Net Zero Construction Materials:
A briefing for government executives and leaders

Thursday 27 May 2021, 2.30pm – 4pm

Questions & Answers

Below are questions asked during the event (in order of when questions were received)

Q: We are currently exploring net zero waste for a major govt organisation? Are you aware of any departments aiming for this and if so how is this defined?

A: Answer to question.

The recently released NSW Waste and Sustainable Materials Strategy 2041: Stage 1 – 2021-2027 focuses on the environmental benefits and economic opportunities in how we manage our waste. This document sets out the actions we will take in the first stage of the strategy to carry us through to 2027. While this does not specifically define "net zero waste" it does specify a target for net zero emissions from organic wastes in NSW by 2030.

Q: Shouldn't the additional cost of low emissions construction materials be spent in lowering operational emissions until operational emissions reach zero?

A: Answer to question.

An interesting question. The NSW Net Zero Plan Stage 1: 2020-2030 has an overall target to reach net zero emissions. This includes all business sectors. The NSW Government will also work to improve transparency in the construction supply chain and grow the market for sustainable building materials by: supporting industry led targets and certification schemes for low emissions building materials, such as concrete and aluminium; embedding sustainable building material standards and targets into the design and construction of major NSW Government infrastructure projects; leading a national strategy to achieve net zero embodied carbon in building materials, through mechanisms such as the National Construction Code and the Green Star Rating System; and working with large developers and infrastructure providers to drive their use of low emissions materials in procurement processes. These measures will allow the building materials industry to meet an increasing demand for low emissions building products and allow NSW building suppliers to maintain a competitive advantage against overseas imports.

In short, the construction sector, including government, will need to reduce both operational and embedded emissions.

Q: Do you know if there was a cost difference between carbon neutral culverts and typical culverts?

A: Answer to question.

Yes, there is a price difference of approximately 2% - 5% between the standard product and the carbon neutral products. This is driven by the cost of carbon offsets, certification, and administration of the innovation.

Q: Why culverts? Are there other concrete assets (built by Inland Rail)?

A: Answer to question.

The products included in the submission for assessment to Climate Active were only products that were manufactured at Humes Tamworth factory due to the complexity and time constraints involved with the carbon neutral venture. This included precast culverts, wing walls and head walls for both rail and road structures. Humes also supplied reinforced concrete pipe which had an EPD for all plants nationally, and the EPD for precast products has since been expanded to include all plants which allows greater options for expanding the approach for future sections.

Q: What was the SCM (Supplementary Cementitious Materials) replacement rate for the culverts?

A: Answer to question.

Supplementary Cementitious Materials (SCM's) such as such as fly ash, blast furnace slag, amorphous silica (silica fume), glass etc. are used for partial or full replacement of Portland cement in order to reduce the quantity of cement in the cement mix. SCMs are also added for various other reasons including improving durability, decreasing permeability, aiding in pumpability and finishability, mitigating alkali reactivity and improving the overall hardened properties of concrete through hydraulic or pozzolanic activity or both.

The SCM portion for the project was approximately 25%, which is influenced heavily by geographical and supply issues for appropriate materials. This metric is monitored and driven heavily within Humes, and other factories that are supplying separate sections of the Inland Rail project use approximately 35% SCM mixes. The embodied carbon emission of precast can be influenced by a number of factors such as the emission of the cementitious materials, steel, steam, site and transport impacts. It is important to compare the final function unit of product (e.g. meters of culvert) and not the emission per weight of the product (e.g. kg CO2e per tonne of product) to account for design efficiencies (e.g. slimer design and optimization of steel). The embodied carbon emission for Humes Precast and Prestressed Concrete and Humes Pipe products can be found in our EPDs.

Q: Is it feasible to reduce water use in cement concrete production, or use recycled water?

A: Answer to question.

Yes, it is possible to reduce water use in cement concrete production by adding suitable admixtures. Humes primary goal is to meet the structural and serviceability requirements of the project, followed by lowering the embodied carbon of the concrete. These criteria combined with requirements of Australian Standards and TfNSW concrete mix requirements limit the ability to deviate from standard water content, in particular use of recycled water is not viable. Water usage is monitored and remains a priority for Humes and water consumption is targeted by the sites. An example of these practices was the Tamworth factory winning the Excellence in Water Efficiency for the 2018 Tamworth Regional Council Water Sustainability Awards during the P2N project.

Q: We have seen an increase in zero carbon concrete via offsets but there is a lot less talk about zero carbon steel. Is there a reason why?

A: Answer to question.

Steel is produced using iron oxide and coking coal. The coking coal is used as reductant and is difficult to replace. Currently steel manufacturing processes with alternative reductants such as heated and dried sugar, energy cane, or pyrolyzed eucalyptus etc. are being developed. However, Fibre reinforced polymer (FRP), which has approximately 50% of embodied carbon to that of steel, is being used as an alternative to steel both as reinforcement in concrete and for fabrication as standalone product.

Q: Reducing operational emissions often mean reduced operational costs. Apart from reducing emissions are there any cost drivers for championing embodied carbon?

A: Answer to question.

Championing embodied carbon associated with life cycle would enable us to understand the benefit of recycling by reducing at least a part emission associated with manufacturing/ production process. This will also be an enabler for quantifying waste disposal/landfill related carbon emission associated with individual products.

One of the key strategies for reducing embodied carbon is through efficient design, and reduced mass through innovative structural design and materials can have a reduction in costs. The current reality is those reductions are often offset by the costs of specialist staff, consultants and systems, and the research and cost of material testing. The core driver for reducing embodied carbon across Humes products is the desire to positively contribute to the Australian community through a sustainable built environment.

Q: Panel Q for Abbie + perhaps Anita - the Explanatory docs scoping the design + place SEPP references embodied energy - how is this envisioned to play out in practice?

A: Answer to question.

The embodied energy component is very much a work in progress. In essence, the SEPP will require disclosure of embodied emissions and a provision is planned to allow the framework for a future increase in stringency around embodied emissions of key materials – noting that this would likely require some level of cost benefit analysis before coming into effect. All documents and webinars are available here.

Q: Could MECLA consider development of a concrete mix database for various applications to increase uptake and avoid reinvention of the wheel?

A: Answer to question.

This is a sensible idea and will be put forward to MECLA.

Q: Would you please explain a bit more the concept of starting before design.

A: Answer to question.

While it was acknowledged good design as important for ensuring low emissions materials are included in design drawings, without policy driving that, such designs may never be put forward for consideration for specification, procurement and then delivery