GLASS AND CERAMICS – SETTING THE SCENE

Finance for Innovation: Towards the ETS Innovation Fund
Workshop 3

Andrea Herbst, Tobias Fleiter, Wolfgang Eichhammer

Fraunhofer Institute for Systems and Innovation Research

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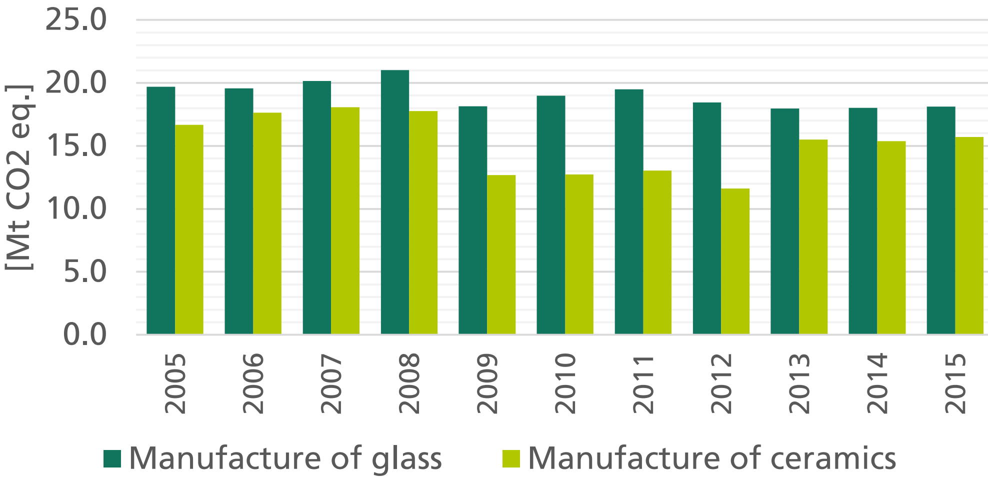
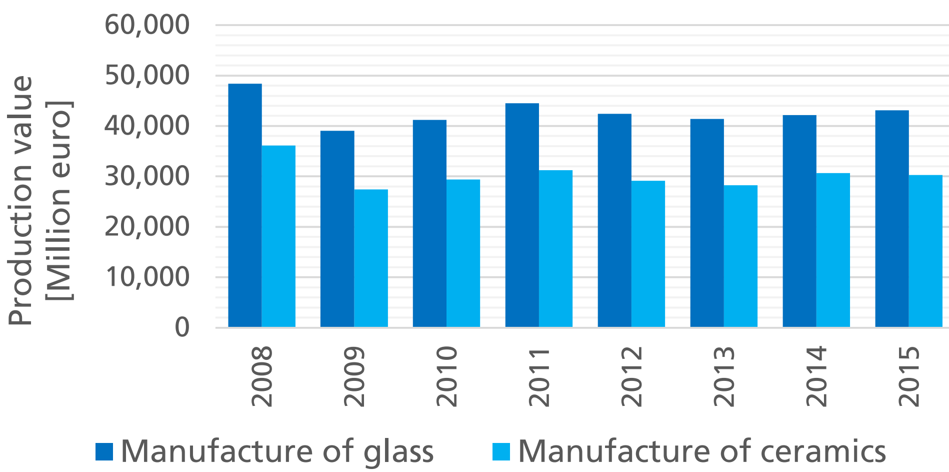
Emissions in glass and ceramics (EU28)





Verified emissions:

- Slight decrease
- EEA 2015 emissions:
  - Glass: 18 Mt
  - Ceramics: 16 Mt
- Statistical break in the manufacture of ceramics emissions 2012/2013

Production value

- Similar trends in both industries

Sources
CO2: EU ETS - data viewer
Production value: Eurostat

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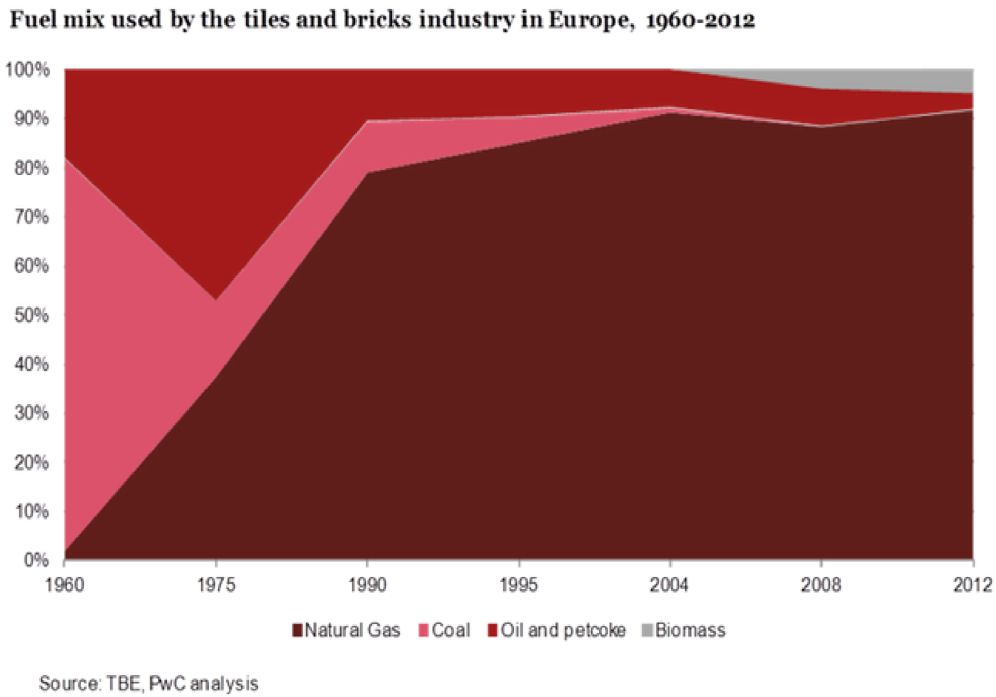
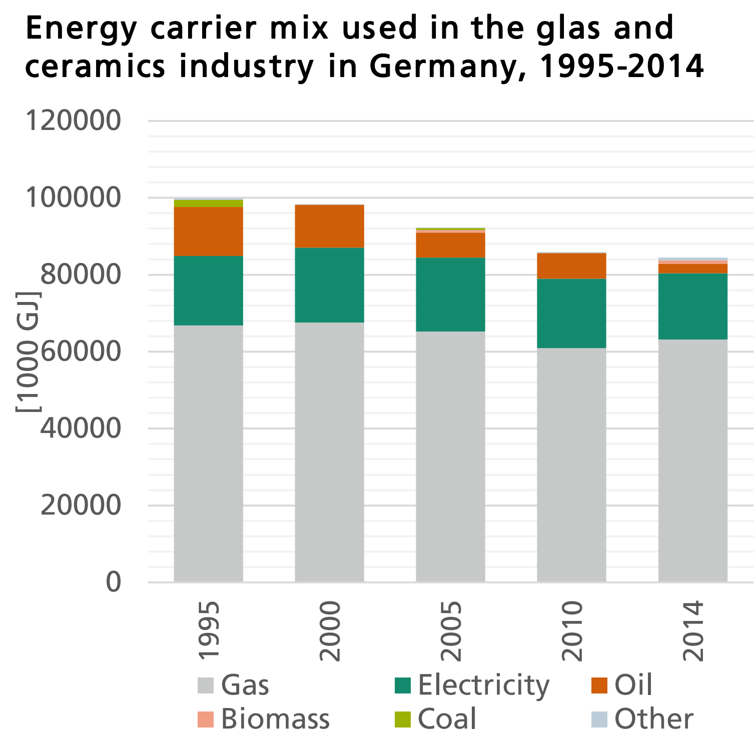
Fuel (EC) mix in glass and ceramics

- 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





Source: TBE

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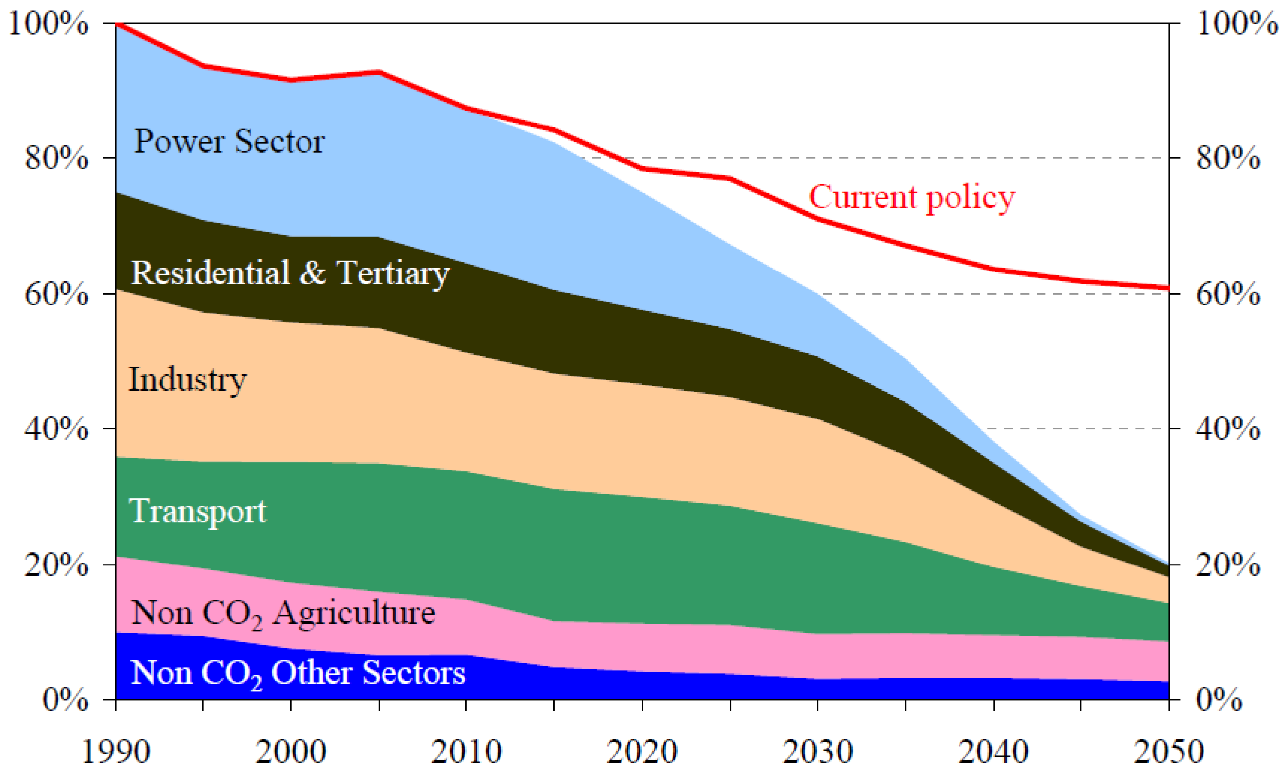
Ambition needed – the EU low-carbon roadmap 2011

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

Technologies in discussion/development

British Glass (2014): Roadmap

- Fuel switch
  (low carbon fuels/electricity, hydrogen?)
- Electrification/electric melting
- Furnace improvements
  (SCM, SMM, …)
- Oxygen-fuel combustion
- Additional waste heat recovery
- CCS/BCC
- Batch reformulation, batch pelletisation
- Material efficiency
- Increased closed-loop recycling

Ceram Unie (2013): Roadmap

- On-site syngas biogas
- Kiln electrification
- New kiln design/process optimisation
- Heat exchanger in kiln stack
- Low-temperature heat recovery from kiln exhaust
- CHP
- CCS
- Raw material formulation changes, clay/raw material preconditioning
- Material efficiency
- Recycling

Clustering mitigation options

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

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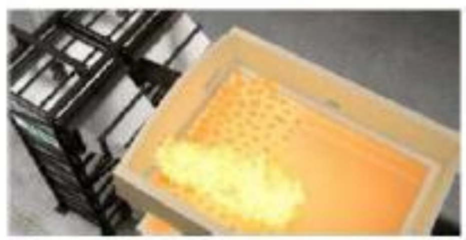
Advanced heat recovery for oxy-fuel fired glass furnaces

Joaquín de Diego Rincón
Praxair Euroholding, S. L



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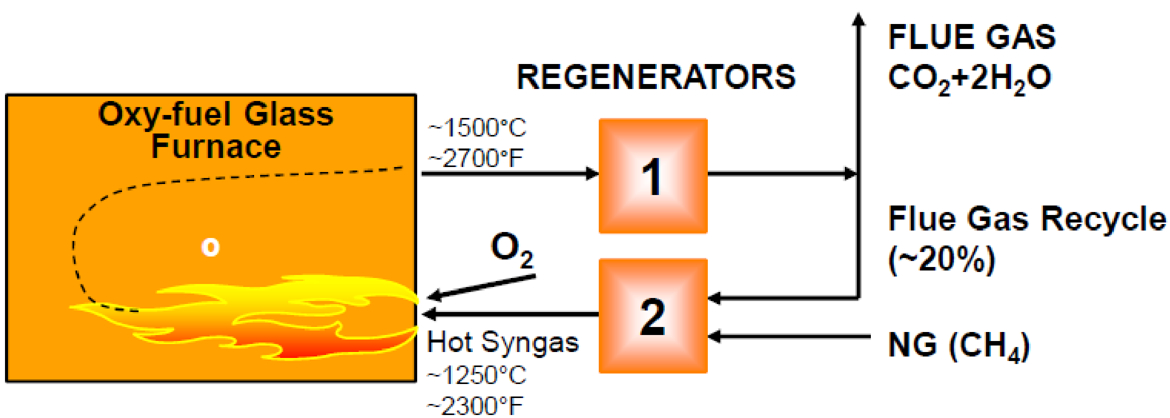
LIBBEY

PRAXAIR
Making our planet more productive

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

OPTIMELT (Praxair & Libbey)

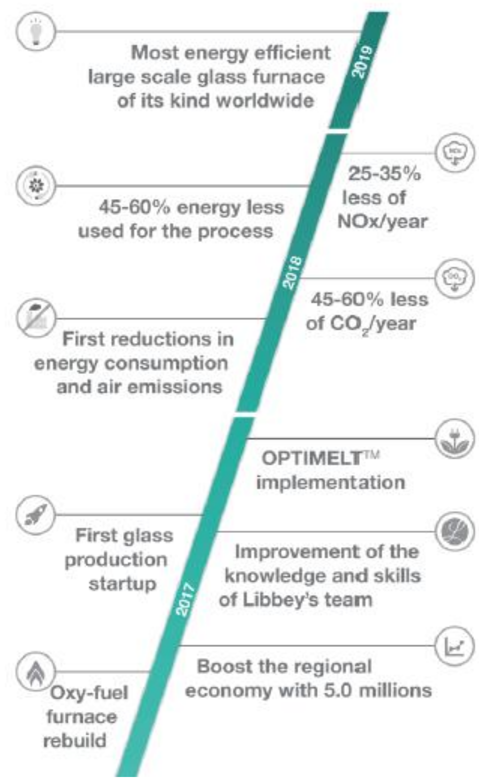
Praxair's OPTIMELT™:

- 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

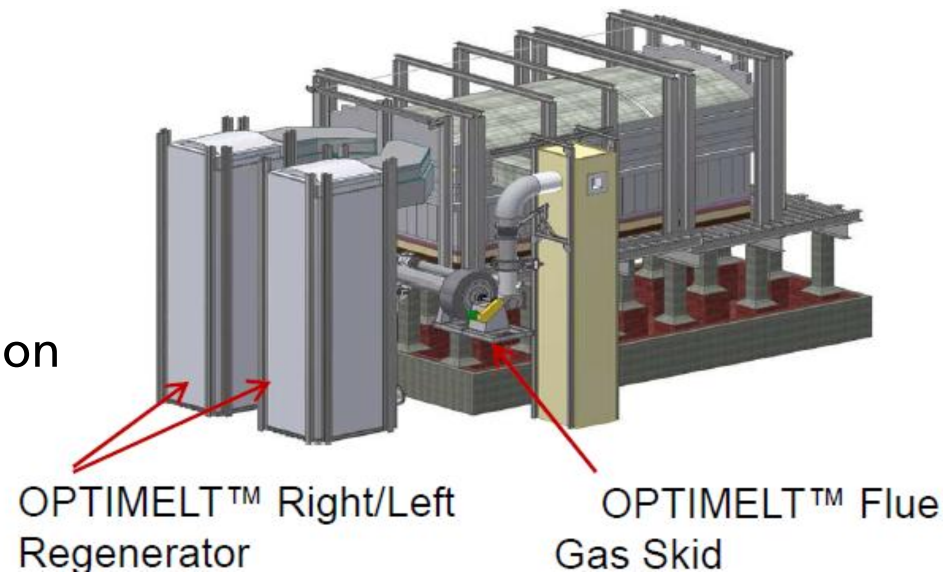


Source: Praxair, Libbey

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:

Joaquín de Diego Rincón
Praxair Euroholding, S. L.
Orense 11 9ª planta
28020 Madrid - Spain
Joaquin_de_Diego@praxair.com

Andrea Herbst
Fraunhofer ISI
Breslauer Straße 48
76139 Karlsruhe – Germany
andrea.herbst@isi.fraunhofer.de