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DECARBONISATION of THE CEMENT INDUSTRY

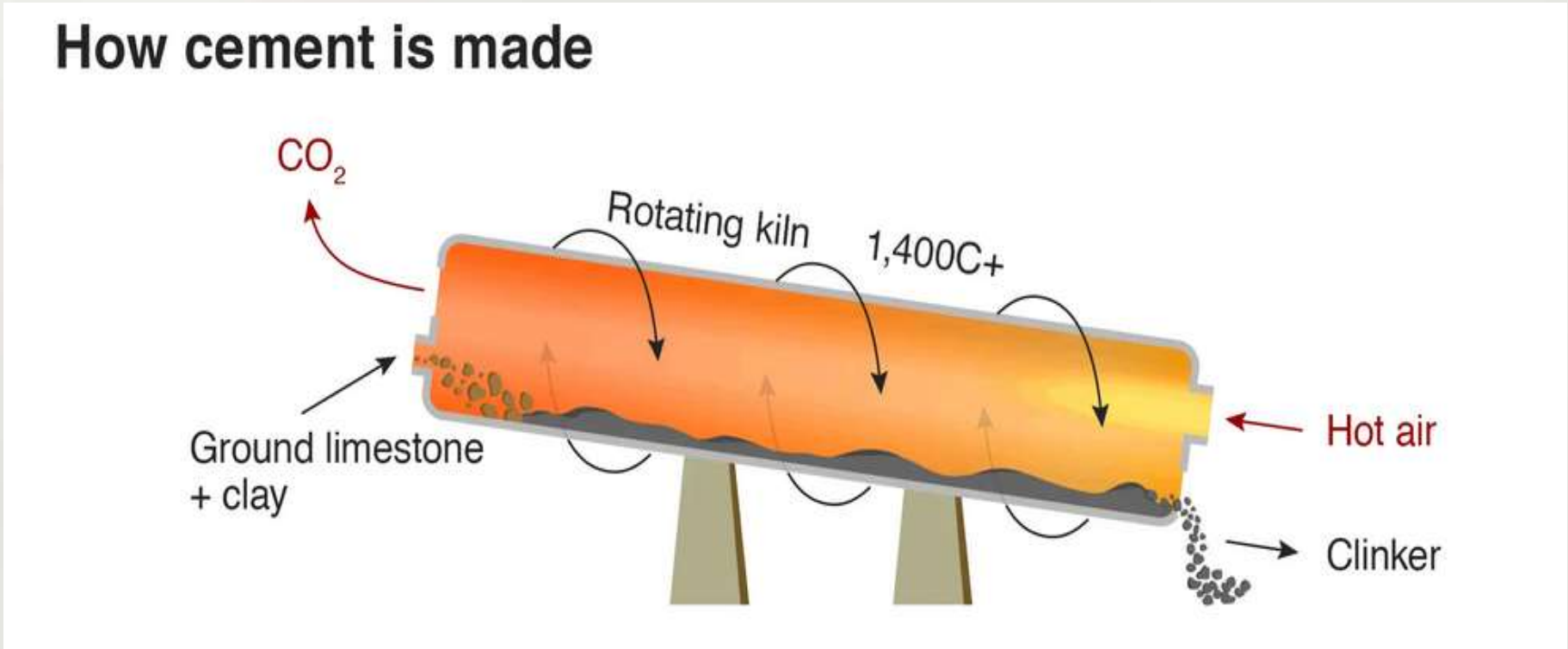
Need of decarbonisation in the cement Industry

- It is the second largest industrial emitter in the world (after iron and steel).
- Contributes about 7% of CO_2 emissions globally.
- Important to achieve commitments of “net zero” emissions by 2050 (or by 2070, as pledged by India).

How CO2 is emitted from cement industry

In the cement industry, Pyro-processing (limestone and clay, are heated in a kiln at more than 1,400oC) is major processes which cause Carbon emissions.

Limestone (CaCO3)+clay/sand (Si)+heat= cement (CaO,SiO2) + CO2



Challenges in India

- India is one of the fastest urbanising countries and is witnessing a housing and infrastructure boom.
- Lack of availability of alternatives for Pyro-processing

Decarbonisation of cement industry Strategies

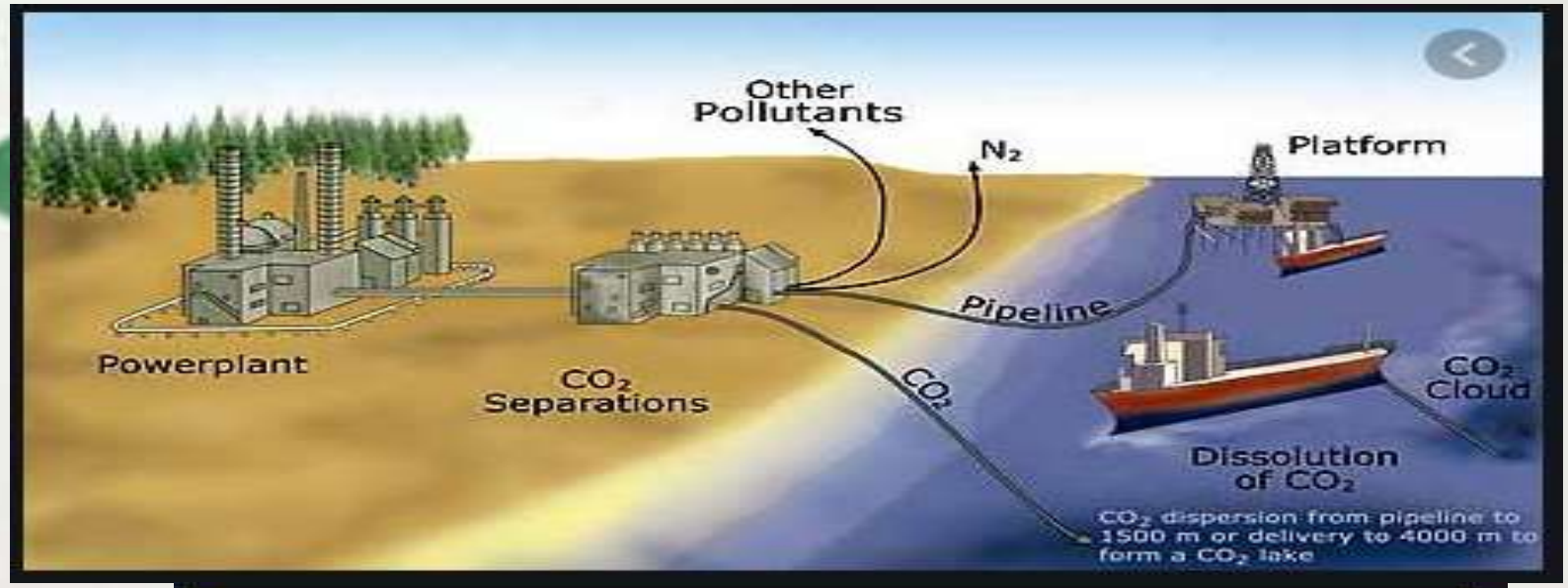
- **Blended Cement:** Increasing the use of blended cement (Blended cement is a mixture of traditional cement and other materials to enhance its properties and reduce environmental impact) to reduce reliance on limestone.

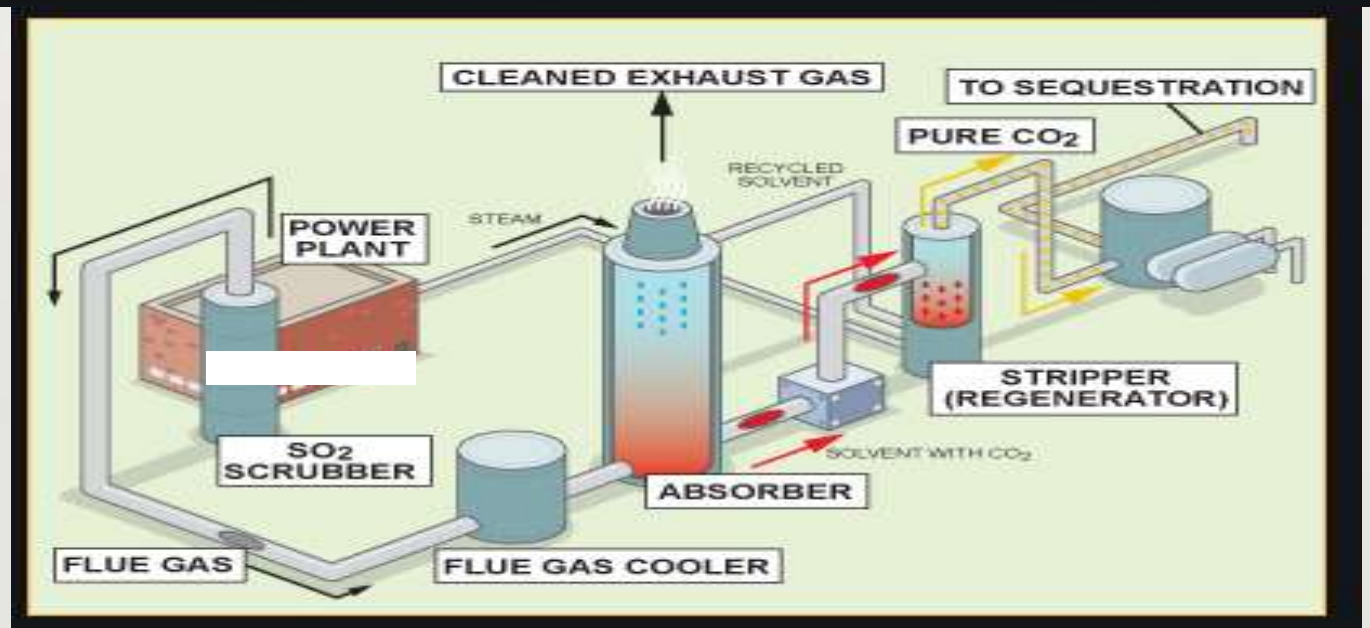
- Its the limestone which is responsible for CO_2 emission
- Limestone($CaCO_3$)+clay/sand (Si)+heat= cement (CaO,SiO_2) + CO_2

- **Advanced Technologies:** Implementing innovative methods such as carbon capture, utilization, and storage (CCUS).

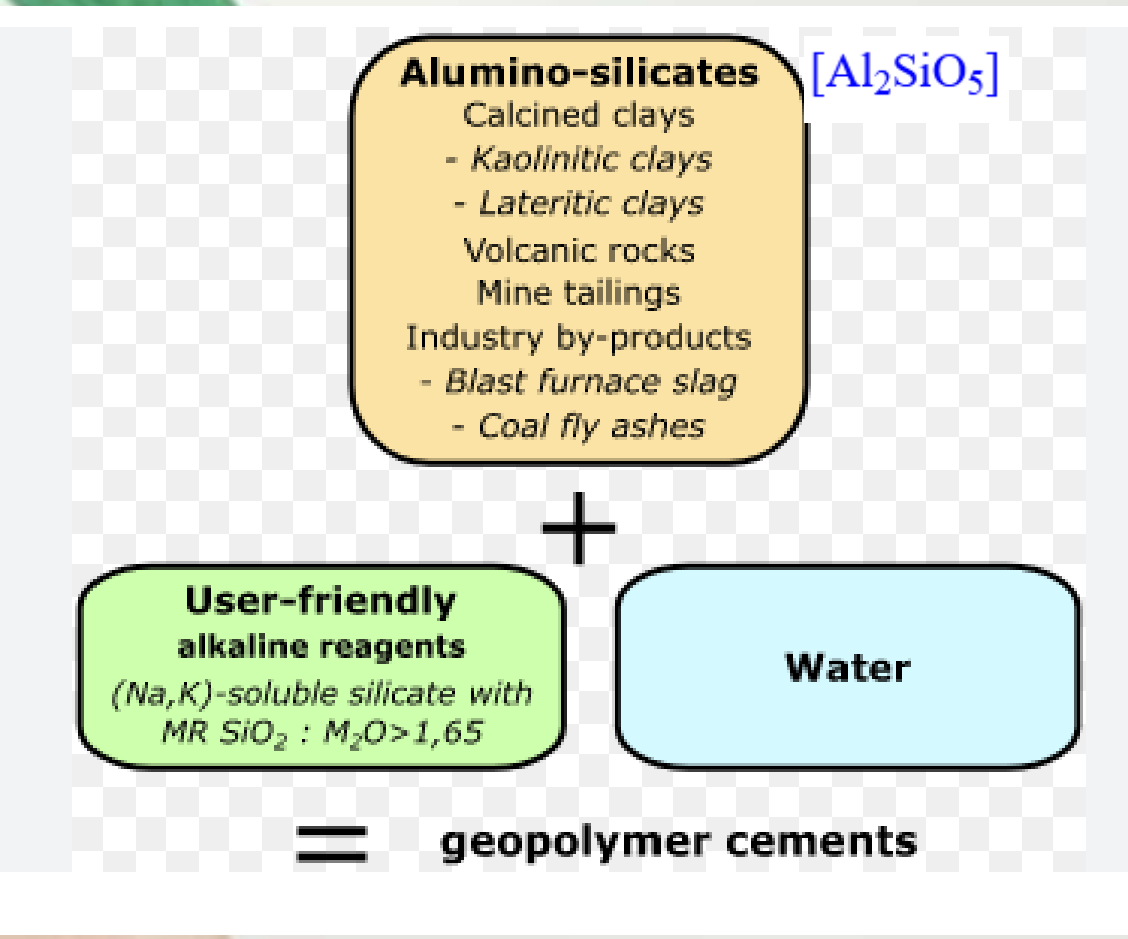
Carbon Capture, Utilization, and Storage (CCUS):

CCUS is an advanced technology that involves capturing carbon dioxide (CO2) emissions from industrial processes like cement industry or power plants





Alternatives to cement



Geopolymer Cement

Geopolymer cement is made from aluminium and silicon.

The sources of aluminium in nature are not present as carbonates and therefore, when made active for use as cement, do not release vast quantities of CO_2.

The high cost of the greener forms of cement such as geopolymer cement makes it difficult for consumers to use it as an alternative.

Cement by limestone

Limestone (CaCO3)+clay/sand (Si)+heat= cement (CaO,SiO2) + CO2

Coal combustion

Fly ash

The most readily available raw materials containing aluminium and silicon are fly ash and slag.

Brazil, for instance, has the availability of raw materials such as pozzolan, a type of siliceous and aluminous material that results in a product with the same technical properties as the traditional cement.

Fly ash composition

Components	Composition (wt %)
SiO_2	18.9
Al_2O_3	15.2
Fe_2O_3	10.6
Na_2O	0.988
CaO	1.18
K_2O	2.23
TiO_2	0.468
SO_3	0.366
MgO	0.348
SiO_2/Al_2O_3	1.2

Composition Matters

India currently produces **four types of cement** whose constituents play a role in determining emissions

Typical composition in %

Limestone/Clinker Fly Ash
Slag Gypsum

Total carbon dioxide emission factor (tonne of CO, per tonne of cement)

- The cement sector is a hard-to-abate sector in terms of greenhouse gas emissions,
- but it is an equally critical contributor to the economic development of the country.
- India is the second largest producer of cement in the world and plans to almost double its production by 2030.
- Under a business-as-usual scenario, the CO_2 emissions from cement production in India are estimated to almost double by 2030.
- So there is need to develop technologies for reduction in cement related emissions

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