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Supplementary Material

Comparative Investigation of Different CO_2 Capture Technologies for Coal to Ethylene Glycol Process

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Table S1. Main reactions take place in gasifier.

Reaction number	Reaction	Heat of reaction
R1	$C + 0.5O_2 \leftrightarrow CO$	−110.4 kJ/mol
R2	$C + O_2 \leftrightarrow CO_2$	−394.1 kJ/mol
R3	$C + H_2O \leftrightarrow CO + H_2$	+135.0 kJ/mol
R4	$C + 2H_2O \leftrightarrow CO_2 + 2H_2$	+96.6 kJ/mol
R5	$CO + 0.5O_2 \leftrightarrow CO_2$	−283.7 kJ/mol
R6	$H_2 + 0.5O_2 \leftrightarrow H_2O$	−242 kJ/mol
R7	$C + CO_2 \leftrightarrow 2CO$	+173.3 kJ/mol
R8	$CO + H_2O \leftrightarrow CO_2 + H_2$	−41.0 kJ/mol
R9	$C + 2H_2 \leftrightarrow CH_4$	+84.3 kJ/mol
R10	$CH_4 + H_2O \leftrightarrow CO + 3H_2$	+206 kJ/mol
R11	$CH_4 + 2H_2O \leftrightarrow CO_2 + 4H_2$	+165 kJ/mol
R12	$CH_4 + 2O_2 \leftrightarrow CO_2 + H_2O$	−893.0 kJ/mol

Table S2. Key parameters for the simulation of four CO_2 capture technologies.

Technology	Equipment	Model	Operational parameters	Equipment	Model	Operational parameters
Rectisol	Lean cooler	Heater	T_{out} = −58°C, ΔP = 0	CO_2 Flash1	Flash	P = 1.38 MPa, Q = 0
	Acid gas Absorber	Radfrac	N = 20, P = 5.5 MPa	H_2S con. column	Radfrac	N = 20, P = 0.2 MPa
	SO_2 Flash	Flash	P = 0.69 MPa, Q = 0	H_2S	Radfrac	N = 10, P = 0.3 MPa
MEA	Cooler	Heater	T_{out} = 40 °C, ΔP = 0	Desorber	Radfrac	N = 11, P = 0.19 MPa
	Absorber	Radfrac	N = 11, P = 0.12 MPa	Lean cooler	Heater	T_{out} = 40 °C, ΔP = 0
	Rich-pump	Pump	P = 0.21 MPa, η = 0.8	Lean pump	Pump	P = 0.21 MPa, η = 0.8
CAP	Heat exchanger	HeatX	T_{cold} = 95 °C, ΔP = 0	Separator	Flash2	T_{out} = 40 °C, ΔP = 0
	Contact cooler	Radfrac	N = 5, P = 0.12 MPa	Rich-pump-2	Pump	P = 0.14 MPa, η = 0.8
	Absorber	Radfrac	N = 20, P = 0.12 MPa	Heat exchanger-2	HeatX	ΔT_{cold} = 5 °C, ΔP = 0
	Rich-pump-1	Pump	P = 1.0 MPa, η = 0.8	Lean pump	Pump	P = 0.14 MPa, η = 0.8
	Heat exchanger-1	HeatX	ΔT_{cold} = 5 °C, ΔP = 0	NH_3-desorber	Radfrac	N = 5, P = 0.12 MPa
	Desorber	Radfrac	P = 2.0 MPa	Cooler-2	Heater	T_{out} = 40 °C, ΔP = 0
	Lean cooler-1	Heater	T_{out} = 25 °C, ΔP = 0	Lean cooler-2	Heater	T_{out} = 10 °C, ΔP = 0
	Flash	Flash2	T_{out} = 40 °C, ΔP = 0	Mixer	Mixer	Adiabatic mixing
DMC	Absorber	Radfrac	N = 10, P = 2.84 MPa, ΔP = 0.02 MPa	Heat exchanger	HeatX	T_{lean} = 30 °C, ΔP = 0
	Flash	Flash2	T_{out} = 30 °C, ΔP=0	Lean MEA	-	35%

Table S3. Ratio factor of the components in the TCI.

Component	Capital Investment	RF
I_{EI}	equipment and installation cost	100
I_{IPE}	instruments, piping and electrical	74
I_{BL}	buildings and land	51
I_{ES}	engineering and supervision	32
I_{CCF}	construction and contractor's fee expenses	42
I_{WCC}	working capital and contingency	76