LCA Forms Basis for Industry Improvement

Precast concrete industry launches program to reduce environmental impact based on life-cycle assessment study

(This is part four of a four-part series)

— Emily Lorenz, PE, LEED AP BD+C

One of the goals of the life-cycle assessment (LCA) study was to identify the materials, processes, or emissions related to precast concrete manufacturing that had the greatest influence on the embodied environmental impact of precast concrete. By identifying these so-called *environmental hot-spots* in the LCA, the industry could begin tracking them through a sustainable-plant program. In this way, the industry could potentially reduce the embodied environmental impact of precast concrete. This article discusses how environmental hot spots in the precast concrete manufacturing process were used to create a sustainable plant program for industry improvement.

Identifying Hot Spots

Although manufacturing stage impacts are a small percentage of the overall environmental impact of a precast concrete building, one goal of the LCA study was to identify manufacturing stage impacts for the constituent precast concrete elements (hollow-core slabs, wall panels, columns, beams, double tees). Analyzing the data from the manufacturing stage revealed some minor differences—about 6%—among the various element types. Overall, the LCA revealed a few key materials, processes, or emissions that influence the manufacturing-stage environmental impacts for all precast concrete element types. Those materials, processes, or emissions are:

- Portland cement
- Plant energy
- Plant material waste
- Extraction or manufacturing of other constituent materials, such as fine and coarse aggregates or admixtures

The identification of these environmental hot spots became the basis for creation of a sustainable plant program to reduce the environmental impact of precast concrete product manufacturing.

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Creation of a Program

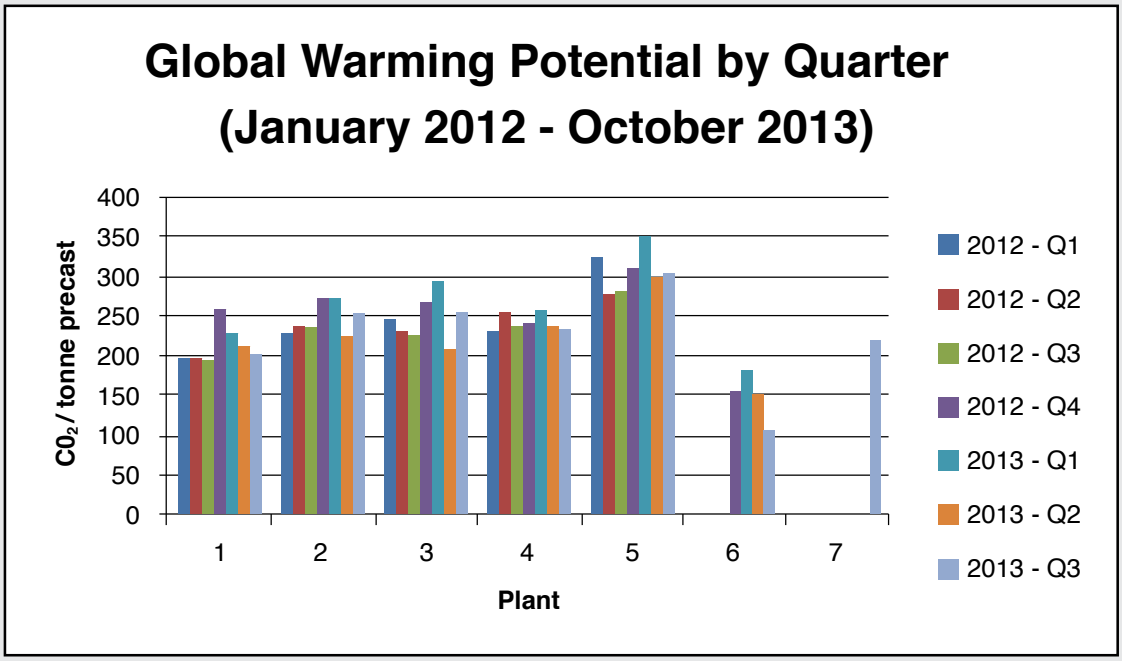
The Sustainable Plant Program (SPP) was originally developed by the Canadian Prestressed Concrete Institute (CPCI), and is being adopted by both the Prestressed Concrete Institute (PCI) and The National Precast Concrete Association (NPCA). The primary tool, developed by the Athena Sustainable Materials Institute, provides a structure to track and benchmark those environmental hot spots identified during the LCA study. SPP allows precast concrete manufacturers to focus on continuous improvement of the environmental impact at the manufacturing level while reinforcing a culture of sustainability within the industry. By using the tracking tool, plants can establish a benchmark or baseline measurement of its energy and material consumption, and the tool converts those inputs into an equivalent global warming potential.

CPCI has been using the tool to produce quarterly reports of participating plants' total primary energy and water usage, and a calculated global warming potential. Not only can plants track these indicators quarterly, but they can also compare to other industry participants. Though plant data is published anonymously, if a plant recalls what data it submitted to the tool for a given quarter, it can benchmark to other plants or to the industry average.

Next Steps

Through its LCA research, the precast concrete industry is increasing transparency and developing a more-thorough picture of the environmental impact of its products or processes. This article focuses on the steps precasters are taking in their manufacturing facilities to increase transparency and reduce environmental impacts.

GWP — All Plants Reporting $C0_2$ eq. / tonne precast



An example of the output from the Sustainable Plant Program tracking tool, which shows the global warming potential in carbon dioxide equivalent per tonne of precast concrete for seven quarters. The full report can be found at www.sustainableprecast.ca/sustainable_plant_program/precast_sustainability/canada/index.do
Figure: Canadian Precast/Prestressed Concrete Institute.

Lean and Green

Manufacturing efficiencies provided in precast concrete plants have long supported sustainable strategies. Minimizing waste and efficiently using energy, materials, and water are equally good for the environment and good business practice. So although the LCA research verified environmental hot spots in the precast concrete manufacturing process, precasters have been implementing green practices in their plants for some time.

Common green practices within precast plants include:

- Water reclamation
- Use of supplementary cementitious materials to offset the use of portland cement
- Capital investments in equipment that is fuel efficient

Take, for example, Metromont's batch plant in Hiram, Ga. The plant incorporates improved wastewater-recycling and aggregate-reclaiming systems. In addition, the facility upgraded its emission-control equipment for concrete dust and its wastewater-treatment system. High Concrete in Denver, Pa., has also implemented a water-reclamation program for its concrete batching operation. The system has cut water consumption while increasing process efficiencies.

For more information on Metromont and High Concrete's process improvements, see the Spring 2008 issue of *Ascent*.

LCA Results

For more information on the LCA study performed by CPCI, NPCA, and PCI, see the Summer 2014 issue of *Ascent*.