GLASS AND CERAMICS – SETTING THE SCENE

Finance for Innovation: Towards the ETS Innovation Fund
Workshop 3

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CO2 emissions in glass and ceramics (EU28)

CO2 verified emissions:
- Glass: slight decrease
- Ceramics: recovery since economic crisis
- EEA 2015 emissions:
  - Glass: 18 Mt
  - Ceramics: 16 Mt

Production value
- Similar trends in both industries
- Does not reflect CO2 increase in 2013 in ceramics

Sources
- CO2: EU ETS - data viewer
- Production value: Eurostat
**Fuel (EC) mix in glass and ceramics**

- Electricity and gas main energy carriers in glass and ceramics
- Natural gas inputs substitute CO2-intensive fossil fuels (like coal, oil and petcoke)
- Low but increasing share of biomass

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**Energy carrier mix used in the glass and ceramics industry in Germany, 1995-2014**

Source: TBE, PwC analysis
Ambition needed – the EU low-carbon roadmap 2011

Figure 1: EU GHG emissions towards an 80% domestic reduction (100% =1990)

- Industry (CO2): -83 to -87%
- Ambition from Paris? „Well below 2°C“

Source: COM
Technologies in development/discussion

**British Glass (2014): Roadmap**
- Fuel switch (low carbon fuels, electricity)
- Furnace improvements
- Oxygen-fuel combustion
- Additional waste heat recovery
- CCS
- Batch pelletisation, Batch reformulation
- Material efficiency
- Recycling, ...

**CeramUnie (2013): Roadmap**
- Electrification of kiln
- On-site syngas biogas
- Clay/raw material preconditioning
- New kiln design
- Heat exchanger in kiln stack
- Low-temperature heat recovery from kiln exhaust
- CCS
- Material efficiency
- Recycling, ...
# Clustering mitigation options

<table>
<thead>
<tr>
<th>Clusters of mitigation options</th>
<th>Technology Readiness Levels TRL</th>
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<tbody>
<tr>
<td><strong>Materials industry</strong></td>
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<tr>
<td>Integrated process improvement</td>
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<tr>
<td>- Energy Efficiency (modernization and replacement)</td>
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<td>- Reduction in process-related emissions</td>
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<tr>
<td>Fuel switch</td>
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<td>- towards renewable energy sources (e.g. based on hydrogen)</td>
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<td>- towards decarbonized electricity (indirect emissions)</td>
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<td>End-of-pipe</td>
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<td>(Carbon Capture and Storage CCS/ Carbon Capture and Use CCU)</td>
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<tr>
<td><strong>downstream</strong></td>
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<td>Recycling and re-use</td>
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<tr>
<td>(innovative recycling processes)</td>
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<td>Material efficiency</td>
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<td>(in production and downstream)</td>
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<tr>
<td>Material substitution</td>
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<td>(downstream)</td>
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OPTIMELT

Advanced heat recovery for oxy-fuel fired glass furnaces

Joaquín de Diego Rincón
Praxair Euroholding, S. L

Brussels, 6th April
**OPTIMELT (Praxair & Libbey)**

- High efficiency non-catalytic reforming process
- Recycled flue gas with CO2 and water vapor is used for CH4 reforming
- Regenerative system allows high operating temperatures/reforming rate
- Regenerators roughly 1/3 the size of air-fired regenerators

**Endothermic reforming reactions**

\[
\begin{align*}
\text{CH}_4 + \text{H}_2\text{O} &\rightarrow \text{CO} + 3\text{H}_2 & 2060 \text{ kcal/Nm}^3 & \text{CH}_4 \ (215 \text{ Btu/scf-CH}_4) \\
\text{CH}_4 + \text{CO}_2 &\rightarrow 2\text{CO} + 2\text{H}_2 & 2630 \text{ kcal/Nm}^3 & \text{CH}_4 \ (275 \text{ Btu/scf-CH}_4)
\end{align*}
\]

Source: Praxair
OPTIMELT (Praxair & Libbey)

Praxair’s OPTIMELT™:
- Reduces energy consumption (~20% vs oxy-fuel, ~30% vs. air-regenerative)
- Reduces CO2 emissions
- Reduces air pollutants to the level of oxy-fuel performance (Nox, CO, etc.)
- Reduces flue gas volume and enables smaller air pollution control

Libbey OPTIMELT™ startup in 2017
- Expected reduction in energy consumption and CO2 emissions of 45 to 60%
- Project partially funded by European Union with LIFE grant (LIFE 15 CCM/NL/000121)

Source: Praxair, Libbey
OPTIMELT (Praxair & Libbey)

OPTIMELT™ Technology Development Path

- Patent
- 2011-2012
  Bench Scale
- 2012-2013
  Pilot Scale Tests (10 TPD)
- 2014-2016
  PAVISA Commercial Demonstration
  (50 TPD)
- 2016-2017
  LIBBEY Tableware furnace
- 2017-2018
  Container Furnace (>200 TPD)
  Engineering Phase
- -> next step: commercial application

Source: Praxair, Libbey
Thank you for your attention!

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