Transformation of value chains and business models for a low-carbon cement industry: a perspective from France

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Cement production process

Other constituents: slag, fly ash, limestone, pozzolanas, calcined clays …

Cement roadmaps usually convey similar narratives to reach net-zero

Net zero will be reached by a combination of:
- Reduction in demand/material efficiency
- Energy efficiency gains
- Use of biomass and alternative fuels
- Reduction in clinker-to-cement ratio
- Carbon Capture Utilisation and Storage (~50% of the abatement)

How does it translate in practice at the plant level? Does it mean that all cement plants should undergo the same transformation?
Evolution of the cement fleet

100% of the plants will undergo:
- ⇓ in production
- ⇓ of the clinker-to-cement ratio
- Decarbonation of the thermal mix
- Optimization technologies

CCS onshore Nouvelle-Aquitaine

CCS zone of Dunkirk

CCS zone of Le Havre

Upgrading of non-BAT plants

Reference scenario

Sectoral Transition Plan for the French Cement Industry

Link to access: https://librairie.ademe.fr/changement-climatique-et-energie/5185-sectoral-transition-plan-for-the-french-cement-industry.html
Reference scenario: close, but not quite

Sectoral Transition Plan for the French Cement Industry

-81% in 2050/2015: GHG emissions target for the French cement industry

Link to access: https://librairie.ademe.fr/changement-climatique-et-energie/5185-sectoral-transition-plan-for-the-french-cement-industry.html
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CCS zone of Le Havre
CCS zone of Dunkirk

Upgrading of non-BAT plants

CCS zone of Fos-sur-Mer

Cement sites conversion to grinding plants, for the production of calcined clay or new alternative binders

Upgrading and increased capacity of CCS plants + clinker production concentrated on the 4 CCS zones

Reference scenario

Extreme « techno-push » scenario

Sectoral Transition Plan for the French Cement Industry

Service Industrie

Link to access: https://librairie.ademe.fr/changement-climatique-et-energie/5185-sectoral-transition-plan-for-the-french-cement-industry.html

6 16/05/2023
Extreme « techno-push » scenario

- Negative emissions from BECCS and mineralisation
- New cement and alternative binders
- Mineralisation
- CCS
- Electrification
- Process optimization and energy efficiency
- Clinker-to-cement ratio
- Thermal mix
- Upgrading
- Construction demand

Total emissions (MtCO₂e)

2015 2020 2025 2030 2035 2040 2045 2050

Extreme « techno-push » scenario
Actual transformation of the French cement fleet

For cement companies, some plants are more strategic than others.

Cement and clinker production are likely to decrease by 2050 due to a combination of:
- Lower demand for infrastructures
- Material substitution and better efficiency in buildings
- Reduction in the average clinker-to-cement ratio

Thus, cement companies face the choice of which clinker lines to stop and which to invest in.

Key factors considered for investment decisions:
- Local market dynamic (competition, demand for low-carbon products)
- Access to locally-sourced materials and fuels (limestone clay, secondary constituents such as slag or activated clays, substitution fuels)
- Long-term access to geological storage

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Project to convert a rotary kiln for the production of calcined clays

Important investments announced or recently committed

27 operating plants in 2020

Dannes: former cement plant closed in 2013
Le Havre: former cement plant closed in 2016
Frangéy: cement plant closed in 2012
La Couronne: former cement plant closed in 2016

Cement plants closed between 2009 and 2020
Closure announced recently
Closure announced in 2020-2021
For a couple of years, especially since the publication of the new building environmental regulation RE2020, there has been a push from some new “smaller” actors/industrial start-ups to penetrate the cement market with innovative low-carbon solutions.

In the past years, ADEME has received many requests for public funding from new cement actors to support their development.

The business models can be divided into three broad categories:

- Blending ground clinker or CEM I with secondary constituents (often sourced locally) to make new cement.
- Preparing and providing secondary constituents (e.g. calcined clays) to incumbent cement companies.
- New innovative binders based on industrial by-products or other raw materials as primary constituents with possibly a small proportion of clinker or activator (for Alkali Activated Materials).
Possible value chain configuration for a low-carbon cement industry

Clay (available locally from quarries or industrial by-products)

Calcination (750-950°C)

Calcined clay

Primary constituents (available locally): clay/calcined clay, slag, gypsum, limestone

Secondary constituents: slag, fly ash, limestone, pozzolanas, calcined clays...

Clinker

Alkali-activator

2/3 process

Direct CO2 emissions

Biomass and alternative fuels

1/3 combustion

2/3 process

CCUS

Low carbon plant

Cement (CEM I)

Secondary constituents (available locally): slag, fly ash, limestone, pozzolanas...

Concluding remarks

- Deep decarbonization might shuffle the configuration of the cement industry but clinker should remain a primary ingredient;
- It is likely that the transformation will be heterogeneous across cement plants;
- More intermediate transport can be expected which leads to the question of decarbonizing logistics chains;
- New cement players have emerged because of climate and circular policies (such as the RE2020 regulation);
- Some seeks to use locally-sourced materials (such as industrial by-products or natural minerals) as an opportunity to penetrate the cement market;
- It will take time for norms and regulations to accommodate new innovative binders which could slow their development;
Thank you for your attention