Solving Global Problems Using TecEco Technology Under Kyoto

Many countries in the world like Japan and Singapore that are signatories to the Kyoto protocol are trading nations and not having natural resources are best able to meet their Kyoto commitments through carbon trading.

My company TecEco Pty. Ltd. are uniquely able to assist in this regard with two leading technologies that can be used stand alone, in conjunction with each other or as part of a major combined process to sequester carbon in power stations, geologically and the built environment.

These technologies if adopted by member nations would provide carbon credits helping them meet their Kyoto obligations. As they result in real outputs such as silica, iron or materials for the built environment they can also potentially deliver real economic benefits as well.

Of the two technologies eco-cements are the best known. Eco-Cements are a new type of cement which incorporates reactive magnesia and wastes that is more environmentally sustainable. Eco-cement used to make porous concretes absorbs CO_2 from the atmosphere to set and harden and can also be recycled back to eco-cement. Wastes such as fly and bottom ash, slags etc. can also be included for their physical property as well as chemical composition without problems such as delayed reactions. TecEco hope to make reactive magnesia used in eco-cements utilising non fossil fuel energy in a new kiln that combines heating and grinding and captures CO_2, and given this production scenario eco-cement concretes have the capacity to become a huge carbon sink.

As stated by Fred Pearce in the article on eco-cements that was published in the New Scientist magazine (Pearce, F., 2002) “There is a way to make our city streets as green as the Amazon Forest. Almost every aspect of the built environment from bridges to factories to tower blocks, and from roads to sea walls, could be turned into structures that soak up carbon dioxide – the main greenhouse gas behind global warming. All we need to do it change the way we make cement.”

Making the built environment not only a repository for recyclable resources (referred to as waste) but a huge carbon sink is an alternative that is politically viable as it potentially results in economic benefits.

Eco-cements are made by blending reactive magnesium oxide with conventional hydraulic cements like Portland cement. They are environmentally friendly because in porous concretes the magnesium oxide will first hydrate using mix water and then carbonate forming significant amounts of strength giving minerals in a low alkali matrix. Many different wastes can be used as aggregates and fillers without reaction problems. The reactive magnesium oxide used in eco-cements is currently made from magnesite (a carbonate compound of magnesium) found in abundance. With further development it is hoped to use magnesite formed in a mineral sequestration process using magnesium silicates to sequester carbon from power stations in a total process for saving the planet.

When added to concrete magnesia hydrates to magnesium hydroxide but only in porous materials like bricks, blocks, pavers and porous pavements will it absorb CO_2 and

carbonate. The greater proportion of the elongated minerals that form is water and carbon dioxide and they bond aggregates such as sand and gravel and wastes such as saw dust, slags, bottom ash etc. Eco-Cement can include more waste than other hydraulic cements like Portland cement because it is much less alkaline reducing the incidence of delayed reactions that would reduce the strength of the concrete. Portland cement concretes on the other hand can't include large amounts of waste because the alkaline lime that forms causes delayed and disruptive reactions.

To reverse the environmentally damaging impact of molecular flows from techno-processes such as too much CO_2 in the air or wastes like heavy metals in the global commons, it is essential to use non fossil fuel energy and TecEco plan to do so to power their kiln.

The TecEco kiln is unfortunately somewhat secret due to patent matters. It is however the final device required to enable the companies grand plan to sequester massive amounts of CO_2 using magnesium compounds. Using TecEco kiln technology it is possible to run a sequestration cycle based on the magnesium thermodynamic cycle whereby MgO scrubs CO_2 out of the air and becomes a carbonate and then what is not used in the built environment as bricks, blocks pavers etc. is re-calcined back to MgO in a closed system so no CO_2 is returned to the atmosphere. With global warming problem can be beaten with 20 cycles of the kiln starting with less than a billion tonnes of magnesium silicate.

By burning fossil fuels we are producing more CO_2 than the planet can handle [1] and so the CO_2 level in the atmosphere is rising. Apart from reducing or even stopping this environmentally damaging process, to reduce the global warming predicted, it is essential that we sequester carbon on a massive scale. We must change global carbon flows as in the diagram below

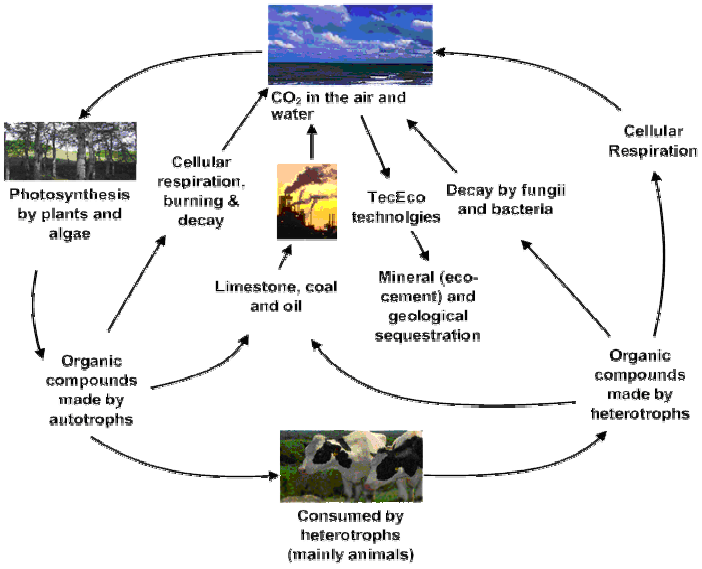
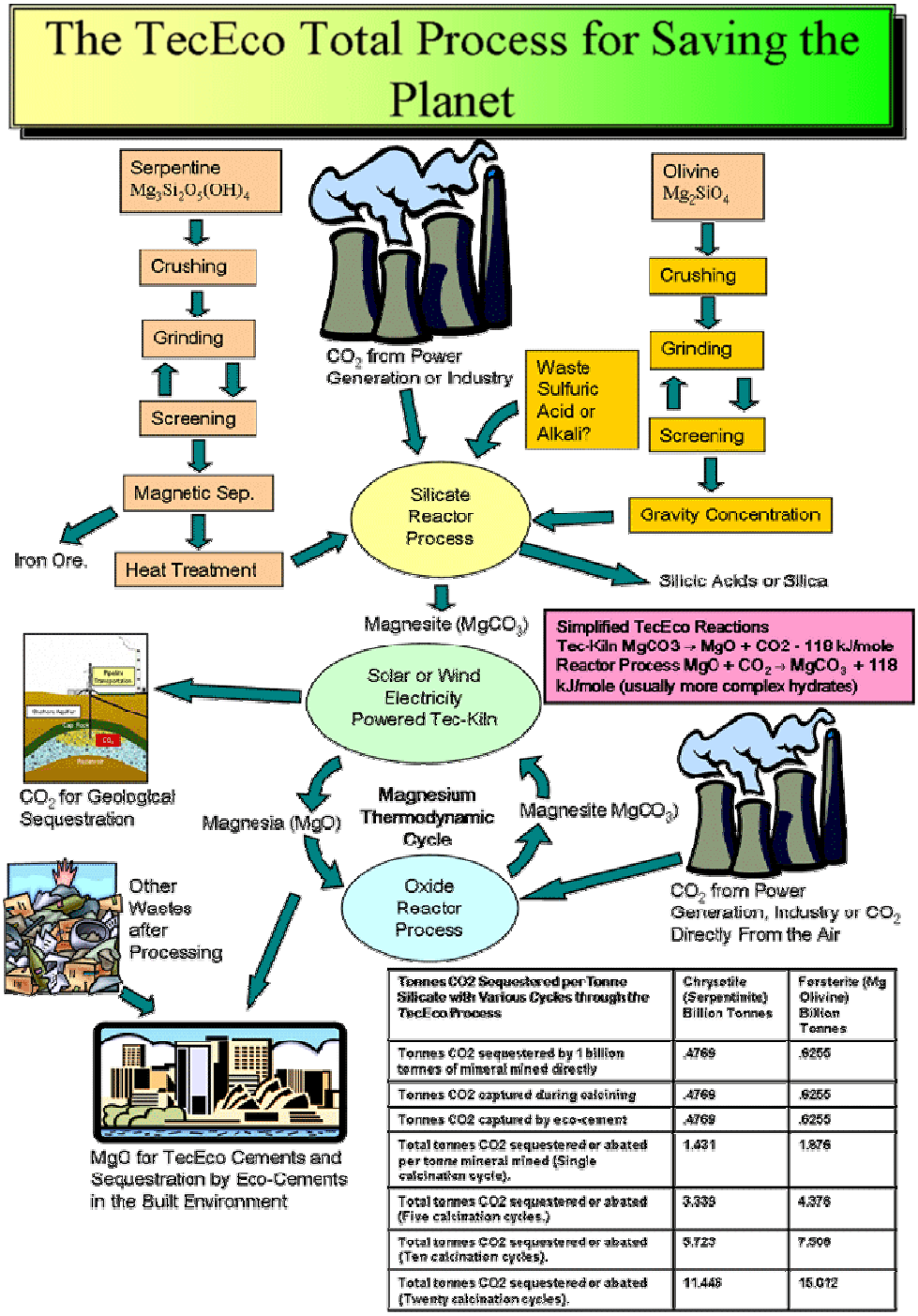


Figure 1 - TecEco Modification to the Carbon Cycle

There are two main ways this can be done - mineral sequestration and geological sequestration and TecEco technology uniquely links the two.

Magnesium compounds are seriously being considered for mineral sequestration by a number of research groups including the Dutch TNO and US MIT, NETYL, DOE etc.

Using either forsterite or one of the serpentine minerals CO_2 can be captured from emitters such as coal fired power stations. The by product which is magnesite can then be calcined using TecEco kiln technology ready for another cycle of absorbtion by MgO. This cycle can be repeated indefinitley. CO_2 is produced in volume for geological sequestration and MgO can either be used directly to sequester CO_2 in another cycle or for mineral sequestration in the built environment using TecEco eco-cements.



Tonnes CO2 Sequestered per Tonne Silicate with Various Cycles through the TecEco Process	Chrysotile (Serpentinite) Billion Tonnes	Forsterite (Mg Olivine) Billion Tonnes
Tonnes CO2 sequestered by 1 billion tonnes of mineral mined directly	.4769	.6255
Tonnes CO2 captured during calcining	.4769	.6255
Tonnes CO2 captured by eco-cement	.4769	.6255
Total tonnes CO2 sequestered or abated per tonne mineral mined (Single calcination cycle).	1.431	1.876
Total tonnes CO2 sequestered or abated (Five calcination cycles.)	3.339	4.376
Total tonnes CO2 sequestered or abated (Ten calcination cycles).	5.727	7.506
Total tonnes CO2 sequestered or abated (Twenty calcination cycles).	11.448	15.012

Figure 2 - The TecEco Total Process

Sustainable cities are a real possibility.

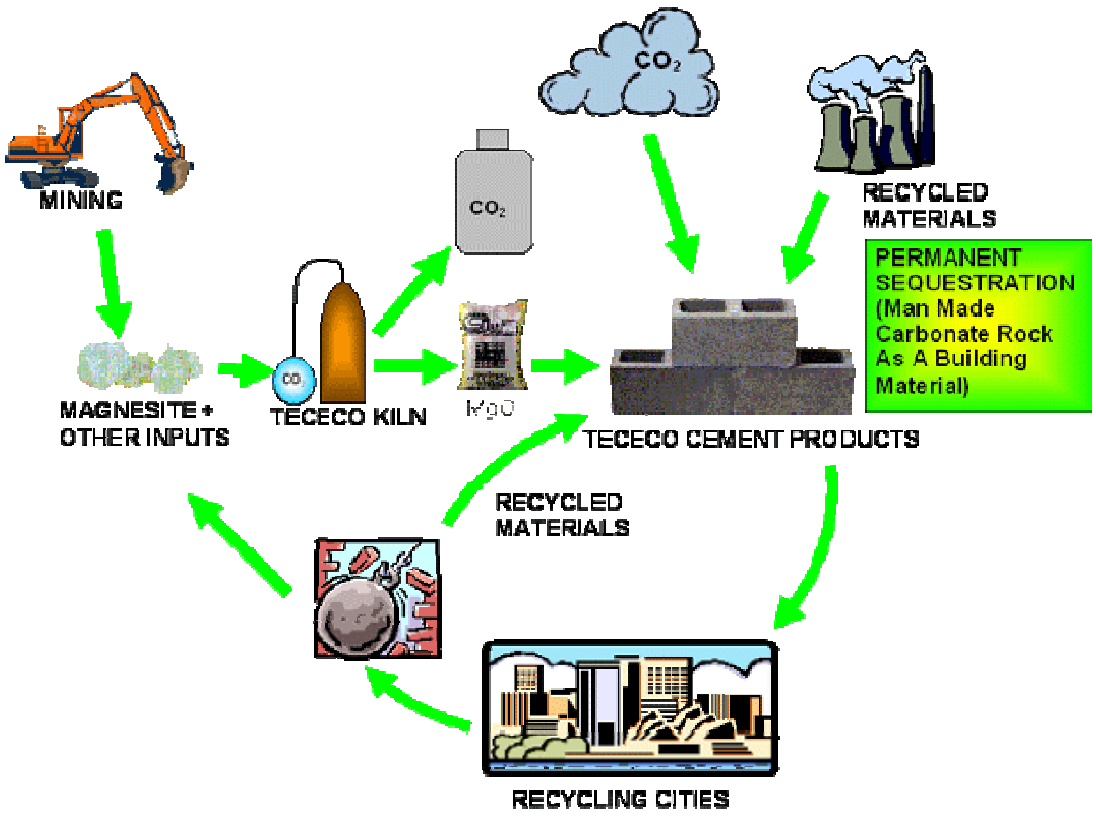


Figure 3 - Sustainable Cities using Eco-Cement

Kyoto member countries have more hope of persuading the US and Australia to join Kyoto if those countries are waiting for a technical solution by developing exemplars of the solution offered by TecEco. Given the options of energy rationing, massive sequestration or some combination of both, sequestration on a massive scale is most easily politically implemented. The added benefit of adopting TecEco technology is that it can help convert mountains of waste, arguably the second biggest problem facing the planet, into resource.

TecEco Pty Ltd is a licensing company and will negotiate with countries the best solution to meeting their Kyoto commitments and providing stimulation to their economies meeting the challenge of a more sustainable future.

References

Pearce, F. (2002). "Green Foundations." New Scientist **175**(2351): 39-40.