

Reducing greenhouse gas emissions

Solios Environnement has been investigating ways of reducing emissions from its gas treatment centres. One method is to calculate a carbon balance to identify major emission sources during manufacture and operation and then actions taken to reduce the total carbon equivalent arising from the gas treatment centres. **By El Hani Bouhabila***

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Global warming and greenhouse gases have become key issues for industry. The aluminium sector has committed itself to reduce emissions of greenhouse effect gases by at least 20%.

Several actions have been taken to reduce the CO₂ equivalent per tonne of aluminium; especially by reducing energy consumption and the emission of perfluorocarbon (PFC) arising from anode effects. Solios Environnement supplies fume treatment solutions to aluminium smelters. Several years ago, the company started looking at ways of reducing CO₂ emissions from its Gas Treatment Centres (GTCs) (Fig 1) for electrolysis pots and anode baking furnaces. First, a carbon balance calculation was performed to identify major sources of emission in both the construction and operation of GTCs. Then, actions were taken to reduce the carbon equivalent of GTCs.

Carbon balance calculation

The carbon balance calculation (CO₂ eq/tAl) of a GTC is calculated through all stages of its lifetime: Installation, Operation, and Dismantling (Fig 2).

Installation consists of: Transportation (lorry, boat, plane), Purchase (electrical machines, valves, filter bags), and Manufacturing and assembling (especially manufacturing steel ducts and concrete structures).

Operation consists mainly of consuming

energy (fans) and reactive (alumina) or other consumables such as filter bags.

Dismantling consists of recycling materials and machines, recycling spent alumina to the pot line and also waste treatment.

Emission factors were used to measure the CO₂ equivalent for each station and each stage. These factors were extracted from the tables published by environmental agencies such as the ADEME, France.

For example, 1.1kg of CO₂ equivalent is emitted to manufacture 1kg of steel duct; whereas 5.9kg of CO₂ equivalent is emitted to manufacture 1kg of polyester filter bag.

In Case 1 the CO₂ equivalent calculated for this GTC is 280kg/t Al (2% of the global carbon emission of an aluminium smelter). In Case 1, the carbon equivalent for electricity generation by gas turbine is 0.620kg CO₂/kWh. Electrical machines represent 96% of the carbon footprint in this case. Exhaust fans account for 90% of the electricity consumed by a GTC.

Boat transportation stands in second position, with 1.58% of the share of emissions while transport by air accounts for 0.82% and truck just 0.01%.

Results of this carbon balance calculation may vary from one case to another. They depend on the method of local electricity production. In Case 2, the carbon equivalent for electricity generation is 0.085kg CO₂/kWh (similar to France

where a high proportion of electricity is generated from nuclear power).

Electrical machines represent 78% of the carbon footprint, whereas transportation now totals a higher proportion of the total at 14% of the carbon footprint (0.152kg CO₂/tkm for lorry transportation and 0.011kg CO₂/t km for ship transportation).

Actions for improvement

Results of carbon footprint made from Fume and Gas Treatment Centres show that most of the carbon equivalent comes from electrical consumption during the operation stage (between 70 and 95% of the global carbon footprint).

Given these results, Solios Environnement decided to perform the following improvements:

- Reducing energy consumption (design and process improvement);
- Reducing pressure drop on gas ductwork;
- Minimising parasitic flows by treating required flows only;
- Reducing compressed air consumption (filter unclogging, alumina handling), and;
- Manufacturing equipment close to aluminium smelters to avoid unnecessary transportation.

By combining these actions, Solios Environnement will reduce the CO₂ equivalent of its GTCs for electrolysis pots by 10-30%.

Solios Environnement will perform a carbon balance calculation for each new product or technology to be validated and supplied to its GTCs.

It will also seek to minimise the carbon equivalent for each stage of a project cycle: design, assembly, operation and dismantling. ■

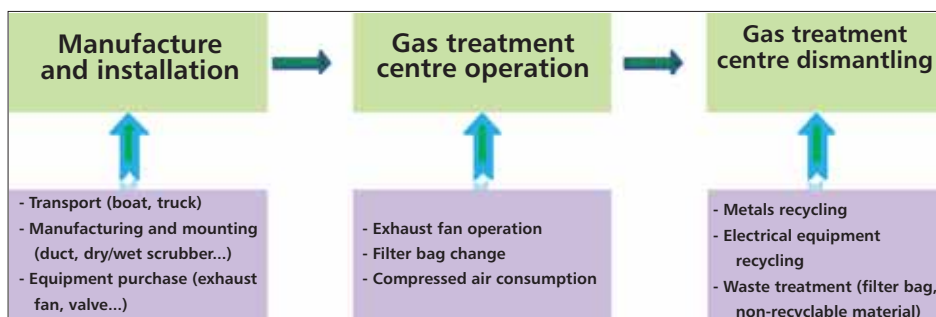


Fig 2 Carbon balance calculation for each stage of a gas treatment centre lifetime

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