

# Is Concrete a **Green Building Material**?

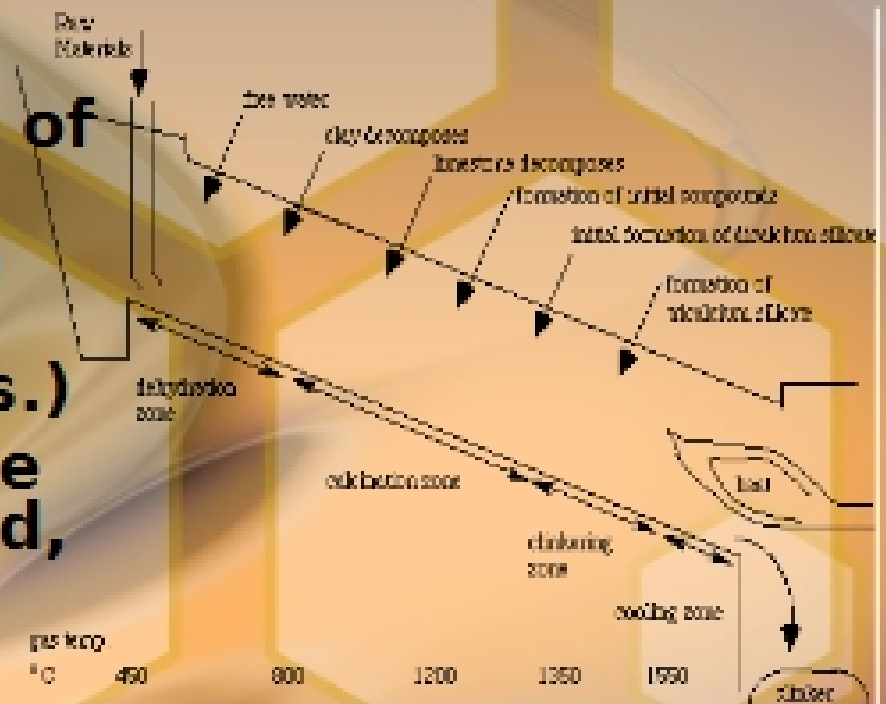
**The Energy and Environmental  
Impact...**

# What is Emergy?

- **Phrase originally coined by Professor Howard T. Odom in 1986**
- **“Emergy can be defined as the total solar equivalent available energy of one form that was used up and directly and indirectly in the work of making a product or service.” (Odom, 1996)**
- **Measured by scientific unit “Emjoule”**
- **“Embodied Energy,” established as a means to understand and evaluate the energy involved in the production and destruction of a particular material...**

# Concrete Production

- Patented in England by Joseph Aspdin in 1824, resembled Isle of Portland quarried Stone
- 75- 90 million tons of Concrete production per year in the last decade... (Portland Cement Ass.)
- Cement production involves the mixture of Limestone, clay/sand, bauxite, iron ore in a rotary cement kiln:



- Kiln rotates slowly mixing contents progressively getting hotter to reach temperatures up to 2700°
- Largest piece of moving industrial equipment in the world

- Concrete is made up of:
  1. Portland Cement 12%
  2. Sand 34%
  3. Crushed Stone 48%
  4. Water 6%

