# GLASS AND CERAMICS – SETTING THE SCENE

## Finance for Innovation: Towards the ETS Innovation Fund
*Workshop 3*

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Brussels, 6th April 2017



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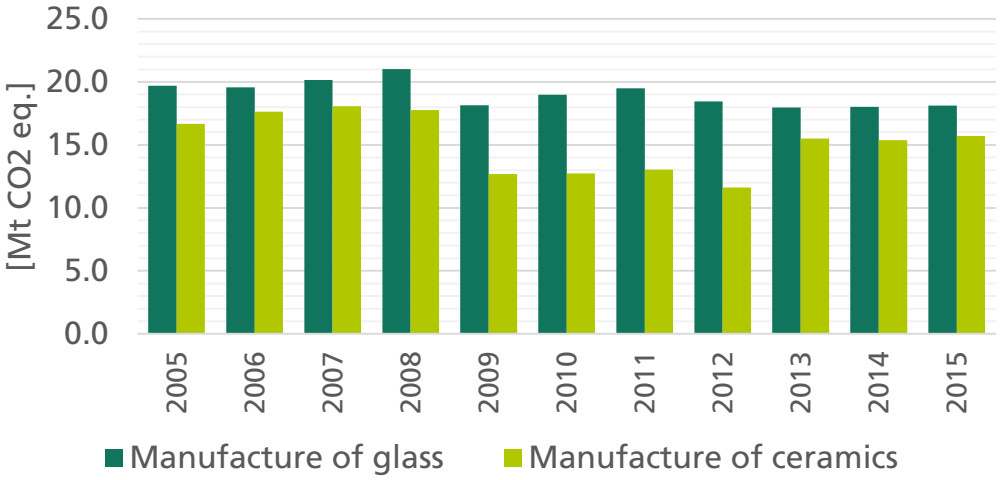
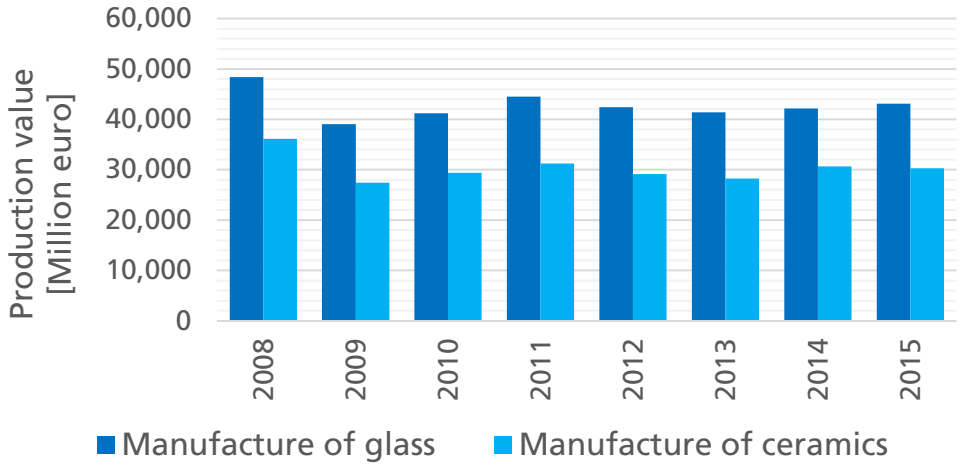
# CO2 emissions in glass and ceramics (EU28)




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

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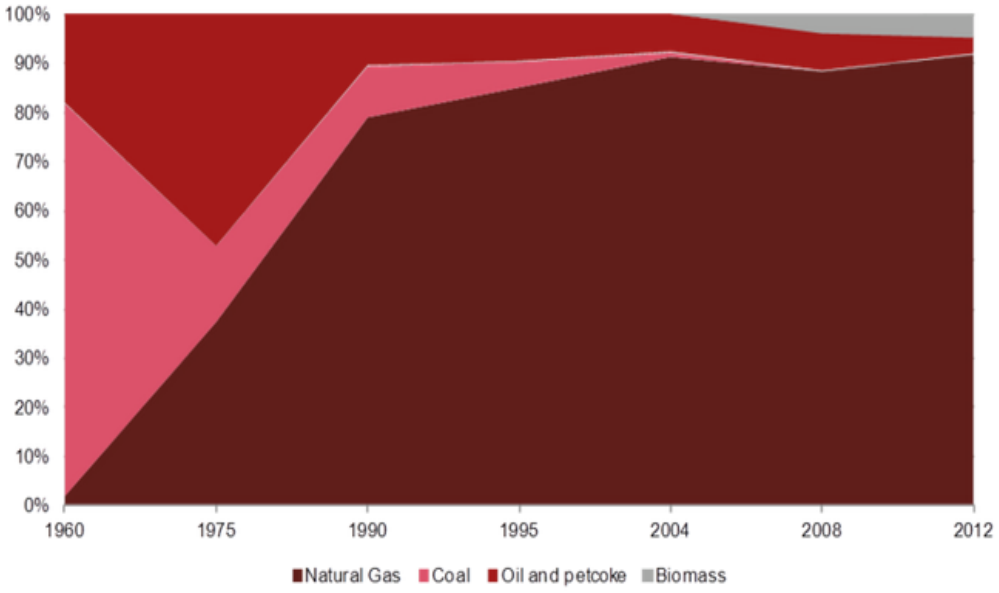
# Fuel (EC) mix in glass and ceramics

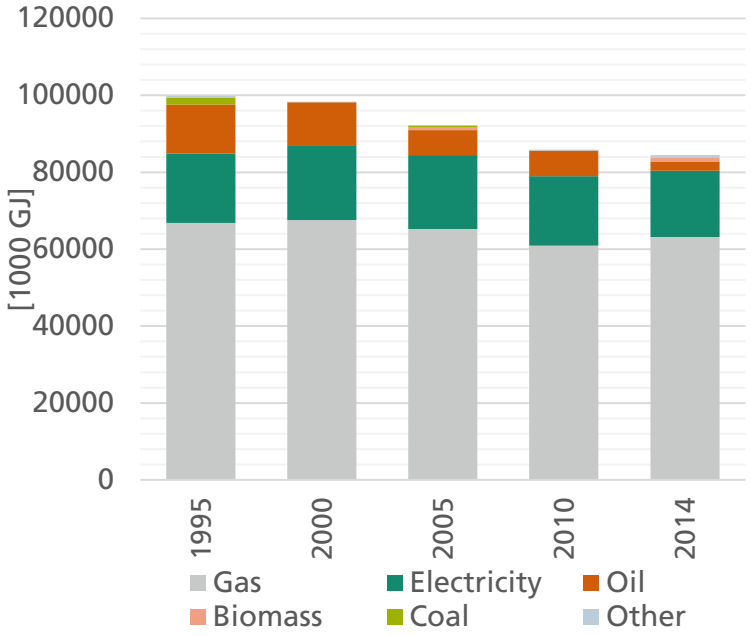
- Electricity and gas main energy carriers in glass and ceramics
- Natural gas inputs substitute CO2-intensive fossil fuels (like coal, oil and petcoke)
- Low but increasing share of biomass

**Fuel mix used by the tiles and bricks industry in Europe, 1960-2012**




Source: TBE, PwC analysis

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




Source: TBE



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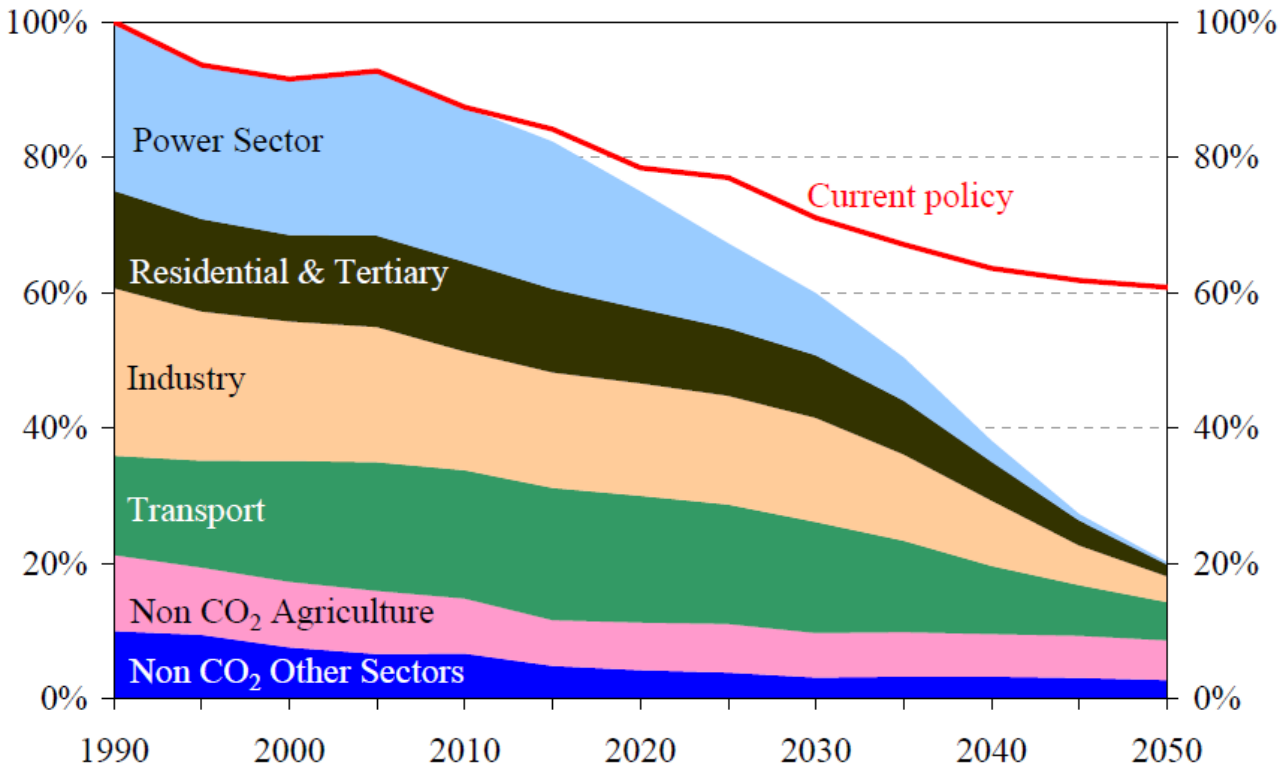
# Ambition needed – the EU low-carbon roadmap 2011

**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



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# 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, ...

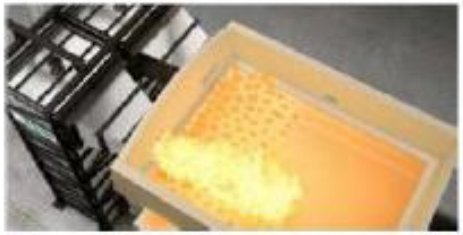
# Clustering mitigation options

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

# OPTIMELT

## Advanced heat recovery for oxy-fuel fired glass furnaces

Joaquín de Diego Rincón
Praxair Euroholding, S. L



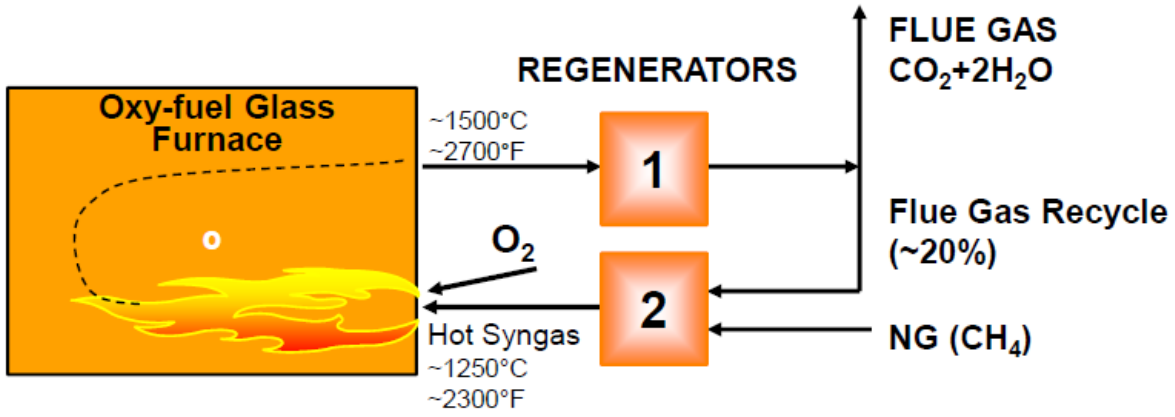
Brussels, 6th April



LIFE13 CCM/NL/000121 - LIFE OPTIMELT

# 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

US Pat. 6,113,874 / EP 0953543B1

$CH_4 + H_2O \rightarrow CO + 3H_2$ 2060 kcal/Nm$^3$ $CH_4$ (215 Btu/scf-$CH_4$)

$CH_4 + CO_2 \rightarrow 2CO + 2H_2$ 2630 kcal/Nm$^3$ $CH_4$ (275 Btu/scf-$CH_4$)

Source: Praxair



LIBBEY PRAXAIR

# OPTIMELT (Praxair & Libbey)

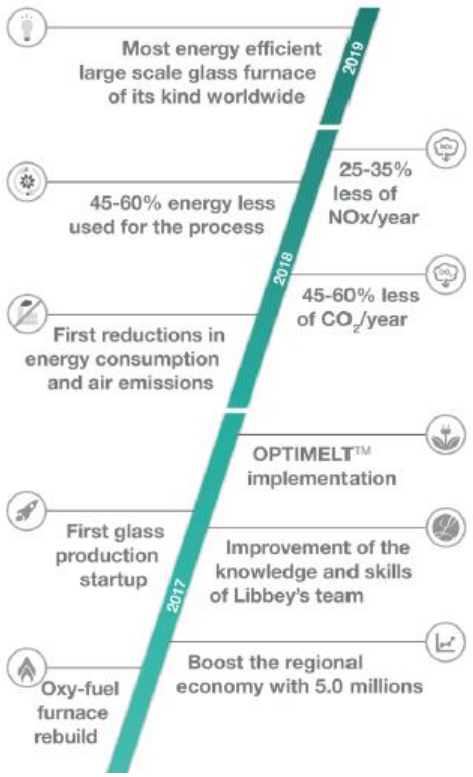
## Praxair's OPTIMELT™:

- 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)

**Air emissions reduction and energy efficiency improvement with OPTIMELT™ technology**




Source: Praxair, Libbey



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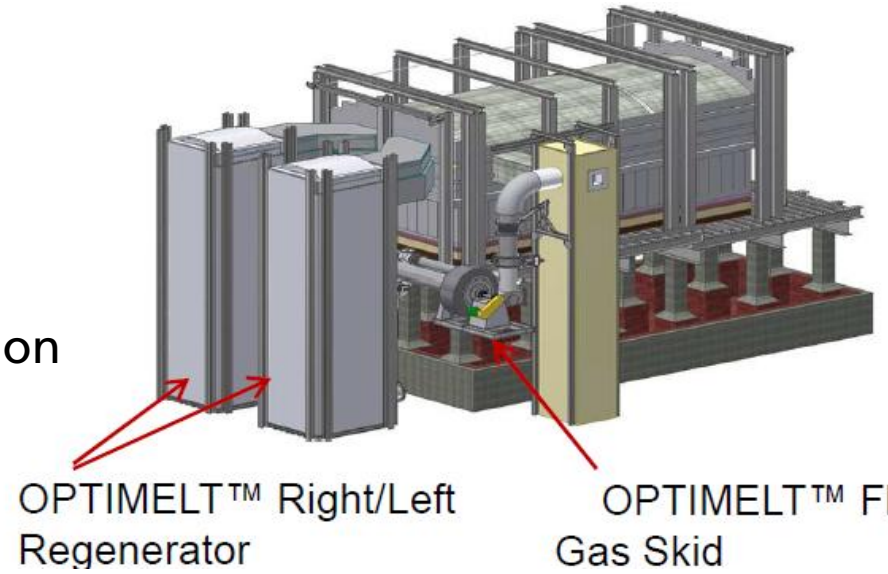
Making our planet more productive

# 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!

**OPTIMELT:**

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