Technology trends for CO_2 reduction

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Industry still dominates the share of greenhouse gas emissions affecting climate change. Emissions are still high despite the urgent need to address the primary causes of climate change. The Paris Agreement seeks to pursue efforts to restrict the increase to 1.5°C while limiting the global average temperature increase to well below 2°C above pre-industrial levels. This has also been incorporated into the crucial Sustainable Development Goals for Energy. In order to achieve climate targets, a highly adaptable system that can handle significant amounts of variable renewable energy sources must be developed. Benefits of system flexibility have been provided by coal- and gas-fired facilities, which are a significant source. These facilities are able to continue offering these advantages and satisfy demands for long-term flexibility because to carbon capture, storage, and utilization. However, reluctance to change, a lack of knowledge, high investment costs, and failure anxiety, all contribute to the delayed adoption of technology. Nevertheless, the rapid rate at which technologies become outdated and the constant flow of new discoveries make this more challenging. Moreover, a common basis for evaluating the impact of CCUS technologies is not available. To this end, all the techniques for the CO2 reduction were gathered and categorised based on the technology pathways and CO2 source.

The classification of these innovative and emerging techniques for combatting climate change has not been established yet mainly due to the numerous combinations available. To this end, all the techniques for the CO2 reduction were gathered and categorised accordingly. In this context, literature review was conducted in order to identify technologies established, but also emerging technologies for reducing CO2, as well as more intensive geoengineering techniques outlined only on research level. Considering the wide range of the technologies available, the classification structured was market oriented. More specifically, the techniques were mainly categorized on the technologies applied at the source of emission and on the atmosphere. Following, the technology pathways were considered for outlining the sub-categories. Each of the technology provided was accompanied by its Technology Readiness Level (TRL).

This way, a common base was established that is useful for comparative analyses. Moreover, valuable information regarding emerging technologies highlight the potential for tailored CCUS solutions per industrial sector. CCUS technologies can provide the means for large-scale energy storage with minimal land use requirements and the use of renewable energy sources. Such technologies can also support the reformation of the transport sector with technologies for clean fuel production from non-fossil sources with low carbon footprint. But above all, CCUS technologies can contribute to the production of chemical products. Therefore, by highlighting the potential for developing CO2-based production routes, the dependency on fossil carbon sources of all subsequent production routes will decrease.