A METHODOLOGY OF TECHNOLOGICAL TRANSFORMATION TO CO_2 FREE INDUSTRY

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NEFI NEW ENERGY FOR INDUSTRY

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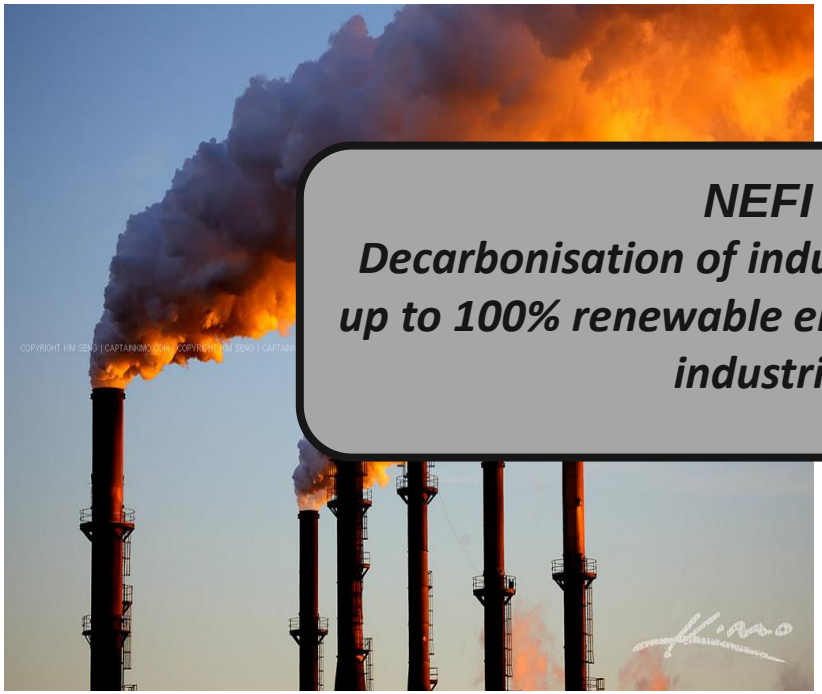
Introduction and motivation

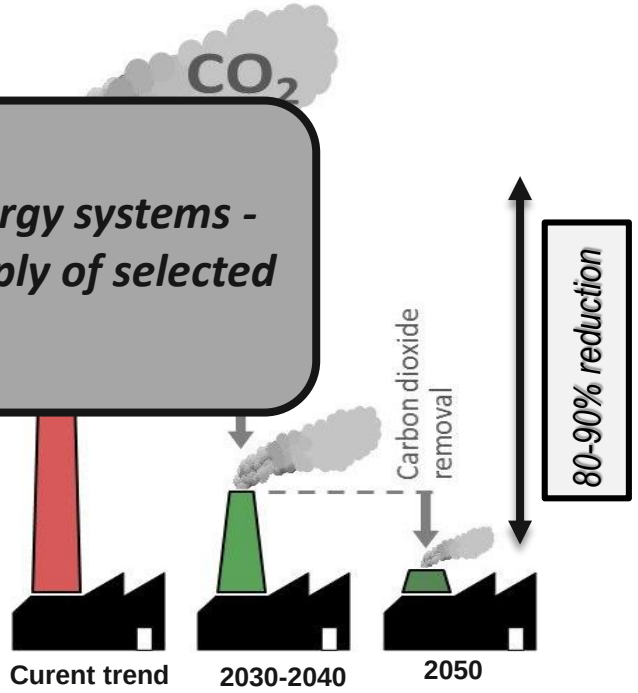
- Final energy consumption by industry : 28%
- Process related CO_2 emission by industry : 21%



- According to the Paris agreement the Austrian industry intends to reduce GHG emissions **by 40% by 2030** and **80-90% by 2050** compared to 1990 levels

NEFI Goal

Decarbonisation of industrial energy systems - up to 100% renewable energy supply of selected industrial sites



Ref : Statistic Austria

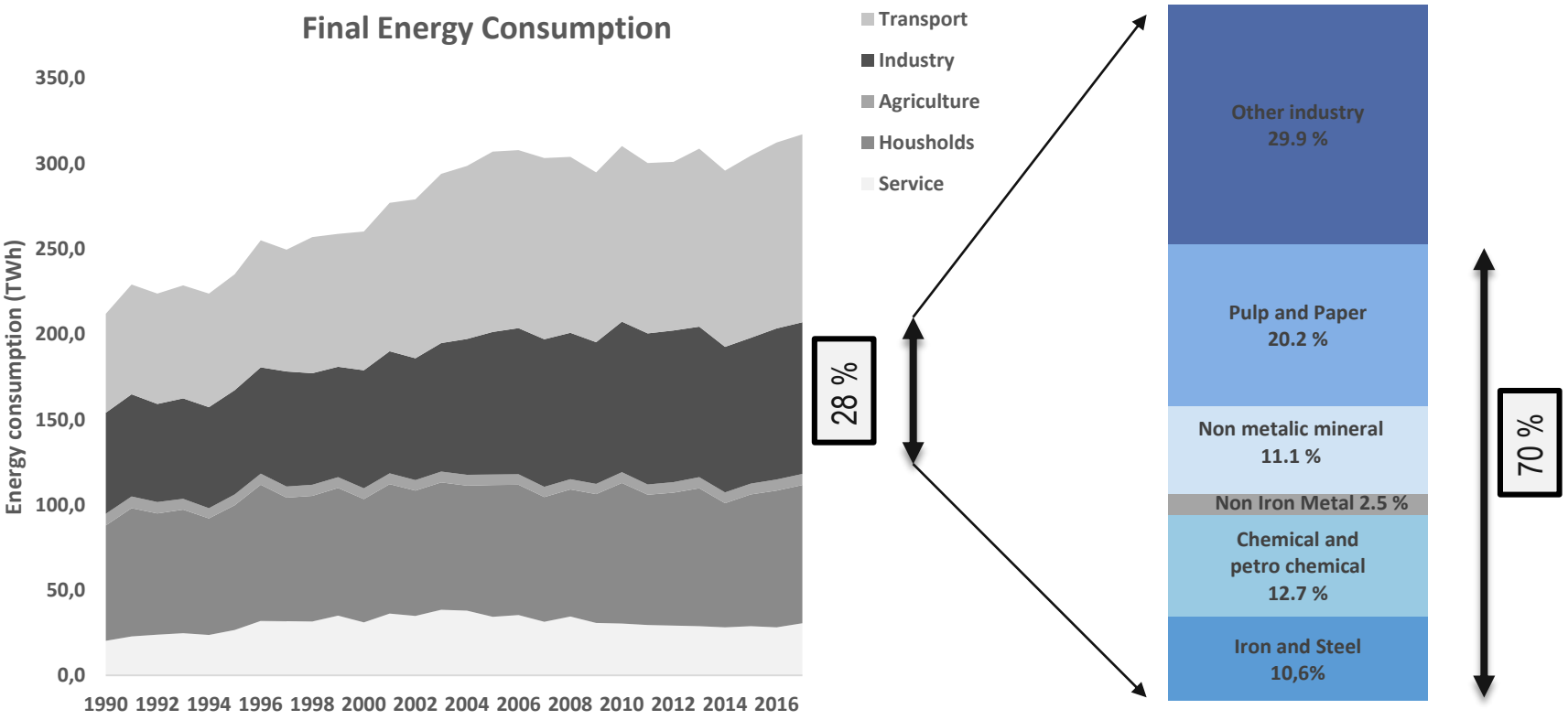
Methodology

Literature Review	Literature Review	Scenario development	Energy System Modelling
• **Base year data extraction** • **Current process analysis** • **key performance indicator**	• **best available technology** (BAT)/ **innovative technology (IT)** • CO_2 emission saving and Energy saving potential for each BAT/IT • **Technology readiness level (TRL)** • OPEX / CAPEX	• **Business as usual scenario (BAU)** • **Mitigation scenario (MT)** • **Deep decarbonisation scenario (DDS)**	• Load profile • Time resolved energy system modelling • HyFlow framework model

Input data for modeling and Technology selection → Key Technology selection and data allocation → Scenario development → Infrastructure implementation analysis

Overview of Austrian Industry sector

- Final Energy Consumption trend

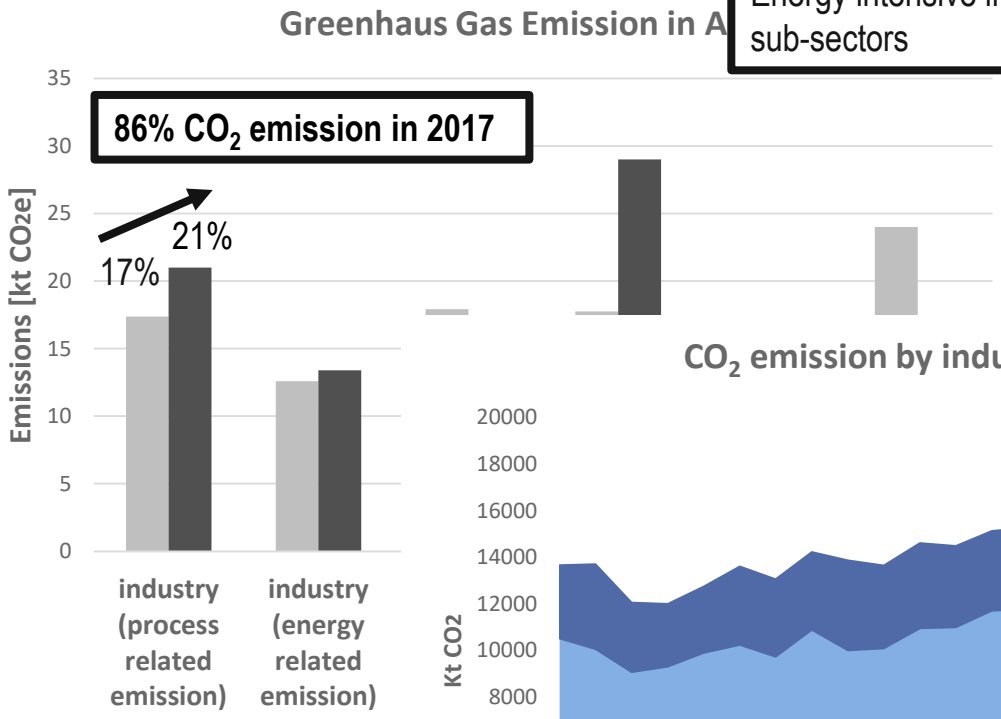


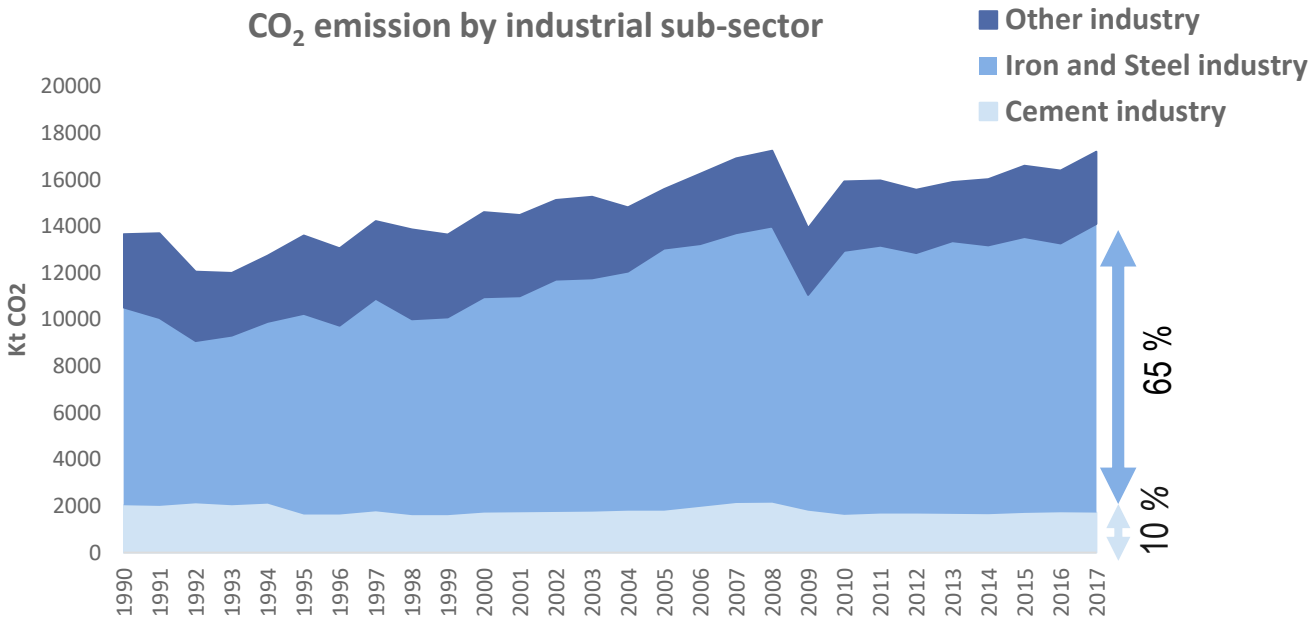
Overview of Austrian Industry sector

CO_2 emission trend

More than 75 % produced by Energy intensive industrial sub-sectors

- Iron and steel
- Non metalic mineral
- Non Iron metal
- Pulp and Paper
- Chemical and petro chemical





Decarbonisation Abatement Options

- **literature review** →scientific publications, the industrial sectors' climate roadmaps, reports from industrial development projects

- **Best Available Technology (BAT):**
  state-of-the-art techniques ➔ Recommend for improving the energy efficiency of installations

- **Innovative Technology (IT):**
  new technologies that need to be further developed or are even only available on a laboratory scale ➔ Recommend for deep decarbonisation

Key Performance Indicator :

☑ Specific energy consumption (MWh/ ton of production)

☑ Specific CO_2 emission (Kton of CO_2/ton of production)

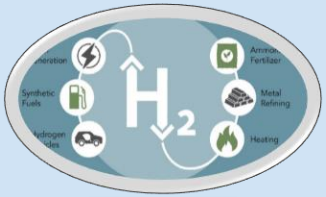
Decarbonisation Abatement Options

Energy efficiency improvement

Adapt the equipments to lower energy use equipments

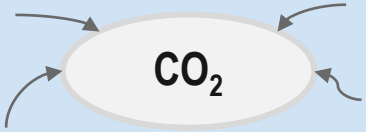
Electrification

Replace fossil fuel with renewable electricity for heating e.g. electric furnaces or kilns, plasma or microwave technologies



Hydrogen

Replace feedstock or fuel with Hydrogen especially when the hydrogen is generated by zero-carbon electricity



CCS/ CCU

Capture the CO_2 emitted from the exhaust gases produced by an industrial process and store or used as feedstock in other industry

Other innovation

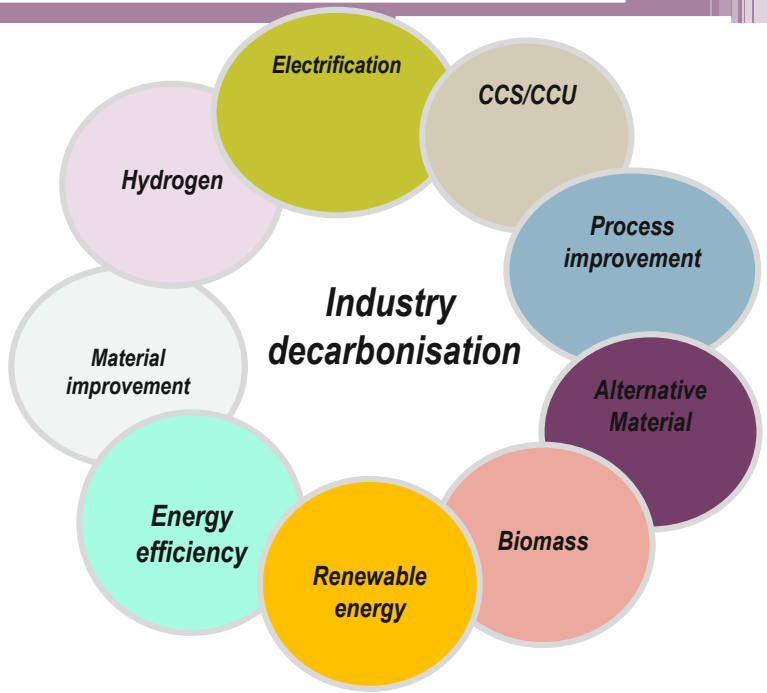
Non-fossil fuel feedstock change, e.g., change in cement feedstock

Decarbonisation Abatement technology

➔Technology Readiness Levels (TRL)

Industry sector	TRL < = 5	TRL 6	TRL7	TRL 8-9
Iron and Steel	HIsarna with CCS		Top Gas Recycling Blast Furness with CCS (TGR-BF)	Direct reduction with natural gas
		Steel making with H_2		
	CCS / CCU			
	High quality steel making by EAF			
Cement	Calcium looping CCS			Alternative fuel
		Oxyfuel CCS		
	Alternative new binder (CO_2 efficient)			
Pulp and paper	Deep eutectic solvents	New drying technology		Electrification of heat production
	Water less paper production			Black liquor gasification

Scenario development



- **The Business as Usual Scenario (BAU)**

➔ Without any significant change and by using the currently best available technologies (BATs) and energy policies.

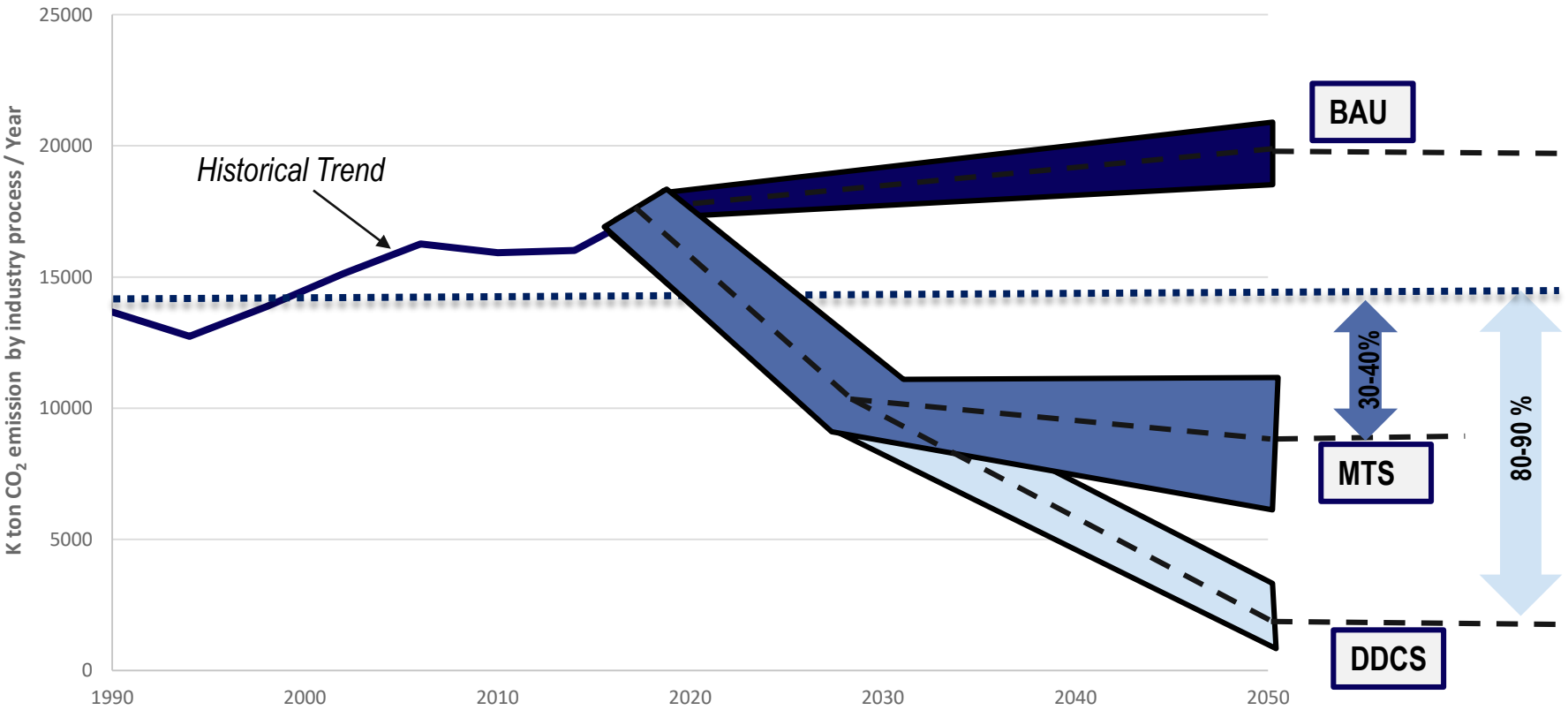
- **The Mitigation Scenario (MGS)**

➔ in regards to the Austrian Climate and Energy Strategy #Mission 2030 and the current EU targets, is based on utilization of BATs and ITs with a short to medium-term implementation horizon and by especially considering the renewable energies as an important source of energy.

- **The Deep Decarbonisation Scenario (DDCS)**

➔a radical shift by focusing on individual innovative CO_2 emission reduction technology option for every sector as well as using the carbon capture storage and usage (CCS/ CCU) to achieve the Austria goal (80- 90% reduction by 2050 compared to 1990)

Scenario development



Conclusion

- Industrial companies can reduce CO_2 emissions in various ways by combination of decarbonisation options such as energy efficiency improvements, electrification, using hydrogen, using biomass , CCS/ CCU, and other innovations

- Access to low-cost zero-carbon electricity is one of the important factor for electrification and decarbonisation of industry.

- The fossil fuel must be replaced by renewable energy sources and total primary energy consumption must be reduced significantly.

- The decarbonisation of the industrial sub sector requires more investments in industrial sites and must be accompanied by CO_2 -free electricity generation

Outlook

- The Decarbonisation Scenario pathways for the Austrian industry will be developed in cooperation with industrial subsectors experts (in the planned NEFI workshop on 30 March 2020).

- The first results of the selected technologies and developed scenarios through the reduction of CO_2 emissions by the Austrian industry will be presented at the NEFI conference in November 2020, to which everyone is kindly invited.

Thank You For Your Attention