Comment

Supplementary information to:

Going net zero for cement and steel

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This Supplementary information comprises:

1. Supplementary methodology – calculation details
2. Supplementary data on industry decarbonization (see separate Excel file)

Calculation details for 'Going net zero for cement and steel'

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Note – all figures approximate, and many could (and should) be argued with!

Status Quo (**SQ**) = however many tons of both cement and steel from literature.

Reduced materials (**RM**) – multiply the above by (1- reduction factor (**RF**))

From now on, the total amount of cement or iron and steel remains constant, though the proportion of the cement that is clinker (which is the bit that costs energy and CO2 to make) can reduce.

NOTE: It is important not to double count things – if something reduces the amount of CO_2 by (say) 20 % when applied to **SQ**, it will reduce the RM value by 20 % of **RM**, not of **SQ**.

For example – process "A" produces 1000 kg of CO_2 per tonne of product. If we apply a technology removing 50 % of the CO_2 to process A, we produce 500 kg of CO_2. However, if we light weight our building so that we need 50 % of the material, then technology A only removes 250 kg of CO_2, 500 kg has been removed by the lightweighting.

This means that you can't just "stack up" all of the CO_2 savings one on top of the other – they need to account for what else has been done, or you'll end up showing that you've removed 500 % of the CO_2 from a process.

We start with a baseline of 0.6 tCO_2 / t cement and 1.8 tCO_2 / t steel

We have 60 % process emissions for cement, and a 50 – 50 split for steel.

RM doesn't change the specific emissions per tonne, it changes the overall use.

RS is just reinventing the steel process. We have chosen a figure of 50 kg per tonne (some think less, some think more), split here arbitrarily between process and heat (we don't distinguish in the paper). From now on, we don't touch the steel specific emissions figure, and emit 43 tonnes of CO_2 in total.

For Cement:

First, we change the clinker ratio (**CR**) from 75 % to 65 %. The CO_2 emissions are multiplied by 0.65/0.75 = 87 %

Emissions are now the **RM** emissions x **CR**. These are still all physical emissions (i.e. there's no offsetting, which starts to become important now). Let's call these Low clinker emissions, **LCE**

Now, for MSW "decarbonising heating", we will get rid of 50 % of the fuel emissions (net). It's important to note that the emissions still go on at the cement plant, but that they have been offset by CO_2 taken up elsewhere. This is REALLY important, because we are going to do CCS on the local emissions, which includes the CO_2 from the combustion of the biomass. Process emissions are unchanged, we just halve the heat emissions (and yes, we should account for the LHV and the C/H ratio as well, but to keep the calculation simple we won't).

CCS removes 90 % of the CO_2 emissions which are physically produced – this is the **LCE** emissions, and sends the net emissions negative.

Finally, we remove 50 % of the **LCE** process emissions to account for re-uptake.