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Keeping you informed about the eco-cement project. Issue 15 21 November 2001

Reversing Global Warming

It is educational to consider for a moment a summarized history of the earth.

In the Beginning

The earth's first atmosphere was probably made of hydrogen and helium (H_2 & He). These gases are now relatively rare on Earth compared to other places in the universe and were probably lost to space early in Earth's history because

- Earth's gravity was and still is not strong enough to hold lighter gases
- Earth still did not have a differentiated core (solid inner/liquid outer core) that creates Earth's magnetic field (magnetosphere=Van Allen Belt) that deflects solar winds. (Once the core differentiated the heavier gases could be retained.)

The Second Atmosphere

Volcanic gasses over 4.5 billion years ago during the Pre-Riphaeican epoch and earlier produced the earth's second atmosphere:

- The gases were emitted were probably similar to those created by modern volcanoes (H_2O, CO_2, SO_2, CO, S_2, Cl_2, N_2, H_2, NH_3 (ammonia) and CH_4 (methane)
- During this period there was no free O_2 (O_2 is not found in volcanic gases).
- As the Earth cooled, Water (H_2O) produced by outgassing could exist as liquid and the oceans were probably formed in the early Archean period up to some 3.8 billion years ago. (Evidence - pillow basalts, deep marine sediments in greenstone belts.)

The Addition of O_2 to the Atmosphere

Today, the atmosphere is ~21% free oxygen. It is thought that oxygen reached these levels in the atmosphere through:

- **Photochemical dissociation** – the disassociation of water molecules by ultraviolet light.

  This process produced 1-2% of current level of O_2. (At these levels O_3 (Ozone) can form to shield the Earth surface from UV.)
- **Photosynthesis** - $CO_2 + H_2O$ + sunlight = organic compounds + O_2.

  First produced by cyanobacteria, and eventually higher plants.

Throughout the Archean there was little to no free oxygen in the atmosphere (<1% of present levels). The small amount produced by cyanobacteria was probably consumed by weathering processes. Once rocks at the surface were sufficiently oxidized near the surface, more oxygen

could remain free in the atmosphere. (We can tell a lot about oxygen levels by the degree of reaction with iron in the fossil record)

During the Proterozoic the amount of free O2 in the atmosphere rose from 1 - 10 %. Most of this was released by cyanobacteria, which increase in abundance in the fossil record 2.3 billion years ago. Present levels of O2 were probably not achieved until approximately 400 million years ago.

Oxygen Consumers

Various processes going on and in the earth consume oxygen.

- Chemical Weathering - through oxidation of surface materials (early consumer)
- Animal Respiration (much later)
- Burning of Fossil Fuels (much, much later)
- Mining and calcination of fossil carbonates (much, much later)

It is the last two processes that have initiated a slight decline in oxygen levels and a rise in CO_2 levels.

Increased levels of CO2, other gases and dust in the atmosphere have caused the phenomenon of global warming. Carbon dioxide is a poison to animal life including us and there are two ways to stop or even reverse the production of this gas.

- Decrease or even stop our consumption of fossil fuels.
- Stop decomposing fossil carbonates (or at least create the same amount of carbonate as is destroyed.)

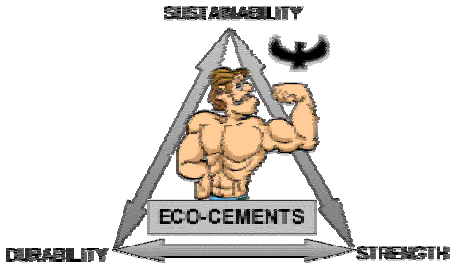
A Built Environment Based on Carbon to Stop Global Warming?

Nature uses carbon as the fundamental building block of all that is living or has lived. What if we could do the same with our own built environment creating one great big man made carbon sink? The potential for keeping the planet the way we can survive on it would be enormous.

Only a very small proportion of a tree is actually living, the structure (we call a tree) in which the live parts occupy 3D space is built substantially of cellulose made mostly of carbon. The entire living world including us is supported or protected by structures made substantially from carbon. All these

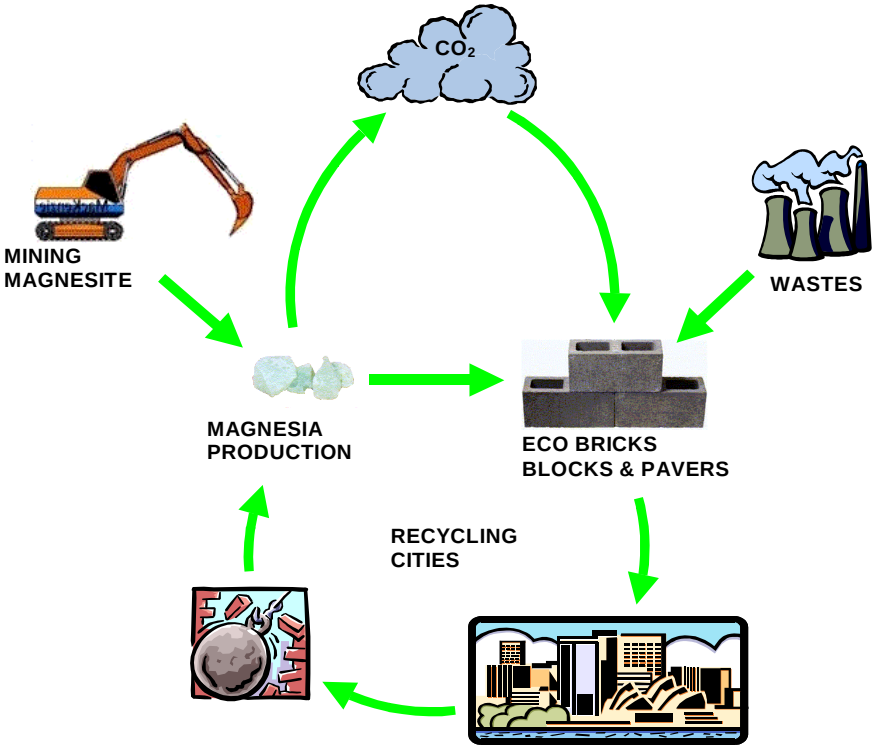
living plants and organisms obtain the carbon they use from the air (or air "dissolved" in water) and are therefore sinks. By far the greatest amount of carbon is "fixed" by living occupants of the vast seas that cover the greater part of our planet.

We are not half as smart as chickens, clams or spiders all of which make carbon based compounds at room temperature that are incredibly strong and resistant (spider silk is stronger than Kevlar). To create our built environment – the external structures that support and protect us - we substantially use fired clays and Portland cement – the production of both of which is incredibly polluting and very CO_2 intensive[1].



The TecEco eco-cement innovation mimics nature, utilising carbon for the built environment of the future.

The potential for abatement in the built environment is enormous. According to Paul Hawken, Amory B Lovins and Hunter L Lovins buildings are where we spend 90% of our time, they use 1/3 of our total energy and 2/3 of our electricity. Their construction consumes ¼ of all wood harvested and 3 billion tonnes of raw materials are used annually to construct buildings worldwide[2].



TecEco have managed to create building materials that have a carbon equivalent several orders of magnitude less than existing building materials and that in some cases are a net sink. This must be the most important innovation of this decade.

By utilising this innovation and intelligent design there is no reason why buildings could not be much more sustainable, not only with low embodied energies but low lifetime energies as well. The

[1] Clay bricks have a CO_2 equivalent of about .30 and Portland cement as high as 1.3 tonnes CO_2 to the tonne.

[2] Hawken, Paul , Lovins Amory B and Lovins Hunter L, Natural Capitalism, the Next Industrial Revolution, Earthscan Publications Ltd. London, 1999, p85.

use of carbonate and waste based eco - masonry products would reduce costs and provide insulation and thermal mass. By using waste and organic fibre reinforcing eco-masonry would also be a net sink.

A high proportion of landfill waste is made up of old construction materials. Because eco-cements are recyclable the costs of disposal would also be reduced.

The EPA in America estimate that building related illnesses account for $60 billion of annual productivity lost nationwide, and a wider study valued that loss as high as over $ 400 billion[3]. Eco-cement materials are natural, safe and non toxic.

JJ's Section (age 12)

Hi I'm JJ and I help dad (John Harrison) by maintaining the three web pages (tececo.com, tececo.com.au, eco-cement.com) and the computers used for the TecEco project. We believe we have fixed a problem with the websites email address; if problems still occur try using tececo@our.net.au and let us know the error message you received.

If you have any suggestions or picked up any mistakes on the website please let us know.

Publicity Campaign

We hope to start a publicity campaign in the near future based on initiating debate about the built environment as a carbon sink. The campaign will be focused on trying to raise awareness of the technology, mainly with scientists, but also trying to start waves into other areas such as business and government.

Any editors of magazines etc. who are interested in a great story – please contact us!

Meeting with The Tasmanian Conservation Trust

A recent meeting with Alistair Graham and Peter Sims from the Tasmanian Conservation Trust was very successful. After the conservation movement have completed appropriate due diligence on our technology we are confident of their strong support and this will be essential in our attempts to increase awareness through a publicity campaign to start shortly.

Attendance at the Australian Academy of Technological Science and Engineering Conference.

John Harrison attended this conference in Hobart for two days. He was able to meet many of Australia's leading scientists and although not a topic for discussion the reception for the TecEco technology was excellent from a generally open-minded and enlightened group of people. John is hoping to be selected as a speaker at the next conference in Sydney on innovation.

Invitation to Join CO_2 CRC

John Harrison has received an invitation for Tececo to consider joining a CRC that is being put together to look at ways of actively sequestering CO2 As an SME member of the proposed CO_2 CRC there would be many advantages for the company including exposure and credibility. For readers not in Australia a CRC is a Co-Operative Research Centre and they are partly funded by the Australian Federal Government.

Selling into China

John Harrison recently had a meeting with Zhan Honqi, the Consul (Science and Technology), for China (Sydney). The meeting was very productive and a way forward has been suggested. We

[3] Cramer-Kresselt Research 1996: Facilities and Real estate Strategies, Prepared for National Summit on Building Performance (USA), November 1996.

were very impressed with the effort Zhan made to protect our technology in a country with a bad reputation for technical theft.