An Action Plan for Carbon Capture and Storage in California: Opportunities, Challenges, and Solutions

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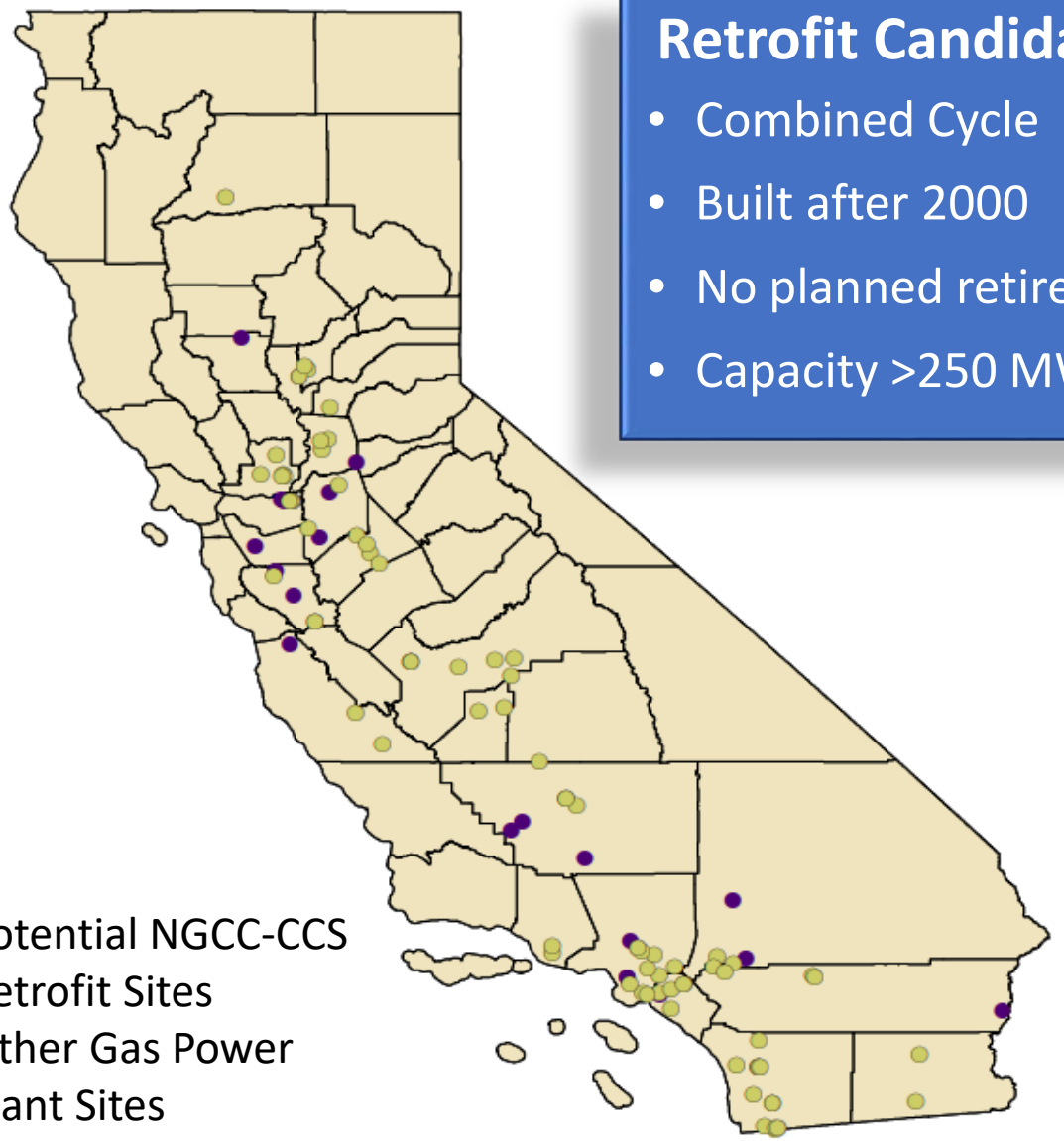
Opportunities for CCS Electricity Sector in California

- 25 natural gas combined cycle power plants meet CCS retrofit criteria
- 14 GW total capacity
- 21.6 Mt CO_2/yr current emissions
- 27.5 capturable emissions Mt CO_2/yr*

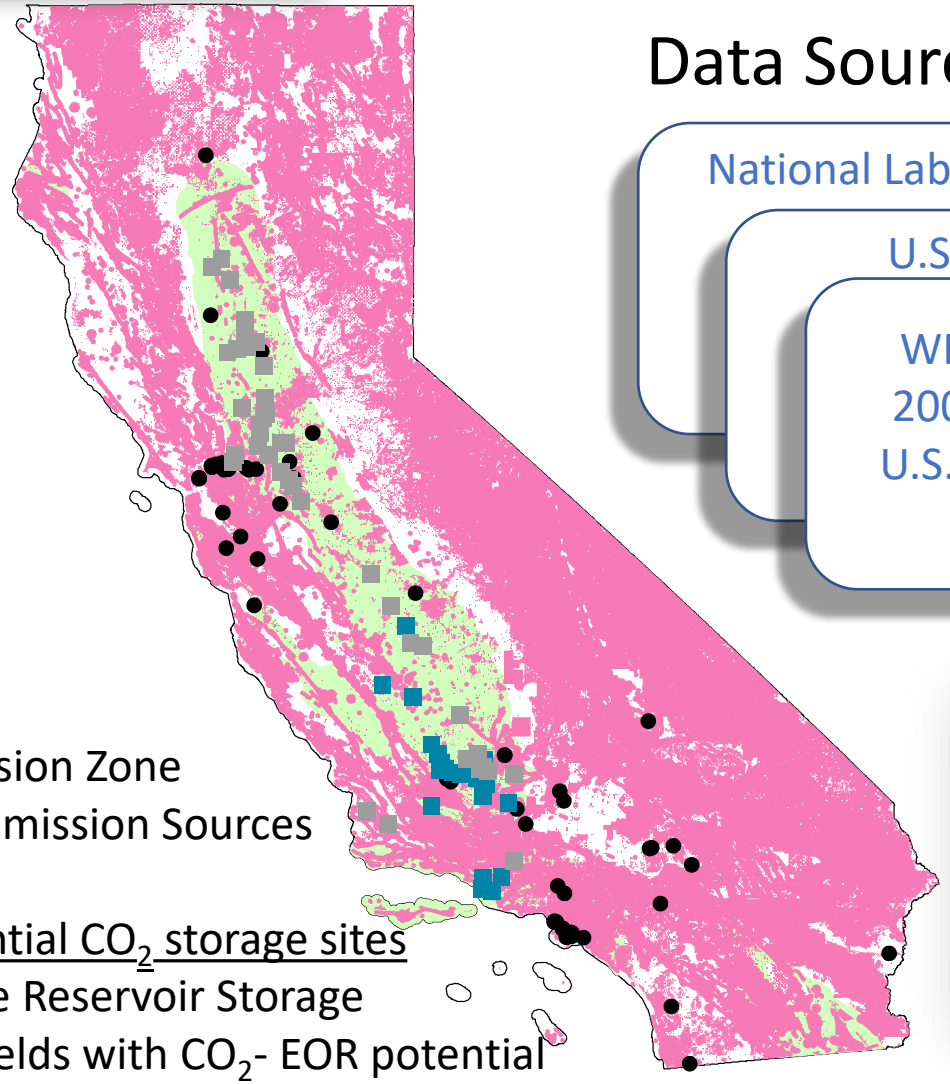
* Capacity factor to increase to 60%



Retrofit Candidates

- Combined Cycle
- Built after 2000
- No planned retirement
- Capacity >250 MW

California Has Abundant and High-Quality CO_2 Storage Resources



Data Sources

- National Labs
- U.S.G.S.
- WESTCARB 2003 - 2013 U.S. DOE and CEC

Screening Criteria

STAGE 1

Qualify sites and saline reservoirs
- Apply LCFS and EPA Class 6 minimum criteria
- Apply additonal "disallowed" conditions

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STAGE 2

Develop Exclusion Layer consisting of geographic information (e.g. faulting, seismicity, population density, sensitive habitats, restricted lands)

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STAGE 3

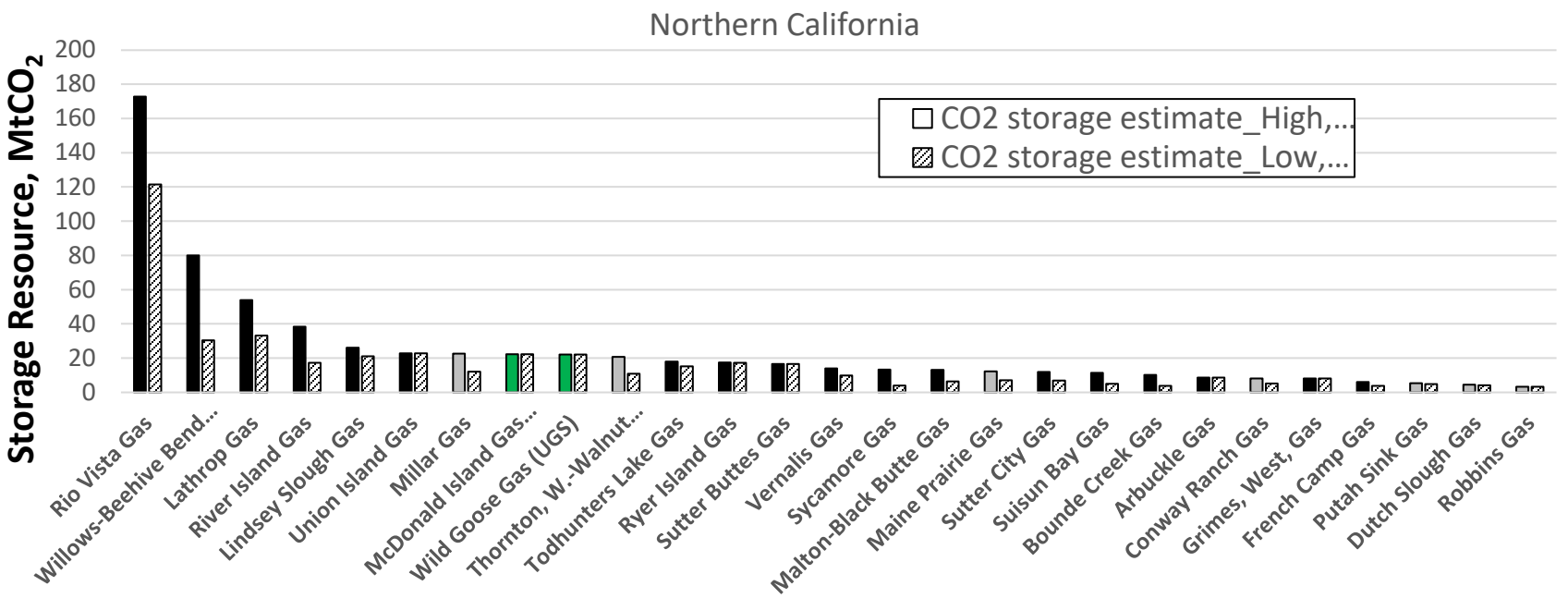
Storage Opportunity Identification by merging qualified sites with exclusion layer.

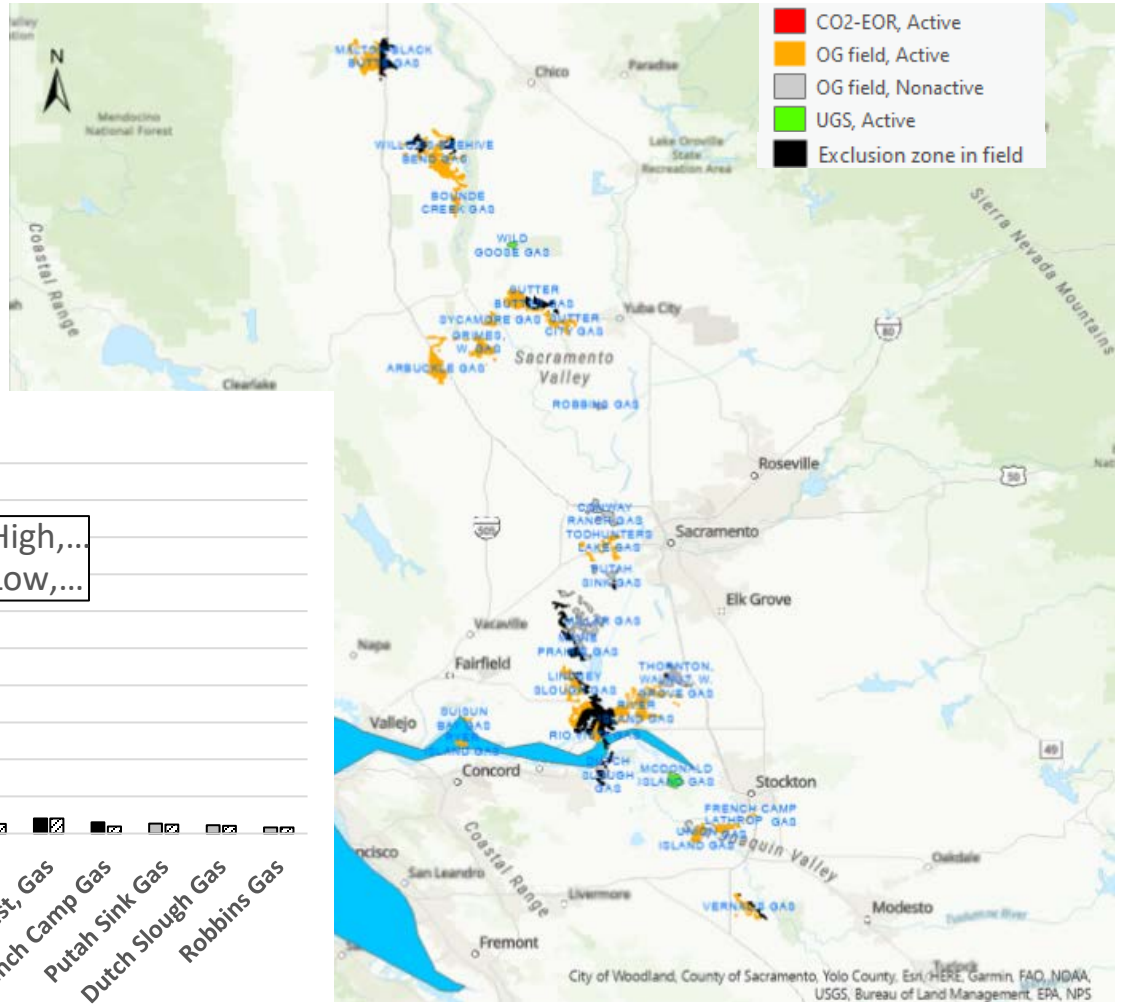
	Storage Capacity (GT CO_2)	
Saline Formations	70	
Oil and Gas	Low	High
	1.1	2.1

California could store 60 Mt/year for more than 1000 years.

Northern California CO_2 Storage Opportunities (O&G and Underground Gas Storage sites)

CO_2 storage resources (Oil and Gas fields and UGS sites) : 442 – 662 $MtCO_2$

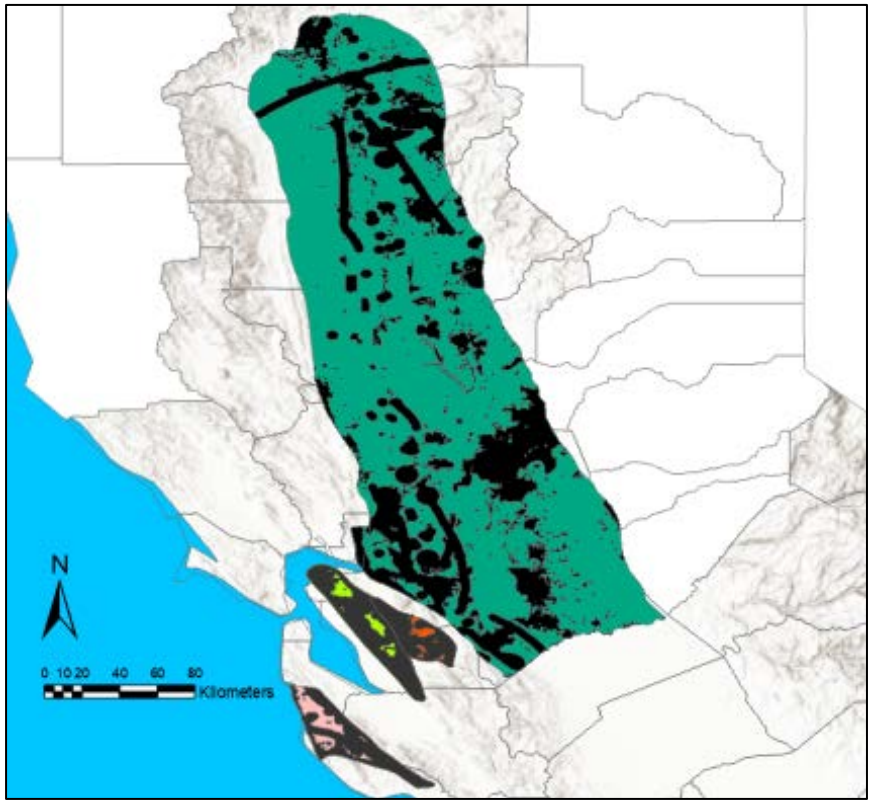


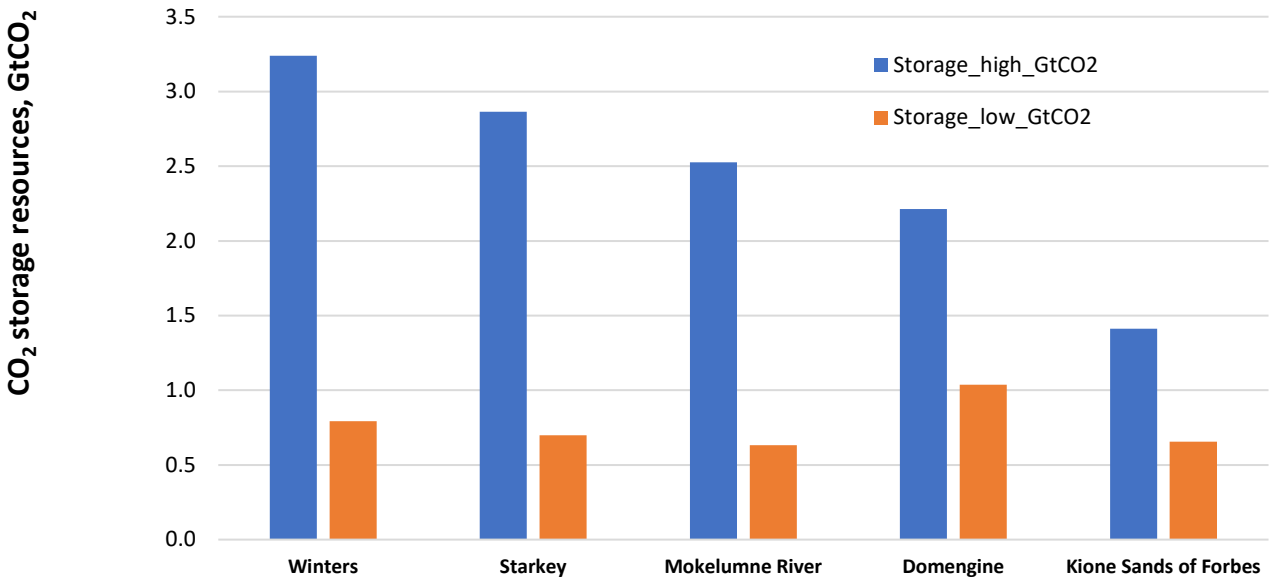


Source: Energy Futures Initiative and Stanford University, 2020.

Northern California CO_2 Storage Opportunities (Saline Reservoirs)

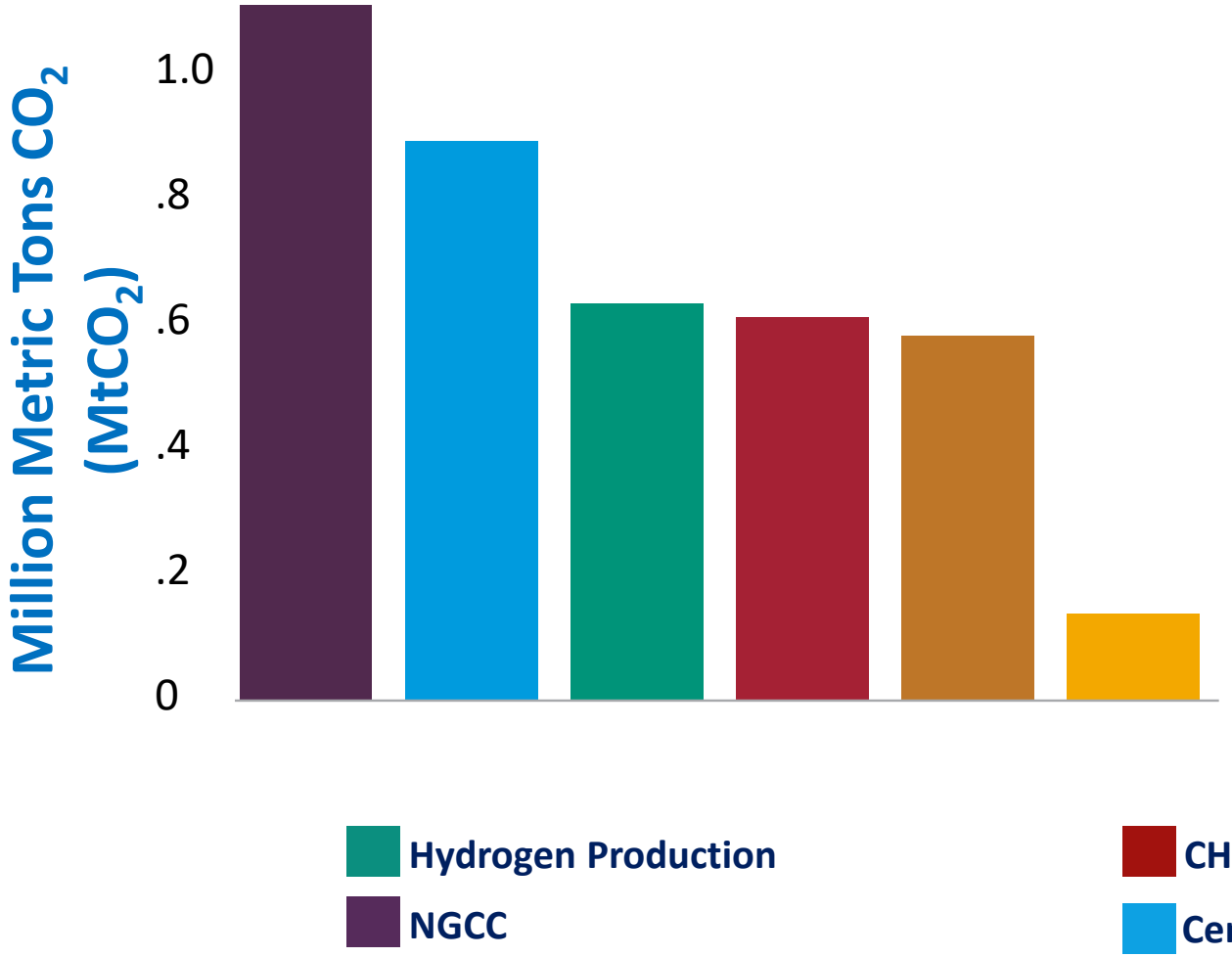
Estimated CO_2 storage resources (Saline Reservoirs) : 3.8 – 12.3 $GtCO_2$



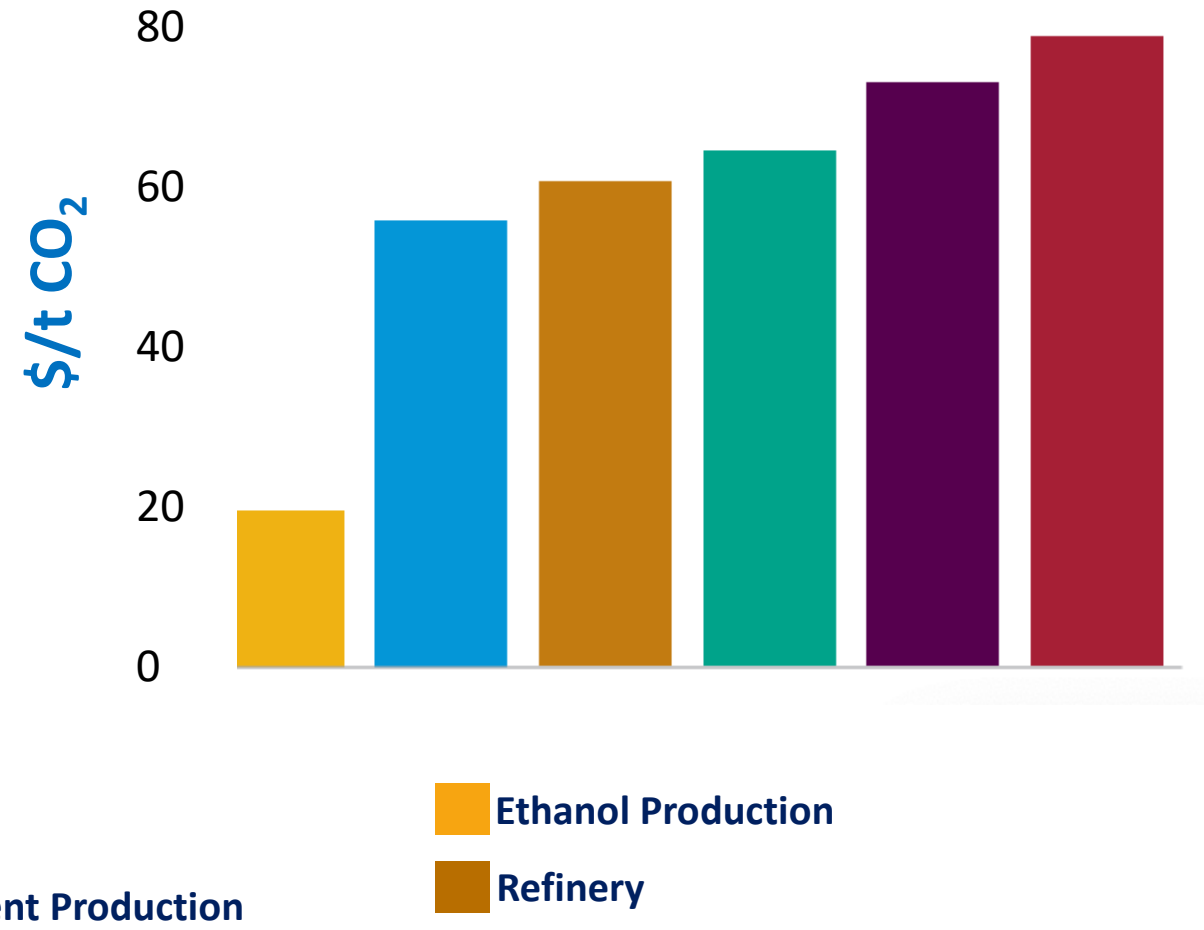


Comparison of Emissions and Capture Costs by Subsector

Average Emissions for Different CO_2 Capture Sources



Average Cost for Capture for Different CO_2 Sources



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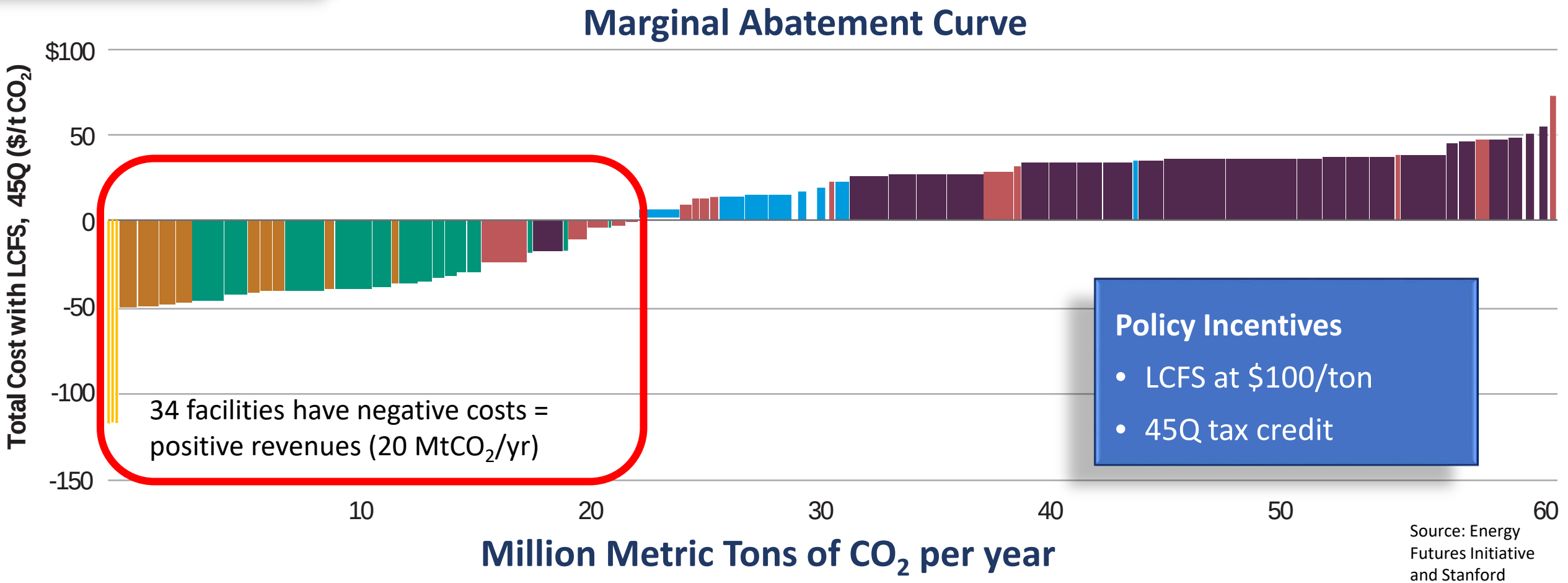
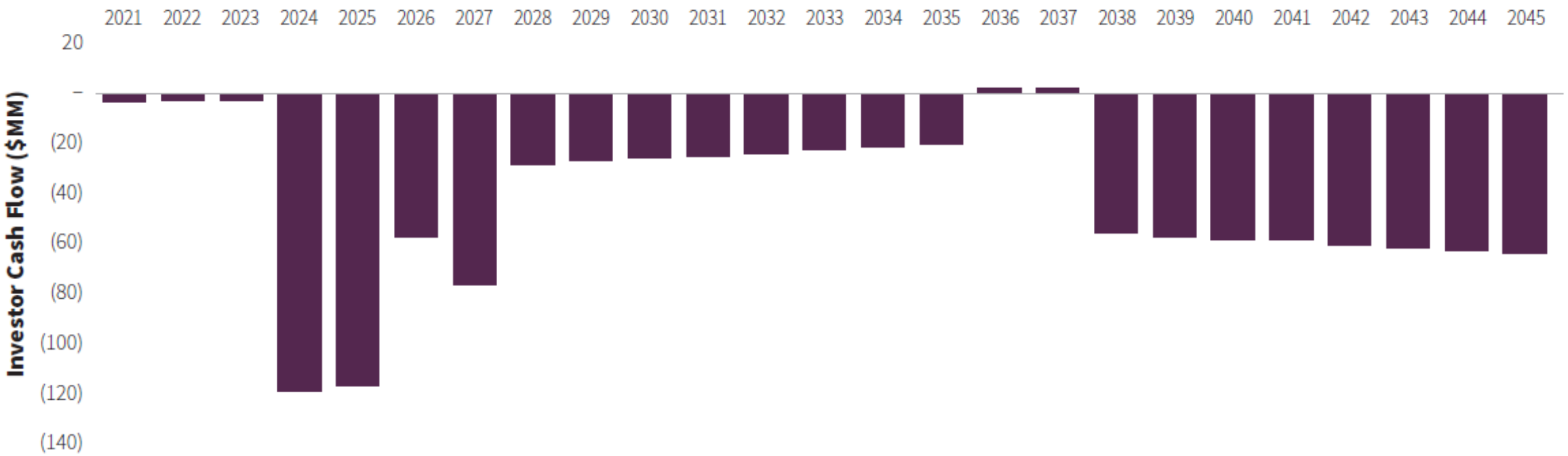
With Current Incentives About 20 $MtCO_2$/yr Could Be Captured Cost Effectively



Source: Energy Futures Initiative and Stanford University, 2020.

Investor Cash Flow – NGCC Plant



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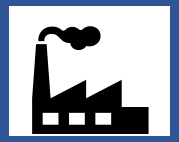
Social Equity and Community Benefits

Local Air Quality Improvements



- Some industrial facilities with high CO_2 emissions also emit high levels of criteria air pollutants such as sulfur dioxide (SO_2), nitrous dioxide (NO_2), and particulates
- **Post-combustion carbon capture requires reduction of these other pollutants creating local air quality benefits**

Local Economic Activity

- CCS projects can **stimulate local economic activity**, including new construction, operations, and maintenance jobs
- **Multiplier effects across the supply chain can drive additional economic benefits**

Job Creation and Preservation

- The economic benefits associated with **job training** could provide new employment opportunities in the low carbon economy
- CCS activities support **employment** for skill sets which may otherwise become obsolete in a clean energy transition