Scratching the Surface: Lessons from First-of-a-Kind Projects

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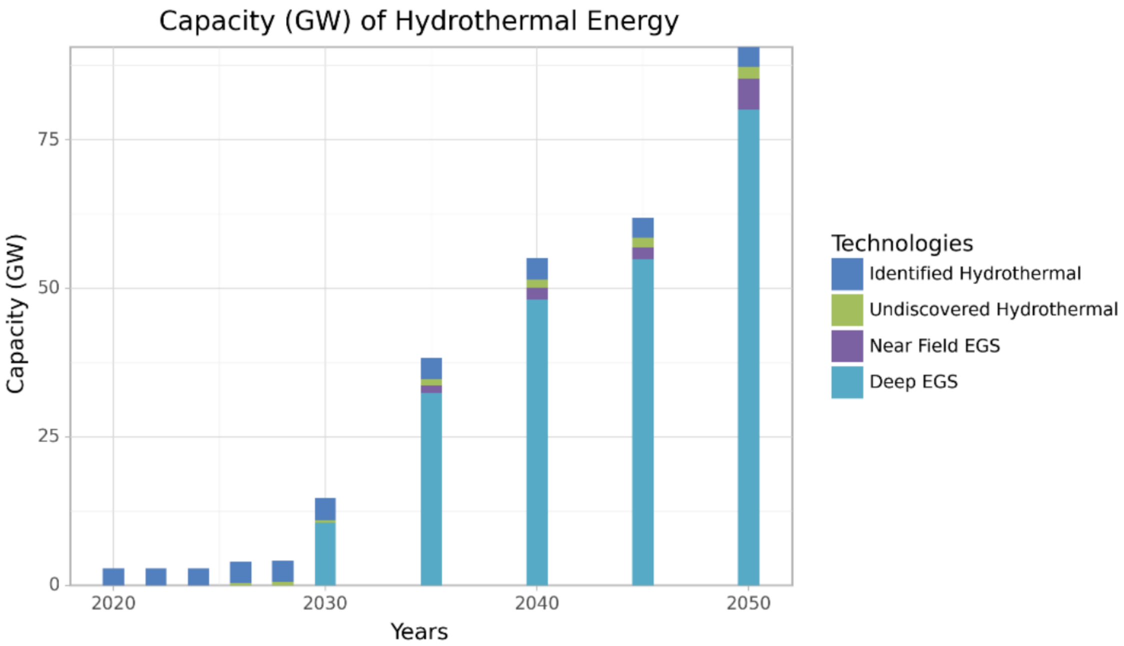
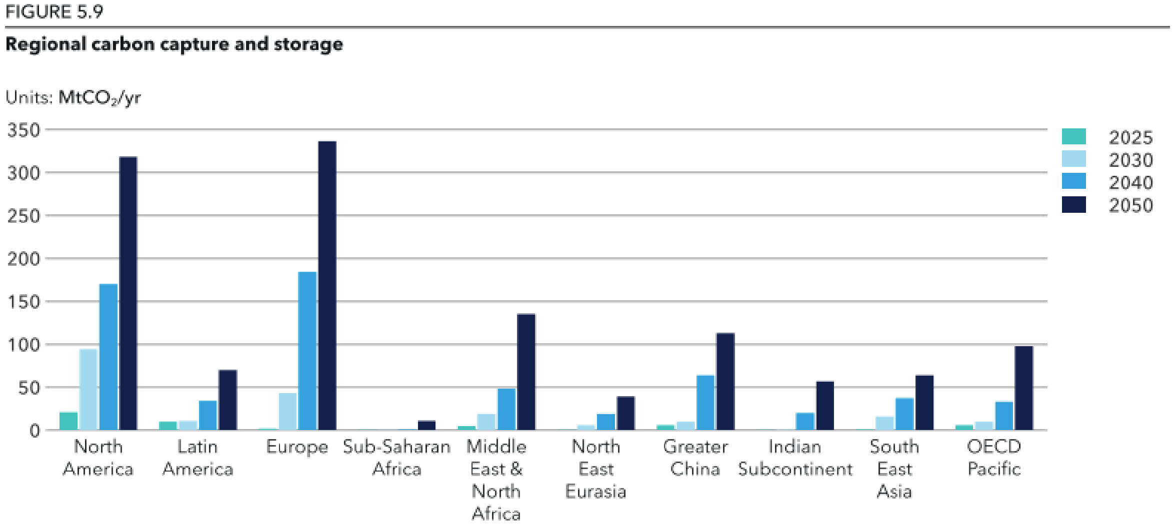
Why?

- Geothermal Support:
  - E.O. 14154, “Unleashing American Energy” [1]
  - DOE GeoVision/EGS EarthShot – >20x scale-up in geothermal power generation by 2050 (~3.9 GW_e [2] → 60-90 GW_e [3,4])
- CCS Support:
  - U.S. 45Q tax credit enables development
  - Voluntary Carbon Market (VCM) growth supports new revenue streams (e.g., low carbon heat/power for DAC, VCM credits)
  - CCS/CDR demand projected to grow 30x through 2050[5]
- Demand for secure, reliable, sustainable energy and CCS for hard-to-abate industries & Carbon Dioxide Removal (CDR)



ReEDS model results for installed geothermal capacity by technology type for the Enhanced Geothermal Shot analysis (Source: Augustine et al., 2023)



Regional projections of CCS/CDR capacity growth through 2050 (Source: DNV, 2025)

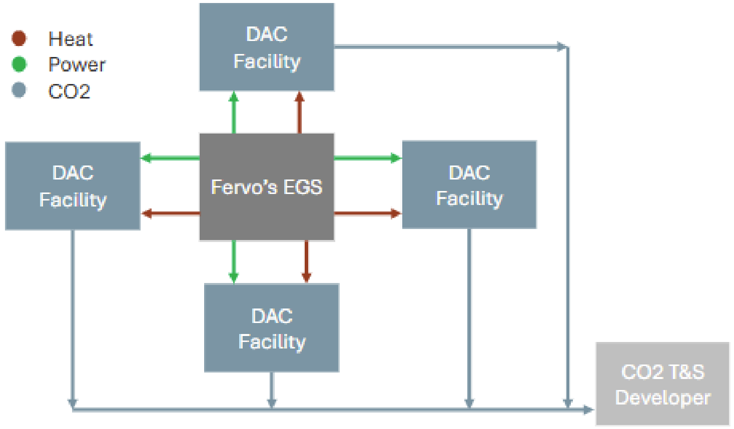
How?

Hellisheiði Geothermal/CCS facility (Source: Carbfix.com)

Nesjavellir Geothermal/CCS facility (Source: Carbfix.com)

- Carbfix (Iceland)
  - Hellisheidi
    - ✓ First onshore CO_2 storage site permitted under EU CCS Directive[6]
    - ✓ 95% capture from a 303 MWe facility + DAC expansion (~100 ktpa CCS capacity)
      - ~40 ktpa DAC capacity (Orca + Mammoth)
    - ✓ 25 million tons of geothermal brine reinjection annually → if optimized, sufficient to do 1 Mtpa CCS[7]
  - Nesjavellir
    - ✓ 2nd site in the Hengill geothermal system, currently capturing 3 ktpa[8] → Full-scale expected by 2030
- Fervo Energy (U.S.)
  - Red Rocks DAC Hub
    - ✓ P50 estimate of 1.9 GW_e power generation capacity [9]
    - ✓ CAPEX reduction through co-utilization of shared infrastructure

Climeworks-Carbfix Mammoth DAC Facility (Source: Carbfix.com)



Fervo Red Rocks DAC Hub schematic diagram (Source: Fervo Energy[9])

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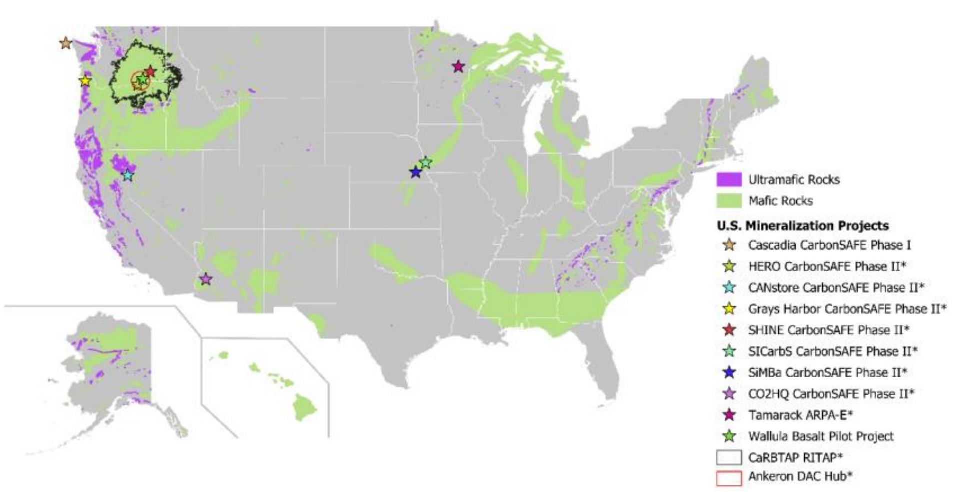
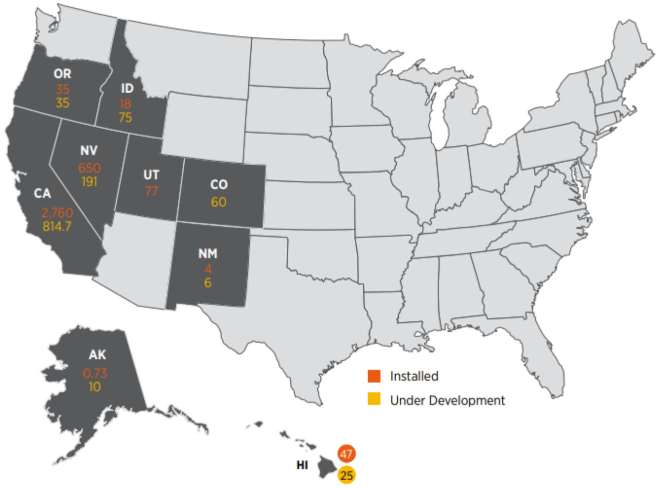
Where?

- Opportunities for co-location of Geothermal energy generation and CCS (particularly for volcanic/mineralization reservoirs)[3,10]
  - Western U.S. has near-term opportunity
- Key subsurface requirements for permeability/caprock are relevant for both Geothermal/CCS[3]
  - De-risks exploration by splitting risk across end-uses
  - Synergistic exploration/resource characterization can support both subsurface uses (e.g., DOE CaRBTAP)[11]



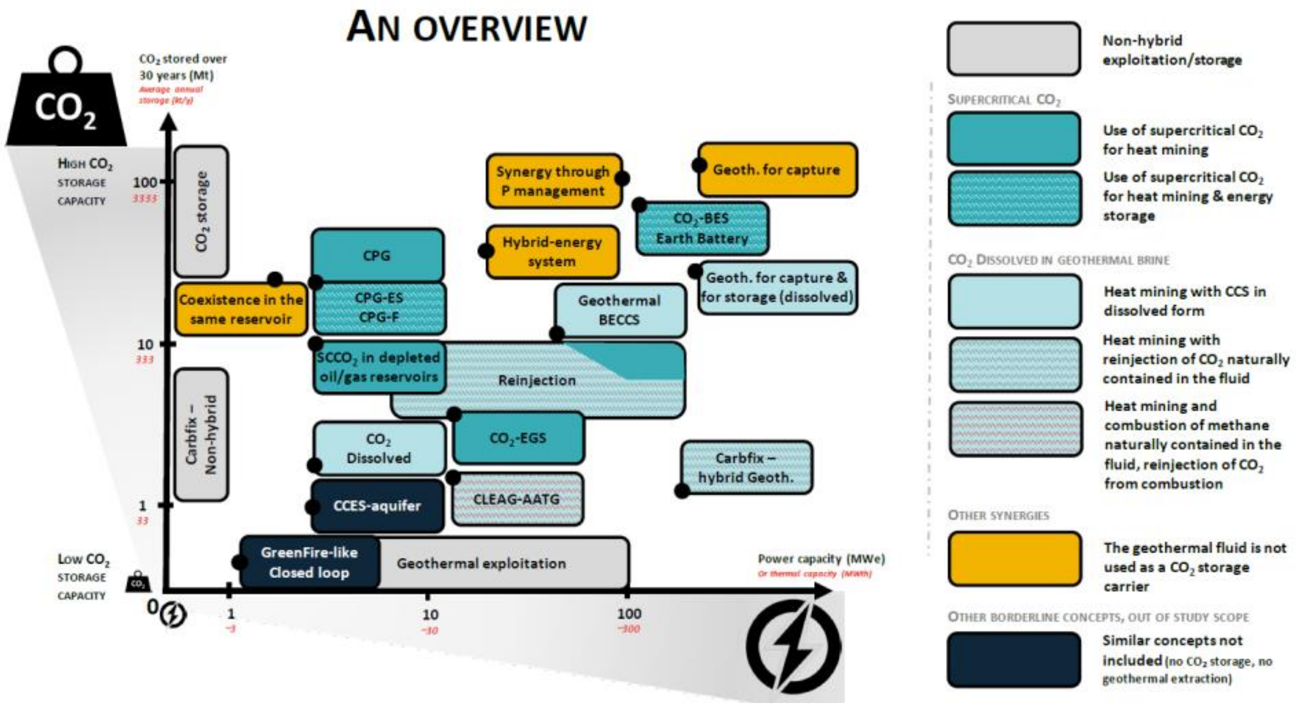
DOE-selected mineralization CCS projects in the U.S. and mafic/ultramafic rocks. *83% of projects were awarded since 2020. (Source: DiRaddo et al., 2025)[10]



Existing and planned U.S. geothermal electricity generation capacity by state (Source: U.S. DOE GeoVision, 2019)[3]

In Conclusion..

- Substantial synergies exist between Geothermal & CCS development
  - Subsurface & surface infrastructure co-utilization can reduce CAPEX/OPEX and upfront risk
  - Brine reinjection constitutes a potential low-hanging fruit for dissolved CO_2 injection in volcanic reservoirs
  - Diversifying revenue streams ensures long-term project stability and may support financing next-generation technologies (e.g., EGS)
- Barriers: Learning & awareness of opportunities; Financing demonstrations/FOAK projects



Other geothermal-CCS concepts considered in analysis by IEAGHG (Source: IEAGHG, 2023)[12]

Education & awareness of co-location opportunities is essential to operationalize these technologies. Capacity building through training, mentoring, and educating students/early career professionals is essential for both Geothermal & CCS. Here, Matt discusses the Carbfix technology for a group of college students as part of The GREEN Program study abroad. (Credit: The GREEN Program)

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