

CHALLENGES IN HANDLING ALTERNATIVE FUELS



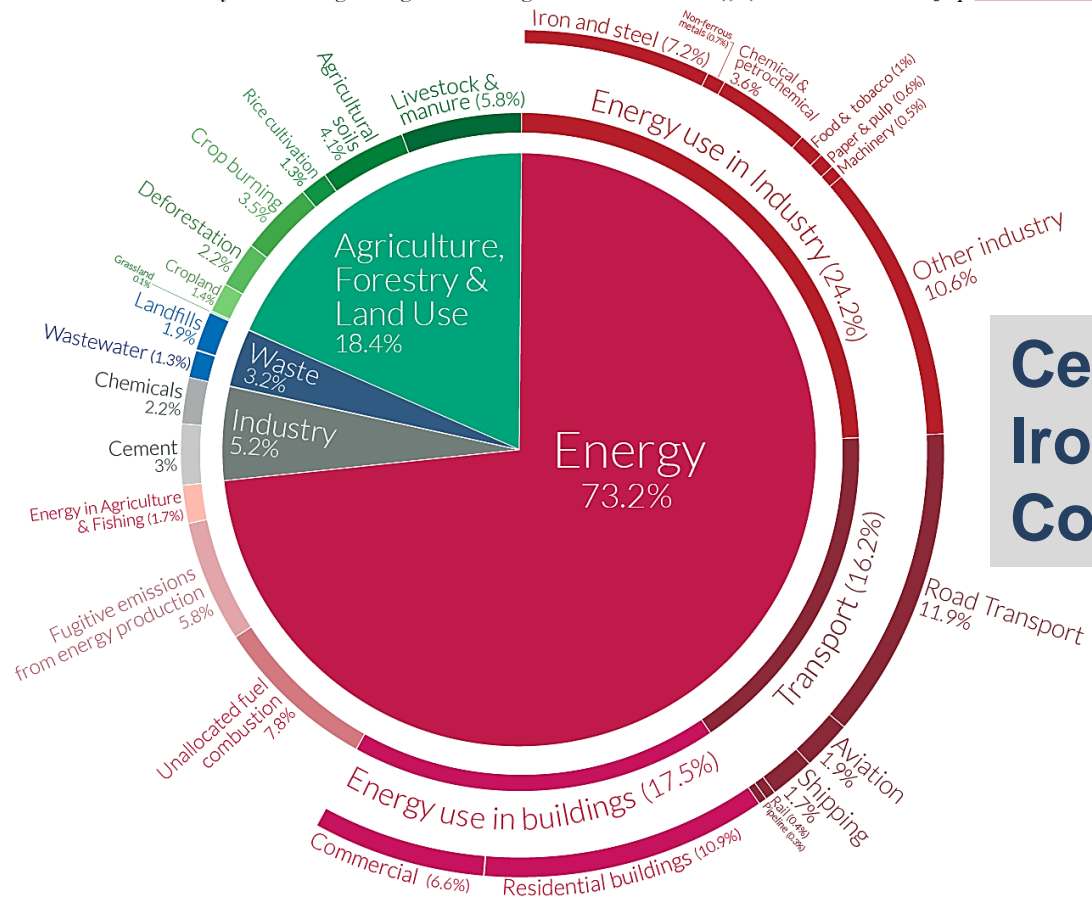
12-13 October 2021

Global CO₂ Emissions

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.

Our World
in Data



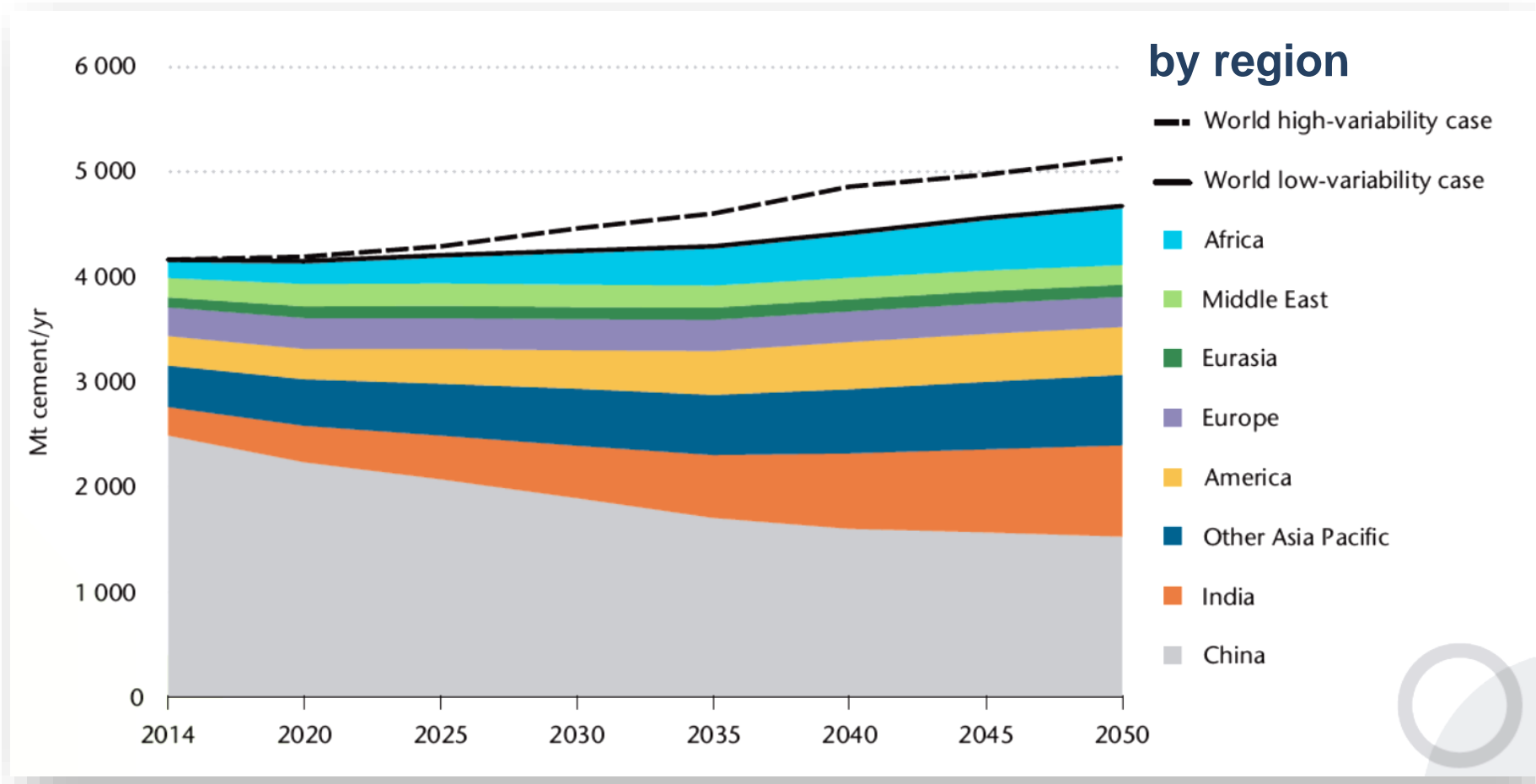
Cement 7%
Iron and Steel 7%
Coal Fired Power 16%

OurWorldinData.org – Research and data to make progress against the world's largest problems.

Source: Climate Watch, the World Resources Institute (2020).

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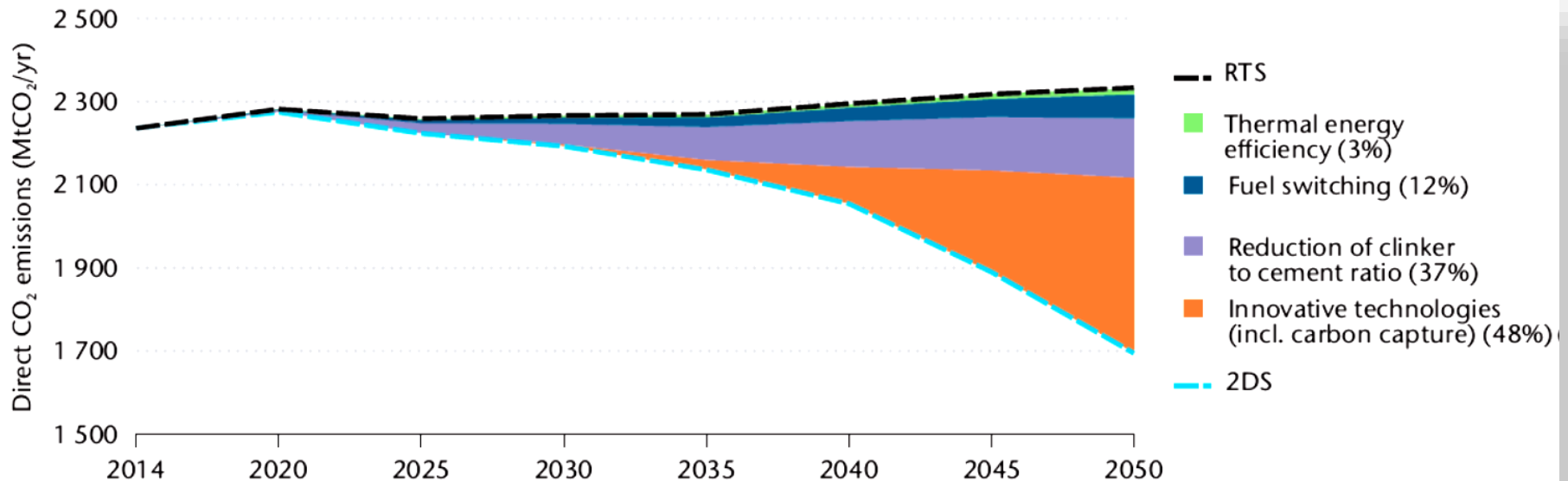
Predictions of Cement Production by 2050



Source: IEA International Energy Agency; Technology Roadmap Low-Carbon Transition in the Cement Industry

CO₂ Emissions: Potential for Reduction in Global Cement Production

Global direct CO₂ emissions reductions between the 2DS (2°C Scenario) and the RTS (IEA Reference Technology Scenario) by mitigation lever



Note: Percentages provided refer to the contribution of each carbon emissions reduction lever to the total direct CO₂ emissions reductions cumulatively along the modelling horizon.

Source: IEA International Energy Agency
Technology Roadmap Low-Carbon Transition in the Cement Industry

Alternative Fuels in Bulk Materials Industries

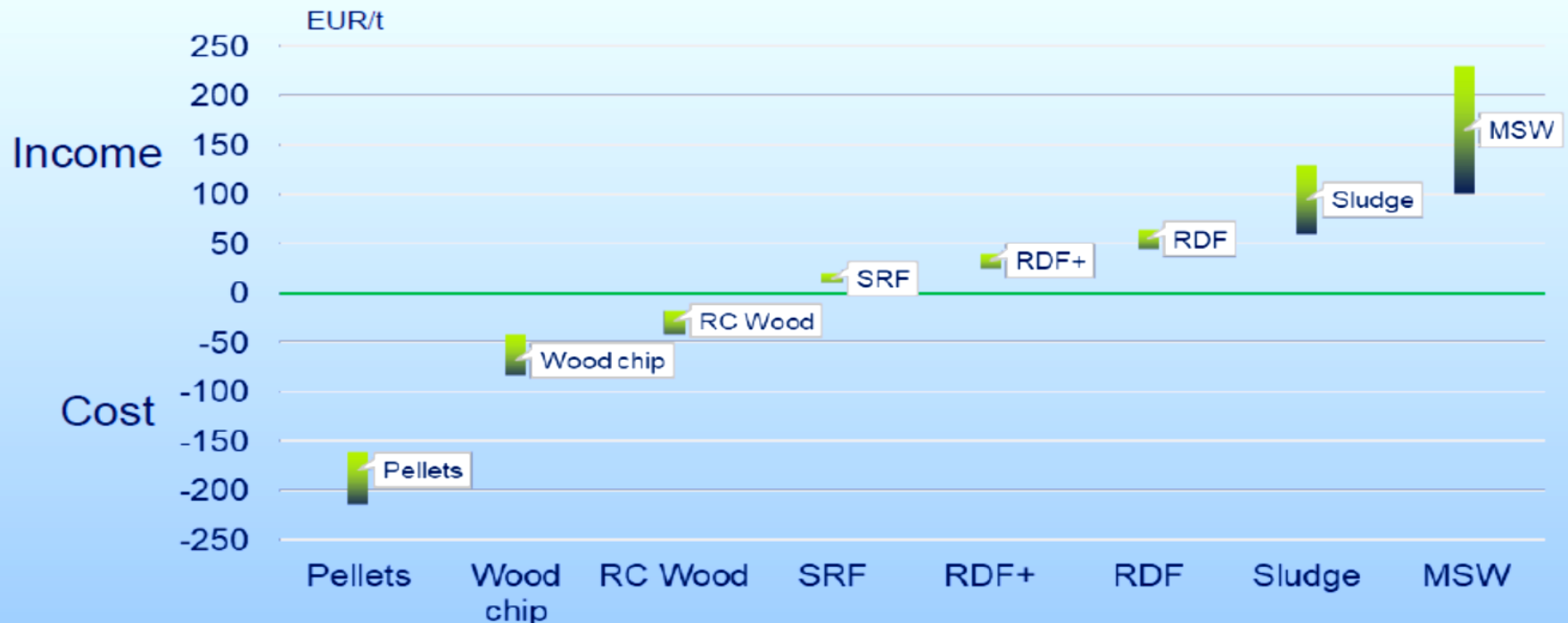
- Processing **waste** materials = improving the global environment / **decreasing CO₂ footprint** by converting waste by-products into productive resources
- **Reducing landfill**
- **Energy ~ one-third of production costs** in cement manufacture
⇒ Kiln fuels offer significant potential for cost-saving



Win-Win Combination

Alternative Fuel Costs

Indicative fuel cost ranges for consumers*



Note* Can vary among countries and even regions

Technical challenges

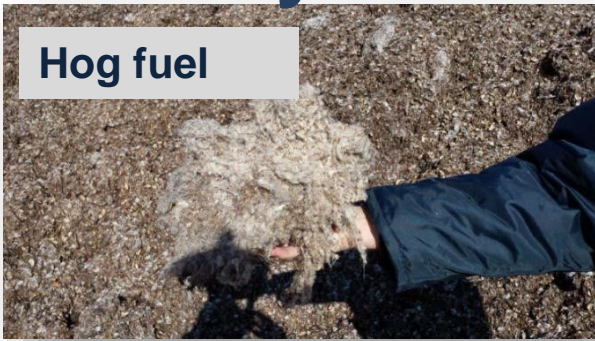
Diversity of Alternative Fuels

Variations of alternative fuels have a big impact on material handling



Variety of Biomass Types

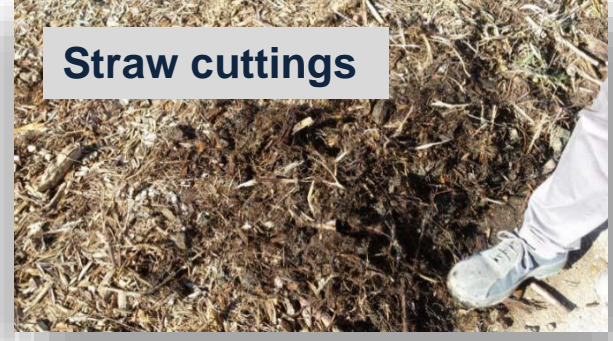
Hog fuel



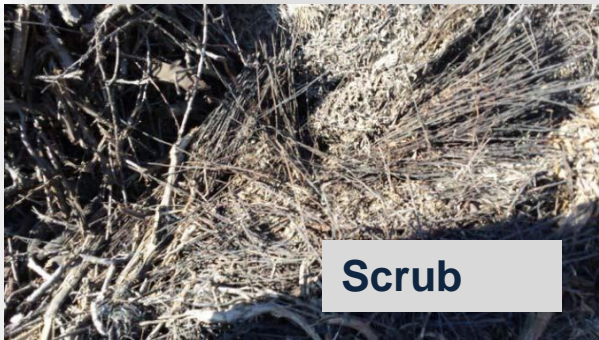
Bales of straw



Straw cuttings



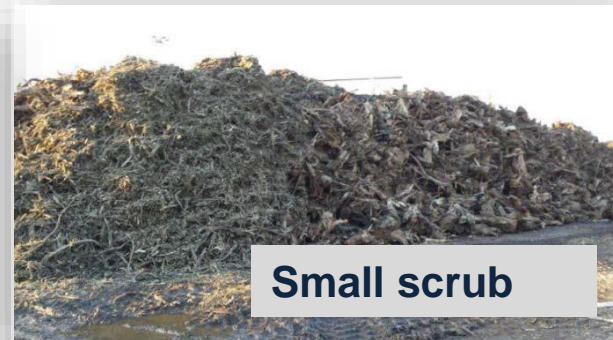
Scrub



Scrub



Small scrub



Grass cuttings



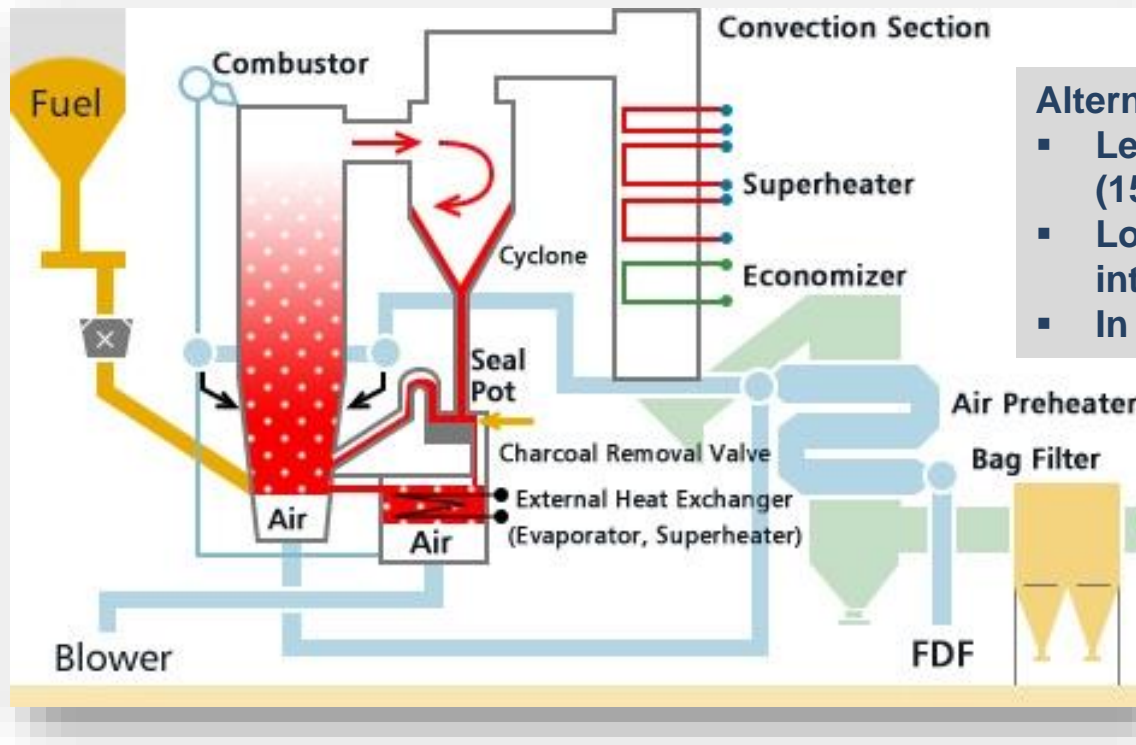
Saw-mill residue



Olive mark



Alternative Fuels in Power



Alternative fuels to boilers

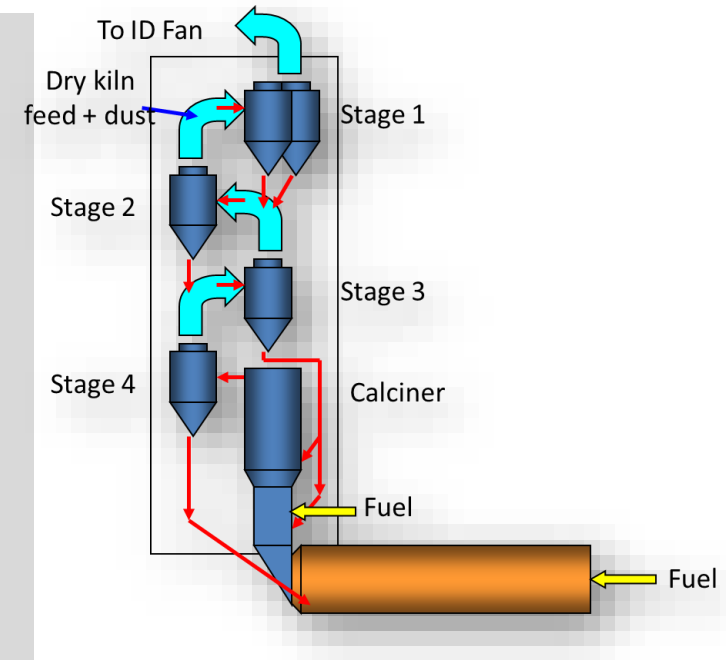
- Less sensitive to particle size (150x40x25) due to long retention time
- Low sensitivity towards chlorine intake
- In general higher capacities required

Alternative Fuels in Cement

Alternative fuels in cement plants

Alternative fuel to kiln

- Light alternative fuel to main burner (< 30 mm 2D)
- Whole tyres to kiln inlet
- Step combustion chamber e.g. alternative fuel to calciner
- Larger size (~ 60 mm 2D) riser duct
- Pneumatic and mechanical feeding
- Very big size (few meters) hot disc
- Sensitive towards chlorine intake



Impact on clinker capacity by (rule of thumb)

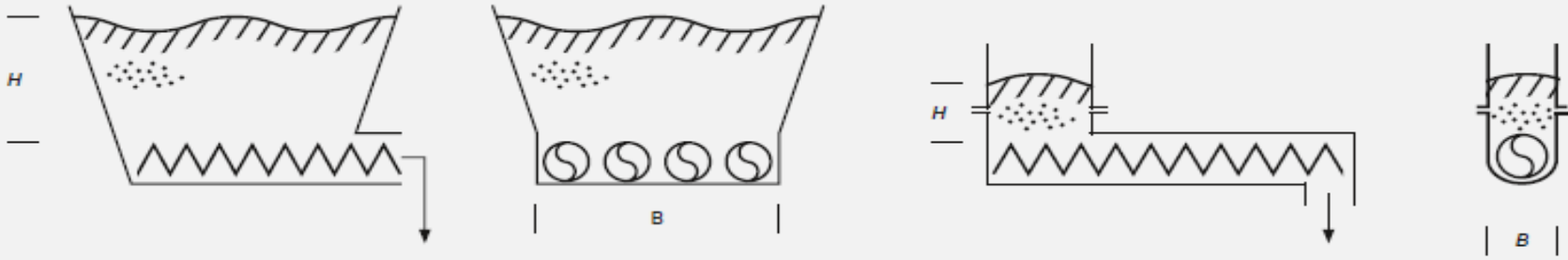
- Water 2 t clinker/t H₂O
- Ash 0.26 t clinker/t ash
- Additional transport air 0.24 t clinker/K Nm³
- Oxygen level 5.7 % clinker capacity per % O₂ increase

Rules of Thumb in General

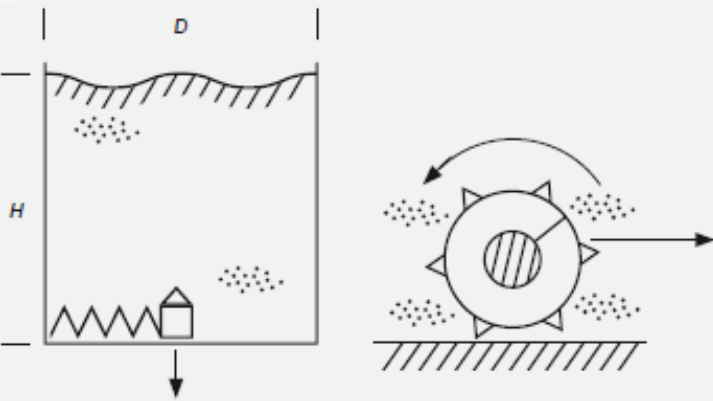
Particle size:	the smaller, the better it flows
Particle shape:	the more regular, the better it flows
Density:	the heavier, the better it flows
Moisture:	the lower in moisture, the better it flows
Fat content:	the lower the fat content, the better it flows



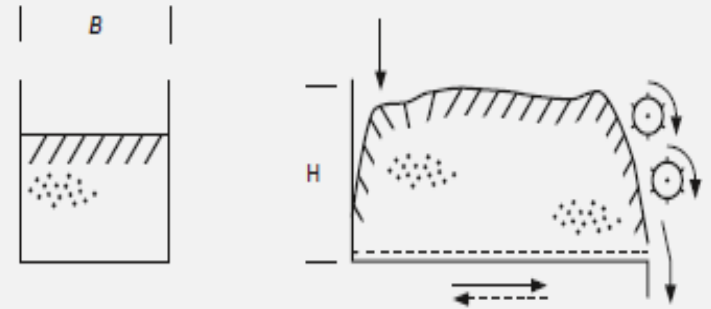
Rules of Thumb for Storage



Gravity discharge: $H \leq B$



Discharge by extraction screw: $H \leq 2 \times D$



All graphics Schenck Process

Discharge from hopper $H \leq 3 \times B$

Rules of Thumb for Pneumatic Transport



Density: 0.05 – 0.3 t/m³
Moisture: <25%
Particle size max.:
2D 50x50mm
3D 30x30x5mm

Photo: FLSmidth Pfister

Rules of Thumb for Mechanical Transport

Conveying equipment for:

$2D > 80 - 100 \text{ mm}$ or $3D > 2D \times 20 \text{ mm}$

- Chain Belt Conveyor
- Bucket Elevator

for smaller particle sizes

- Belt Conveyor
- Drag Chain Conveyor
- Screw Conveyor
- Moving Floor



Trailer Docking Station

Reception of different bulk materials from walking floor trucks



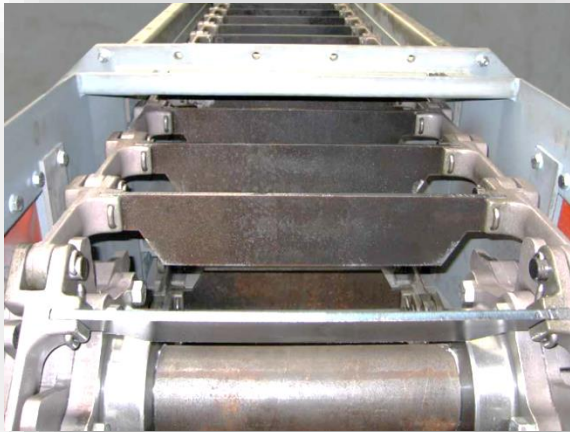
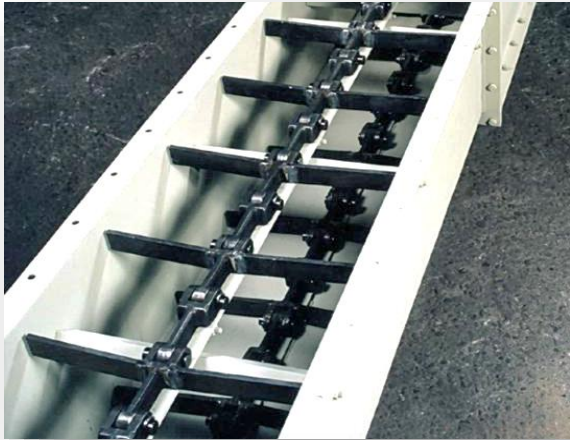
Discharge of alternative fuels such as wood chips (fresh or used wood), wood pellets, saw dust, or plastics

Self unloading trailer with built-in walking floor



Drag Chain Conveyor

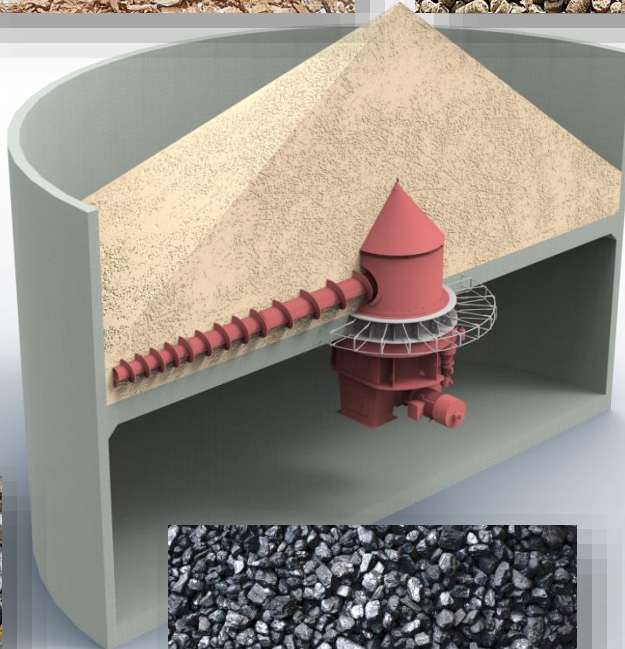
with forged link chain / with roller chain



Rotating Screw Discharger



- Wood chips
- Wood dust
- Pellets
- Briquettes



- RDF
- Bypass dust
- Animal meal
- Cellulose
- Coal
- Salt



Processing: from RDF to Fluff



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