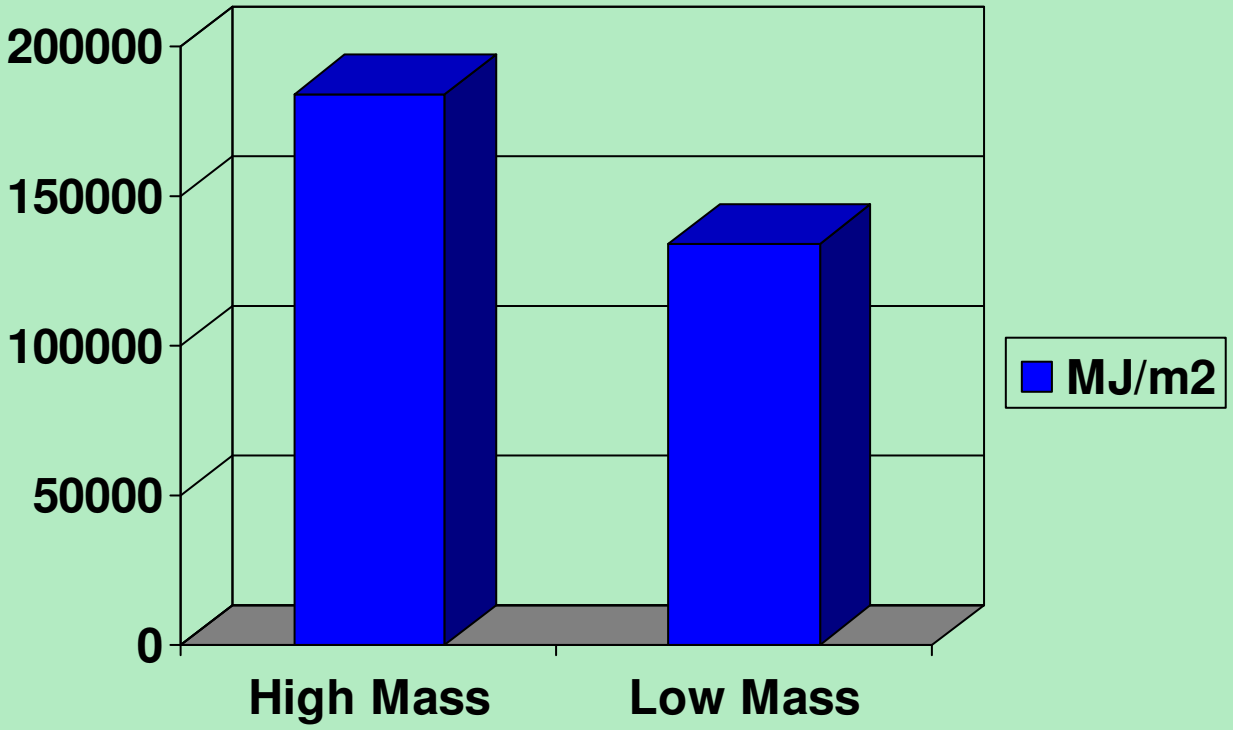
Embodied Energy – High Thermal Mass

Element	Material	Area	Embodied Energy	Total Embodied Energy
External Walls	Cavity Brick	78.8	860	67768
Internal Walls	Cavity Brick	45.6	430	19608
Floor	Concrete	105	645	67725
Roof	Tile	105	251	26355
Roof Insulation	R2 Batts	105	32.2	3381
Wall Insulation	N/A			
Total				184837

Embodied Energy – Low Thermal Mass

Element	Material	Area	Embodied Energy	Total Embodied Energy
External Walls	Fibre Cement	78.8	169	13317
Internal Walls	Plasterboard	45.6	245	11172
Floor	Timber	105	293	30765
Roof	Steel	105	330	34650
Roof Insulation	R3 Batts	105	42	4410
Wall Insulation	Aircell	78.8	220	17336
Floor Insulation	Aircell	105	220	23100
Total				134750

Embodied Energy – High/Low Thermal Mass



Possible Solutions?

As an example material selection, considering the emission differences between low and high thermal mass buildings;

- Low thermal mass = average saving of 50087 M/J of energy consumption per house,

Possible Solutions?

- 10% annual new housing stock constructed using low thermal mass = saving of 547 million MJ of energy, or
- 4.7 million Trees planted annually or 24000 cars from our roads each year.

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