Cost issues in the glass industry

EGTEI Meeting - Nice, 12 June, 2012

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Agenda

- Institut du Verre and Glass Alliance Europe
- What are the costs associated with abatement? Examples with dust
- Combinations of technologies are not always relevant. Examples of cross media effects

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What is glass?

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Institut du verre and French Glass association

- The Institut du Verre is the environmental department of the French glass association. We deal with all environmental issues linked to the glass industry : climate change, emissions to air, REACH, recycling, energy efficiency, etc.
- Key figures for France (2010):
  - French Glass Association (FCSIV) represents 24 companies (41 production facilities)
  - Global production (source FCSIV) : 4,6 millions tonnes, i.e. 16% of European production
  - Direct employment : ~ 20000
  - Turnover : 3,8 milliards €
  - However, the French glass industry has been affected by the current crisis, production has faced a decrease of -20% between 2007 and 2009.

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The glass industry in France

With 41 factories, the French glass industry is a major actor in economic development…

…, contributes to the international prestige of the label « made in France »…

Crystal for tableware, flaconnage for luxury parfums

… and brings an important input for industrial innovation, with some of the largest glass R&D centres.

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A strong involvement in favour of the environment

- **A policy of permanent innovation to improve glass performance**
  - **Products of high environmental added value for buildings** : windows with high insulation performances, fibre glass insulation, light weight glass fibre reinforced polymer composite products for automotive, wind turbines etcetera
  - **Glass is 100% and infinitely recyclable** (bottles are produced with up to 90% of recycled glass)
  - **R&D is a priority**: design of very energy efficient furnaces
- **Significant investments in favour of the environment**
  - According to a SESSI study (2007) : 37 M€ are invested annually, e.g. 1,7% of the AV
  - Example : major investments for the implementation of dust filters
  - CO_2 emissions of the glass industry in France have decreased by -25% ($kgCO_2$ / tonne of glass) by 2010 compared to 1990 (and even -70% compared to 1960)

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French Glass association members

CHAMBRE SYNDICALE DES FABRICANTS DE VERRE PLAT	CHAMBRE SYNDICALE DES VERRERIES TECHNIQUES	CHAMBRE SYNDICALE DES VERRERIES MECANIQUES DE FRANCE
EUROFLOAT	CORNING SAS	ARC INTERNATIONAL
AGC France SAS	KERAGLASS	ARC INTERNATIONAL COOKWARE
INTERPANE GLASS France	OWENS CORNING FIBERGLAS France SA	O-I MANUFACTURING France
RIOGLASS	SAINT GOBAIN ISOVER	DURALEX INTERNATIONAL France SAS
SAINT GOBAIN SULLY	OCV CHAMBERY France	VERALLIA - SAINT GOBAIN EMBALLAGE
SAINT GOBAIN GLASS France	OCV CHAMBERY International	SGD
SAINT GOBAIN SEKURIT France	SAINT GOBAIN QUARTZ SA	TOURRES & CIE – VERRERIES DE GRAVILLE
		VERRERIE DU LANGUEDOC & CIE
		VERRERIES DE MASNIERES – BORMIOLI ROCCO
		VOA VERRERIE D'ALBI

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The glass industry in Europe is represented by Glass Alliance Europe

- Glass Alliance Europe is an umbrella association, gathering together :
  - The national glass associations from the European countries
  - The European sectoral associations (container glass, flat glass, domestic glass, fibre glass, special glass)
- Key figures :
  - Annual production: 34 millions of tonnes
  - Turnover : 36 billion euro
  - 200 000 employees

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How to estimate the costs of abatement

- In 2007-2008, a survey on the costs of APC (air pollution control) has been conducted by the TNO (« *Evaluation of costs associated with air pollution control for glass melting furnaces. A study to support the revision of the IPPC reference document on best available techniques in the glass manufacturing industry 2008* »)
- Estimation of the total price for primary methods (for example low-Nox burners, oxy-fuel heating) or a secondary measures (like SCR, dust filter)
- The elements taken into consideration are :
  - Capital and investment costs, including
    - costs for the equipment, the piping, valves connection, engineering and so on,
    - costs for site preparation like foundation, building,
    - costs for changes in chimney (including erection of an extra chimney if needed),
    - costs for analysis (monitoring) system for the flue gas composition
  - Operating costs, including :
    - Costs for extra energy consumption (for example electricity asked to produce oxygen, for the functioning of the ESP filter, extra fuel in case of R processes, etc.)
    - Costs for chemical agents (ammonia, limestone, etc.), for oxygen (oxy-fuel technology)
    - CO_2 permits
    - Costs for filter dust disposal
    - Labour costs for maintenance and operation by manpower

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An example of costs associated to an electrostatic dust filter + dry scrubber for SOx (lifetime 10 years)

- The glass production technology : float glass furnace of 700 tonnes/day, producing glass for windows (building and automotive). This furnace is fired with gas.

Total investments (capital + foundation / civil works)	4 699 500	€
Capital costs / year (including interest rate)	603 206	€/year
Total operating costs / year (including disposal of the dust)	909 641	€/year
Total costs / year	1 512 848	€/year
Initial dust concentration	140	mg/Nm^3
Dust concentration after filtration	5	mg/Nm^3
Initial SOx concentration	800	mg/Nm^3
SOx concentration after filtration	536	mg/Nm^3
Specific costs	5,92	€/molten tonne of glass
Specific costs for dust	13,34	€ / kg dust reduced
Specific costs for SOx	0,66	€ / kg of SOx reduced

Source : TNO study, 2008

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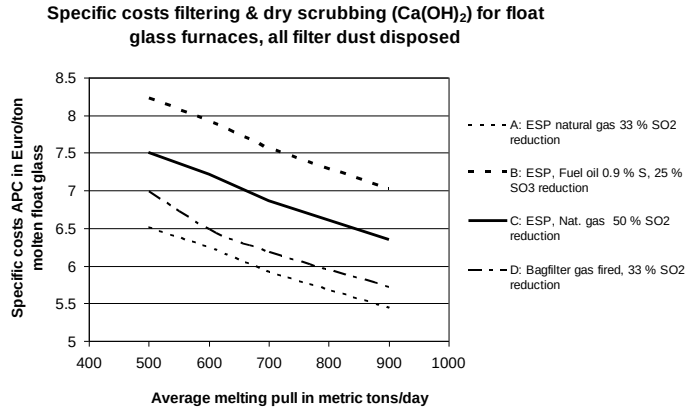
Costs depends on size of the furnace (in tonnes/day), fuel (gas or fuel oil) and APC technology (electrostatic filter or bag filter)



Source : TNO study, 2008

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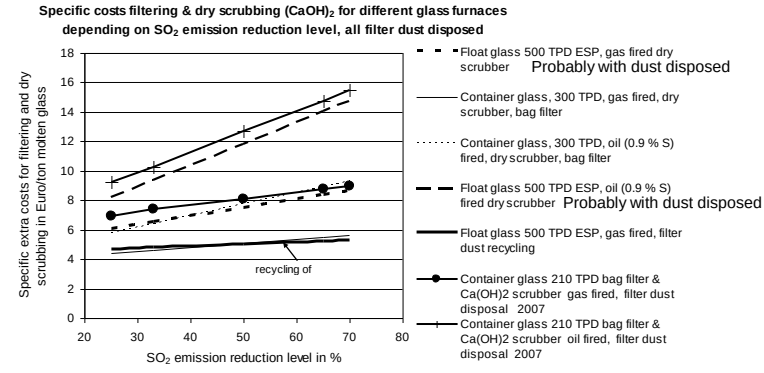
Costs depend on abatement required and on the re-use of the dust (recycled or disposed of)



Source : TNO study, 2008

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What are the limitations to the cost evaluation?

Deriving these costs is not an easy task. We can identify at least three different limitations :

- How to estimate the costs associated with the reduction of a given pollutant in cases where different species are filtered by the same APC (example : dust filter + scrubber for SOx equipment) ?
- How to take into account the indirect emissions (of NOx, CO_2, SOx, dust) due to the electricity generation, oxygen production and chemical reagent production (ammonia, lime, etc.) ?
- How to manage the natural differences between facilities all over the EU:
  - Differences of electricity prices, labour costs, chemical reagent costs, etc.
  - Differences of distances between the glass furnace and APC
  - Differences of required site preparation for the APC installation
  - Differences of the safety measures required,
  - Difference in filter dust disposal conditions & costs,
  - Year of installation

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Cross media effects

It is important to note that all the different measures cannot always be applied in the same installation, because the reduction of a given pollutant could (overall) lead to the increase of another. The cross media effect is a wide and complex issue and we give here only few examples for illustrative purposes.

- The temperature of the waste gas after the regenerator chambers is around 600 C and the question of heat recovery could be raised. However, the functioning of dust filter and SCR (for NOx) implies maintaining the waste gas in a temperature range of 350 – 400 C, reducing the interest of such a recovery
- An easy way to decrease SOx emissions is to switch from fuel oil to gas (natural gas is free of sulphur). But at the same time, combustion with gas in a glass furnace generally increases NOx emissions. The choice between the two fuels (or a mix of the two, which is sometimes the case) depends on one hand on the price of the fuel, on the other hand on local environmental priorities.

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Cross media effects

- Dust in the glass industry is essentially composed of sulphates. Furthermore, the scrubbing associated to the dust collector captures other acid gases like HCl, in addition to SOx, Thus, recycling the dust into the glass furnace is not always possible, because :
  - An excess of chlorides could lead to chemical attack of the refractories and damage the furnace or the regenerator chambers
  - Sulphates are transformed into SOx during the melting process; thus a high amount of sulphates in the dust (especially when producing glass with a low solubility of sulphur) and recycling this dust can lead to a higher concentration of SOx in the waste gas
  - Filtering the SOx and dust can lead to the creation of a waste stream (filter dust with low density, higher volumes), i.e. a further environmental and cost issue
- The use of chemicals and extra electricity is associated with indirect emissions at other sites (e.g. power plants)

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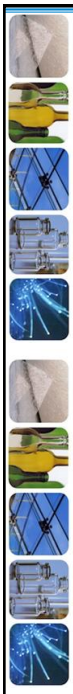

Thank you for your attention.
Any questions, comments ?

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