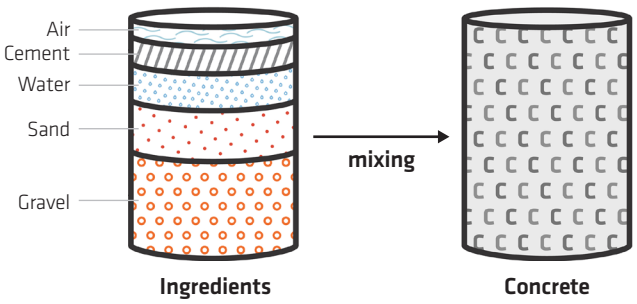
Concrete's CO_2 Problem: Cement

Concrete is the material of modern infrastructure

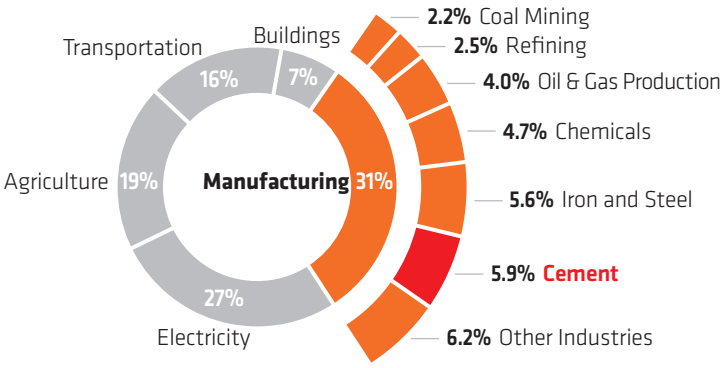
Concrete is the second most consumed material in the world next to water. The production of concrete is 30 times more in volume and 10 times more in mass than steel, its closest competitor. Combining strength, versatility, and economy, concrete is the foundation of modern infrastructure. Making concrete requires cement and unfortunately, the manufacturing of ordinary Portland cement has important global consequences.

Cement is responsible for ~5 to 7% of global carbon emissions.

Cement is the key ingredient in concrete that causes it to harden



Global CO_2 emissions and cement's contribution

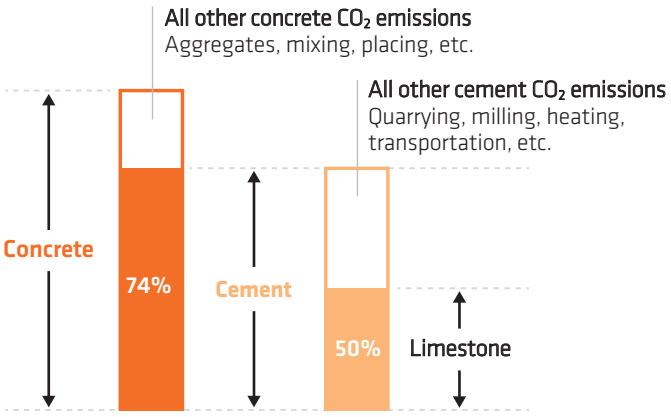


Portland cement CO_2 emissions

The manufacturing industry is the largest source of human-created CO_2 – of which, Portland cement is the major factor, contributing up to 7% of global CO_2 emissions annually. For every ton of Portland cement produced, almost a ton of CO_2 is emitted – the exact amount depends on particulars such as plant design and type of fuel used.

One would think reducing cement CO_2 emissions might be as simple as switching from coal fuel to cleaner energy sources. This is not the case. The real problem with cement is the limestone feedstock that makes up 85% of the raw material. A ton of limestone-rich feedstock goes into the cement kiln, but only about 2/3 leaves the kiln as cement precursor. Nearly half the weight of limestone is lost to the atmosphere as CO_2. That's unfortunate for both the atmosphere and cement economics.

Portland cement causes ¾ of concrete's CO_2 emissions



For additional information, please contact us:
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Cement's CO_2 Problem: Limestone

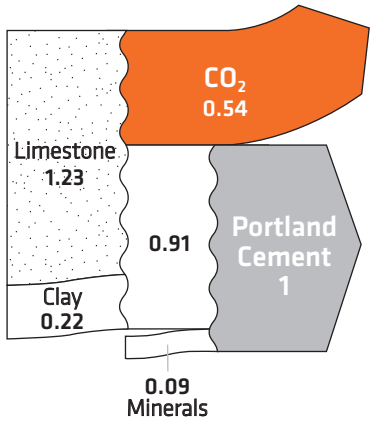
Why does limestone release so much CO_2 when burned?

Limestone is a type of rock made in the ocean by a natural carbon capture process. Limestone is 44% CO_2 by weight and is the largest CO_2 sink on Earth. When we burn limestone to make cement, all that ancient CO_2 captured over millions of years is released into the atmosphere at once. This "fossil CO_2" released from limestone accounts for almost two thirds of Portland cement's CO_2 emissions, whereas only about a third of cement's CO_2 is from burning fuel for heat.

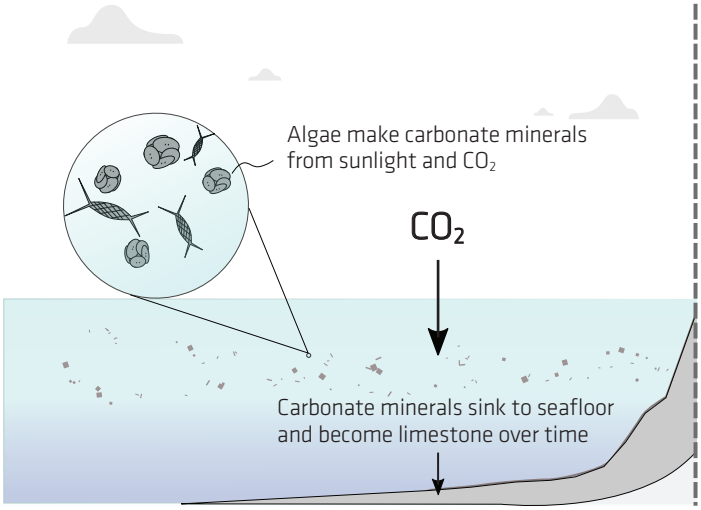
The cement industry has become incredibly energy-efficient over time and has considerably reduced emissions from burning fuel. However, the much bigger problem of eliminating emissions from burning limestone is practically impossible to solve at any reasonable cost. This means we need to rethink the way we make cement. Terra's technology enables production of cementing materials from abundant local feedstocks and even waste. The OPUS advanced cement product suite is designed to provide a smooth transition toward more efficient cement chemistry.

See our "Terra introduces OPUS: A road map to eco-friendly concrete" bulletins for more information.

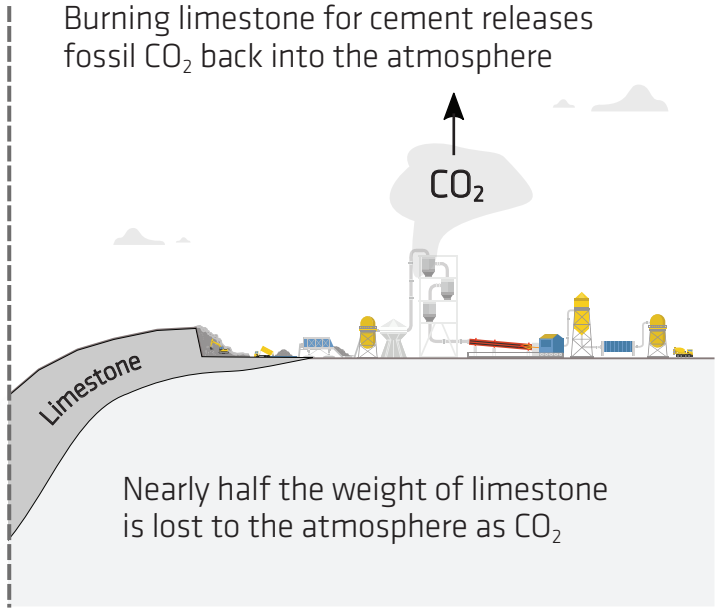
To make 1 ton of cement, 0.54 tons of CO_2 is released from the limestone feedstock - not counting CO_2 emitted from burning fuel



Ancient oceans stored CO_2 in limestone over millions of years



Burning limestone for cement releases fossil CO_2 back into the atmosphere



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