



U.S. DEPARTMENT OF
ENERGY

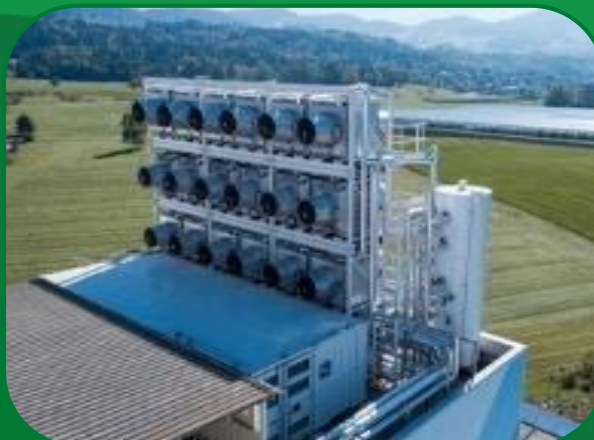
Fossil Energy and
Carbon Management

FECM Perspectives on Carbon Management

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OFFICE OF CARBON MANAGEMENT

March 16, 2022



Legend:

- Light Rare Earth Elements
- Heavy Rare Earth Elements
- Critical Rare Earth Elements
- Critical Minerals

H																	He															
Li	Be																	B	C	N	O	F	Ne									
Mg																	Al	Si	P	S	Cl	Ar										
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr															
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe															
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn															
Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og															
																		La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
																		Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

* Gas: RARE EARTH, LANTHANUM, YTRBIUM, LUTETIUM, SCANDIUM, YTHORIUM, ZIRCONIUM, NIOBIUM, MOLYBDENUM, TECHNETIUM, RUTHENIUM, RHODIUM, PALLADIUM, SILVER, CADMIUM, INDIUM, TIN, ANTIMONY, TELLUR, IODINE, XENON, ARGON, NEON, HELIUM. ** Excluded with rare earth elements.



Fossil Energy and Carbon Management (FECM)

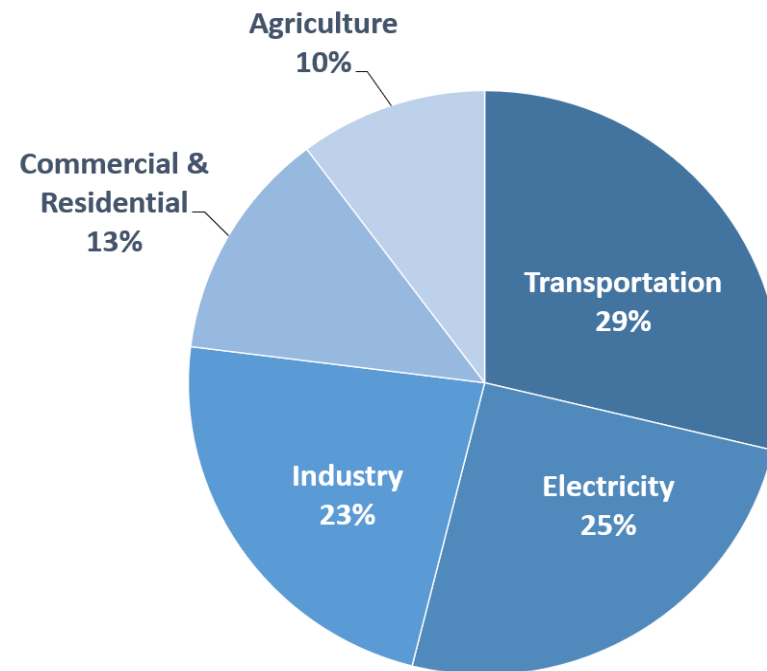
Office of Fossil Energy and Carbon Management

DOE-FE is now DOE-FECM

New name for our office reflects our new vision

- President Biden's goals:
 - 50% emissions reduction by 2030
 - CO₂ emissions-free power sector by 2035
 - Net zero emissions economy by no later than 2050

Total U.S. Greenhouse Gas Emissions
by Economic Sector in 2019



U.S. Environmental Protection Agency (2021). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019

FECM Mission: Deep Decarbonization and Environmental Justice

Minimize environmental and climate impacts of fossil fuels from extraction to use

Priority Technology Areas

1. Point source carbon capture
2. Carbon dioxide (CO₂) removal
3. CO₂ conversion into products
4. Reliable CO₂ storage
5. Hydrogen production

**Office of Carbon
Management**
(FECM-20)

6. Critical mineral production from industrial and mining waste
7. Methane mitigation

**Office of Resource
Sustainability**
(FECM-30)

Enacting Justice and Supporting Legacy Communities

- Good-paying jobs
- Job growth acceleration
- Healthy economic transitions
- Improve community conditions

Address hardest-to-decarbonize applications in the electricity and industrial sectors

CCUS and CDR Facilitate Deep Decarbonization

Reduce the cost of capture/increase rates

- Power Sector
- Industry
- Carbon Dioxide Removal
- Design Studies and Demonstrations

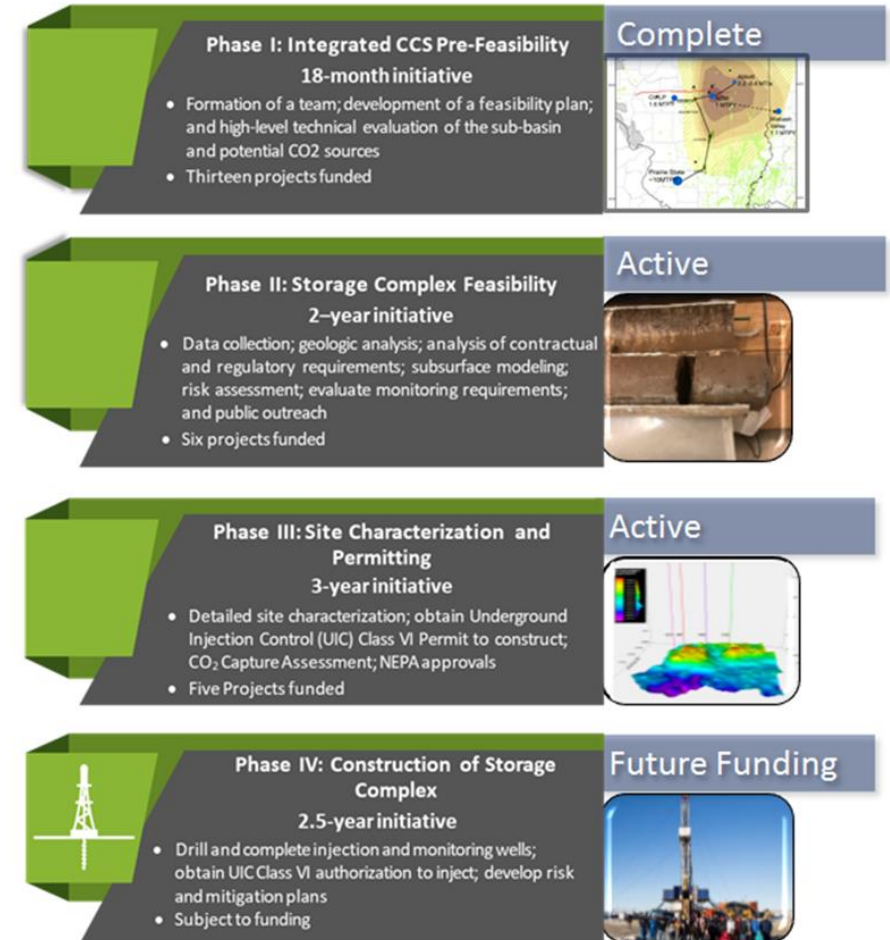
Develop low-carbon supply chains through conversion

- Aggregates
- Fuels and Chemicals
- Solid Carbon Products

Optimize geologic storage operations

- CarbonSAFE Infrastructure, Partnerships
- Geomechanics (pressure and state of stress)
- Conversion of fossil assets
- Enabling real-time decision making through AI

CarbonSAFE - Infrastructure

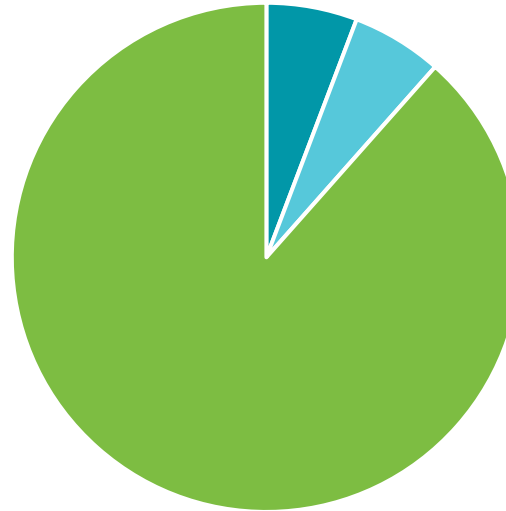


Carbon Negative Shot: Key Performance Elements

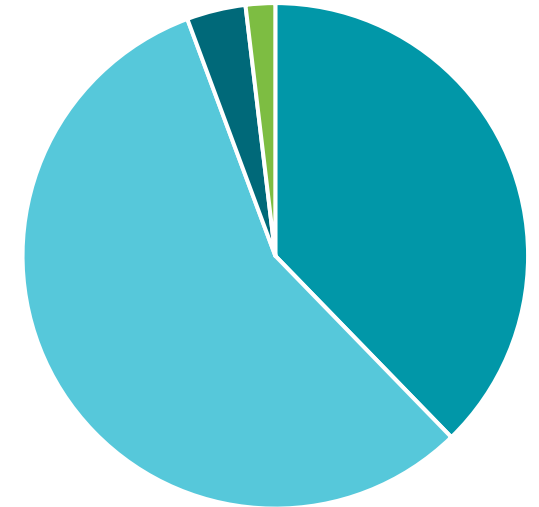
Carbon Negative Shot's key performance elements will guide a **responsible** industry that is **responsive** to the climate crisis, such that multiple true, durable removal pathways can be deployed at their most affordable cost at the scale required to address the climate crisis.

- 1 Less than **\$100/net metric ton CO₂e** for both capture and storage
- 2 Robust accounting of full life cycle emissions
- 3 High-quality, durable storage with costs demonstrated for MRV for **at least 100 years**
- 4 Enables necessary **gigaton-scale** removal

Soil Carbon Sequestration



Direct Air Capture and Storage



Blue are costs associated with ambient air capture
Green are costs associated with ensuring durable storage



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Ensure the first ton of removal
is true, durable removal

Ensure the last ton of removal is
as affordable as it can be



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Questions?



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* Gas. ** Liquid. *** Solid. **** Not included with rare earth elements.

