Adapted from U.S. DOE, Biological and Environmental Research Information System.)
Carbon Management Landscape

Capture Sources
- Concentrated Sources
  - (e.g., power plants, gas cleanup, biomass combustion, or fermentation)
- Air Capture
  - (e.g., in terrestrial and marine ecosystems, and direct air-capture with chemicals or weathering)

Capture and Conversion Processes
- Advanced Combustion
- Solvent
- Sorbent
- Cryogenic
- Membrane
- Electrochemical
- Thermo-chemical
- Photo-electrochemical
- Mineralization
- Biological

Capture Products
- Gaseous or Supercritical Carbon
- Organic Carbon
- Inorganic Carbon

Pathways and End States
- Fuel
  - CH₄
  - Liquid fuels
  - Biomass
- Chemicals and Materials
  - Plastic
  - Cement
  - Construction materials
- Minerals
  - Ex situ carbonate formation
- Geological Formations
  - Oil and gas reservoirs
  - Saline formations
  - Basalt formations
  - Shale and coal
- Grasslands and agriculture
  - Management practices
  - Crop selection
  - Biochar
  - Enhanced species
  - Microbial enhancement
- Forests
  - Reforestation
  - Afforestation
  - Land management
  - Enhanced species
- Wetland creation and restoration
  - Direct CO₂ injection
  - Ocean fertilization
  - Alkalinity augmentation

CO₂ Utilization
- NGI sunset
- SCOS sunset
- Natural Capital Project
- Center for Ocean Solutions
- Center on Food Security and the Environment

Modified from SEAB Report, 2016. CO₂ Utilization and Negative Emissions
Stanford Carbon Initiative
Current state – lots of programs, centers, faculty doing great work
Stanford Carbon Initiative
Step 1: Form a community

Form a Community: Informal links, get folks talking to each other and working together, identify gaps. Become identifiable to outside world.
Stanford Carbon Initiative
Next step: Secure start up funding

Start up funds: for business development activities and to sponsor some initial research in areas that link up faculty and/or fill existing gaps
Stanford Carbon Initiative
Vision: Fund additional research in this space
Stanford Carbon Initiative

Vision
A community of Stanford faculty and industry partners with interest in carbon management to address climate change.

Mission
The Stanford Carbon Initiative (SCI) engages faculty across the Stanford campus to carry out the many types of research needed to capture, utilize and store CO2 emissions at the gigaton per year scale. This initiative supports, improves, and extends the university’s ongoing efforts related to carbon management and is aligned with Stanford’s Sustainability Accelerator. The SCI will forge collaborations and partnerships amongst Stanford faculty, researchers, and students in 3 key areas:

- A Holistic View of Carbon Management
- Tools for Assessing Carbon Mitigation Options
- Life Cycle Analysis
- ......
Carbon Initiative Roadmap

Sept 2019: Confirm interest from Precourt Institute for Energy

Nov 8: Carbon Management Workshop

Oct/Nov 2019: Socialization meetings with key Stanford faculty
Carbon Initiative Roadmap

Sept 2019: Confirm interest from Precourt Institute for Energy

Nov 8: Carbon Management Workshop

Jan – Mar 2020: Secure start up funds, Engage with sponsors

Fall 2020: Fund first research projects

Oct/Nov 2019: Socialization meetings with key Stanford faculty

Jan 2020: Hold Framing Workshop with key faculty

Spring 2020: Launch
Research Opportunities

- Systems Modeling – model the global carbon balance including carbon mass transport, reactions, phase equilibria and various thermodynamic and kinetic effects for both natural as well as engineered systems
- Global data collection to support Systems modelling

- Lifecycle Analysis – Consider full “upstream” and “downstream” processes in analysis of costs and to understand environmental trade-offs of different options.
Thank You

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