





LIFE CYCLE ASSESSMENT OF LC³

IIT MADRAS, TARA & IIT DELHI











Life Cycle Assessment

Broad Objectives

- Assess the improvement in the carbon footprint of concrete through a **>>** study of energy use/emissions related with OPC and LC³production
- Assess implementation strategies **>>**

Work Plan

- Year 1: **>>**
 - Identification of an appropriate sustainability analysis framework for typical **>>** concrete elements/structures where LC³ could be used
- Year 2: **>>**
 - Documentation of energy use and emissions of the production for OPC and **>>** LC³, based on case studies.
 - Identification of major components of energy use and parameters affecting » the carbon footprint of OPC and LC³ plants.
 - » Assessment of market potential and barriers for large-scale adoption of LC³ in the Indian construction sector





Life Cycle Assessment

- » Year 3:
 - » Sustainability analysis considering the technical assessment , economic viability and environmental impact
 - » Evaluate market potential and alternate supply chain scenarios.
 - » Drafting of policy framework for gradual establishment of LC³ as a mainstream cement





Immediate objectives

» Assess the improvement in the carbon footprint of concrete through a study of energy use/emissions related with OPC and LC³ production

Data for the expected outcomes

- » What is the reduction in energy footprint?
- » What is the reduction in carbon footprint?
- » What is the additional capital investment? Cost analysis for raw materials and production processes.
- » Cost/Performance and Footprint/Performance assessment during service life, strength and durability
- » What is needed for standardization?
- » What is needed for facilitating large-scale production and usage?





First phase of the work by India Team

- » Study of the cement production processes, collection of data for the inventory of energy use and emissions, and costs
- » Study of processes related to the substitution of clinker with calcined clay + limestone, collection of data for the inventory of energy use and emissions, and costs

LC³ production scenarios being considered

- » Clay industry extracts suitable material (use existing mines; revive industry) and calcines the clay {local operation} and supplies cement plant; calcined clay added to ground clinker
- » Clinker transported to clay source; clinker, limestone and calcined clay interground
- » Grinding units buy clinker and calcined clay, and blend
- » LC2 produced as a mineral admixture.





LIFE CYCLE ASSESSMENT

Process mapping, Energy consumption



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Data from Cement Sustainability Initiative (CSI)

Parameter	2012 average	
Production of companies surveyed	125 million Tonnes	
Clinker ratio	70.5%	
Thermal energy consumption for clinker	3080 MJ/Tonne	
Thermal energy consumption for cement	2415 MJ/Tonne	
Gross CO ₂ emissions (excluding emissions from electric power)	817 kg/Tonne of clinker 579 kg/Tonne of cement	
vw.wbcsdcement.org/GNR-2012/index.html		

www.wbcsdcement.org





Data from Cement Sustainability Initiative (CSI)



www.wbcsdcement.org/GNR-2012/index.html www.wbcsdcement.org





Data from Cement Sustainability Initiative (CSI)



excludes CO₂ from electric power

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Process mapping

- » Case studies (April 2015):
 - » J K Lakshmi Cements, Sirohi, Rajasthan (Production: 14500 Tonnes/day)
 - » UltraTech Cement, Reddipalayam, Tamil Nadu (Production: 1.4 million Tonnes/annum; Winner of FICCI award for Environmental sustainability)

First approximation of energy & CO₂ emissions

Impact	OPC	LC ³
Energy consumption (MJ/Tonne of cement)	5245	4240
CO ₂ emissions (kg /Tonne of cement)	856	543

What we need from the Industry?

- Expression of interest to exchange information with the project team and examine the viability of producing LC³ in India
- Facilitating site visits, process mapping and data collection (resources, energy consumption and emissions)
- Sharing of LCA related information

www.LC3.ch

Thank you!

→ Weare << brief description of your company>>. As our company is a leading player in the construction sector in India, we are committed to the promotion of materials and technologies that consume less energy for fabrication and cause lower carbon dioxide emissions.¶

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→ We have had interesting discussions with you about the research project."Low Carbon Cement", on limestone calcined clay cement (LC3), funded by the Swiss Agency for Development and Cooperation (SDC) and undertaken by EPFL, IIT Delhi, TARA, IIT Madras and IIT Bombay. We find the results promising and would be willing to carry out tests on the LC3 samples provided by you and further trials in our plants. ¶

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We have read the agreement between EPFL and << IIT or TARA>>, and are aware of the antecedents. All information given to us will be treated as confidential until they have been made public by the relevant research group. If

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We will enter into a specific agreement with the researchers in case the results and trials lead to the large scale production of LC3.

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