

Managing a Separation and Capture Portfolio

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Comparing scope of AGCI Separation to FE Separation and Capture

- AGCI definition of separation includes aspects of Vision 21, the current Fuels program, and elements of sequestration
- Existing activities include system and subsystem assessments within each topic
- Current program planning environment calls benefits studies, & independent review



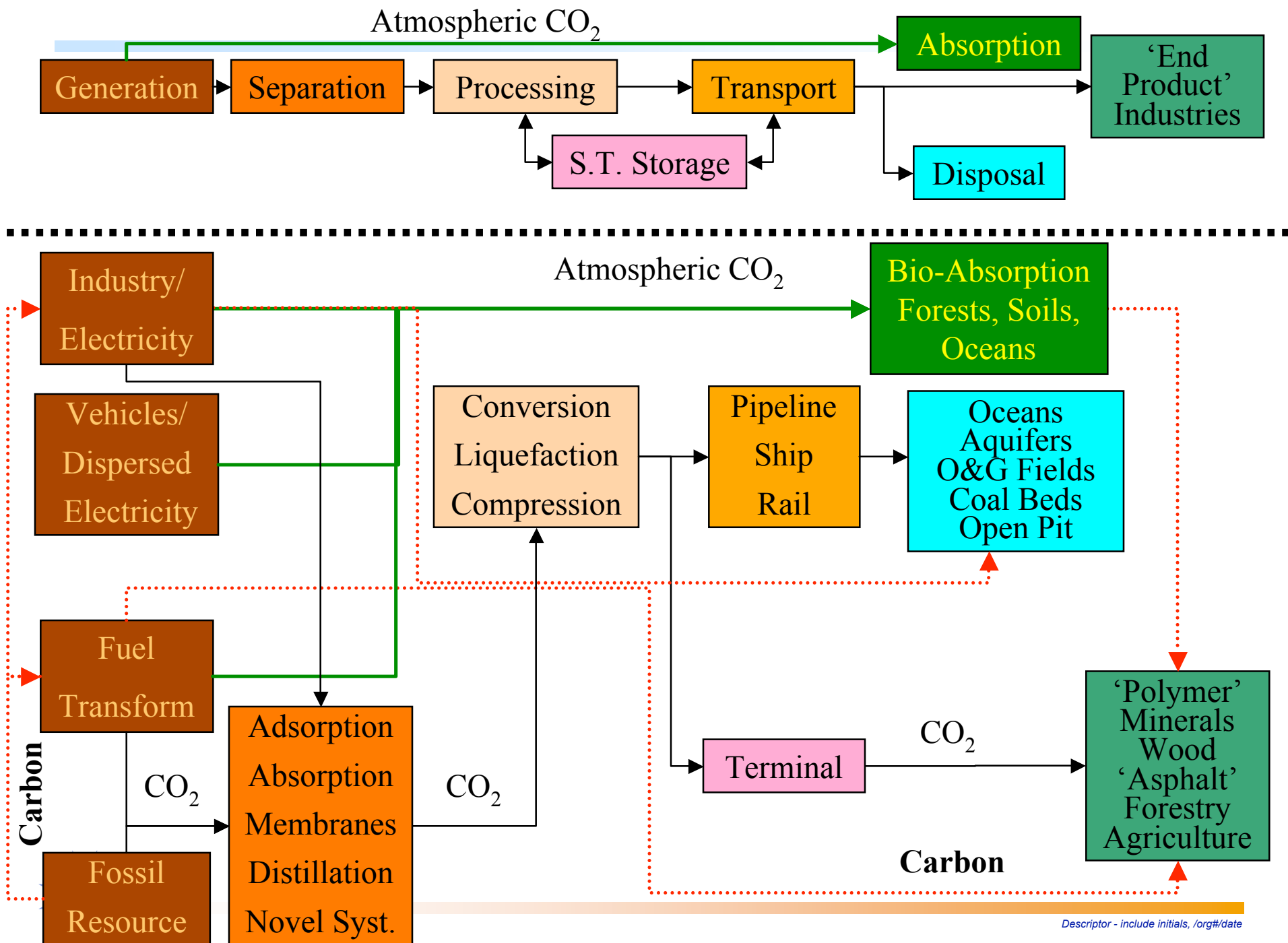
Sequestration is one of three elements in an effective greenhouse gas mitigation strategy.



Capture and Separation

- Fossil fuels key sources of energy in world energy mix due to availability and affordability.
- Continued use of fossil fuels makes capture and separation a critical step in managing GHG's
- Validate options comprising separation and sequestration by developing the knowledge base and readying technologies for deployment.
- Capture and separation processes applicable to anthropogenic point sources is the focus of the FE program.



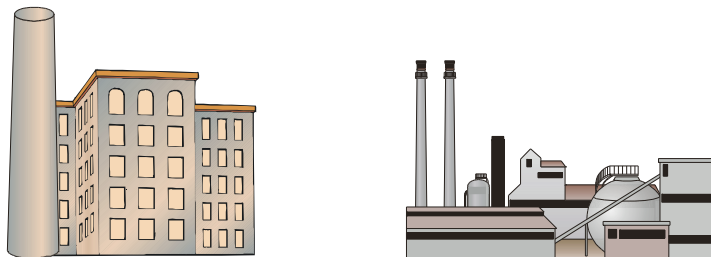


FE Sequestration Program History

- January 1997 -MIT White Paper
- 1997 -PCAST report
- 1997 - Technical Opportunities to Reduce U.S. Greenhouse Gas Emissions report
- 1998 - 1999 Office of Science/ Fossil Energy report developed
- 1999 - PCAST international report issued
- 1998 -\$1Million for CO2 control (environmental)
- 1999 - \$4 Million budget item
- 2000 - \$9.2 Million to initiate R&D program
- 2001 - \$19.0 Million (est.) to expand program
- Program plan looks to 2015



Direct Carbon Sequestration



Capture CO₂ from hydrocarbon conversion systems and store it in:

Oil & Gas Reservoirs

Unmineable Coal Seams

Saline Formations

Oceans

Indirect Carbon Sequestration



Remove CO₂ from the atmosphere to offset emissions from small disperse sources

Forestation

Agricultural Practices

Mineralization

Ocean Fertilization

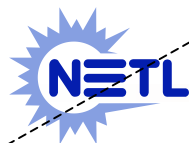
Advanced Concepts

Convert CO₂ to:

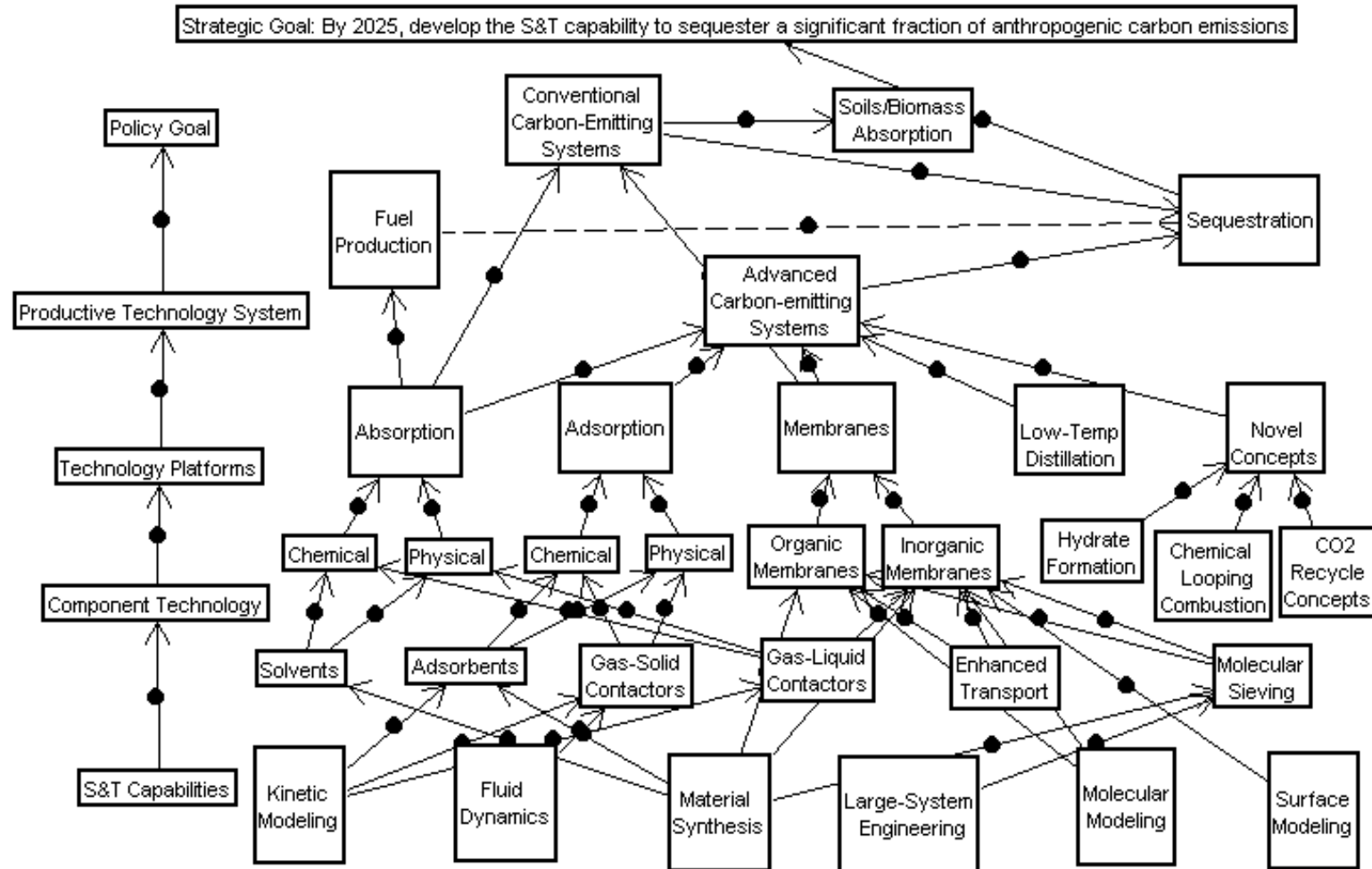
Stable Benign Solids

Useful Products

Hydrocarbon Fuels



Separation and Capture R&D Roadmap



Creating a portfolio

- **Identify needs**
 - Stakeholder meetings (MIT, BP/AMOCO, EPRI)
 - Key reports and national studies (PCAST)
- **Establish priorities**
 - Road-mapping exercises (DOE OSC and FE)
 - Workshops (Gaithersburg)
- **Develop program plans and budgets (FE)**
 - 1999 - 2004
 - 2000 - 2015
- **Early action - Initiating R&D (FE)**
 - Novel concepts (I & II) - National Lab solicitation
 - Industry/ University solicitation

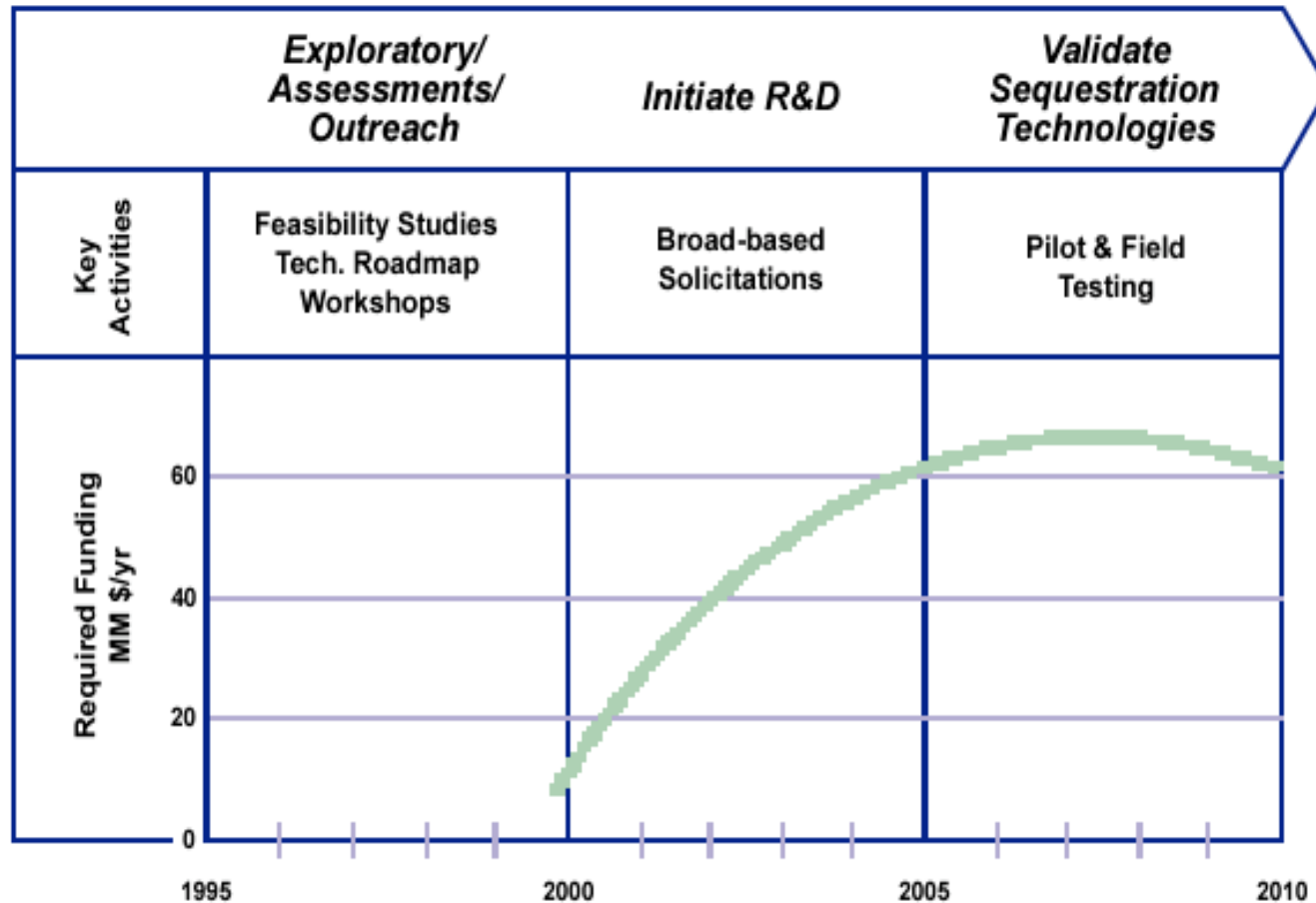


Sequestration Program Portfolio Criteria

- **Sequestration Potential**
- **Cost per ton of carbon avoided**
- **Environmental Acceptability**
- **Likelihood of Success**
- **Multiple Benefits**
- **Flexibility**
- **Program Balance**
- **Program Enhancement**
- **Partnerships**
- **Leveraging - aggregate cost share from non-DOE participants**



Program Phases & Proposed Budgets



What's missing - right now?

- **Portfolio assumes growth in fuel use, supply of fossil fuels, technology improvement**
- **It does not address aspects of larger transformations in society**
- **It does not explore impact of solutions that unintentionally increase energy demand**
- **It may not completely address other linked problems such mercury, land use, etc...**
- **These topics are being considered...**



Assessments and Validation

- **Cost and performance assessments of technology system and subsystems continues across program**
- **Comprehensive analyses combining options and comparing to alternatives is at an early stage**
- **Current program planning environment calls for LCA, benefits studies, & independent review**
- **Results of on-going assessment and communications efforts a key step in refining criteria and in directing program**



Sequestration R&D

- Expands options for dealing with GHGs.
- Is needed to validate concepts and achieve benefits.
- Provides an alternative to expensive changes in the energy infrastructure.
- Could be the only practical solution if drastic reductions are needed.
- Could provide an economic benefit of billions of dollars.
- Separation and Capture one element in a larger portfolio

The FE R&D program is a science- and technology-based research effort to guide long-term sequestration technology development.

