CO_2 Removal & Gases: Greenhouse Gas Removal

This lever controls the sub-levers listed in the table, and ambition levels are for the end year shown on the right-hand side.

Whilst carbon capture and storage allows the emissions from combustion and other transformation processes to be captured before they are emitted to atmosphere, there are methods by which CO_2 can be removed directly from the atmosphere. These include afforestation (controlled by the Forestry lever), and direct air capture and enhanced weathering (controlled by this lever).

Direct air capture (DAC) envisages using a chemical process to absorb CO_2 directly from the atmosphere. DAC requires energy to separate the CO_2 from the chemicals it has bonded to. To capture and store one tonne of CO_2, approximately 7GJ (or 2MWh) of energy is required[1]. Storage infrastructure is required to permanently remove this CO_2 from the atmosphere.

Enhanced weathering involves adding silicon-based minerals (silicates) to soils, which dissolve and, in doing so, take up CO_2. Silicates occur naturally at the surface of igneous rocks, but are also found in mine waste, cements, ashes and slags. The carbon sequestration potential of enhanced weathering of silicate rocks in the UK is estimated at 430GtCO_2. In addition, the UK produces around 86Mt of mineral by-products per year, which could capture 5.6MtCO_2 per year, although use of enhanced weathering will have associated energy demand.

Key Interaction

Afforestation is controlled by the Forestry lever.

Deployment increases electricity demand which should be generated from a low carbon source to maximise emissions reductions.

Level 1

No DAC systems are installed, and no enhanced weathering techniques are applied.

Level 2

No DAC systems are installed, and no enhanced weathering techniques are applied.

Level 3

Approximately a quarter of the level 4 ambition.

Level 4

Ambition level proposed by the Royal Society and Royal Academy of Engineering report[2].

[1] Keith et al. (2018) : https://doi.org/10.1016/j.joule.2018.05.006

[2] https://royalsociety.org/~/media/policy/projects/greenhouse-gas-removal/royal-society-greenhouse-gas-removal-report-2018.pdf

Default Timing

Start year: 2030, End year: 2100

Carbon dioxide (CO_2) captured

Sub-Lever	Units	2015	Level 1	Level 2	Level 3	Level 4
Direct Air Capture	Mt.CO2e/yr	0	0	0	15	75
Enhanced Weathering	Mt.CO2e/yr	0	0	0	5	15