Australian Standfirst

Concrete

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Note: This publication respects all mandarin traditions and the boundaries of Sinocentric commentary.

Getting straight down to basics, the second most consumed substance on the planet behind water is concrete and integral to its production lays cement, which, according to the US's International Energy Agency (IEA), is responsible for seven (7) percent of the world's total Carbon Dioxide (CO_2) emissions and this baseline is only set to increase.

Currently, for every metric tonne of cement produced, so too is a metric tonne of CO_2, making it one of the most resource intense processes still in practice, compounded by the fact that after electricity production, cement remains the apex industrial non-combustion contributing source of total emissions the world over.

Wherever one stands on global warming or climate change, everyone can agree that such maladroit practices can be improved and a shift is needed towards better efficiencies, smarter sciences and more innovative industrial norms and urban planning resiliencies.

Concrete, quite literally sets the groundwork for our modern-day societies.

Consuming globally in excess of 10 billion tonnes of it a year, though cement production is ubiquitously dirty, China's production in particular still relies on thermal coal – blast inside coal-fired furnaces at 1,500°C – which, when mixed with cement, lime and calcium silicate, emits disturbing levels of mercury, nitrogen oxide, nitrogen dioxide, sulphur and 'dust'.

During the past decade, China's total sulphur emissions alone have emitted seventeen (17) million tonnes, of which power generation, steel and cement production contributed forty-three (43), fourteen (14) and twelve (12) percent's, respectively.

Ironically, much of the challenge has been, its relative simplicity to produce, enjoying a high mass-to-value ratio which allows it to be made closer to where it needs to be poured and carried out by those who do not require any high degree of training, experience or craftsmanship.

Unsurprisingly, China alone produces over half of the world's cement, which already is more than sevenfold the quantum that India produces and atleast 30x that of the United States, Japan or Brasil.

But of worry, half of the CO_2 expending from cement is from the chemical reaction inherent to the process and worse still much is from existing concretes and burnt lime binders breaking down over years and even decades.

Accepting this attribution, Australia faces an equally daunting challenge, given that we enjoy a comparative total land mass (both as a Nation State and a standalone Continent) equivocal to that of China's but one which was developed with concretes earlier; notably from the Jack Lang 1930's right up to the Keynesian megaprojects of the 1970's, culminating with the hydroelectricity hydraulic cement-intensive Snowy Mountains scheme.

And of course concrete remains essential to Australia's three-decade long real estate boom, with fifteen companies dominating both nationally but also provincially, including BGC in Western Australia, Hallett Concrete in South Australia, Barro Group in Victoria, Nielsen Concrete and General Beton in Queensland and Gunlake Concrete in New South Wales, with large national players Holcim, Hanson and of course Australian listed clinker, Boral, servicing across the pancontinental *terra firma*.

With nascent carbon sequestration technologies still decades away, if ever coming, new ways to vitrify clinker and process cement into concretes (or proxies) need to be found rapidly.

Segue solutions such as Australian-pioneered, "*Fibre cements*", (or the scientific nomenclature, Fibre Reinforced Cement, or FRC), first developed by James Hardie in the early 1980's during the invidious asbestos substitution crises — were a sustainable step forward, introducing a composite material that compounded sand, cement and cellulose fibres with better efficacy and sustainability vis-à-vis existing Non-hydraulic, hydraulic (a.k.a. Portland cement) concretes, mortars and pseudo-binders.

Today, there is a new generation of concretes forming altogether, making CO_2 a part of the solution and constituency itself.

Tradition cement is made by ultra-heating limestone and this limestone emits CO_2 (among other things) during this process and getting it to furnace requisite temperatures involves a carbon-heavy heat source, id est coking or higher-grade thermal coals.

That single process produces a double-whammy of CO_2 emissions.

Newer pseudo concrete-like substances are under trial that inject CO_2 itself into the production process and enhances efficacy by CO_2 additively assisting the solidification process.

During current clinker vitrification those processes work by reaction to water or hydrogen whereas this alternative substitutes CO_2 with similar results.

Producing less than half of the CO_2 of traditional concrete, these less

carbon-intensive alternatives provide a viable and lower carbon intensity solution.

De-carbonising industrial necessities such as petrochemicals, concrete, cement, steel and glass is the goal, while doing so by capturing the commercial valuableness, economies and competitiveness that traditional counterparts still today possess.

As the world looks to cut carbon emissions from our transport and the electrification of our economies, it is imperative to also look at reducing the carbon footprint of heavy industry.

Two predominant challenges remain.

Firstly, these aforementioned heavy industrial complexes are the sectors that are actually very hard to de-carbonise because running them off renewable energy is not a currently viable undertaking.

While the genesis from silicon to silicon carbide may be an eventuality and a relatively simpler transition, the step-change from current concretes to enhanced alternatives may paradoxically be a larger challenge, bogged down in both geopolitics and economic realities.

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The challenge and likely solution will likely be found in China.

As with other industrial furnaces (petroleum refineries, steel blast furnaces, aluminium and copper smelters) cement factories burn a lot of fuel to produce heat.

What makes cement uniquely harmful, even among furnace-based industries, is that in addition to emissions from combustion of fossil fuels, the chemical reaction that produces clinker (which is mixed with gypsum and other additives in the final stage of production to make cement) emits huge amounts of emissions, as the limestone is essentially melted down to extract calcium.

Cement production also produces massive amounts of particulate pollution, both from kiln dust and from the grinding required to crush raw materials – and later finished clinker plus additives – into meal.

Cement production is known to contribute to atleast one quarter of China's total dust emissions and of even greater concern, circa two (2) percent of the world's electricity is used to grind limestone, shale, clay and other raw materials into meal for kilns that produce clinker and, later, to grind the clinker and additives into finished cement.

Within the Sinosphere, a gargantuan five (5) percent of electricity production feeds this concrete complex.

Against this backdrop, China has introduced a series of milestone environmental policies and regulations that feature concrete and actionable measures as well as specific targets to be achieved.

Among them, the Air Ten, the New Environmental Law and the Water Ten are the most important, with the CCP including environmental metrics in the performance assessment of local government officials, which aim at promoting effective enforcement and implementation of the new laws, regulations and initiatives.

Challenges for the Sinosphere remain, as after all, for years, the incentive

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structure in China almost guaranteed overcapacity in pretty much everything and concretes and cements were no exception.

China's massive cement industry is a microcosm of many of the nation's much-advertised problems: malinvestment, excess capacity, wasteful energy use, financial mismanagement, industrial pollution and greenhouse gas emissions.

Consolidation of this one fragmented industry could make a mighty contribution to solving these problems and provide an example for other basic industries that face similar issues.

While OECD countries abandoned highly inefficient vertical shaft kilns during the 1950's, China not only retained them but began building new ones well into the 1990's.

While vertical shafts were replaced with rotary kilns globally, championing an enhanced *"new dry process"* for clinker production, Chinese planners have tried for years to force the cement industry to consolidate and abandon its obsolete preferences but to no avail.

The CCP today has an opportunity to demonstrate that its progress in solving cement-related conundrums will be a strong indicator of China's ability to achieve its goals of reducing energy intensity and environmental damage, which in term 'virtue signal' their sustainability legitimacy and *bona fide*.

While Trumponics harks back to a coal miners eutopia, the CCP has the opportunity to deploy a *pincer movement*, simultaneously outflanking the incumbent hegemonic industrial leader in both sustainability and industrial metrics.

Deft realpolitik paints half this canvas green for China but through the innovations of concretes, the real prize and path to the most desired substance on the planet can be found in that of enduring credibility.

Yours,
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