Pinch Analysis Targeting For CO_2 Total Site Planning

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ABSTRACT

Rising CO_2 emissions that have been primarily attributed to fossil fuel utilisation have motivated extensive research on optimal CO_2 reduction planning and management. Carbon (more precisely CO_2) capture and storage (CCS) and carbon capture and utilisation (CCU) have been the potential solutions to control CO_2 emissions. However, mitigating CO_2 emissions via CO_2 storage in geological reservoirs without utilisation is merely a technology transition, and CO_2 utilisation is limited due to the short lifespan of products. The integration of CCS and CCU, described as carbon capture, utilisation and storage (CCUS), has recently been introduced as a better option to mitigate CO_2 emission. This study introduces a new algebraic targeting method for optimal CCUS network based on a Pinch Analysis–Total Site CO_2 integration approach. A new concept of Total Site CO_2 Integration is introduced within the CCS development. The CO_2captured with a certain quality from the largest CO_2 emissions sources or plants is injected into a CO_2 pipeline header to match the CO_2 demands for utilising by various industries. The CO_2sources and demands are matched, and the maximum CCU potential is targeted before the remaining captured CO_2 is injected into a dedicated geological storage. One or more headers are divided into certain composition ranges based on the purity level of the CO_2 sources and demands. The CO_2 header can satisfy the CO_2 demands for various industries located along the headers, which require CO_2 as their raw material. The CO_2 can be further regenerated, and mixed as needed with pure CO_2 generated from one or multiple centralised CO_2 plants if required. The main consideration for the problem is the CO_2 purity composition of targeted sources and demands. The proper estimation of CO_2 integration will reduce the amount of CO_2emission needed to be stored and introduced to systematic CO_2 planning and management network.

KEYWORDS: CO2 emission reduction; CO2 sources and demands; CO2 management; CO2 capture, utilisation and storage; CO2 total site

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