

OIL AND GAS CLIMATE INITIATIVE

Practical action for a lower carbon footprint

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PETROBRAS

THE INITIATIVE : LOWER CARBON VIA COLLECTIVE ACTION & PARTNERSHIPS





CLIMATE INVESTMENTS : LOWER CARBON VIA INVESTMENTS





INVEST in innovative low-carbon technologies and solutions.



SUPPORT our portfolio companies with access to customers and deployment.



COLLABORATE with OGCI members and other stakeholders to gain speed and global reach.



ENERGY & INDUSTRIAL 50 GIGATONNES MANMADE ~3/4 OF MANMADE GHGs GREENHOUSE GASES (GHG) Atmosphere ~15 Gt CO_2e ~20 years to +2°C ~ 35 Gt Carbon sinks CO₂e



CLIMATE INVESTMENTS (\$1B+)



Reduce methane emissions in oil & gas



Reduce carbon dioxide emissions in energy & industrial



Recycle & store carbon dioxide in energy & industrial (CCUS)

INVEST	>	DEPLOY	>	COLLABORATE	

Source: IEA WEO 2018

Source: IPCC (2014)

Source: Carbon Brief (2017) & IPCC (2014)

Reduce methane emissions

Investments to reduce methane emissions









Reduce carbon dioxide emissions

Investments to reduce CO₂ through energy efficiency





Source: IEA WEO (2017) & Lawrence Livermore National Laboratory (2018)

Secondary Energy*: comprises all fuels and electricity "ready to use" (i.e. available to the customer)

Recycle & store carbon dioxide

(Carbon Capture, Utilisation & Storage)

Investments in CCUS technologies





Investments in CO₂ capture & utilisation technologies and in CCUS business models

CI CCUS project investments: prove business models



Illustrative CCUS projects proximate to CO2 storage or EOR offtake offer the most attractive opportunities with expected unlevered IRRs of up to ~25%

			Investment CapEx				Unlevered		
	Plant type for CCUS	Emissions (Mtpa)	Capture ¹	Transport ²	Storage ³	Total CapEx	project IRR		
Concentrated Streams	Ammonia Natural Gas Processing PetChem Ethanol	0.4 – 1.2	\$28-100M	\$18-22M	\$13-40M	=~\$60-160M	~10%-25%		
Dilute Streams	ÀÀ. Pet. Refining ▲ Metals prod. E Cement ▲ Gas to power	Ma	Many economic projects with modest reductions in capture costs or additional policy support						
	Representative power project: Gas pe	eaker ⁴ 1.5 \$	400- 500M	\$18-22M	N/A	=~\$420-525M	~2%-7%		

1.Capture capex includes compression, dehydration, development and contingency costs 2. All scenarios assume 30mi, 8 inch pipe 3. Ammonia: investors self-develop storage, ethanol: storage is developed in JV, nat gas processing/gas peaker: CO2 utilized only for EOR 4. Gas peaker modeled in ERCOT using historical day-ahead prices; high-end of IRR range assumes fixed \$2.5/MMBTU fuel cost Note: Costs presented as ranges based on high cost and medium cost scenarios; IRR calculated over 14 years, with 2 years of construction included; first year of operations modeled as 2026 Source: Global CCS Institute, National Energy Technology Laboratory (NETL), State of Kansas, Zero Emissions Platform (ZEP)

CI CCUS project investments: prove business models



UK – TEESSIDE PROJECT

- Greenfield project: power & industrial
- Potential impact 3-5 Mtpa
- Start date ~ mid-2020's
- Policy structure: hybrid
- Partners : 6 OGCI companies



USA - WABASH VALLEY Brownfield project: industrial Potential impact 1.5 Mtpa Start date ~ 2023 Policy structure: 45Q + state level Partners: developers + DOE



DEVELOP 5 CCUS HUBS VIA PRIVATE & PUBLIC PARTNERSHIPS



GOAL TO KICKSTART A CCUS MARKET



- "Everyone" has a goal of carbon neutrality by 2050
- Regulatory frameworks are improving
- Economics work for SOME projects now
- Continued innovation is needed to improve economics
- We have a choice, or no choice

Thank you

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