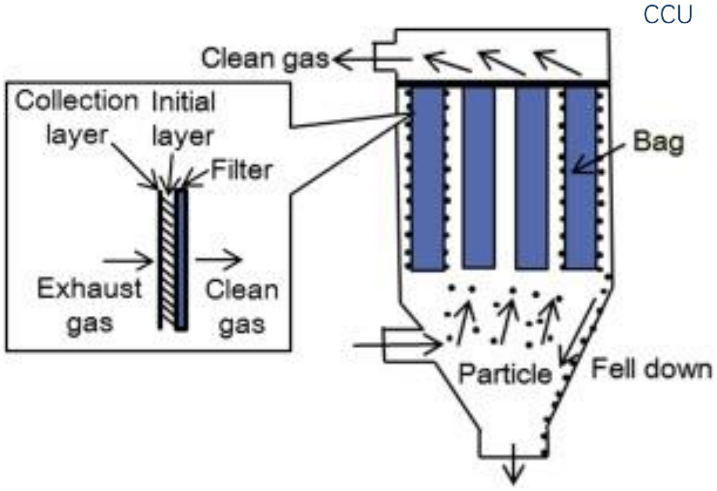
PARTICULATE REMOVAL USING BAG FILTER

map-it CCU

Bag filters, mostly known as fabric filters, are widely used in industrial applications to remove particulate matter (PM) and other pollutants from flue gases.[1] These filters operate by directing the gas stream through a series of fabric filter bags, which physically capture fine dust, ash, and other suspended particles. The bag filters are generally designed to withstand the demanding conditions of flue gas treatment. Typically made from heat- and chemical-resistant materials like PPS fibres with PTFE membranes, they ensure durability and resist corrosion in harsh environments. In addition to removing particulates, bag filters can perform flue gas cleaning functions when paired with dry sorbent injection (DSI). Reagents like sodium bicarbonate ($NaHCO_3$) or hydrated lime ($Ca(OH)_2$) react with acidic gases (e.g., SO_2), enabling partial desulfurization while reducing the load on downstream systems.[2]



Schematic of a bag filter installation

REMOVED COMPONENTS

- Particulate matter (PM): dust, ash, soot, and other fine particulates up to >99%.[3]
- Partially removes sulfur dioxide (SO_2) and nitrogen oxides (NO_2 and NO) when appropriate materials are used in the bag filters.[2]
- Also removes trace amounts of heavy metals present in the gas stream.

FUNCTION IN CCU VALUE CHAIN

- Enhancing CO_2 capture efficiency.
- Ensuring flue gas purity for utilization.
- Protection of carbon capture equipment.
- Improving operational stability and safety.

LIMITATIONS

- Filter clogging: high particulate loads can lead to frequent clogging, requiring more maintenance.[4]
- Temperature sensitivity: Bag filters are not suitable for extremely high-temperature gas streams.
- Chemical compatibility: filter media must be compatible with the chemical composition of the gas stream to avoid degradation.

ENERGY

- Electricity is mainly used to power the fans and is also used to control the gas stream temperature.

CONSUMABLES

- Filter bags need regular replacement due to wear and degradation.

Energy & consumables

Electricity (kW per m^3/s gas) *	0.8 – 2.0[4]

**Power requirement for a reverse air fabric filter with a typical dust loading of 0.2 – 20 g/m^3 gas.*

COSTS

The cost of collecting dust and particulate matter from flue gas using fabric filters can vary based on several factors, including the size of the system, the type of fabric filter, and the specific application. The average cost ranges based on gas flow rate from **€58 - €372 per tonne of particulate matter** removed.[5]

[5] *gas flow rates – 1 to 470 m^3/s; particulate matter loading – 9 g/m^3; 1999 euros.*

TECHNOLOGY PROVIDERS

- Fabric filter (FF) by **Andritz Group**, Austria
- Pulsed Jet Fabric filters by **Babcock & Wilcox**, USA
- Eco Pulser™ by **Sumitomo Heavy Industries**, Japan
- Bagfilter (Ecopuls) by **GEA**, Germany

ALTERNATIVE TECHNOLOGIES

- **Electrostatic precipitators** (ESP) use electrostatic forces to remove dust from flue gases. They charge particles negatively, which then move to positively charged plates. The collected dust is dislodged and collected by electrode rapping.[6]
  Wet and Dry ESP by **Babcock & Wilcox**, USA.
  Wet and Dry ESP by **GEA**, Germany.
- **Cyclone separators** use centrifugal forces to separate particulates.[3]

- **Wet scrubbers** use liquid to wash out particulates from the gas stream.[3]
  Wet gas scrubber by **Babcock & Wilcox**, USA.
- **Ceramic filters** remove particulate matter and acidic gases with very low dust emissions and are thermally stable under high operating temperatures.
  Ceramic Candle Filter by **GEA**, Germany**.**

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