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# The Current State of CCS, as Observed from the IEA's Database

Yoshikazu Kobayashi
Senior Economist, Manager, CCUS Group
Fossil Energies & International Cooperation Unit
The Institute of Energy Economics, Japan

The International Energy Agency (IEA) has been releasing the CCUS Project Explorer, a database tabulating the world's CCUS projects, since 2022[1]. This paper aims to present an overview of the current state of the world's CCUS projects, based on that database.

Projects at each stage of the CCUS process – $CO_2$ capture, transportation, utilization and storage – are recorded on the database separately. Focusing to begin with on projects at the capture stage, when projects that are currently operating are tallied with projects at the construction stage and at the planning stage, projects for capturing approximately 360 million tons of $CO_2$/year currently exist worldwide. Of that figure, the capacity for the projects that plan to be operational as of 2030 is approximately 320 million tons/year. According to the "Net Zero by 2050" report published by the IEA in 2021, in order to reach net-zero greenhouse gas emissions as of 2050, it will be necessary to be capturing 1.6 billion tons of $CO_2$ per year as of 2030. It is therefore clear that under the current circumstances, the world's $CO_2$ capture projects are falling far short of what is required, both in terms of scale and speed of introduction. Furthermore, of the 320 million tons mentioned above, a large amount is still at the planning stage: the combined capacity of projects that are currently operational, and projects for which investment decisions have already been made and which are at the construction stage, is just 42 million tons/year. A serious gap exists between the CCUS capacity that is required based on "backcasting" from how things should look as of 2050, and the accumulated capacity of projects that are being planned at present.

When it comes to the regional distribution of $CO_2$ capture projects, the largest number of projects is located in North America, and they account for around half the total number (Fig. 1). Within that, projects in the United States account for the largest number, but there are also projects being planned in Canada, including projects that combine oil sand production with CCS. Somewhat surprisingly, the region where the next largest number of projects exists is Europe: the region accounts for around 30% of $CO_2$ capture projects worldwide. By country, the United Kingdom has the largest number of projects, with plans totaling 50 million tons/year, followed by countries such as the Netherlands and Norway, which will be able to use depleted oil and gas fields in the North Sea for $CO_2$ storage. On the other hand, in the Middle East region, which in all likelihood conceivably boasts the world's largest potential

[1] IEA (2023), CCUS Projects Explorer, IEA, Paris. https://www.iea.org/data-and-statistics/data-tools/ccus-projects-explorer. Accessed on April 20, 2023

capacity for implementing CCUS, the number of projects being composed as $CO_2$ capture projects is still small, with plans totaling 5 million tons/year being pursued in the UAE and Qatar, respectively. With regard to Saudi Arabia, only the existing Uthmaniyah project is listed on the database. However, against the backdrop of the country's enormous storage capacity, in the future there is a strong possibility $CO_2$ capture projects will be composed from hydrogen and ammonia production, for example. In Asia, China accounts for the largest number of $CO_2$ capture projects, with projects capable of capturing 10 million tons planned by 2030 (many of them for promoting capture at oil fields). Indonesia follows China, with projects for 7.6 million tons, followed by Malaysia at 3.3 million tons.

Looked at in terms of the sources of the $CO_2$ captured, in the projects that are currently operating, the largest number capture $CO_2$ from the natural gas processing process (largely projects that capture $CO_2$ produced associated with oil and natural gas production). Toward 2030, however, projects to capture $CO_2$ from power generation and heat utilization account for the largest number of projects planned, followed by projects to capture $CO_2$ from hydrogen and ammonia production and energy conversion (petroleum refinery and chemical plant) (Fig. 2). As yet, there are few projects to capture $CO_2$ from cement and steel production, processes for which reducing emissions is said to be difficult. They account for just 4% and 1% of all projects, respectively.

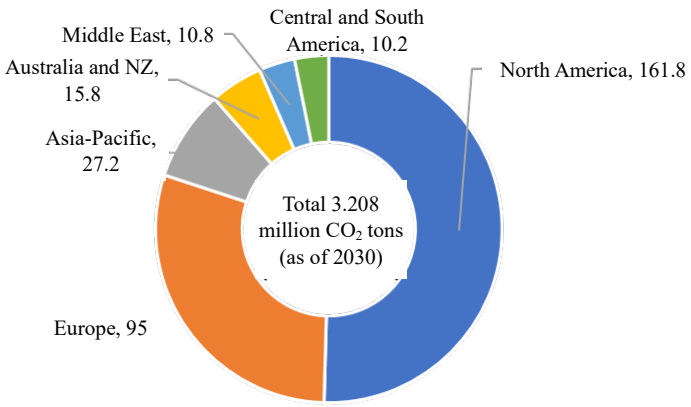
As to where the captured $CO_2$ is sent, for the most part it is stored underground (CCS), including through enhanced oil recovery (EOR). Projects that utilize the $CO_2$ for other purposes, such as CCU/carbon recycling, only amount to 16 million tons/year, even worldwide. By region, many are being planned in the US and Europe, and in terms of specific final products, consideration is mainly being given to manufacturing methanol and fuels, including e-fuels. Incidentally, because the fuel and methanol products arising from this CCU/carbon recycling will generate $CO_2$ when burnt as fuel, one view holds that the $CO_2$ they use as raw material should only be $CO_2$ derived from bio feedstock or from the atmosphere. By comparison, according to the IEA's database, among the CCU/carbon recycling projects that are currently being planned, in addition to projects that utilize those $CO_2$ sources, there is also a large number that utilizes $CO_2$ emitted from the energy conversion sector, including power plants, and from the industrial sector, beginning with steel and cement.

The storage of $CO_2$ will also be utilized as a negative emissions technology that achieves a net reduction in the $CO_2$ in the atmosphere through combination with Direct Air Capture (DAC) and the capture of $CO_2$ derived from biomass. However, as yet there is only a small number of negative emissions projects such as this also. Where BECSS (Bio Energy with Carbon dioxide Capture and Storage) projects that combine CCS with the capture of biomass-derived $CO_2$ are concerned, projects totaling 28 million tons/year exist, but the total capacity of DACCS (Direct Air Capture with Carbon Storage) projects that combine CCS with DAC is only 9.1 million tons/year. The majority of these negative emissions projects are being planned in the United States. As a result of the Inflation Reduction Act established in the country in 2022, a large tax credit of $180 per ton of stored $CO_2$ will

be applied to DACCS projects, and in light of that, there is also a possibility new projects will increase in the country in the future.

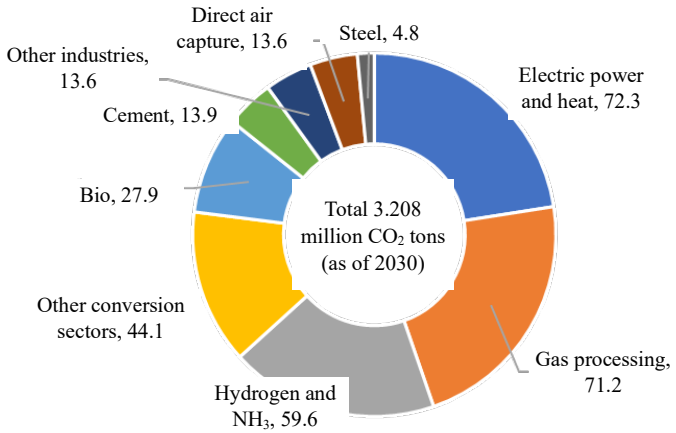
That the IEA is maintaining this database on the world's CCUS and publishing it for free is extremely significant. As a result of the projects that are being considered in regions around the world being assembled in a single database in this way, it is possible to secure a grasp of the current state of CCUS adoption in the world today both comprehensively and efficiently. It is expected that this database will be continuously updated and maintained going forward also, to become a tool that enables a larger number of users to accurately evaluate CCUS' potential.

Fig. 1 Outlook for the world's $CO_2$ capture projects as of 2030 (by region, 1 million $CO_2$ tons)




Source: Created by the author based on the IEA's CCUS Project Explorer

Fig. 2 Outlook for the world's $CO_2$ capture projects as of 2030 (by capture source, 1 million $CO_2$ tons)




Source: Created by the author based on the IEA's CCUS Project Explorer

Contact:report@tky.ieej.or.jp