THE ROLE OF CCS IN A NET-ZERO CALIFORNIA

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The IEA's 2050 Scenarios....Require CCS



Stated Policies Scenario > 2.5 Degrees C by 2100 Efficiency

Renewables

Fuel Switch, CCUS & Other

Sustainable Development Scenario 2050 ~1.5 Degrees C by 2100

Source: GCCSI, 2021 (based on IEA World Energy Outlook, 2020)

CCS Facilities Around the World (2021)



California Historic Emissions and Future Targets



CCS Opportunities in the Industrial & Electricity Sectors

- 25 NGCCs meet CCS retrofit criteria
- 14 GW total capacity
- 21.6 Mt CO₂/yr current emissions
- 27.5 capturable emissions Mt CO₂/yr*



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51 Facilities

35.8 Mt CO2/yr current emissions

31.8 Mt CO2 /yr capturable emissions

Comparison of Emissions and Capture Costs



Marginal Abatement Curve



Geologic Storage Opportunities

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Source: Energy Futures Initiative and Stanford University, 2020.

Exclusion Zone
CO₂ Emission Sources

Potential CO₂ storage sites

- Saline Reservoir Storage
- Oil Fields with CO₂- EOR potential
- Other Oil & Gas Fields



Challenges for CCS in California



Social Equity and Community Benefits



Can Renewables save the day???



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NGCC Power Plants + CCS: An Option for Clean, Firm Power

SB100 & AB32

•60% renewable electricity by 2030 System capacity model for 2030 with and without CCS shows 4 GW of CCS in the system results in:

- Lower capacity needed
- Lower costs



Source: Energy Futures Initiative and Stanford University, 2020.

Conclusions

- Including CCS in wide-ranging portfolio of options for reducing emissions of CO₂ can provide a way to deal with hard-to-decarbonize sectors of the economy
- We have enough experience with injection of CO₂ in the subsurface to be able to design and operate CCS projects safely at sites that are carefully chosen
- CCS with dispatchable electric power generation can improve reliability for a power system deep penetration of intermittent renewables (wind and solar) and do so at lower system costs than battery storage alone
- Streamlining and coordinating the processes for permitting CCS projects would allow projects to move forward more quickly
- Air quality and jobs benefits would follow from CCS projects



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