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# ENERGY SAVING OPTIONS FOR INDUSTRIAL FURNACES – THE EXAMPLE OF THE GLASS INDUSTRY

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# Improvement potential for furnaces and ovens used in different sectors

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Sector	Improvement potential of energy consumption
Large steel reheating	ca. 10 %
Glass melting and processing	10 to 20 %
Ceramics - large size	10 to 20 %
Metal melting / foundries / scrap refining	20 to 40 %
Medium sized ovens and furnaces – electric	ca. 10 %
Medium sized furnaces and ovens - gas/oil	20 to 40 %

(Goodman et al. 2012)

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# The glass industry

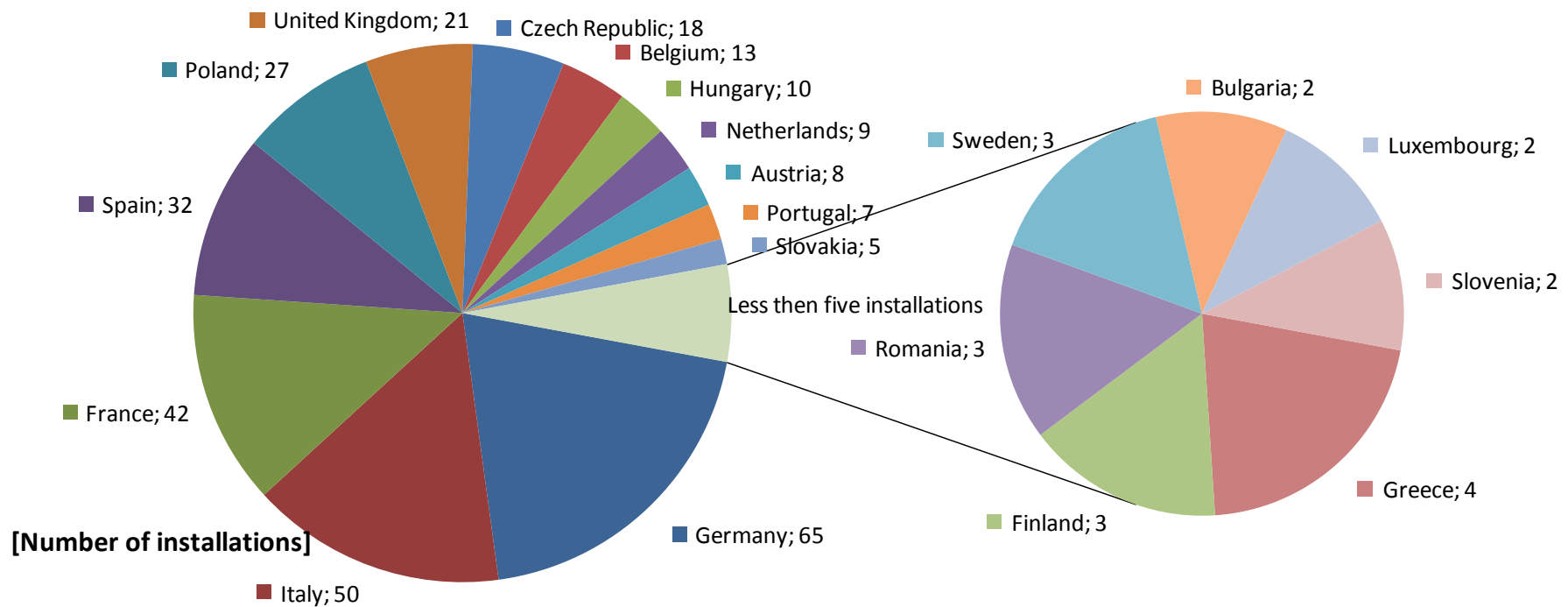
## Four major products

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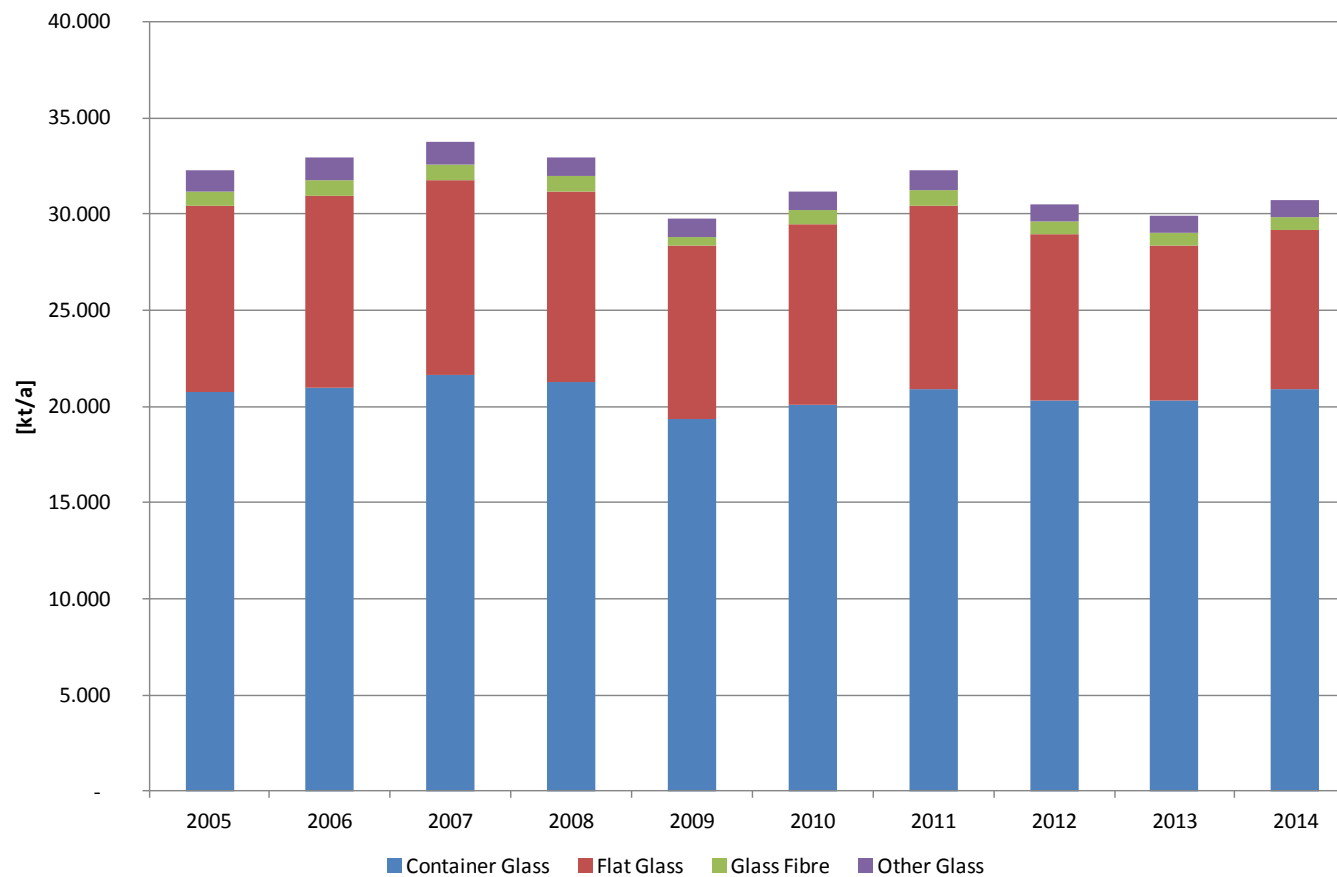
- Container glass for beverages and other liquids
- Flat glass for windows or windscreens
- Continuous filament glass fibre
- Glass used in other forms

# Glass is everywhere

## Glass manufacturing sites in Europe

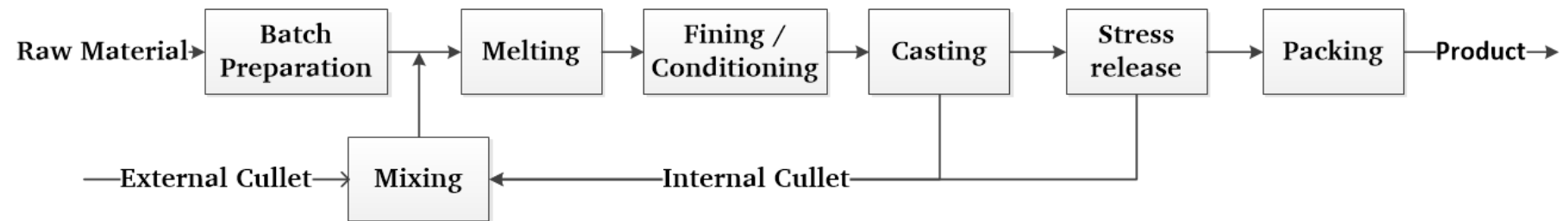


# As time goes by...



# The process...

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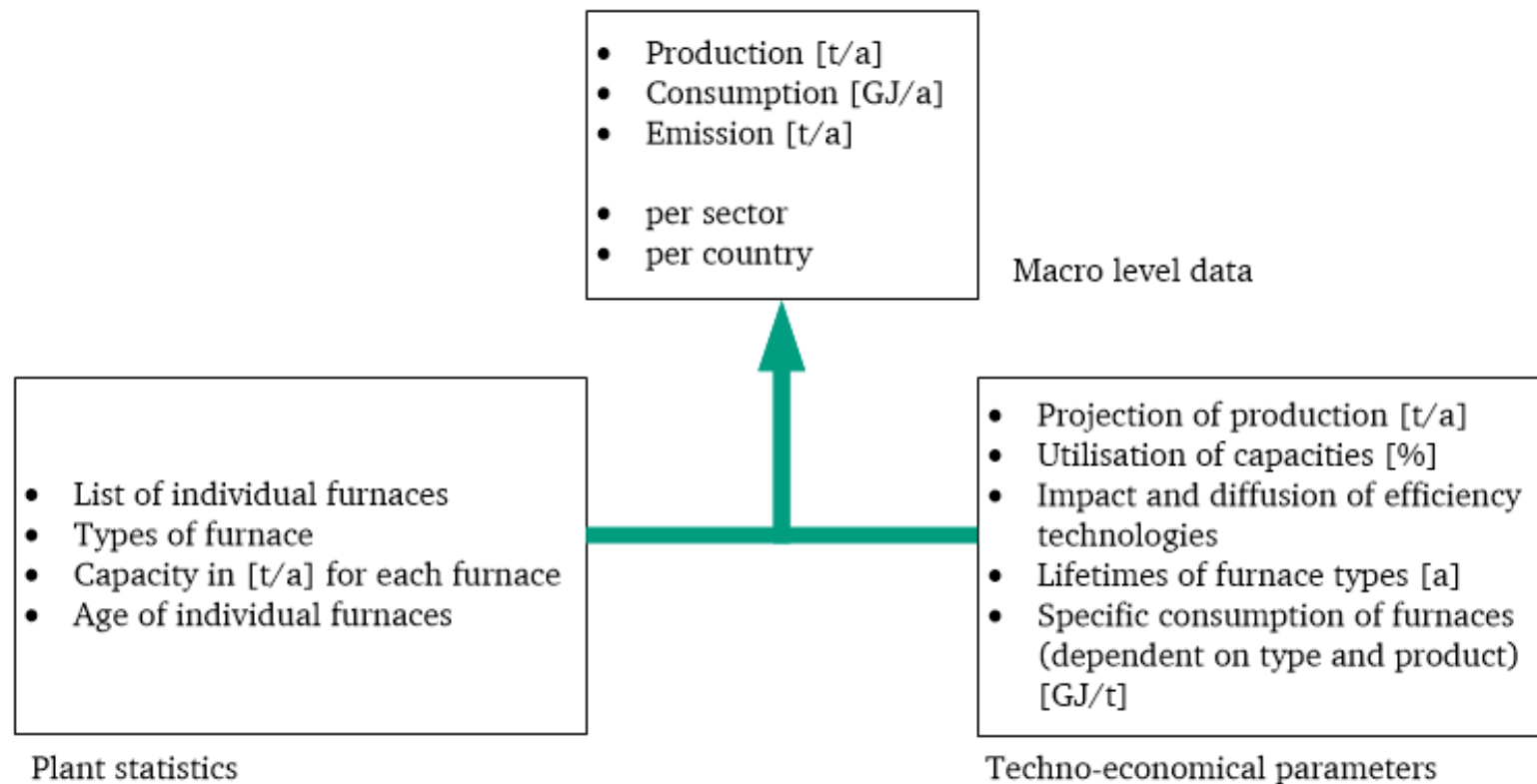
# ... and the improvements ...

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- **pre-heating of cullet and the raw material**
  - Up to 10-20 % Energy savings
- **Waste heat boilers**
  - < 1% Energy savings
- **Use of cullets**
  - 2,5-3% per 10% of cullets
- **Fluxing agents and preliminary treatment**
  - 5-10% (fluxing agents)
- **Process Control System**
  - 2-8%
- **Furnace Insulation**
  - 2-3%

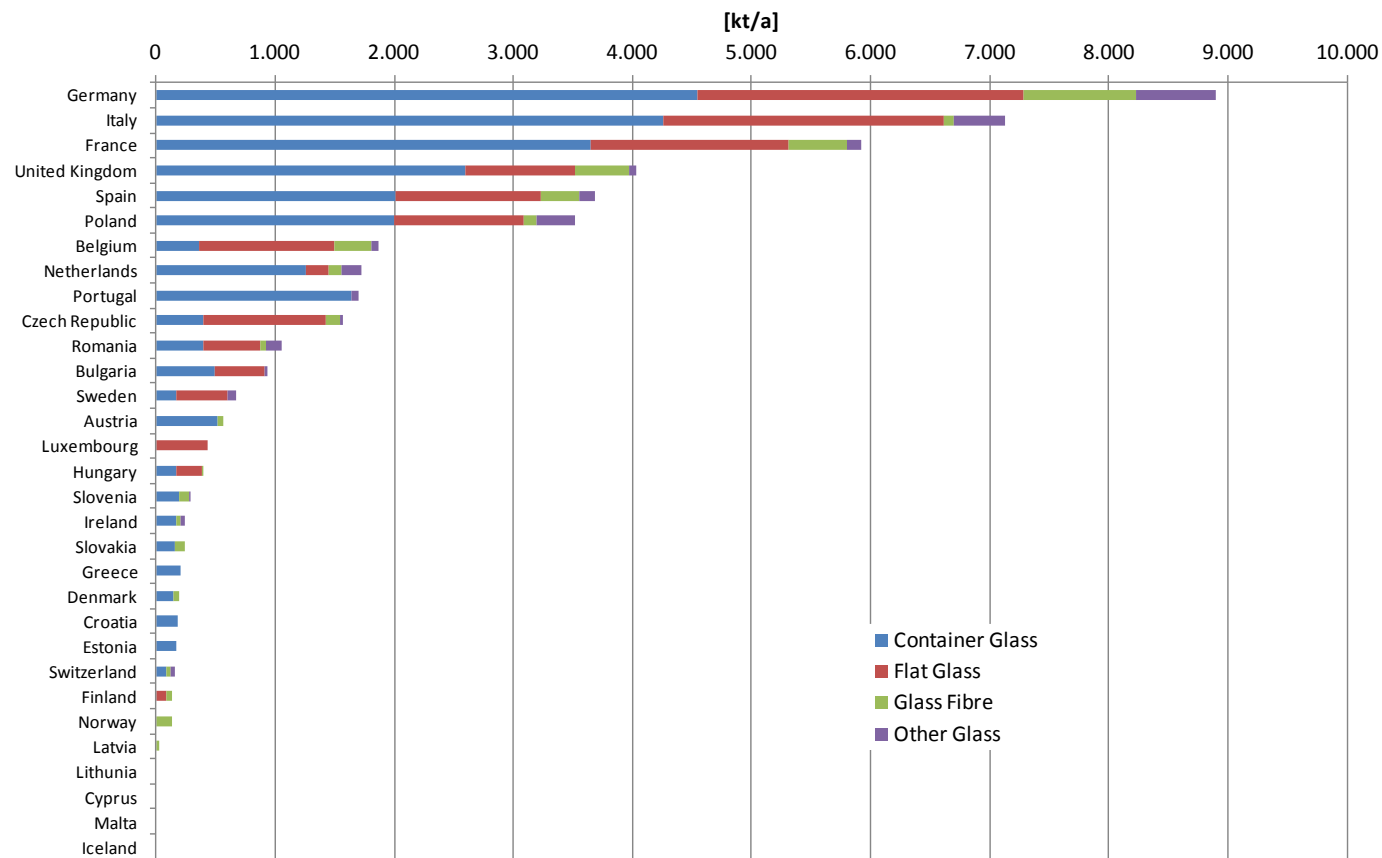
# The model

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# Capacity distribution



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# The specific Energy demand (GJ/Mg)

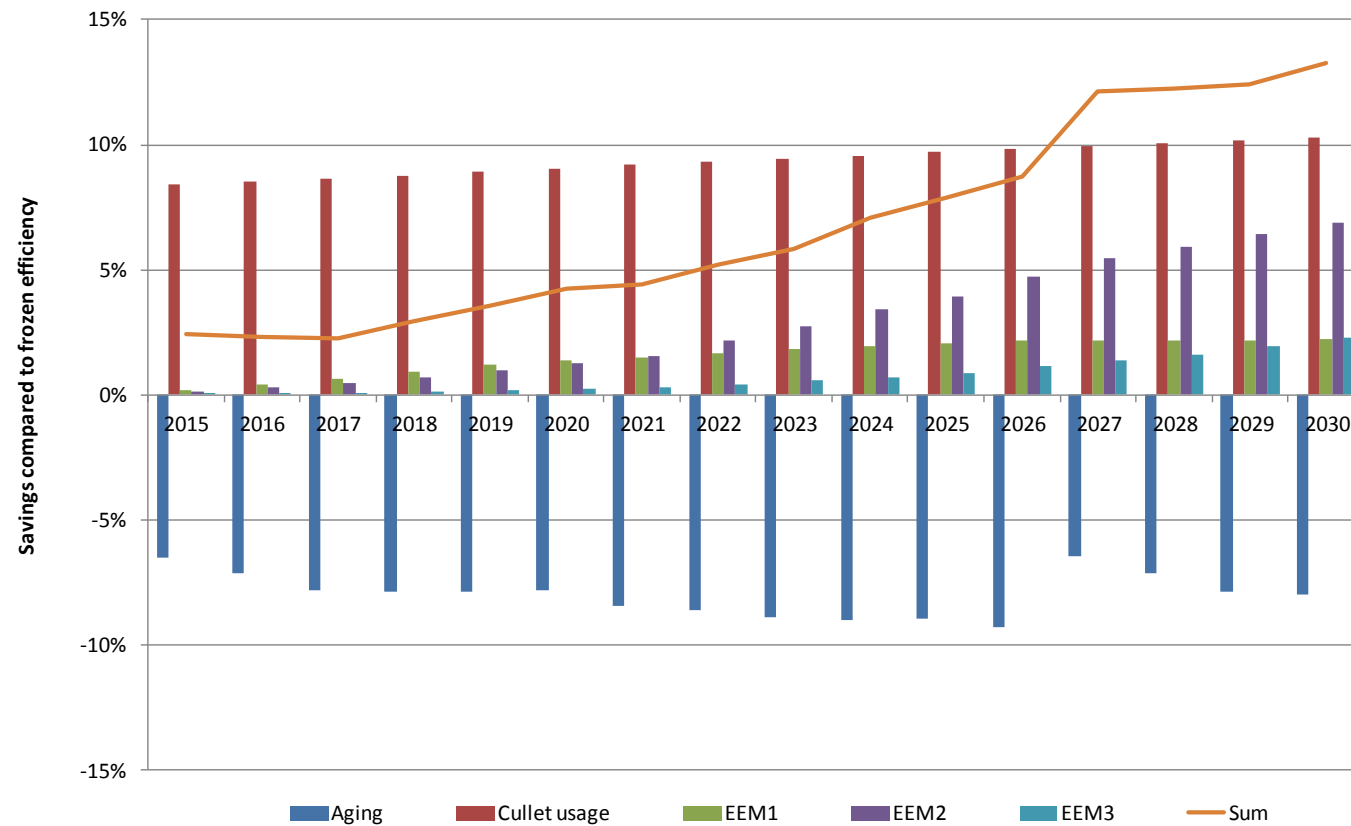
*(based on IPCC 2013a and Worrel et al. 2008).*

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<b>Furnace type</b>	<b>Glass Sector</b>	<b>Container Glass</b>	<b>Flat Glass</b>	<b>Glass Fibre</b>	<b>Other Glass</b>
Regenerative End Fired		5.4	7	12,5	6.1
Regenerative Side Fired		5.2	7.7	12.5	10.5
Recuperative		7.1	-	8.2	9.7
All Oxygen Fired		5.3	6.3	8.7	6.5
Electric Melting		3.7	-	6.5	6.5

# Results

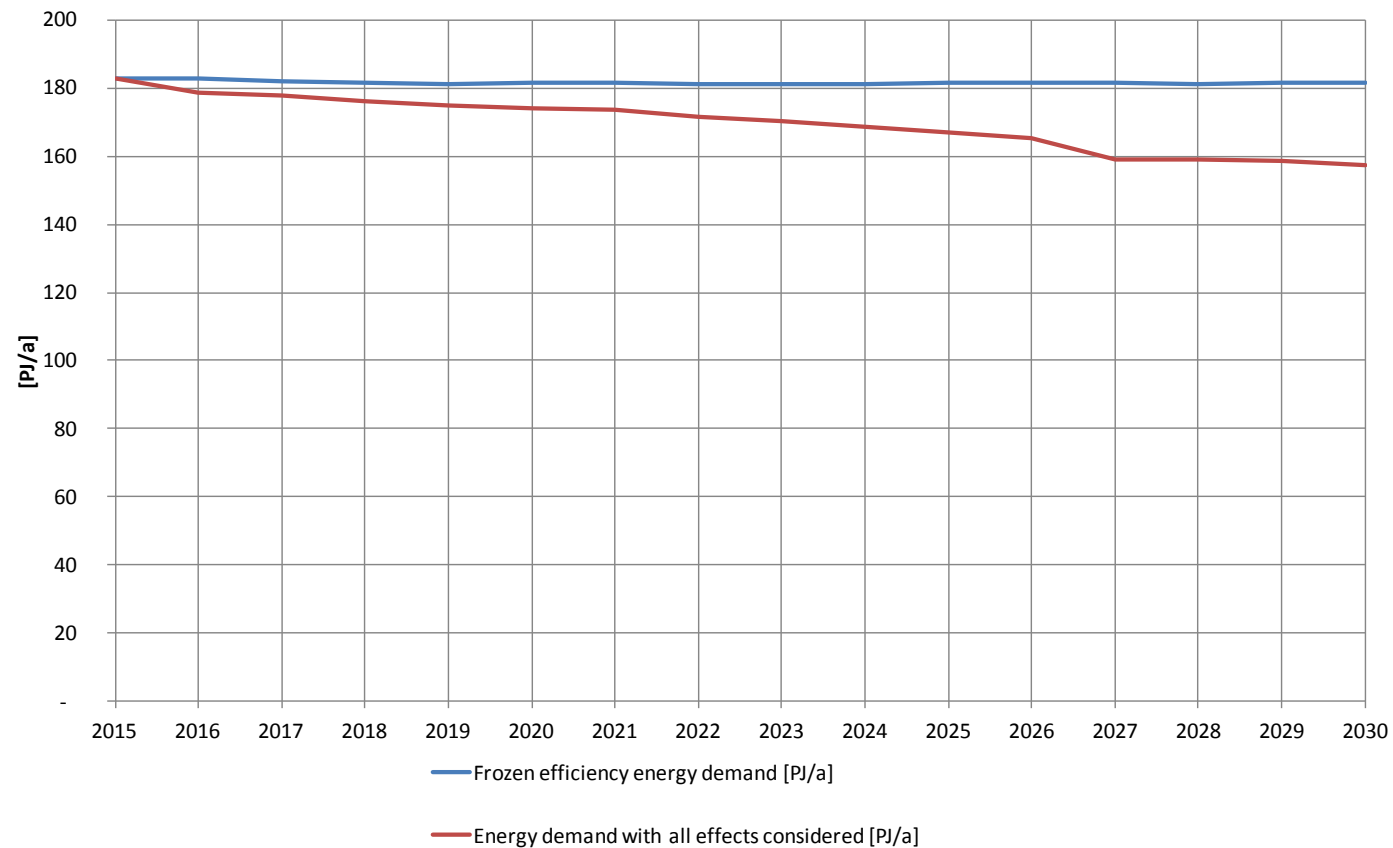
## Impact of EE measures



# Results

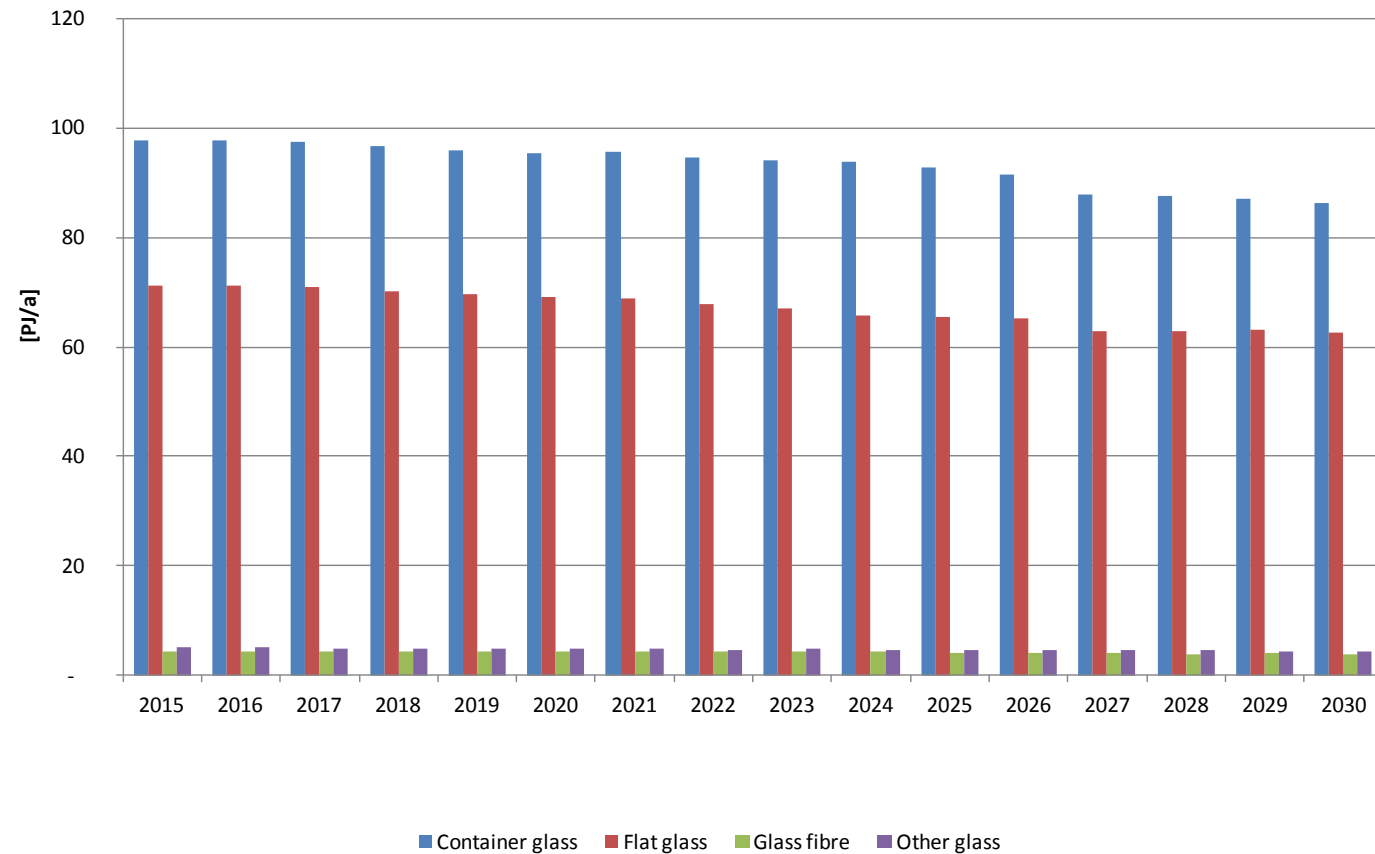
## Development of Energy demand over time

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# Results

## Energy demand over time



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# Conlusions

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The energy demand of furnaces can be reduced by Energy efficiency measures!

Modelling result: reduction of ~12% until 2030

Impacts on Energy demand:

- Ageing of furnaces
- Operation and load cycles
- Use of cullet
- Energy efficiency measures

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# Thank you for your attention

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