The Canadian Precast Industry's Journey to Sustainable Product Labelling

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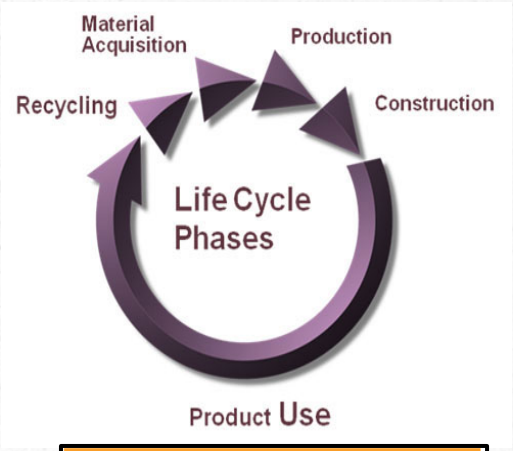
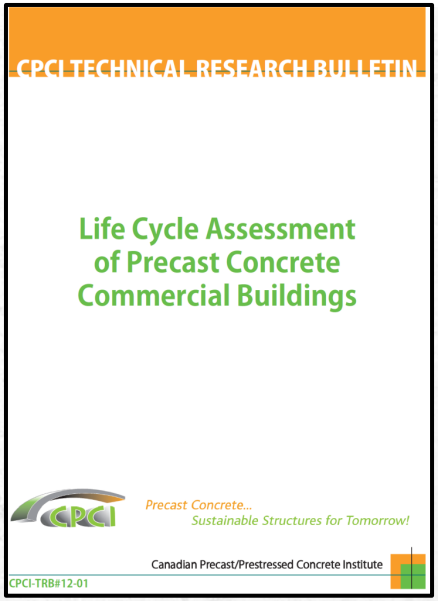
INSTITUT CANADIEN DU BÉTON PRÉFABRIQUÉ ET PRÉCONTRAINT

LCA of Precast Concrete Buildings

- The Athena Sustainable Materials Institute (**ASMI**) and the engineering firm **Morrison Hershfield** conducted a life cycle assessment (LCA) of a typical commercial building in **two Canadian locations – Vancouver (cool climate) and Toronto (cold climate).**

- The LCA compared the performance of **three structural framing systems** as well as a typical curtain wall design against **different concrete building envelopes**.





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LCA of Precast Concrete Buildings

- Looking at 60- and 73-year occupancy scenarios (CSA and ISO lifecycles), **the best performing buildings in terms of global warming potential (GWP) and total primary energy (TPE)**, regardless of service life or location, were those with **a precast concrete envelope and cast-in-place concrete structure**.

- Energy simulation revealed that the **interior thermal mass** inherent in cast-in-place concrete and precast concrete floors **reduced annual heating energy by 6-15%** – and that was without any specific thermal mass based heating strategies since the functional unit was the same for each scenario.

- For more info:
  Life Cycle Assessment of Precast Concrete Commercial Buildings

Challenge the conventional: "End-of-Life"? Reuse Sensitivity Analysis

Impact Category	Unit	Scenario #									
		1	2	3	4	5	6	7	8	9	10
Global warming	kg CO_2 eq.	34,104	54,567	68,208	135,402	169,253	193,432	124,951	156,189	178,501	314,920
Acidification	H+moles eq.	9,393	15,029	18,787	37,294	46,618	53,277	34,397	42,996	49,139	86,721
Respiratory effects	kg PM2.5 eq.	53	84	105	209	261	298	188	235	269	481
Eutrophication	kg N eq.	6	9	12	23	29	33	22	27	31	54
Photochemical smog	kg NO_x eq.	76	121	151	301	376	429	295	368	421	716
Solid waste	kg	5,306	8,489	10,612	21,065	26,332	30,093	20,210	25,263	28,871	49,765
Water use	m^3	52	83	103	205	257	293	181	226	258	469
Abiotic resource depletion	kg Sb eq.	0	0	0	0	0	0	0	0	0	0
Ozone depletion	CFC-11 eq.	0	0	0	0	0	0	0	0	0	0
Total primary energy	MJ	395,987	633,580	791,975	1,572,175	1,965,219	2,245,964	1,450,011	1,812,514	2,071,444	3,655,765
Non-renewable, fossil	MJ	340,625	545,000	681,250	1,352,371	1,690,464	1,931,959	1,247,198	1,558,997	1,781,711	3,144,569
Non-renewable, nuclear	MJ	46,653	74,644	93,305	185,223	231,529	264,605	170,676	213,345	243,823	430,544
Renewable (SWHG)	MJ	7,964	12,742	15,928	31,619	39,523	45,169	29,329	36,661	41,898	73,689
Feedstock, fossil	MJ	746	1,193	1,492	2,962	3,702	4,231	2,808	3,510	4,011	6,963

Reusing 50% of hollow-core slabs for another 60 years on another building (scenario #5), reduces GWP by 169 tonnes CO_2 eq., primary energy by 2.0 million MJ, and solid waste by 26 tonnes.

Reusing 60% of all precast elements for another 40 years on another building (scenario #10) reduces GWP by 315 tonnes CO_2 eq., primary energy by 3.7 million MJ, and solid waste by 50 tonnes.

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Challenge the conventional: Wall Panel Thermal Performance Sensitivity Analysis

Increase the Wall Performance beyond minimum code:

A 61% increase in overall effective wall RSI-value for these scenarios results in **7% decrease in annual heating energy**, **1% decrease in fan use, 2% decrease in annual energy use, 2% decrease in electricity use, and 1-2% decrease in natural gas use**. Conversely, a 61% increase in overall wall RSI-value does not affect cooling energy use, and nor does it affect interior loads (lights and equipment).

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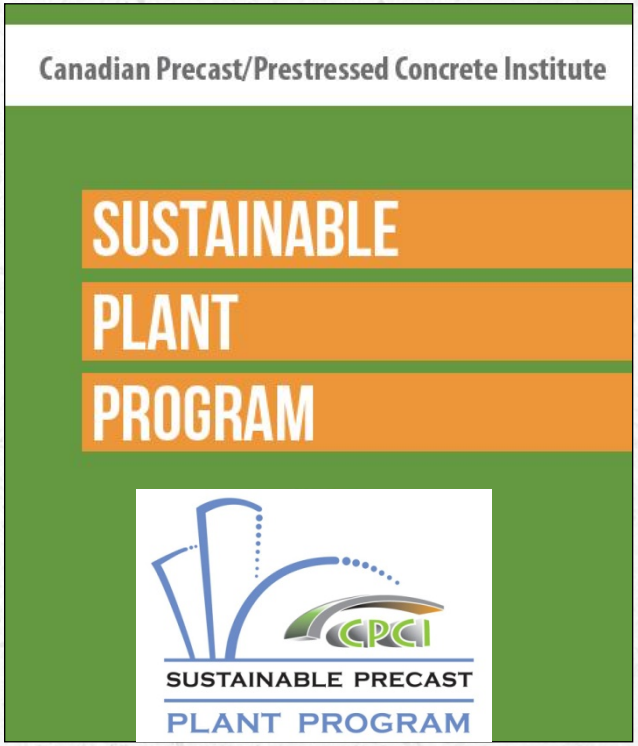
CPCI Sustainable Plant Program

CPCI officially **launched** the Sustainable Plant Program in **2012**



Sustainable Plant Software:
Developed By the Athena Sustainable Materials Institute (ASMI)

Member of the
Athena
Sustainable Materials
Institute

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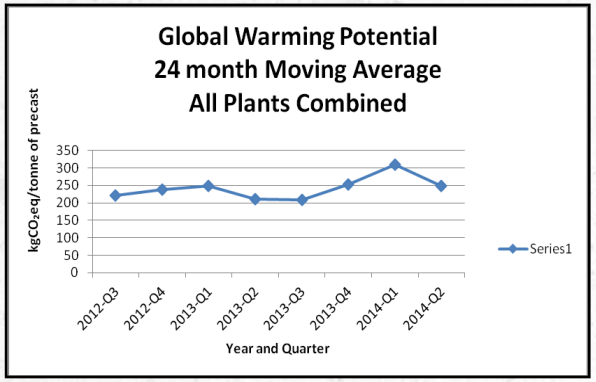
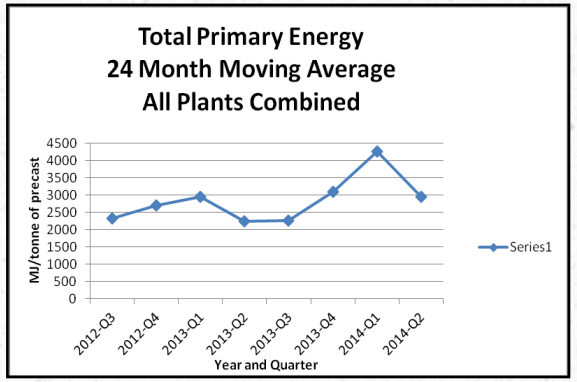
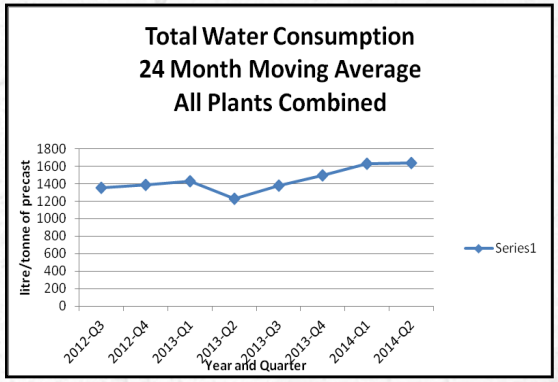
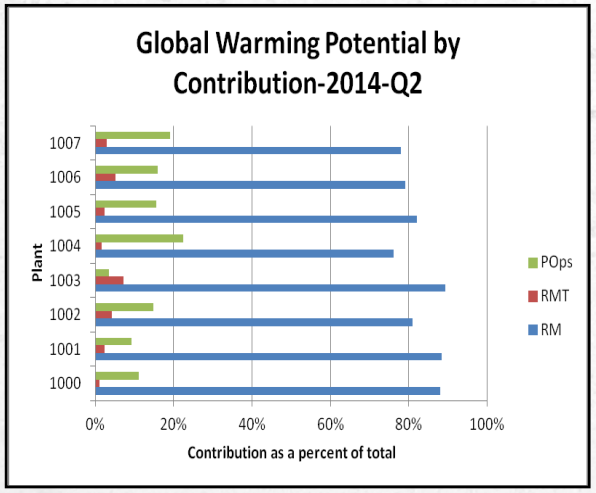
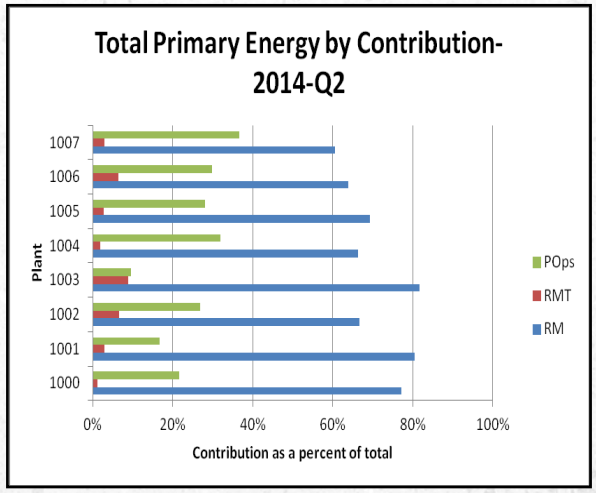
Performance Markers: Global Warming Potential, Total Primary Energy, Water

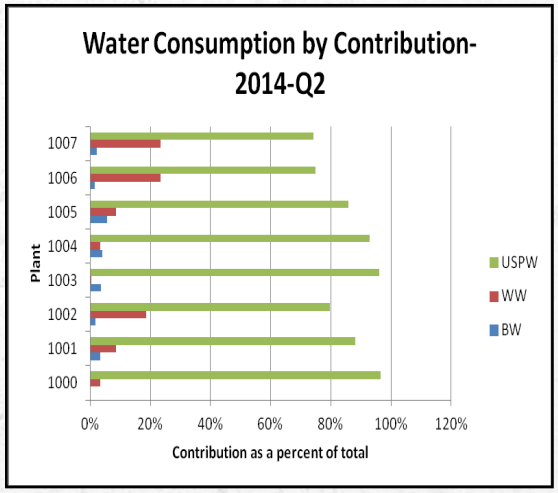




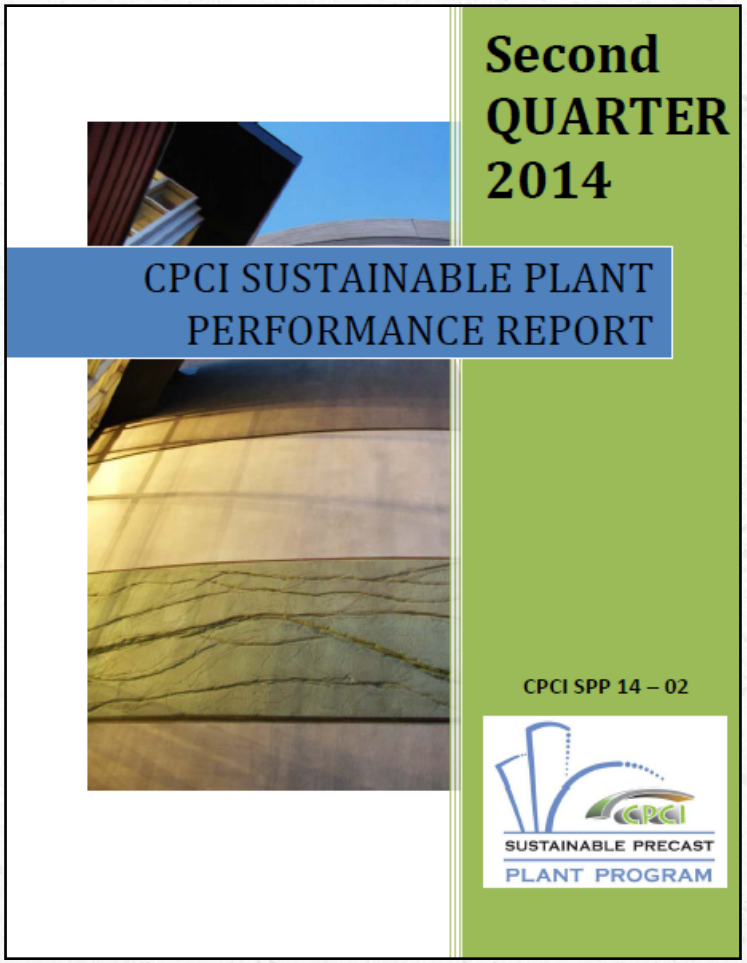








CPCI Sustainable Plant Performance Report

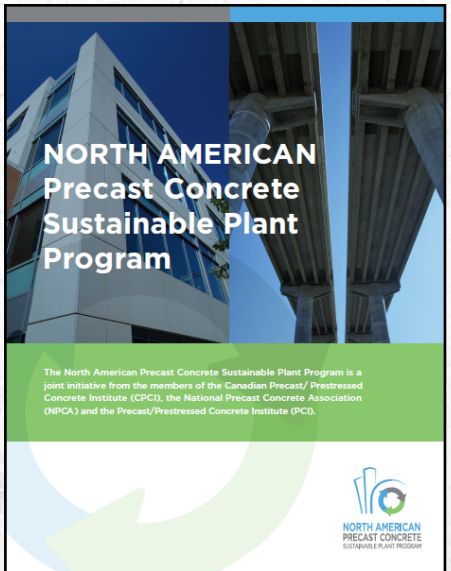


Next Steps for the Precast Industry

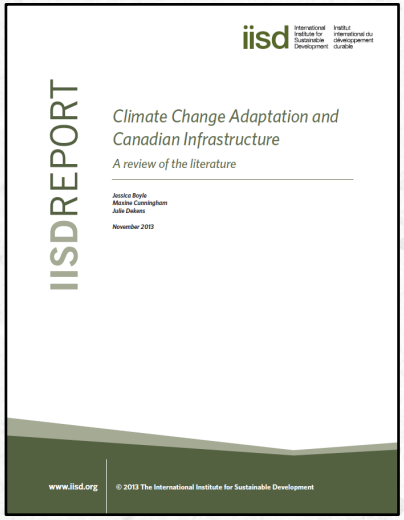
The Sustainable Plant software will be used to provide credible, timely, and up to date data for **Precast Product EPD's - in 2015**

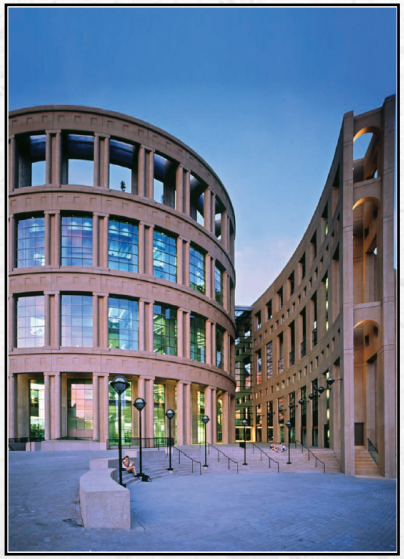
Launch of the North American Precast Concrete Sustainable Plant Program - in 2015:

The industry will collectively use the same software tracking program developed by ASMI



Where does the conversation go from here?





- Development of **Responsible Sourcing Requirements** to Ensure **Resilient Infrastructure:**
  - Increased Longevity
  - Increased Robustness
  - Improved Sustainability
  - Improved Life Safety
  - Increased Durability
  - Increased Adaptability for Reuse
  - Increased Resistance to Disasters

For More Information

Publications available for download

www.cpci.ca/?sc=publications

- Life Cycle Assessment of Precast Concrete Commercial Buildings Technical Brochure
- LCA Product Transparency Guide
- Sustainable Plant Program Guide
- Sustainable Plant Performance Report
- **CSCE 2012** Paper - LCA for Sustainable Design of Precast Concrete Commercial Buildings in Canada
- **TAC 2013** Paper - Implementation of GHG Tracking Software for Sustainable Transportation Infrastructure Projects

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Thank you

For more information on
CPCI Sustainability Initiatives
www.sustainableprecast.ca
Visit at Booth #1014 at IIDEX Canada

For more information on
Athena Sustainable Materials Institute
www.athenasmi.org