Sodium Bicabonate for Flue Gas Treatment

Continuum Technology

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Continuum Industrial Solutions

Filtration
&
Flue Gas Cleaning

Milling

Analytics
&
Controll

Industrial Emission Directive 2000/76/EC

For Boilers (Power Generation):

- No regulation about HCl
- SO2 at stack: from 200 to 400 mg/Nm^3 dry 6% O_2 (70 to 140 ppm)
- minimum SO2 mitigation rate from 80 to 97% !

For Waste Incinaration:

- HCl emission limit 10 mg/Nm3 dry 11% O2 ~ 0.010 lb/MMBTU
- SO2 → 50 mg/Nm³ dry 11% O2 (17 ppm) / HF → 1 mg/Nm³ dry 11% O2 (1.1 ppm)
- Depending on the facility → results in 99.0% to 99.8% HCl mitigation

Benefits of Sodium Bicarbonate

Sodium Bicarbonate neutralises acid gases much more efficiently than other commonly used dry injection reagents, e.g. lime ($Ca(OH)_2$).

When Sodium Bicarbonate is dry injected into hot flue gases there is rapid thermal decomposition, creating a high surface area Sodium Carbonate. The surface area can increase by up to eleven-fold, depending on process conditions.

This fresh, high surface area Sodium Carbonate reacts quickly and efficiently with the acidic components of the gas.

Neutralisation Reaction Efficiency

Focusing on the two main acid gas components, the reactions with Sodium Bicarbonate are:

$$NaHCO_3 + HCl \quad > \quad NaCl + CO_2 + H_2O$$

$$2\ NaHCO_3 + SO_2 + 1/2\ O_2 \quad > \quad Na_2SO_4 + 2\ CO_2 + H_2O$$

$$NaHCO_3 + HF \quad > \quad NaF + CO_2$$

Reaction Mass Balance

With 100% efficiency the following would occur (calculated from the stoichiometry of the above neutralisation reactions):

2.3 kg $NaHCO_3$ neutralises 1kg HCl

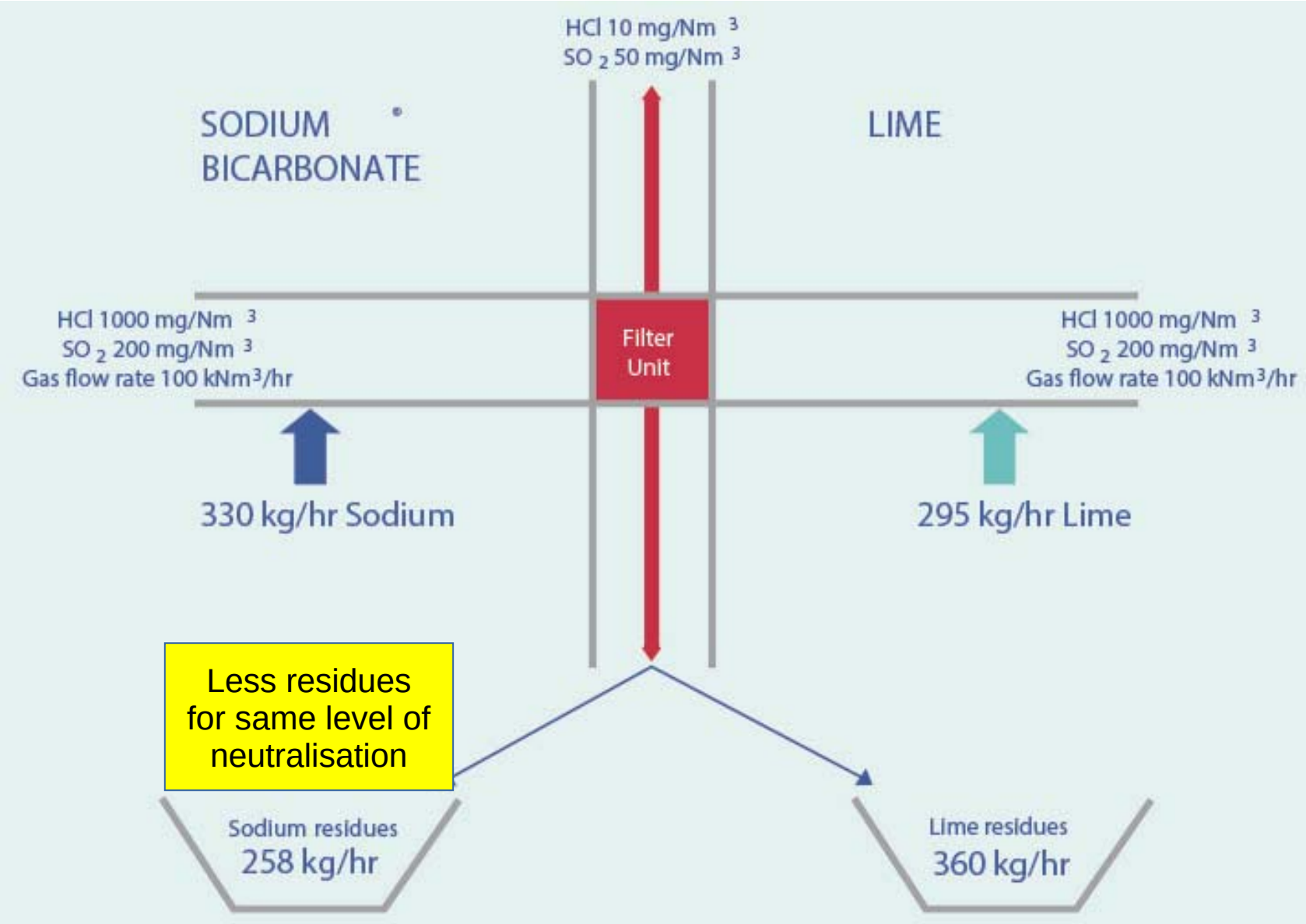
2.6 kg $NaHCO_3$ neutralises 1kg SO_2

Reductions of up to 99% in HCl emissions and over 95% in SO_2 emissions can be obtained. At such high removal efficiencies typical stoichiometric ratio of 1.25 is achieved

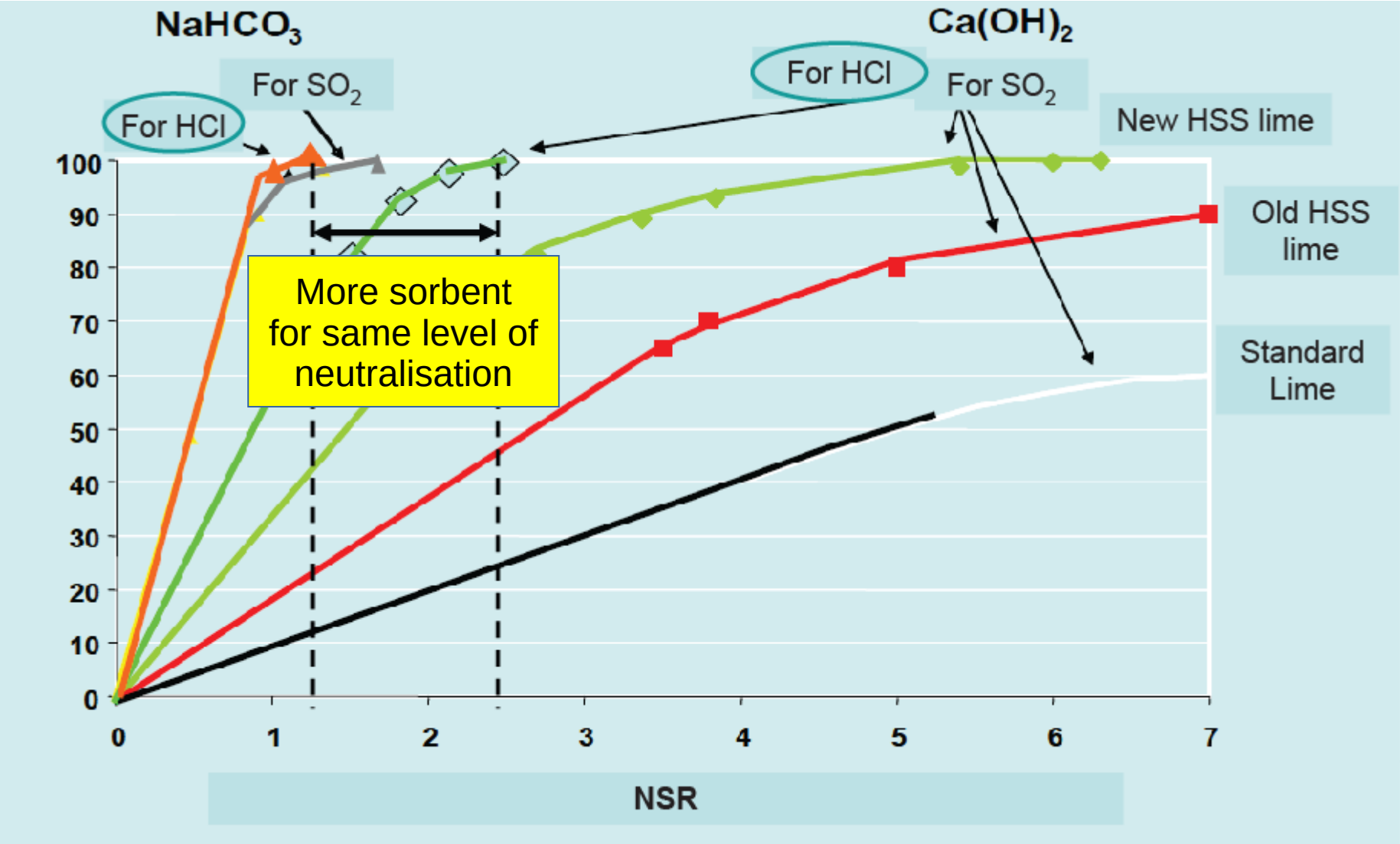
Reagent	Acid gas	Residues
Sodium Bicarbonate	HCl SO_2	0.7 tonnes 0.8 tonnes
Lime	HCl SO_2	1.5 tonnes 1.8 tonnes

The above calculations assume a 100% reaction.

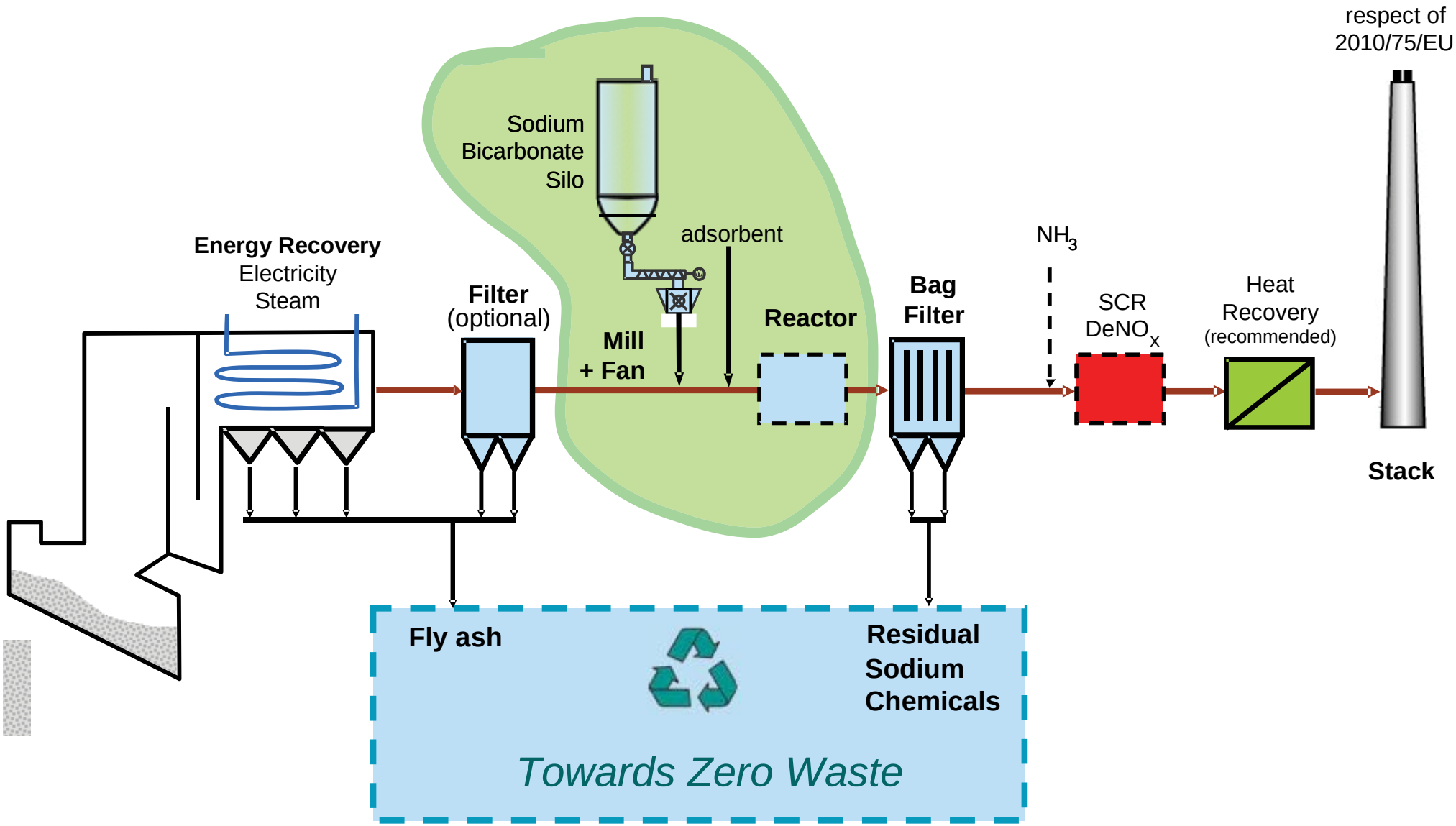
Usage and Disposal Example 100.000 Nm^3/h



Sodium vs. Lime

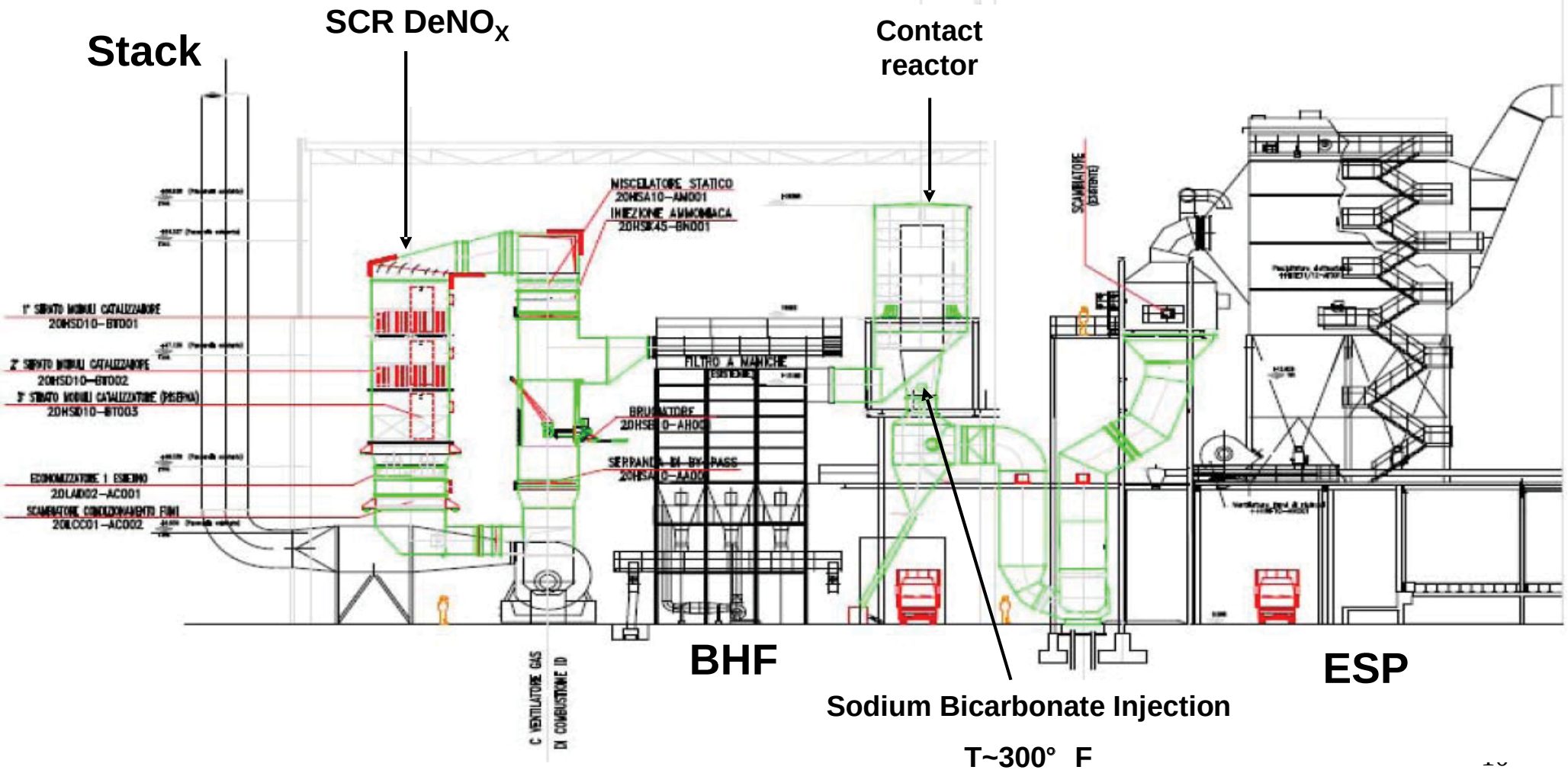


The **Continuum** Process Solution

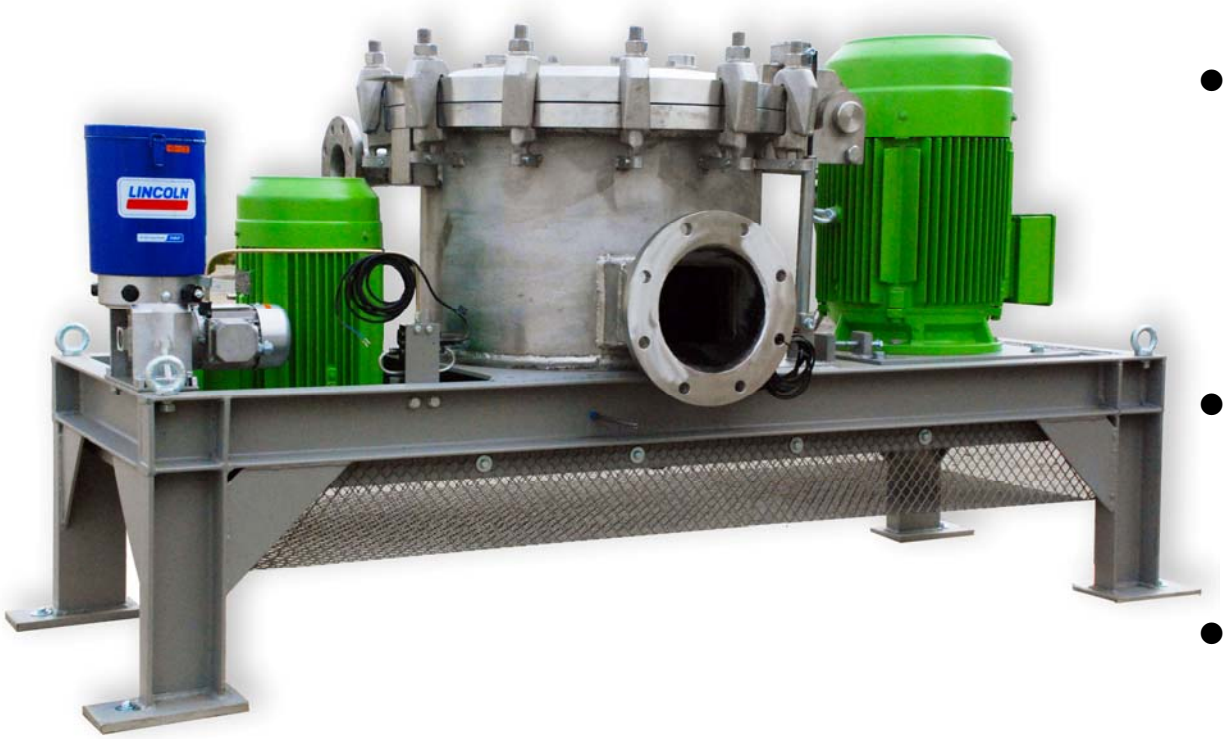


Installation Example

Power : 184 MW_t

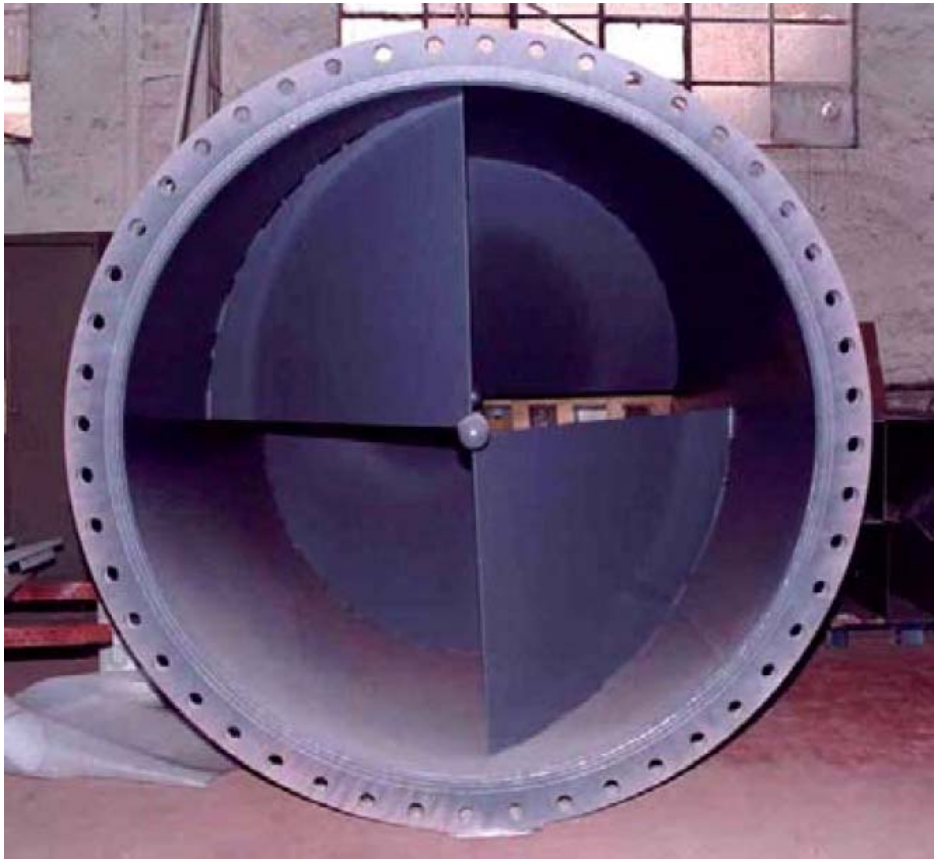


Continuum Classifier Mill milling below D_{90}=30 µm



- Milling **and** Classification in one step
- Milling of powders down to D_{90}<10 µm
- High Productivity

Flow Optimized Injector CIM



- No movable parts
- High homogenity
- Minimal pressure loss
- Abrasion resitent

Low Operational Costs

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