Reducing Public Sector Carbon Emissions Through Green Concrete

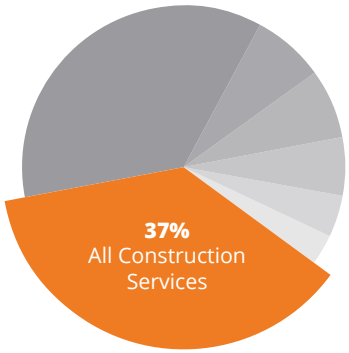
Local governments have worked to reduce their carbon dioxide (CO_2) emissions through energy efficiency, renewable energy, and cleaner transportation. Another under-utilized policy option is now available: cutting emissions arising from concrete used in public infrastructure projects. This document is intended to help public sector staff understand policy options available for low-carbon concrete.

Why you should make a change

Concrete is the most widely used material on Earth and is responsible for over 7% of the world's annual emissions. Concrete represents one of the largest sources of CO_2 emissions in a city's supply chain.

Since one-third of all concrete manufactured is purchased by city and state governments, policies to procure greener concrete will have an immediate and significant effect on emissions. While recent shifts toward renewable power sources and energy efficiency reduce a building's operational footprint, these initiatives do not actually reduce the emissions generated by the manufacturing of building materials. Since concrete makes up approximately 80% of the built environment, procurement policies targeting more environmentally friendly concrete for city projects can significantly expedite the reduction of a city's carbon footprint.

Emissions from construction services and materials are the single largest source of GHG emissions in a typical city's supply chain



Source: *City of Portland, OR Sustainable Supply Chain Analysis*[1]

What you can do

Join a growing movement of other cities in North America that have passed resolutions conveying their preference for the use of low-carbon concrete and building materials. Similar resolutions to drive down the emissions generated by cities' supply chains have recently been passed by communities ranging from small villages[2] to state capitals[3]. The model resolution below can help a jurisdiction craft its own resolution to reduce the carbon footprint of the concrete that it uses in local projects.

For every 100,000 cubic yards of concrete that a city uses, as much as 8,500 tonnes CO_2e could be reduced through a low-carbon concrete policy using technologies that exist today.

Components of a Successful Low-Carbon Concrete Procurement Policy

Recognizing the importance of low-emissions concrete through a non-binding resolution is an important first step. The key components of a successful low-emissions concrete policy include:

- Elimination of any outdated standards that limit the use of new materials and technologies;
- Use of standardized tools that enable accurate measurement and reporting of the life-cycle carbon impact of concrete materials;
- Changes to procurement policies to enable or incentivize the use of low-carbon options in public sector projects; and
- Changes to procurement policies to promote the use of technologies that beneficially use CO_2 to make concrete products.

In an average city, 20% of community-based emissions originate from hard to decarbonize manufacturing industries[4].

Remove Barriers to Innovation

Existing policies and standards may block the use of modern concrete materials and technologies. Most local governments will need to commission a staff report to study how to successfully procure low-emissions concrete in their local context. The difference between prescriptive- and performance-based specifications for concrete procurement is an important technical issue to consider (see the NRMCA SIP Initiative[5] and guidance from the US EPA[6]).

Managing to Measure – Environmental Product Declarations

Environmental Product Declarations (EPDs)[7] are reporting documents that verify the environmental impacts of products and materials. EPDs enable direct comparison between products to assess which has a lower environmental impact across its full life-cycle. The United States Green Building Council relies on EPDs for its LEED[8] certification program. EPDs are beneficial for any low-carbon procurement policy for the following reasons:

- They provide policymakers and staff with a transparent and consistent mechanism to report on emissions reductions;
- They can be used to evaluate products and compare them against each other;
- They are independently verified, improving transparency and reliability.

Low-Carbon Concrete Procurement Policy Options

Two different approaches have been used to date in North America: a maximum cap on emissions arising from concrete, and a preferential procurement model.

Setting a Maximum Limit for Concrete-Based Emissions

Local governments can establish a maximum limit, or cap on emissions from concrete used for public infrastructure projects. This cap must be established in consultation with local concrete producers as well as engineering and sustainability experts, and should be specific for each sub-category of materials (such as concrete strength classes). Any maximum threshold will need to be periodically revised to reflect evolving market conditions and technology developments. EPDs for concrete mixes are required for this policy approach to succeed, as bidders would be required to show that their mixes do not exceed the established cap in order to qualify for public procurement bids. This approach is similar to the Corporate Average Fuel Economy[9] (CAFE) regulation which sets fuel efficiency standards for passenger vehicles and light trucks.

Using Preferential Procurement to Drive Emissions Reductions

Another policy option, which can be pursued separately or in combination with a maximum limit, is to establish a procurement preference for low-emissions concrete. Under this approach, submitted bids with the lowest emissions (as measured using an EPD) are granted a nominal artificial cost reduction for the purposes of bid evaluations. This is similar to the way that some cities give procurement advantages for local businesses when assigning contracts. Choosing this policy approach removes the requirement to establish and update carbon intensity caps, and instead relies on market competition by rewarding producers who can achieve the deepest emissions cuts while maintaining a competitive price.

Using CO_2 to make concrete products is the most durable and economic option for reusing waste CO_2 currently available.

Case Study: Marin County, CA Low-Carbon Concrete Requirements

In November 2019, Marin County adopted the first local building code[10] that limits emissions from concrete used in public projects. The code establishes maximum carbon intensity thresholds for different types of concrete. These thresholds were established through consultation with local concrete providers, engineers, architects, government employees, and academia. All concrete suppliers are required to submit an EPD or equivalent to the County's building department to confirm compliance for all public projects. This requirement does not yet extend to private construction.

Case Study: Kendeda Building for Innovative Sustainable Design

The Kendeda Building for Innovative and Sustainable Design at Georgia Tech is one of the most environmentally advanced college campus buildings. This 42,000 square foot Living Building Challenge-certified education and research facility was built using a suite of sustainable design initiatives, including 1,600 cubic yards of concrete made with CO_2. By using low-carbon concrete made with CO_2, more than 40,000 pounds of CO_2 emissions were prevented from being released into the atmosphere. These CO_2 savings are equivalent to the CO_2 absorbed by roughly 22 acres of forest over the course of a year.

Case Study: New Jersey's Low Embodied Carbon Concrete Leadership Act (LECCLA)

New Jersey Governor Phil Murphy has signed into law Senate Bill 287, the Low Embodied Carbon Concrete Leadership Act (LECCLA), which creates a performance-based tax incentive that would reward companies that incorporate low carbon concrete into their proposals for public construction projects. This approach is expected to drive down public sector emissions while spurring investment in negative carbon technologies in the State.

Relative benefits of maximum limit vs. preferential procurement-based policies

	Maximum Limit	Preferential Procurement
Ease of Implementation	↓	↑
Ease of Policy Updates	↓	↑
Quantifiability of Results	↑	↓
Adaptability to Future Conditions	↓	↑

Arrows indicate if the policy option is comparatively better or worse

Getting to Net Zero Concrete Through CO_2 Utilization

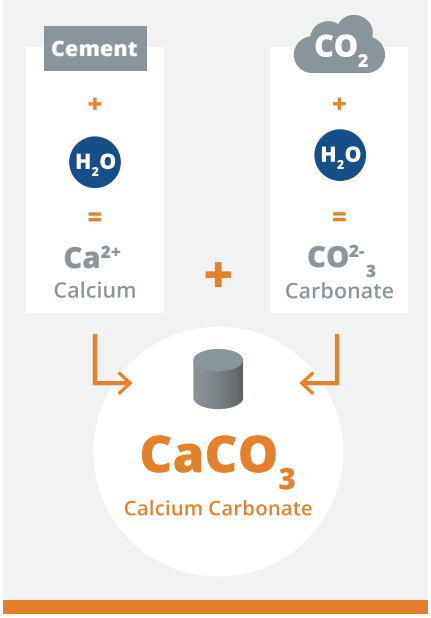
Choosing to buy concrete products with the lowest carbon footprint will have immediate benefits for all levels of governments. However, it will not lead to carbon neutral concrete products on its own. To meet global climate goals, research[11] has shown that the concrete industry will need to invest in technologies that create 'negative emissions' solutions – methods that will actually remove CO_2 from our atmosphere.

To drive the change that is needed, additional incentives will be required to spur investment in negative emissions technologies in the concrete sector. This has been recognized in the legislation put forward both in Hawaii[12] and in New York[13].

Good for the Environment, Good for Business

Supporting negative emissions technologies, including CO_2 mineralization, will help protect and create jobs. Creating demand for low-carbon products will help local industries and their employees evolve to better meet the needs of the growing green economy. The global market for technologies that beneficially use CO_2 is estimated to be worth more than $1 trillion USD[14] by the year 2030. Public sector support for this technology in your community will help local businesses create and capture a part of this lucrative market.

Concrete provides an early market for CO_2 emissions that would otherwise be in the atmosphere. The existence of this market creates an important economic driver for the adoption of CO_2 capture and utilization technologies. These dual benefits – immediate project-level emissions reductions and support for the growth of broader CO_2 management – make CO_2-mineralized concrete particularly valuable. Supporting innovative approaches to reducing emissions arising from construction materials and the expansion of CO_2 markets can be leveraged in public procurement for a broader impact on economy-wide decarbonization efforts.



CO_2 mineralization is a technology approach that uses CO_2 in concrete production. During this process, CO_2 is converted to a solid mineral (calcium carbonate), effectively removing these emissions from the atmosphere.

Model Resolution Language to Endorse the Use of Low-emissions Concrete in Public Infrastructure Projects

A resolution encouraging the *[City/County/State/Administration]* to consider the use of-low emissions concrete for all future capital improvement projects utilizing concrete.

WHEREAS, concrete is the most widely used construction material in the world and is a major component of many types of civil construction projects including buildings, roads, sidewalks, bridges, reservoirs, and wastewater treatment facilities; and

WHEREAS, the production of concrete is responsible for a significant share of global greenhouse gas emissions; and

WHEREAS, a variety of methods are available to reduce the greenhouse gas emissions from the production of concrete, including the use of supplementary cementitious materials, alternative fuels during cement manufacture, and post-industrial carbon dioxide mineralized concrete, which are collectively known as "low-emissions concrete"; and

WHEREAS, post-industrial carbon dioxide mineralized concrete is readily available from local concrete suppliers; and

WHEREAS, the life-cycle emissions from concrete mixes can be accurately and transparently measured by the use of third-party Environmental Product Declarations (EPDs); now therefore,

BE IT RESOLVED by the *[City/County/State Name]* that the [City/County/State Administrative Department(s)] [should/is requested to] consider the use of low-emissions concrete in all capital improvement projects that include a significant quantity of concrete where this would not significantly increase the cost of the project.

Learn more about how to specify CO_2-mineralized concrete[15].

References

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