THE RELEVANCE OF CCS AS A CLIMATE POLICY INSTRUMENT IN VIETNAM

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1. Overview

To meet rising energy demand in next decades, coal is expected to be a major fuel for electricity sector. Particularly for South East Asian (ASEAN) countries, primary energy demand is projected to increase 76% from 2007 to 2030 and of this demand, coal will dominate the largest proportion (ADB, 2010). If the current development policy is continued, CO_2 emissions will double from 7.2 Gt in 2009 to 14.3 Gt by 2030 in both China and the five ASEAN economies: Indonesia, Malaysia, Philippines, Thailand, and Vietnam (World Bank, 2010e). Carbon capture and storage (CCS) is the only technology available for large-scale fossil fuel use to mitigate the dangerous threat of climate change (IEA, 2008a; IEA, 2009). Over the last decade, many researchers have assessed its socio-economic technical feasibility (David and Herzog, 2000; IPCC, 2005; IEA, 2008a,b; Ha-Duong et al., 2009) and sought to integrate knowledge about its economics into economic models (Eckaus, et al., 1996; Dooley, et al., 1999; Kim and Edmonds, 2000; McFarland, J. R., et al., 2004; Johnson and Keith, 2004; Stangeland, 2007; Wise and Dooley, 2009). All these suggested integrating CCS into electricity generation industry is a necessary answer to the major challenges of energy security associated with the disruptive climate change. Using the Integrated Resource Planning (IRP) model, this paper permits to give new insights about the extent to which CCS would be cost-effective deployed in the Vietnamese electricity industry over the period from 2010 to 2040 and could how it could play an important role in a broader climate change mitigation effort. The study also examines cost-competitiveness of CCS to other available carbon mitigation options in the electricity sector.

2. The Integrated Resource Planning (IRP) model

Nguyen (2011) presents the bottom-up IRP model, which is built using mixed integer linear programming problem. The model finds out the least cost combination of electricity generation capacities of different types of plants and the level of end-use electrical appliances to be added and the level of power generated by different power plants in meeting electricity demand during a planning horizon subject to technical, economical, environmental and resources constraints. In this model, the integration of various CCS options is performed under different assumptions about the level and timing of carbon prices that might be imposed to the electricity sector.

3. Results

3.1 CCS enters after 2030 at CO_2 values over $25

Overall, with a moderate trajectory of carbon price (MCV scenario), increasing gradually from 25 US$/t$CO_2$ by 2030 to 35 US$/t$CO_2$ by 2040, would be incentive to favor the deployment of CCS in the Vietnamese electricity generation industry.

However, the energy capacity integrated with CCS seems to be very modest (2.1 GW) compared to the total capacity within the electricity generation system (154 GW). When the IRP simulates higher carbon price increasing gradually from 5 US$/tCO2 to 50 US$/tCO2 over 2010-2040 in the CCS-HCV scenario, four candidate gas-fired power plants with CCS (4x750 MW) would become economic for electricity production, providing 240.6 TWh to the electricity network and a greater CO2 reduction of 78 Mt during 2030-2040 (Table 1).

Table 1: Total power capacity and capacity with CCS in scenarios (GW) by 2040

No.	Scenario	Total power capacity	CCS-integrated power capacity	
1	MCV	153.8	2.1	1.4%
2	HCV	154.3	3.6	2.3%

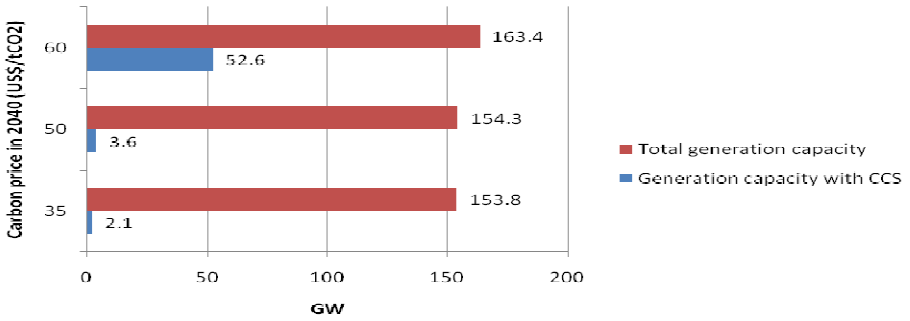
3.2 Renewables cheaper than CCS without enhanced oil recovery (EOR)

Results from IRP simulation suggest that for the decades to come, i.e. before 2040, CCS-based power plants would not be cheaper than renewables-based power plants for mitigating CO2 emissions in the Vietnamese power sector. Most of generation plants using renewables sources would become cost-effective at carbon prices varying from 6 US$ to 10 US$ while those using CCS would not be economically deployed at carbon price below 25 US$.

3.3 CCS as a climate instrument: a potential 20% abatement at $60/tCO2

In a climate mitigation action scenario (in which carbon prices are assumed to be increasing gradually from 5 US$/tCO2 in 2010 to 40 US$/tCO2 by 2030, and to 60 US$/tCO2 by 2040), 52.6 GW in capacity using CCS would be installed, accounting for 32.2% of the total system capacity (Figure 1), and plants using CCS would provide 24.6% of total energy production by 2040, and help cut down about 20% the baseline CO_2 emissions (7.2 Gt) during 2010-2040.

Figure 1: Total power capacity and capacity with CCS in scenarios (GW) by 2040



4. Conclusions

The ability and prospects to capture and sequester CO2 emissions (CCS) offers a promising technology of significant CO2 reduction in a way that is compatible with the future fossil-fuel power generation industry whereas allowing coal to meet the pressing needs for energy in Vietnam for next 30 years. Moreover, Vietnam is estimated to have significant potential for geological storage of CO2, a part in conjunction with Enhanced Oil Recovery (EOR) and Enhanced Coal Bed Methane

(ECBM). All these provide that climate mitigation options for the Vietnamese electricity sector in the coming decades could potentially include the CCS.

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