Decarbonization as a differentiator in the building materials industry

ISEC International sustainable energy conference 2022

Wietersdorfer Gruppe – DI Stefan Schriebl

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Wietersdorfer Group

Cement & Concrete

https://alpacem.com/360/

- **Cement and ready-mix concrete plants in the Alpe Adria Region**
  - Main markets Austria, Slovenia and Italy
  - Around 2.0 million metric tonnes of cement and binding agents per year
  - Around 250.000 m³ of ready-mix concrete per year

Quick & Hydrated Lime

- **Customized lime solutions**
  - Main products limestone, quick lime, hydrated lime and mixtures
  - Areas of Application: Iron and Steel, Pulp and Paper, Chemical Industry, Agriculture and Forestry, Construction and Civil Engineering
  - Production sites in Austria, Slovenia and Croatia

Industrial Minerals (Fillers)

- **Fillers made of calcium carbonates**
  - Production sites in Slovenia, Croatia and Netherlands
  - Areas of Application: Paper, Paints, Plastics, Glass and Food
  - Main markets Slovenia, Croatia, Austria, Germany, Italy, Netherlands

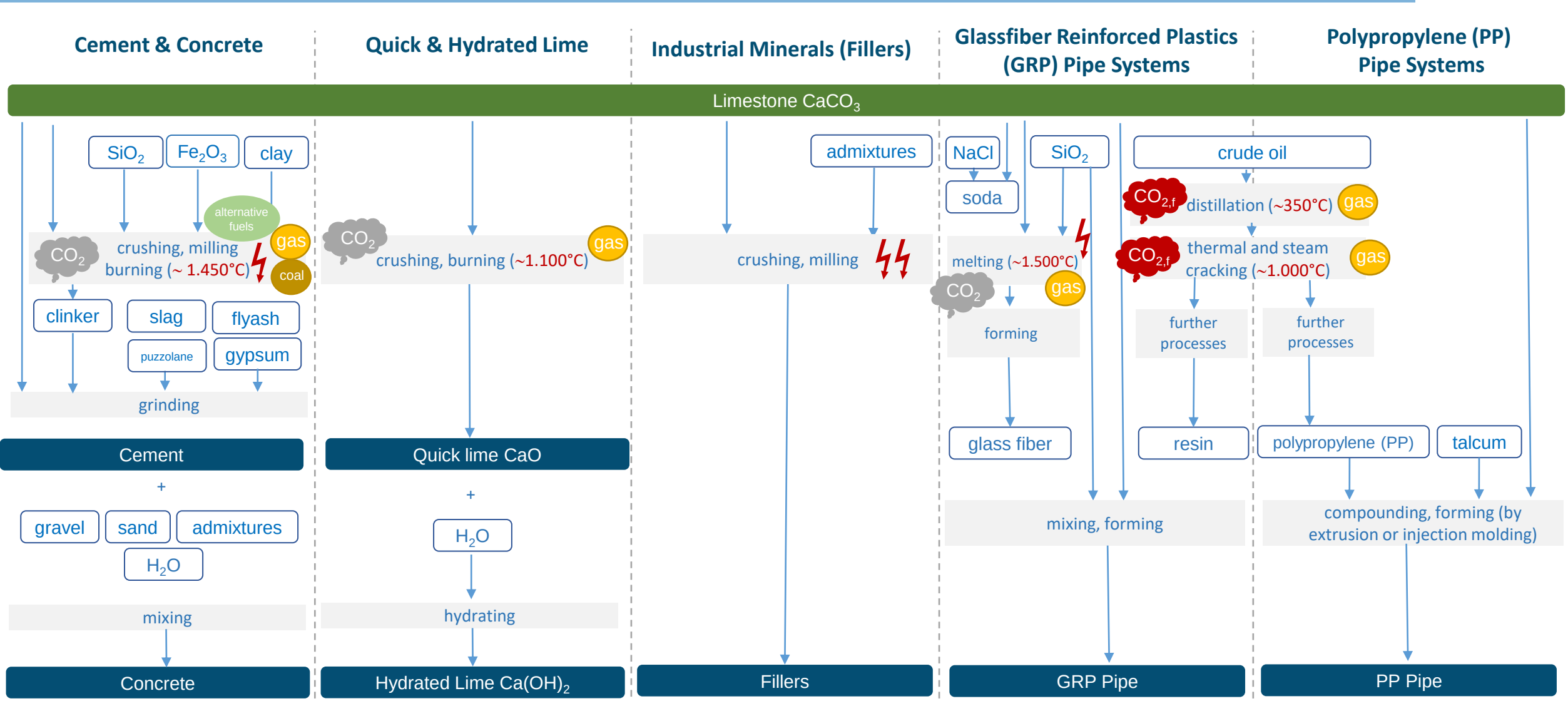
Glassfiber Reinforced Plastics (GRP) Pipe Systems

- **Sewage water, portable water and Hydro-Power**
  - Amiblu is a 50:50 joint venture with Amiantit
  - HOBAS Pipe USA is wholly owned by WIG Wietersdorfer Holding GmbH

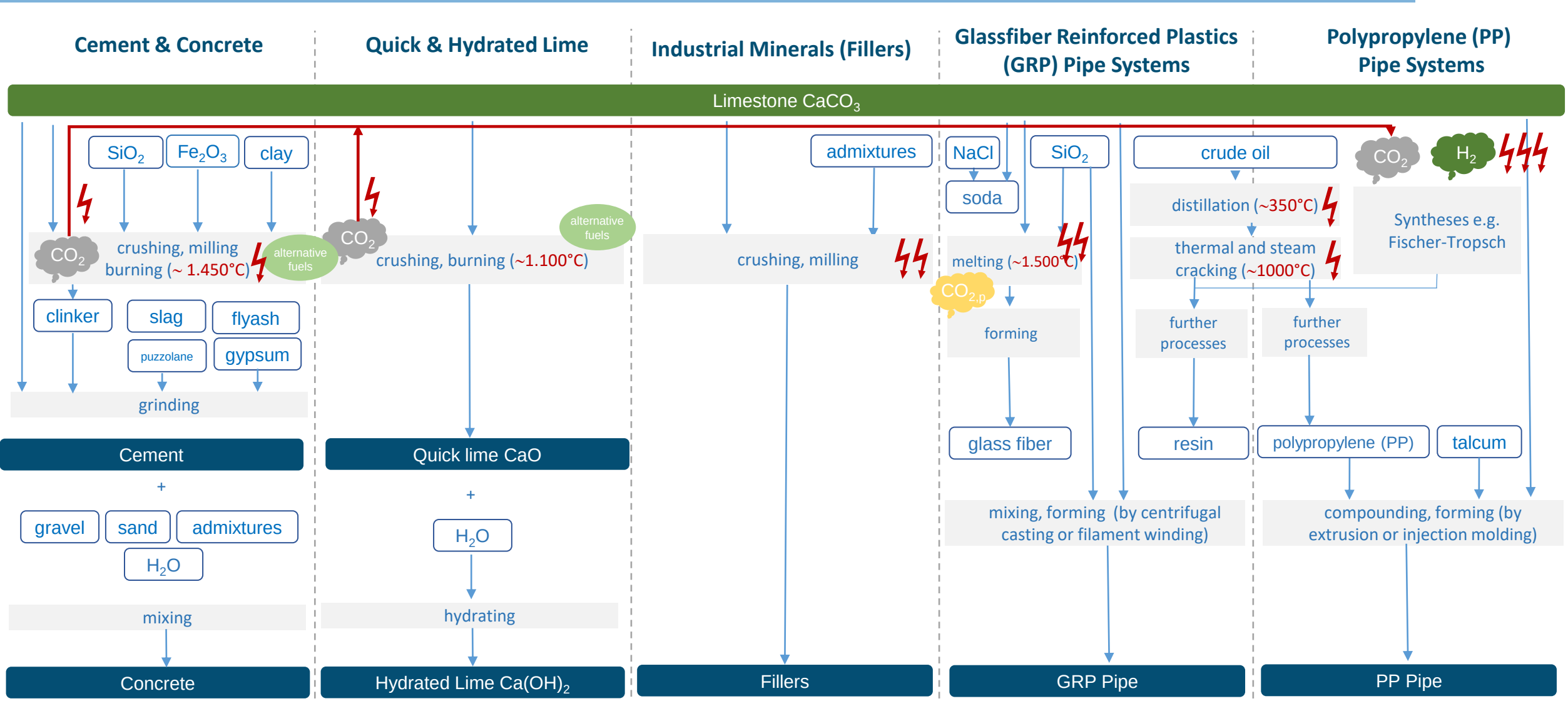
Polypropylene (PP) Pipe Systems

- **Technology leader in plastic pipe systems**
  - Sewage and water supply systems
  - Main markets are Austria, Germany, France, Italy and Scandinavia

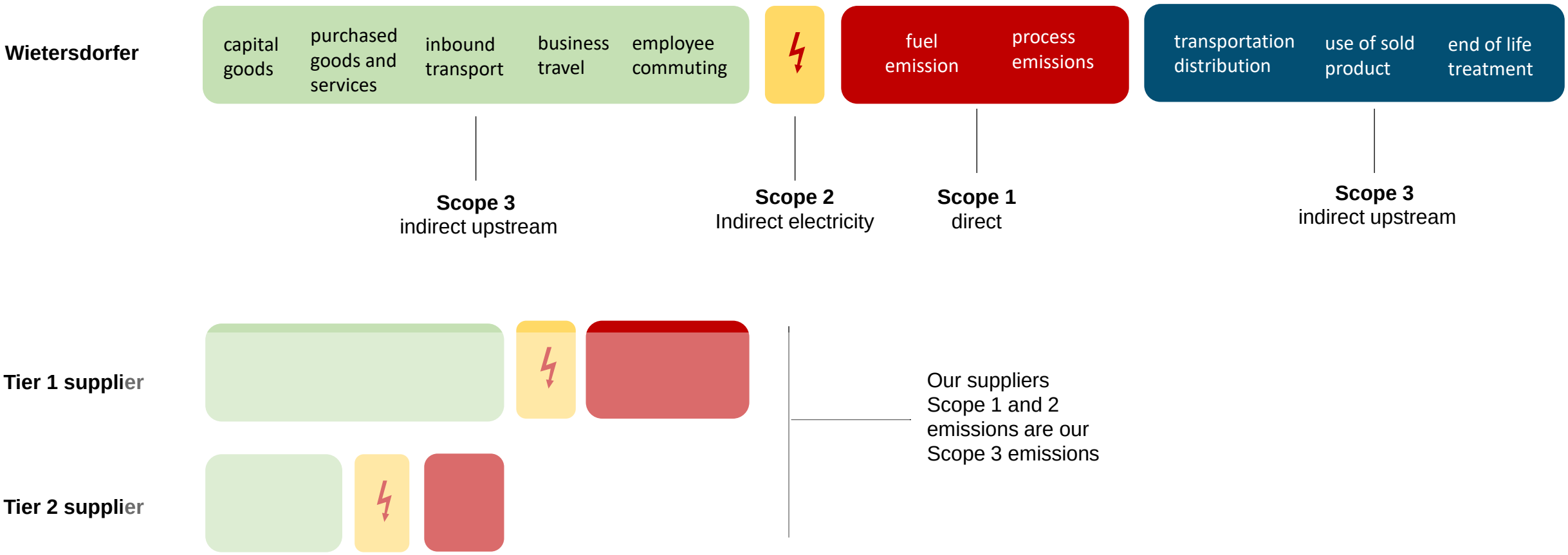
Overview Production Processes



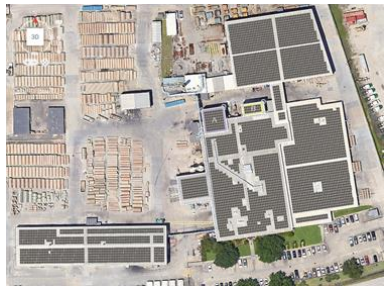
Overview Production Processes



Structuring CO_2 emissions



Decarbonisation - Defossilisation (1/6)

	Cement & Concrete	Quick & Hydrated Lime	Industrial Minerals	Glassfiber Reinforced Plastics (GRP) Pipe Systems	Polypropylene (PP) Pipe Systems
▸ **Increase share of renewable electricity**	**Modernization hydropower plants** in Austria**.** Realization of **PV Project in Salonit Anhovo**  © Salonit Anhovo Further photovoltaic projects under realization. Participation in **development projects for renewable energy power plants**. Use of waste heat for energy generation (**waste heat recovery**).	Further **photovoltaic** projects under realization in different lime plants.	Further **photovoltaic** projects under realization in different plants. Participation in **development projects** for renewable energy power plants.	Use of roof space for **photovoltaic** panels at Hobas USA in Houston  © Hobas USA Further photovoltaic projects under realization in other plants.	Use of roof space for **photovoltaic** panels at Poloplast in Leonding.  © Poloplast

Decarbonisation - Defossilisation (2/6)

	Cement & Concrete	Quick & Hydrated Lime	Industrial Minerals	Glassfiber Reinforced Plastics (GRP) Pipe Systems	Polypropylene (PP) Pipe Systems
▸ **Electrifying combustion engines**	- Switch to **carbon free transport** in progress (rail transport, evaluation of hydrogen trucks with shipping companies etc.) - **Electric business cars** promoted, loading infrastructure on site with local generated energy				
▸ **Electrifying heat generation**	- Evaluation and replacement with **heat pumps** - Fossil heating planned to be replaced with **heat exchanger** and/or **electrical heating** at lower temperatures				
▸ **Circular economy**	**Non-recycleable plastics:** Polyolefins such as poly-ethylene (PE) and poly-propylene (PP) are thermo-dynamically too stable for easy depolymerization into monomers. Incineration of used polyolefins seems to be more suitable. The resulting CO_2 can be catalytically converted with (green) hydrogen to methanol, which is further converted to propene monomer. **Recycled concrete**.	Quick and hydrated lime become p**art of the final product,** which partly can be recycled	Filler becomes part e.g. in **paper** or **plastics**, which can be recycled.	**Recycled GRP:** several projects to recycle GRP in progress. Windmill blades must be replaced after 20 to 25 years. They are not recycled on large scale but very often landfilled.	**Recycled PP:** several projects to use recycle PP are in progress. From recycled propene monomere, based on CO_2 from cement and lime production, polypropylene can be produced, replacing crude oil.

Decarbonisation - Defossilisation (3/6)

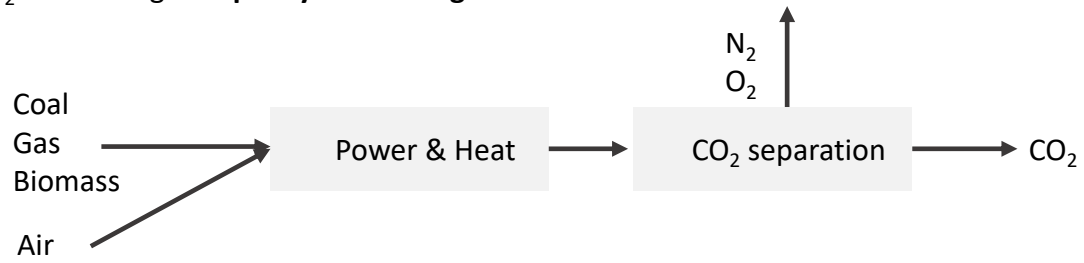
	Cement & Concrete	Quick & Hydrated Lime	Industrial Minerals	Glassfiber Reinforced Plastics (GRP) Pipe Systems	Polypropylene (PP) Pipe Systems
▸ **Alternative Raw materials**	Use of **substitute raw materials** that emit less to no CO_2 in clinker production. **Reducing** the **clinker content** Substituting partly with slag and fly ash, which are not available in the necessary quantities. The proportion of limestone and pozzolans (e.g. newly developed calcined clays) will be increased. New cement and concrete standards are being developed.		**Non-fossil-based additives** are under development with suppliers.	**Glass fibers** and **resins** with **low carbon footprint** are under development together with suppliers.	Cooperating with Borealis in developing **Bornewables™**, which are circular polyolefin products, manufactured with **second generation renewable feedstock** (non-food crops, waste, not suitable for consumption: e.g. waste and residues from vegetable oil refining, used cooking oil), available at scale. Bornewables polymers are sustainability certified by ISCC Plus.
▸ **Alternative Fuels**	**Substitute** fossile fuels **with alternative fuels**. Technical optimization and modification of the equipment.	Use of **wood dust** from **non-recyclable wood waste** in order to reduce the proportion of fossil fuels.			

Decarbonisation - Defossilisation (4/6)

- **Carbon Capture for cement & lime kilns**

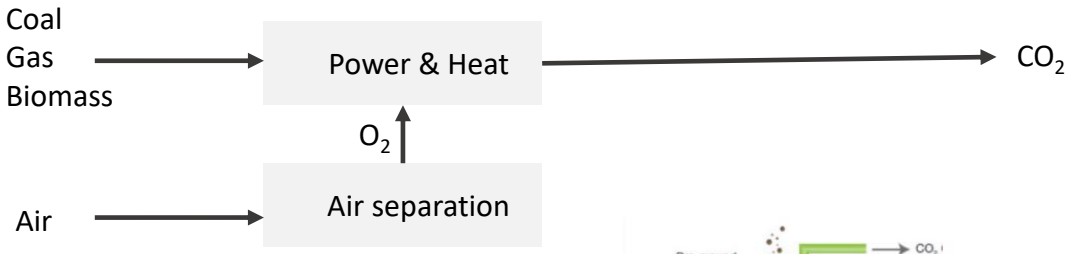
Target is seperation of CO_2 from flue gas at **purity level of highter than 95%**

Post-combustion



Amine scrubbing (TRL 8)
Calcium looping tail end (TRL 6-7)
Mineralisation (TRL 7-8)
Adsorption process (TRL 4-5)
Membranes (TRL 4-5)

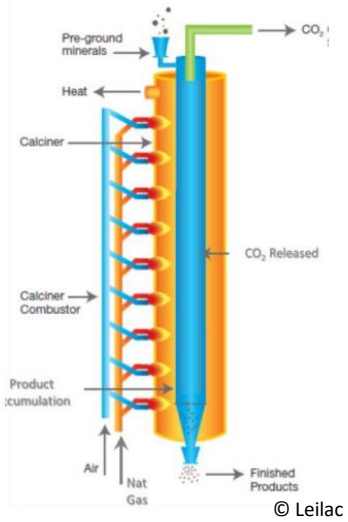
Oxyfuel



Oxyfuel technology 1st generation (TRL 6): recirculation of flue gas to maintain volume flows and temperature in existing heat exchangers
Oxyfuel technology 2nd generation (TRL 3-4): No flue gas recirculation

Integrated capture technology

Indirect calcination: Separation of process CO_2 by an indirectly heated



© Leilac

Leilac (TRL 6)

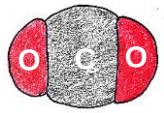
Source: ECRA Online Seminar OS21-03

Decarbonisation - Defossilisation (5/6)

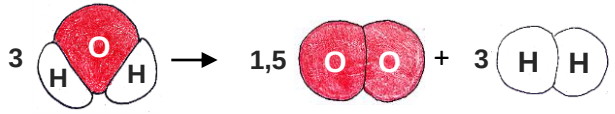
- **Carbon Capture Use**

Example for methanol syntheses with CO_2 and H_2 from a 2.000 tato clinker line

~13 x 120 m³ tank trucks per day



1.659 t/d CO_2

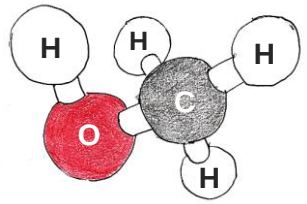


228 t/d H_2

Production of Methanol

$CO_2 + 3\ H_2 \rightarrow CH_3(OH) + H_2O$

1.208 t/d Methanol $CH_3(OH)$



679 t/d H_2O

~ 50 kWh/kg H_2

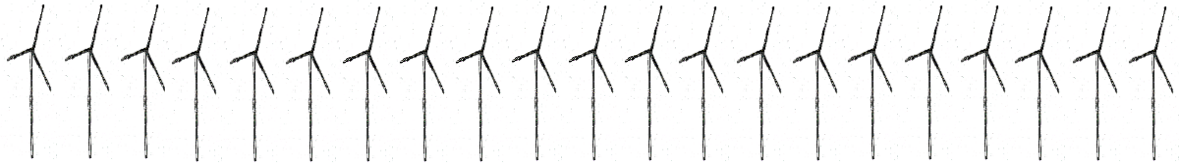
→ 11,9 GWh/d

→ 3,6 TWh/a

V1: Hydro power plant Freudenau
1,052 TWh/a → 2,9 GWh/d

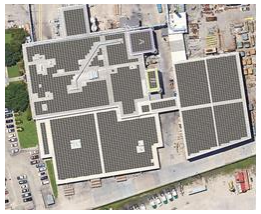
4,1 hydro power plants

V2: Windmill onshore
diameter 170 m, 5,6 MW, 2.250 full-load hours → 0,035 GWh/d



… 344 windmills

V3: PV modules
100 kWh/m² per year
→ 0,274 GWh/d

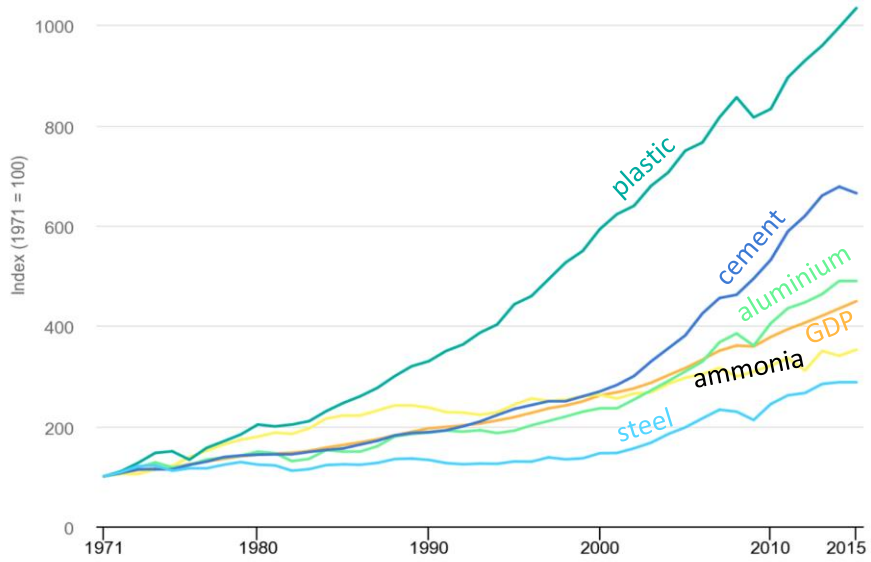


43,4 km² PV modules

Decarbonisation - Defossilisaton (6/6)

- **Indirect Emissions from Polypropylen and Resin production**

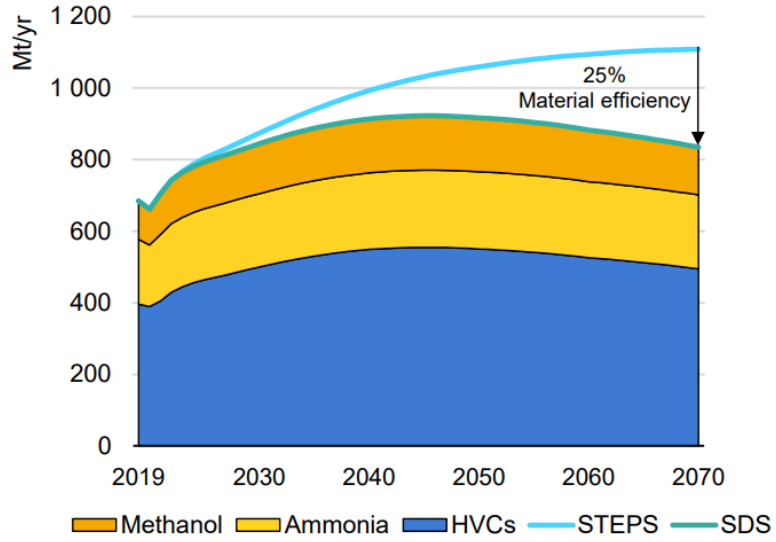
1. **85% of chemcials are based on oil and gas** (14% of global oil demand, 9% of global gas demand).
2. **High temperature needs:** ethylene, propylene and BTX-aromatics are cracked in steam crackers at around 1.000 °C.
3. **Chemical industry largest global consumer of energy** (30% of industrial energy use). **Transformation into final products** like plastics consumes **less energy.**



Production growth for selected bulk materials and GDP 1971 – 2015

Source: IEA

1. **Avoid unnecessary use of plastics:** single-use items (drinking straws, plastic bags)
2. **Effective plastic waste management systems**: Packaging makes up 36% of plastics demand → Reduction of food-waste: 1/3 produced globally is wasted (FAO 2011).
3. Further R&D on **chemical recycling processes** to avoid „down-cylcling“. **Defossilisation:** replacement of carbon and hydrogen from a combination of CO_2 captured, green hydrogen, recycled chemical products and/or bioenergy.



Global chemical production: HVCs = high-value chemicals (); STEPS = Stated Policies Scenario;. SDS = Sustainable Development Scenario.

Why are emissions from heavy industry hard to reduce? What are the alternatives?

1. **High-temperatures required**: Generating high-temperature on non-conductive applications or e.g. crackers in chemical production is costly with today's commercial technologies → carbon capture, utilization and storage (CCUS), hydrogen technologies

2. **Process emissions**: e.g. CO_2 resulting from calcination reaction to produce quick lime and clinker, the active ingredient in cement → involving different raw materials

3. **Long-lived capital assets**: Typical lifetimes are 30-40 years → options to retrofit or adapt

4. **Products in highly competitive global markets**: High investments in emission reducing equipment without being undercut in price → long-term, predictable and credible policies, international agreements vs. carbon border adjustments, technology transfers

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