A METHODOLOGY OF TECHNOLOGICAL TRANSFORMATION TO CO2 FREE INDUSTRY

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The energy-intensive industrial sectors account for one-third of global energy demand and more than 30% of total greenhouse gas emissions in the world. In Austria, the industry sector consumes about 126 TWh of primary energy representing 34% of total primary energy consumption [1] and emits approximately 17 Mt greenhouse gas (GHG) corresponding to 21% of total national emissions. About 70% of this primary energy is consumed in the energy-intensive industrial sub-sectors: iron & steel, cement, pulp & paper, aluminium and chemical & petrochemical industries [1]. These industries are also responsible for around 70% of sectoral CO2 emission [2].

According to the Paris agreement, Austrian industry intends to reduce GHG emissions by 80-90% by 2050 compared to 1990 levels. For this reason, the industry needs to create an infrastructure that will have a vital impact on CO_2 emission abatement.
The current work is a part of the NEFI (new energy for industry) project. One of the goal of NEFI is providing an integrated concept for the deep decarbonisation of the Austrian industry energy system driven by a transformation of the Austrian industry toward a sustainable, efficient and low-carbon economic sector.
The aim of this paper is to describe a framework for the development of scenarios for industrial decarbonisation (see Figure 1). Each scenario consists of different technology options that may be implemented over time. This study provides a comprehensive overview of a range of technologies that the industrial sub-sectors can deploy over the coming decades.

This work looked at the technologies in two main groups: Best Available Technologies (BATs) and Innovative Technologies (ITs). However, energy-intensive industries have the technical potential to reduce their current total energy consumption and CO_2 emissions and improve their energy efficiency through the use of Best Available Techniques (BATs), but BATs are not sufficient to achieve deep decarbonisation by 2050, so a comprehensive innovative technology with low CO_2 emissions should be taken into account.

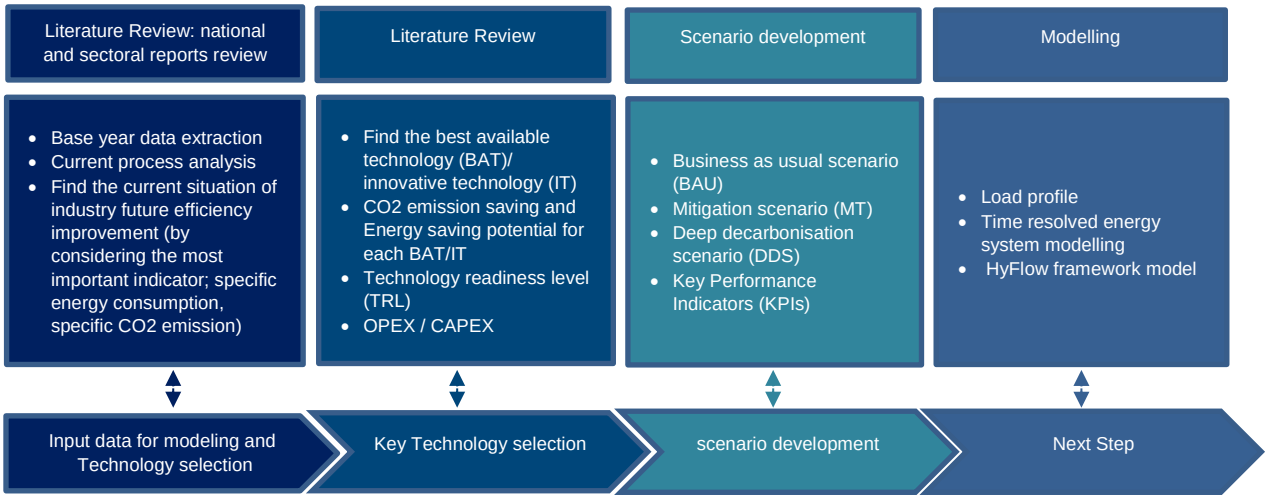

Figure 1: scenario development framework for industrial decarbonisation.

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The visioning and technology selection will start with the evaluation of recent development state of Austrian industry and it is completed by monitoring the two important key performance indicators (KPIs): specific energy consumption and specific CO_2 emission of Austrian industrial sub-sectors.

The selected technologies can reduce CO_2 emissions and energy consumption in the industrial sub-sectors in a range of 5% to 95% compared to the current level, although the deployment of some key technologies requires changes in the subsector infrastructure, hence the investment cost as well as government policies must be considered.

In conclusion, three alternative techno- economic development scenarios are constructed based on the key technologies (figure 2). The business as usual (BAU) scenario, referring to the currently enacted energy policies and describes a development path without significant future changes, the mitigation scenario (MGS) builds on currently feasible reduction measures (technological and structural) to reduce CO_2 emissions in the industrial sector and the deep decarbonisation scenario (DDCS) represents the development path for a deep decarbonisation of the industrial energy system, characterized by innovative CO_2 reduction technologies such as those developed previously.

The decarbonisation scenario analysis illustrates of how sectors can decarbonise from the base year to 2050.

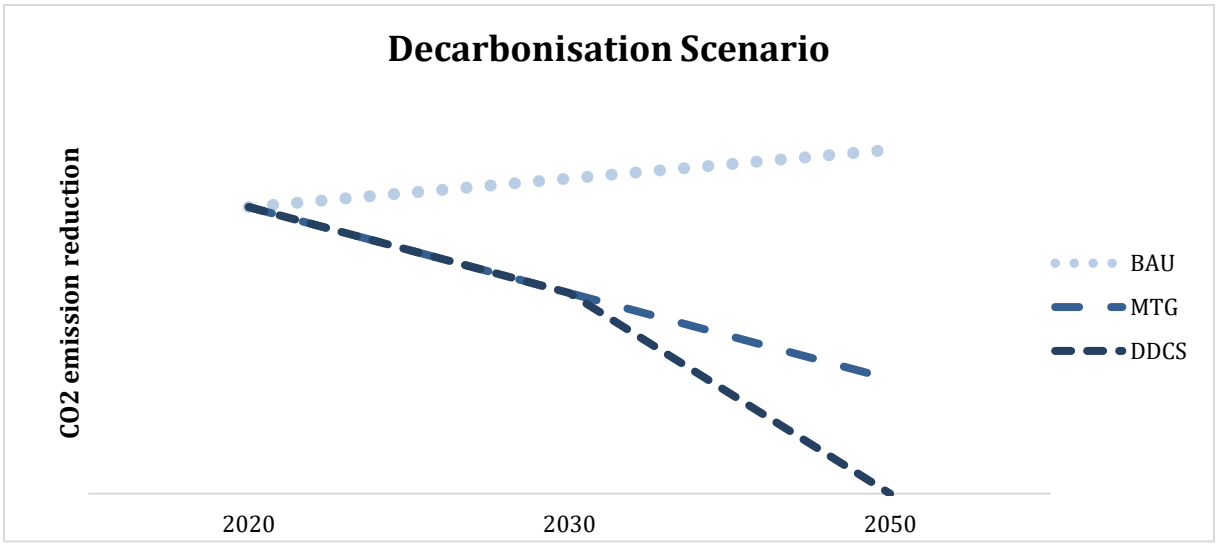

Figure 2: CO2 emission mitigation through the development scenarios to 2050

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