SHURA ENERGY TRANSITION CENTER

SHURASTAT
Energy transition in numbers

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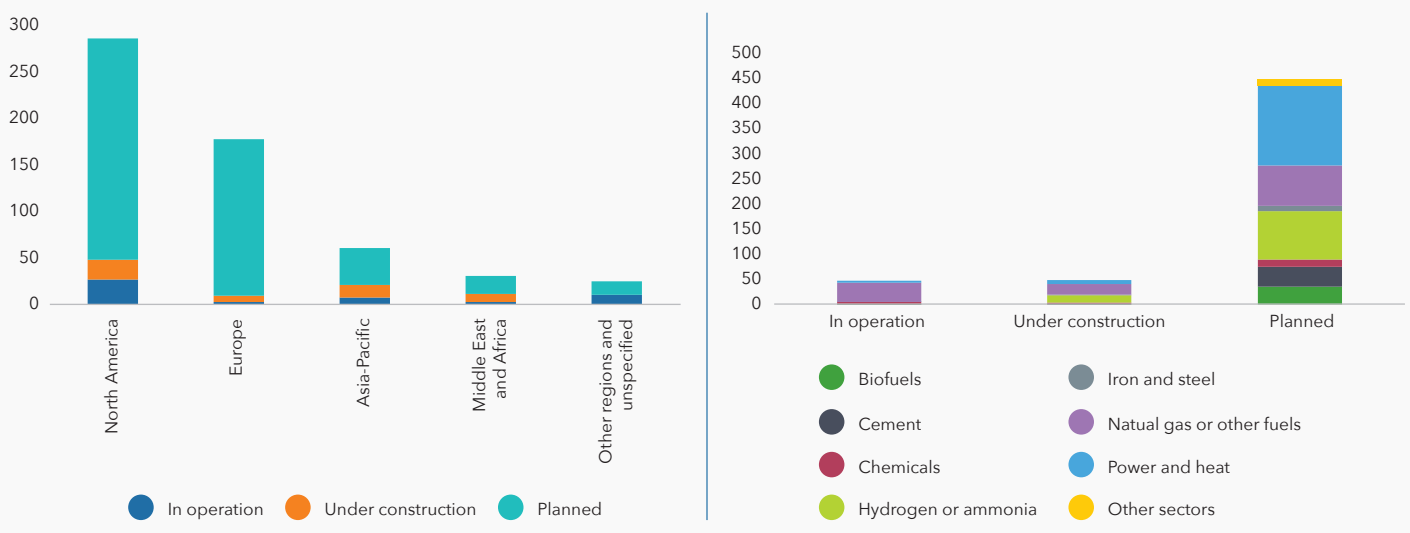
Priority solutions for emissions reduction in hard to de-carbonize sectors are energy efficiency, direct use of renewable energy, electrification and green hydrogen. In cases where these solutions are insufficient for de-carbonization, carbon capture, utilization and storage (CCUS) becomes an alternative. Nevertheless, existing CCUS facilities, which concentrate mostly in North America, are mainly used for enhanced oil recovery. Projects planned and under construction are more diversified, however, and the focus has shifted primarily toward power and heat generation as well as hydrogen or ammonia and biofuels.

Regional (left) and sectoral (right) distribution of in operation, under construction and planned CCUS capacity ($MtCO_2$/year)

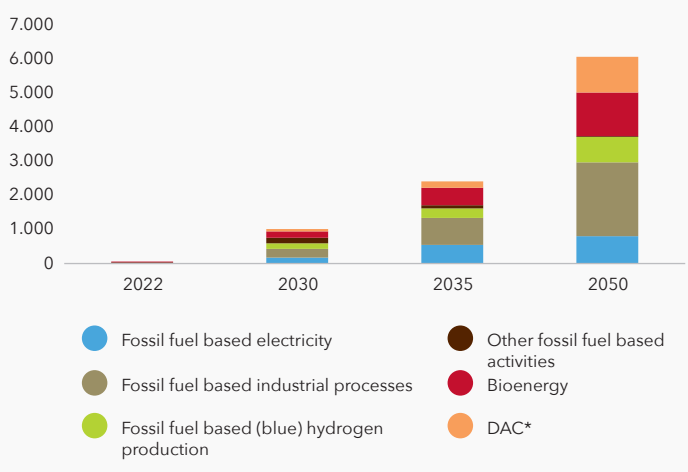


Existing and planned CCUS applications tend to concentrate on enhancing natural gas and other fuel production or on fossil fuel-based power and heat production where alternative clean energy solutions are already available. Thus, in the medium term, CCUS is expected to make only a limited contribution to effective de-carbonization.

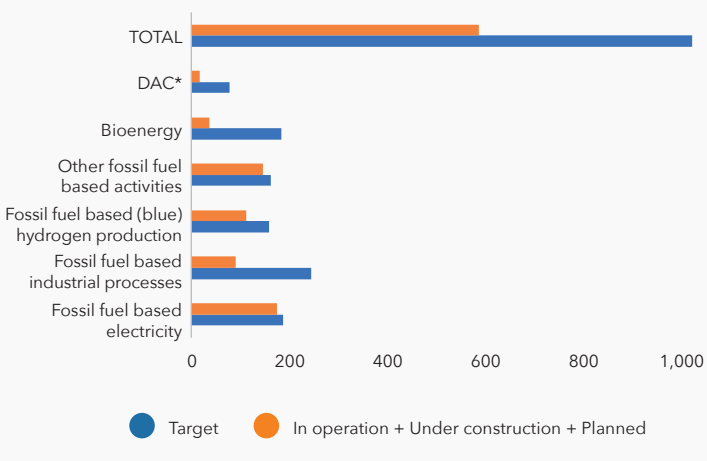
Source: IEA (2025)

According to the net zero 2050 scenario of the International Energy Agency (IEA), total captured carbon amount is targeted to reach 1 billion, 2.4 billion and 6 billion tons/year by 2030, 2035 and 2050 respectively. The scenario foresees by 2050, an increase from 9% to 35% in the share of fossil based industrial processes, which is deemed a priority area for CCUS, and a reduction from 86% to 0.3% in the share of other fossil fuel uses, such as oil and gas production. The shares of uses that are currently not in operation and that can contribute to effective decarbonization, in bioenergy, hydrogen (produced from fossil fuels with CCUS), and direct air capture (DAC), are targeted to reach 21%, 12% and 17% respectively by 2050. On the other hand, the share of CCUS for power generation from fossil fuels is targeted to peak in 2035 and revert to 13% by 2050.

Targeted capacity of CCUS plants by activity according to the IEA net zero scenario ($MtCO_2$/year)



Comparison of targeted CCUS capacity in the IEA scenario in the year 2030 with probable realization in the same year ($MtCO_2$/year)



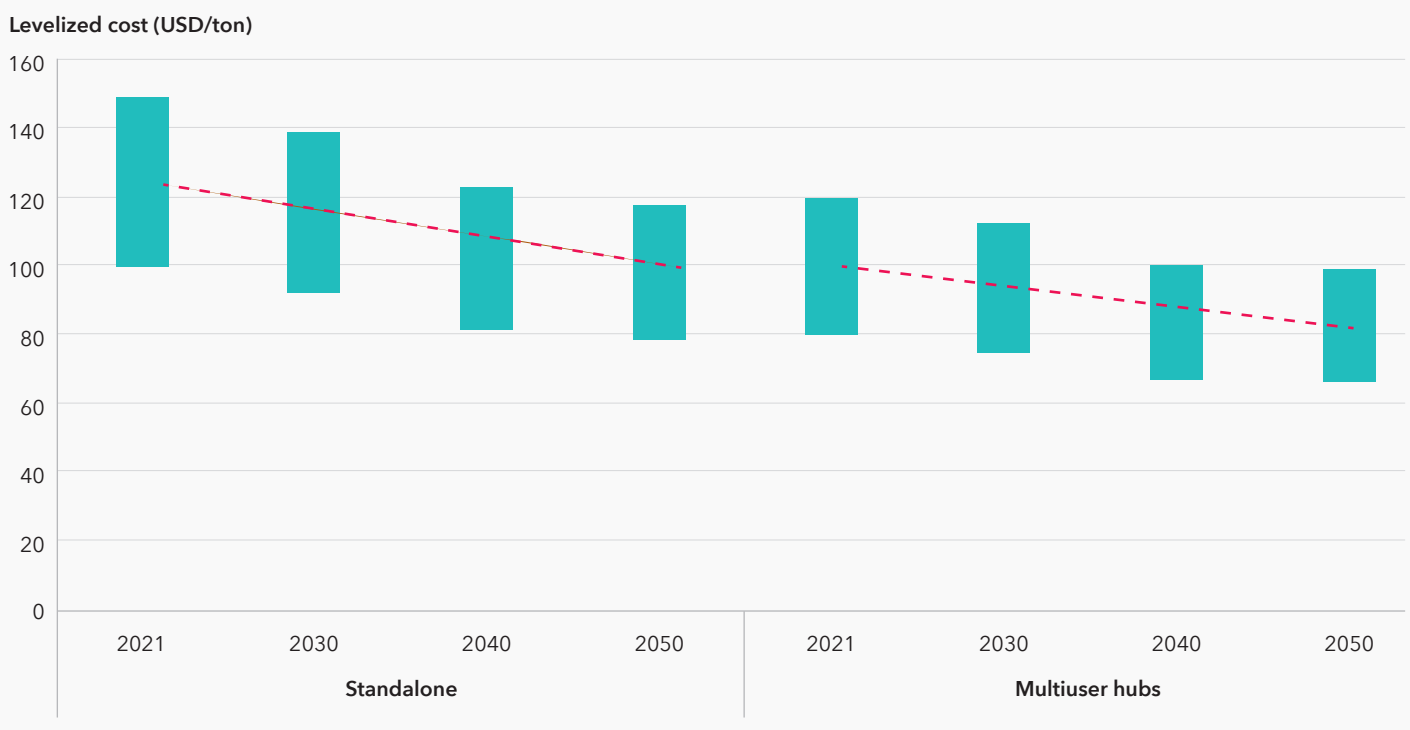
**DAC: Direct Air Capture*

An assessment of planned and under construction projects reveals that in 2030 probable total CCUS capacity in operation will be 40% lower than the capacity targeted for that year in the IEA scenario. While the oil and gas sector and hydrogen production from fossil fuels are expected to dominate and come close to the IEA target, fossil based industrial processes will likely reach only one-third of the targeted level.

Source: IEA (2025)

In addition to technical difficulties related to storage and environmental concerns, high investment and operational costs are a major constraint on scaling CCUS projects. Levelized cost of carbon capture significantly exceed current carbon prices in major carbon markets. Studies reveal that the range of costs vary by a wide margin depending on technologies and location and that average costs are expected to decline only by around 20% by 2050.

Levelized cost of CCS: Comparison of standalone projects with projects in multi-user hubs



Source: Wood Mackenzie, 2021.

- Nearly all CCUS projects require extensive infrastructure investment for transport and storage in addition to capture costs.
- Utilization of the captured carbon is limited to a few applications in the cement, chemicals and food/beverage sectors and the amount of potential use is very low in comparison to the amount captured. Therefore, the majority of the captured carbon is required to be kept in special storage areas and protected against leakage.
- Establishing capture-storage-utilization hubs that bring together potential users and operate on a cyclical manner can contribute to reducing costs, increasing efficiency and minimizing environmental impacts of CCUS projects.

- Currently, high costs, technical difficulties primarily related to storage and environmental concerns impede widespread adoption of CCUS. For effective decarbonization, CCUS should only be considered in the absence of other more economical alternatives.
- Despite the setbacks, over the past few years, there has been a remarkable increase in CCUS projects under construction and planned. Obligations faced by hard-to-decarbonize sectors, increases in carbon prices and new carbon offset mechanisms trigger interest in CCUS projects in addition to other decarbonization methods.
- The Turkish Technology Development Foundation (TTGV) finds that creation of a storage atlas and sectoral feasibility studies, development of pertinent legislation and carbon markets and support for industrial clusters and collaboration will be required for effective implementation of CCUS. Prioritizing cement and iron and steel sectors and use of captured carbon in combination with industrial wastes are deemed important to ensure that CCUS makes a meaningful contribution to climate objectives.