A Game theoretical approach for CCS infrastructure design

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***Abstract***

Carbon capture and storage (CCS) is recognised as an attractive option for CO2 abatement on a large scale from centralised energy systems and it enables the continued use of fossil fuels. The major challenge toward deployment of CCS is its high cost, while carbon trading approach is proposed for emission control from economic incentives. The emitters have two options: investing on CCS systems or buying carbon credits for the excess emissions above their allowances [1]. Qatar currently targets emission reduction by exercising tight controls on gas flaring. In this work, a mixed integer linear programming (MILP) model is developed for the fair design of integrated carbon capture, transport and storage infrastructure in Qatar under carbon trading scheme based on the work in [2]. The critical carbon credit price is determined first between to invest on CCS systems or to buy carbon credits from abroad. Then the fair design of the CCS infrastructure is obtained by applying the game theory Nash approach. Costs is distributed fairly among power plants in Qatar by selecting the CO2 resources (power plants) with available capture technologies and materials, designing the transportation pipeline network to connect the resources with the sequestration and/or utilisation sites and determining the carbon trading price and amount among power plants. Under the fairness scenario, the total costs are slightly higher than that from minimising the total cost to obtain the fair cost distribution. It results from the selected carbon trading price and transfer amount between power plants. Power plants with higher CO2 emissions determine to install CCS system, while other power plants buy the carbon credits from domestic or international market to fulfil their carbon allowance requirements.

***Key words***: *CCS; carbon trading; Game theory; mixed integer linear programming (MILP)*

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