



Green solutions for carbon capture and utilization by fluid engineering

Dr. Cecilia Mondelli



Outline

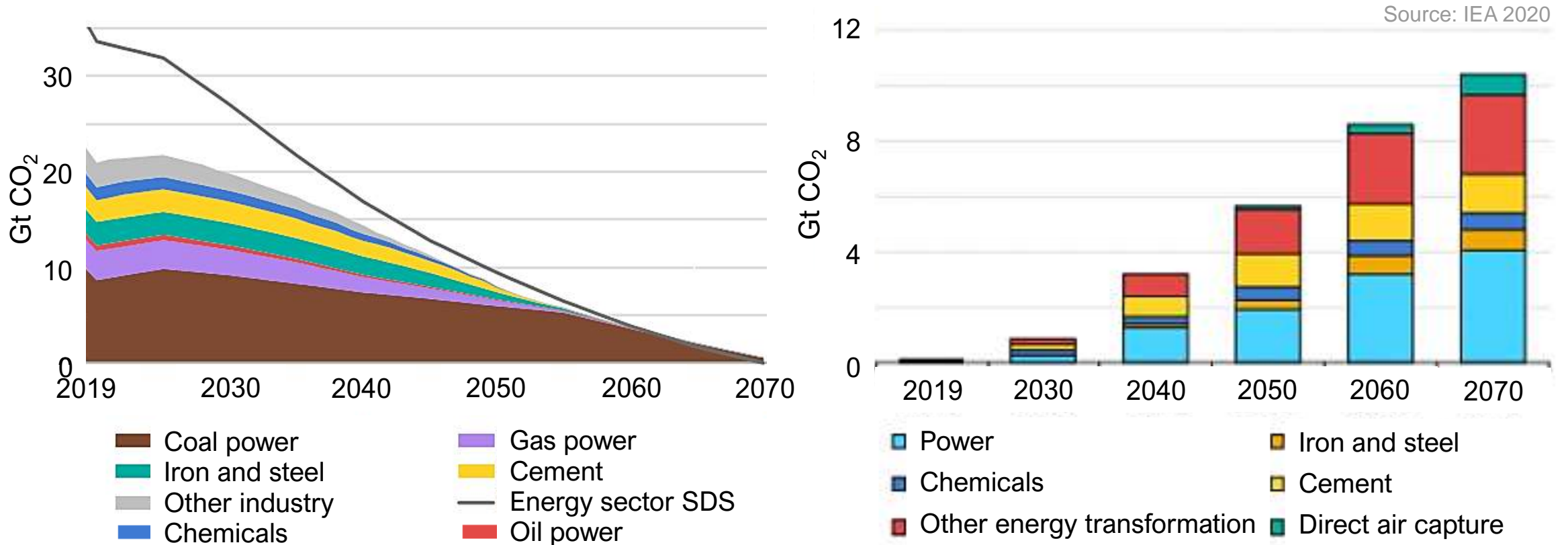


- Present and future of CCSU
- Unique mass transfer equipment for CO₂ absorption
- From pilot to large-diameter columns
- Success stories of carbon capture applications
- New developments in CO₂ utilization



Carbon emissions and capture forecasts until 2070

Breakdown per sector to meet the Sustainable Development Scenario - SDS

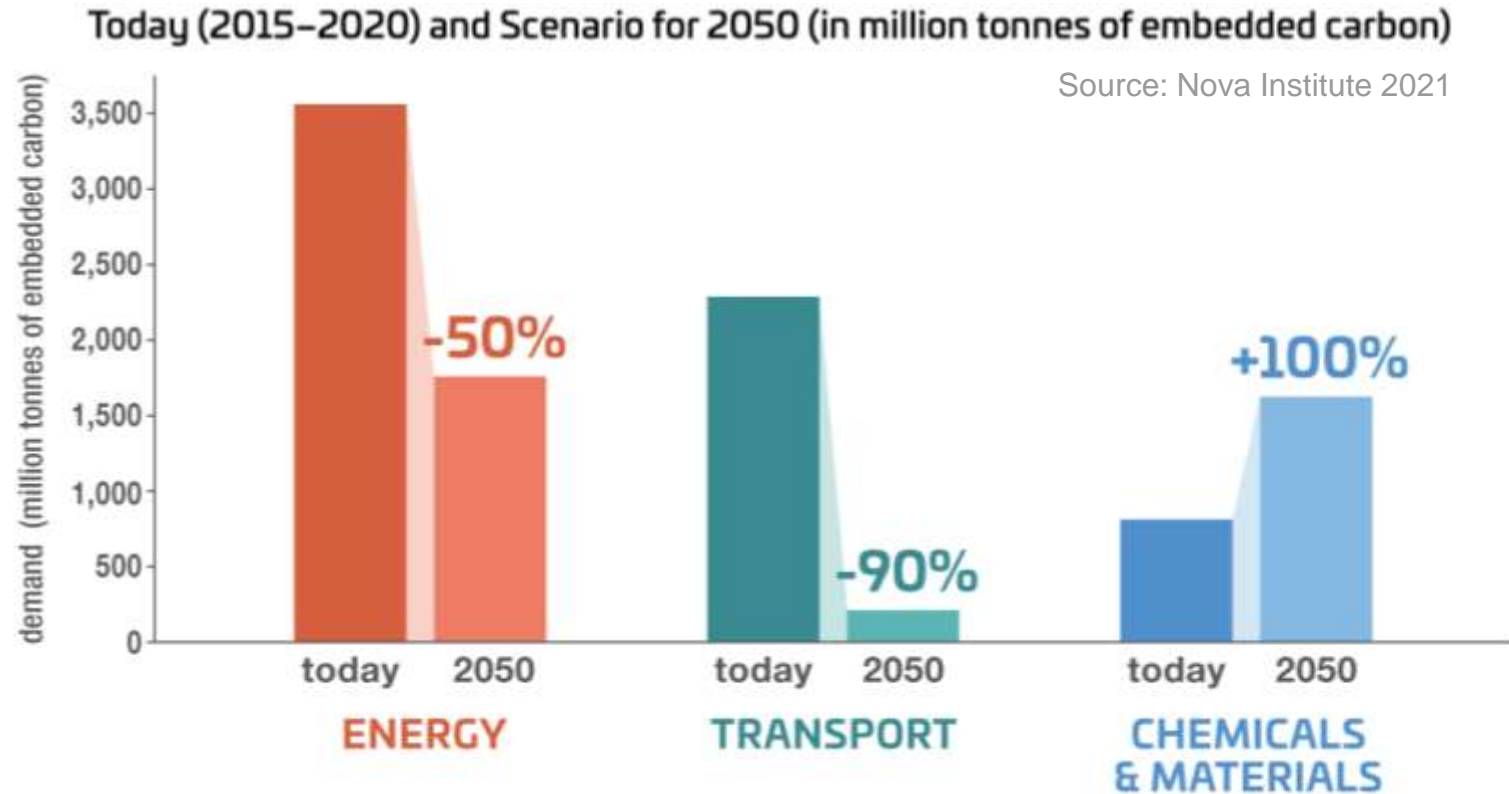


- Carbon capture will increase considerably focusing on point emissions, especially of the power sector and of the cement industry



Global carbon demand

Diverging scenarios for the main sectors

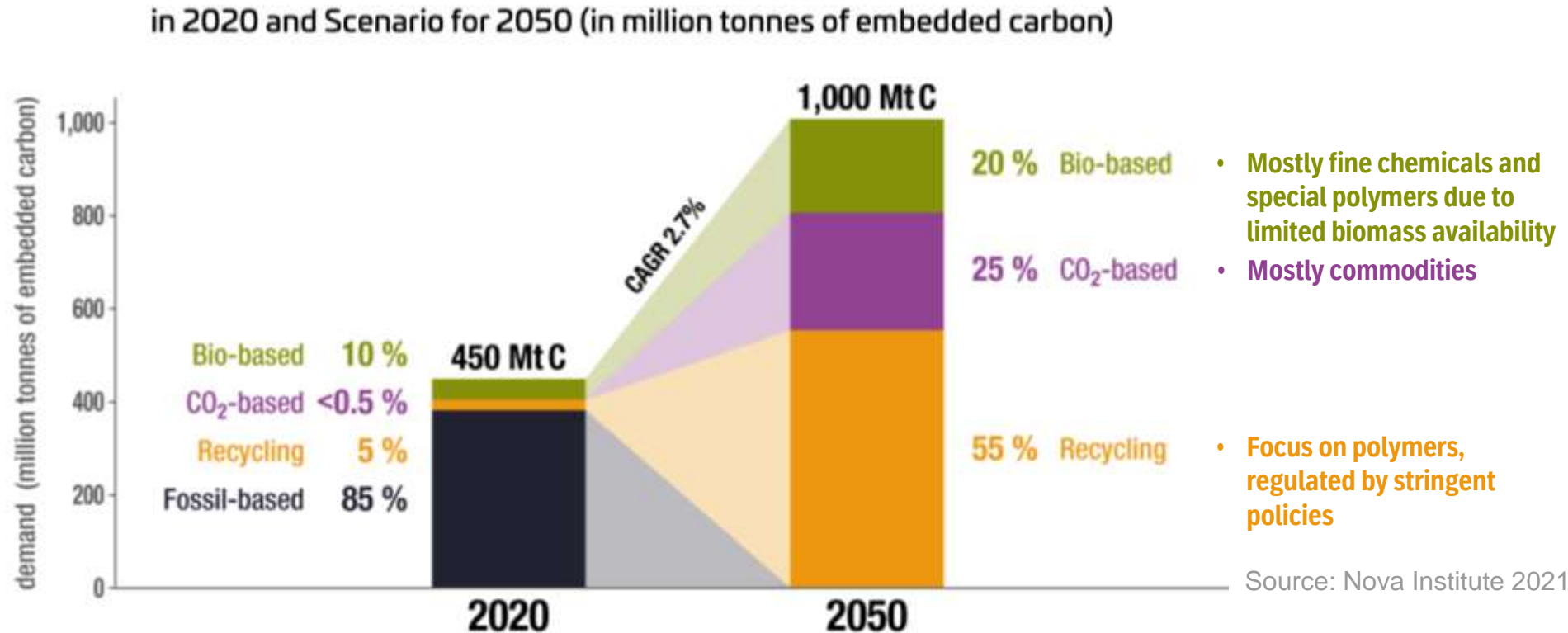


- Energy and transport will undergo strong decarbonization, while chemicals and materials will demand twice as much carbon by 2050



Carbon demand for chemicals & materials

CO₂ to become >50-times more relevant as a feedstock

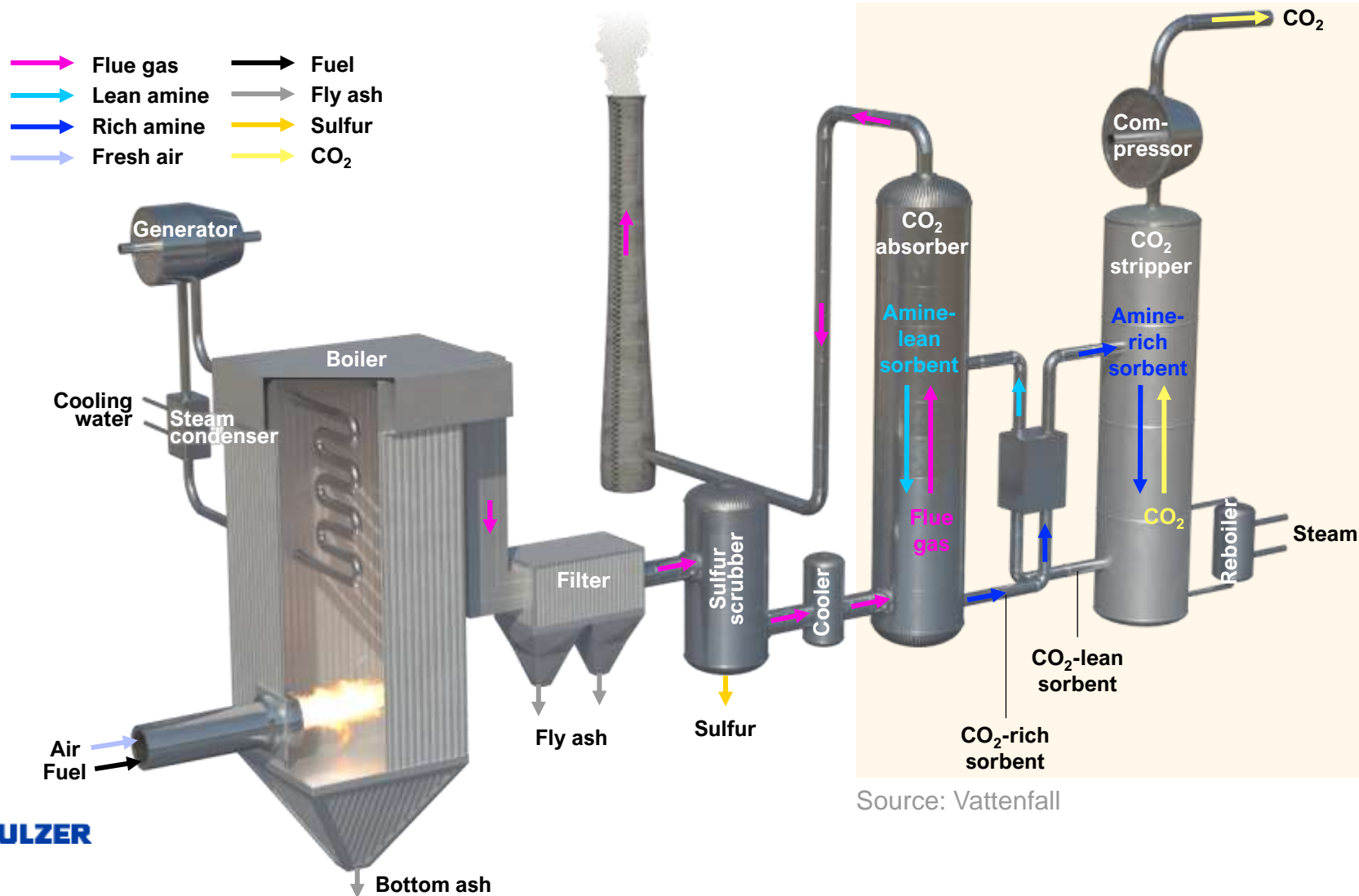


- Carbon tax and tax-emission credits and technological development through R&D investments will be key drivers to establish CCU solutions



Unique equipment and know-how for CO₂ absorption

Example of post-combustion CO₂ capture installation



Source: Vattenfall

Extensive know-how
and experience in gas sweetening and carbon capture with pilot and commercial plants across the globe

Dedicated structured packing and internals
Developed for CO₂ capture applications

Large columns ID
References with ID >10 m





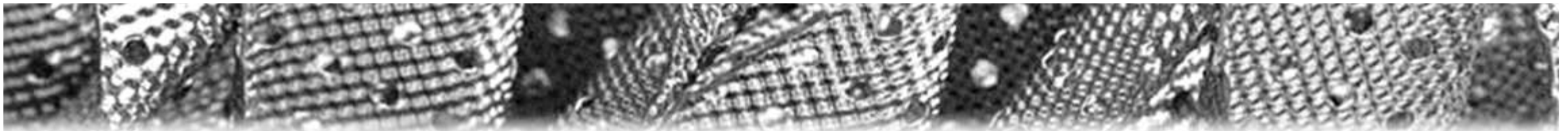
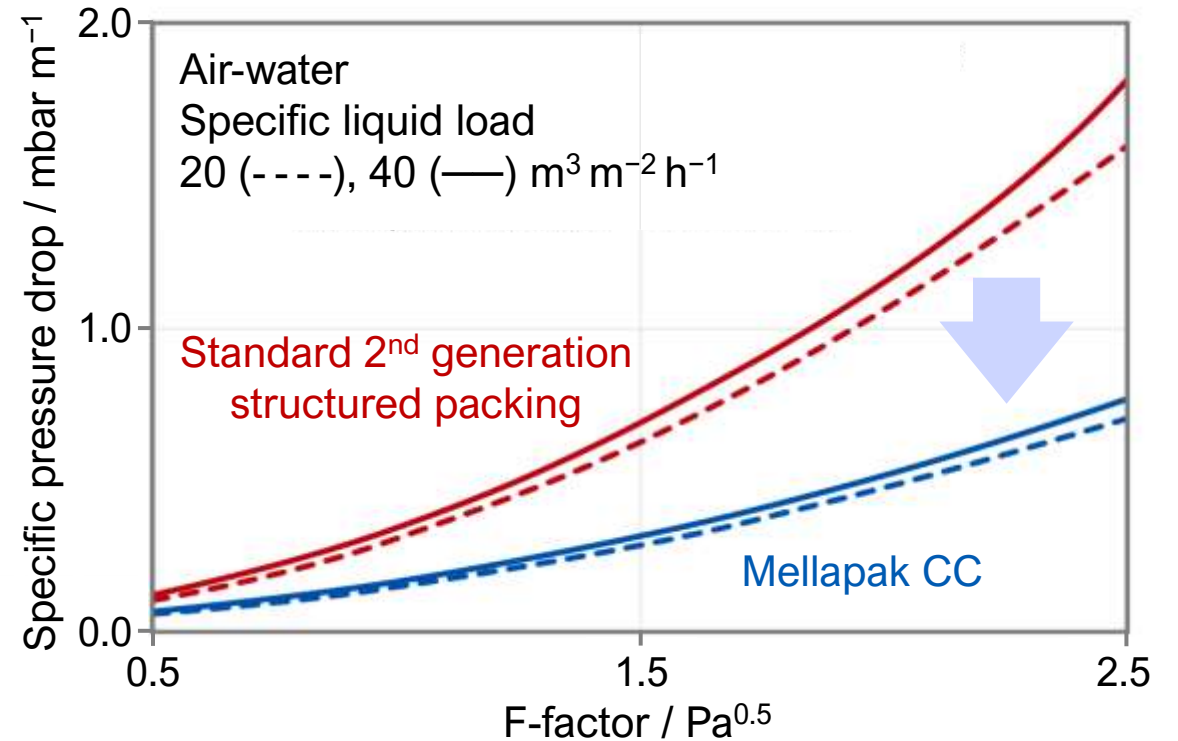
Mellapak™ CC structured packing

Optimum separation performance at the lowest possible pressure drop

- Reduction of pressure drop in the CO₂ absorber by up to 60% compared to prior top-end structured packing
- This technological advance translates into substantial savings in operating costs

Process parameter	Value
Pressure drop reduction	5 mbar
Annual electrical cost savings	MioEUR 0.9

*Estimated for a capture unit in an 800 MW coal power station, based on a 5-mbar decrease in pressure drop and an electrical cost of EUR 0.20 kWh⁻¹ as Europe average value in 2021



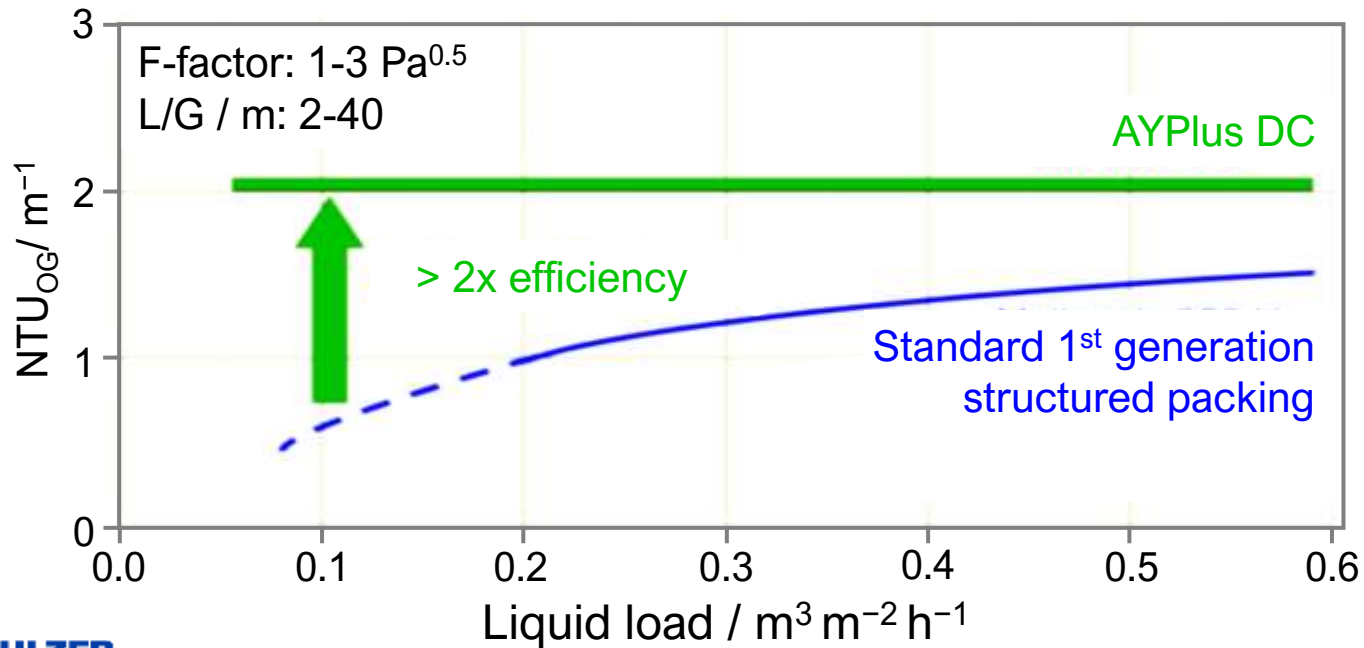
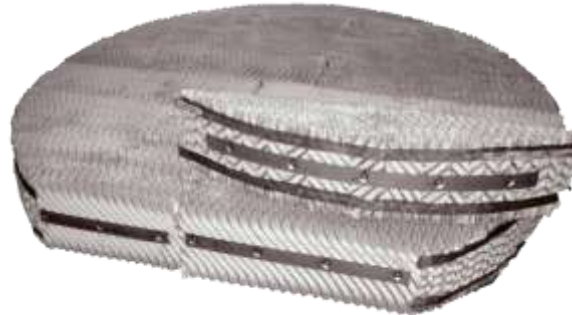


AYPlus™ DC structured packing and VEPK distributor

High efficiency at extremely low liquid loads

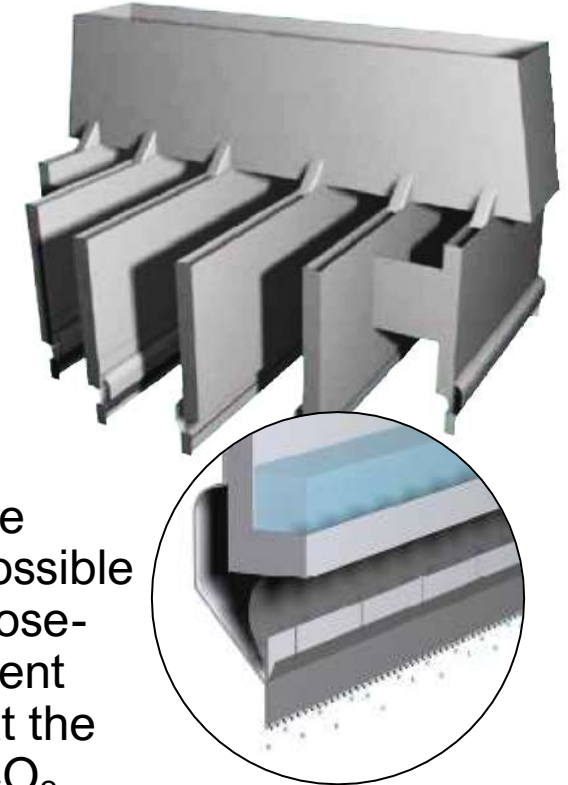
AYPlus™ DC

- Extraordinary wetting properties with aqueous media minimizing aerosol formation



VEPK

- Drastically increased separation performance making it possible to realize close-to-zero solvent emissions at the top of the CO₂ absorber





Pilot testing

Best-in-class facility for testing of solvents and packings

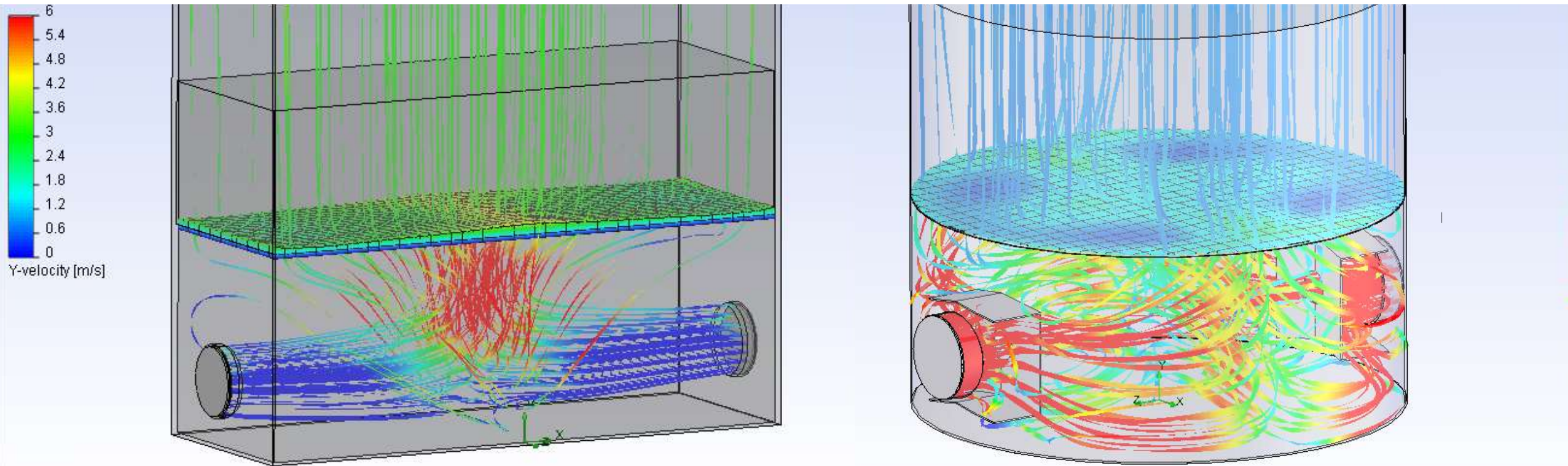


- Key advantages include:
 - Complete absorber-stripper circuit
 - Adequate column dimensions treating up to 450 kg CO₂ per hour for confidence in scaling up
 - On-line CO₂ and pH analyses and broad laboratory analysis capabilities



Mega-columns design

Gas distribution modelling



- Computational fluid dynamics modelling to evaluate distribution quality for various vapor inlet devices and for square or circular column geometries



Mega-columns design

Liquid distributor



- Effective liquid spreading over the packing enables to reach the target efficiency also for the more demanding large formats



Supporting the world's largest carbon capture projects

SaskPower coal power plant - the first sustainable innovation example

Source: SaskPower

Boundary Dam - Canada



- The company commissioned the building of the world's first and largest commercial scale post-combustion carbon capture facility
- Sulzer provided customized separation equipment which prevents 90% of the carbon released from entering the atmosphere with >1 million tons of CO₂ captured yearly
- In 2010 SaskPower started with one 120 MW unit in their plant with a governmental industry partnership project, a next installation was purchased in 2020



Supporting the world's largest carbon capture projects

Petra Nova post-combustion capture project - going greener with retrofitted solutions



Source: Petra Nova

- To further reduce carbon emissions, the company was looking for technologies that could be retrofitted to their existing post-combustion capture system
- Exploiting our Mellapak, their WA Parish plant can now capture more than 1 million tons CO₂ per year, reducing emissions by 92.4% so exceeding the initial expectation of only 90%



Supporting emerging carbon capture and utilization routes

Blue Planet Systems - engineering meets chemistry towards a carbon sink for the built environment

Source: Blue Planet

sfbayaggregates.com



- The patented process combines CO₂ capture from any source with mineralization into aggregates, equivalent to standard quarried aggregates in strength, performance, and cost, but sequestering 440 kg of CO₂ in each tonne, to enable the production of carbon-negative concrete
- Sulzer partnered with Blue Planet to develop an optimized process to make this CCU system an industrial reality



Thank you!



Speaker

Dr. Cecilia Mondelli

Technologist Carbon Capture
Solutions

Sulzer Chemtech Ltd
Neuwiesenstrasse 15
8401 Winterthur
Switzerland

+41 52 262 31 55
cecilia.mondelli@sulzer.com



Contact

biobased@sulzer.com

