Regional Opportunities for Carbon Dioxide Capture and Storage in China

Project Update

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Topics

- Key findings to date
- Project team and objectives
- Inventory of CO_2 point sources
- Candidate storage formations
- Cost curve development
- Preliminary results
- Possible next steps

Select Findings

- Over 1620 large stationary CO_2 point sources with total emissions of more than 3,890 $MtCO_2/yr$
- Estimated CO_2 storage capacity on the order of 2300 $GtCO_2$ in onshore basins in China
- 91% of these large CO_2 point sources have a candidate CO_2 storage reservoir within 100 miles (161 km)
- There appears to be strong potential for CCS technologies to offer significant emissions reductions in China at costs less than $\$10/tCO_2$ for transport and storage

Regional Opportunities for Carbon Dioxide Capture and Storage in China

A Joint China-U.S. Research Collaboration

- Sponsoring Government Agencies
  - United States Department of Energy
  - Chinese Ministry of Science and Technology
- Project Team
  - U.S./China Energy and Environmental Technology Center
  - Leonardo Technologies, Inc.
  - Battelle
  - Institute of Rock and Soil Mechanics, Chinese Academy of Sciences
  - Pacific Northwest National Laboratory
  - Tsinghua University
  - Montana State University

中美能源技术中心
US/China EETC

Tulane University

清華大學
Tsinghua University

LTI

Battelle
The Business of Innovation

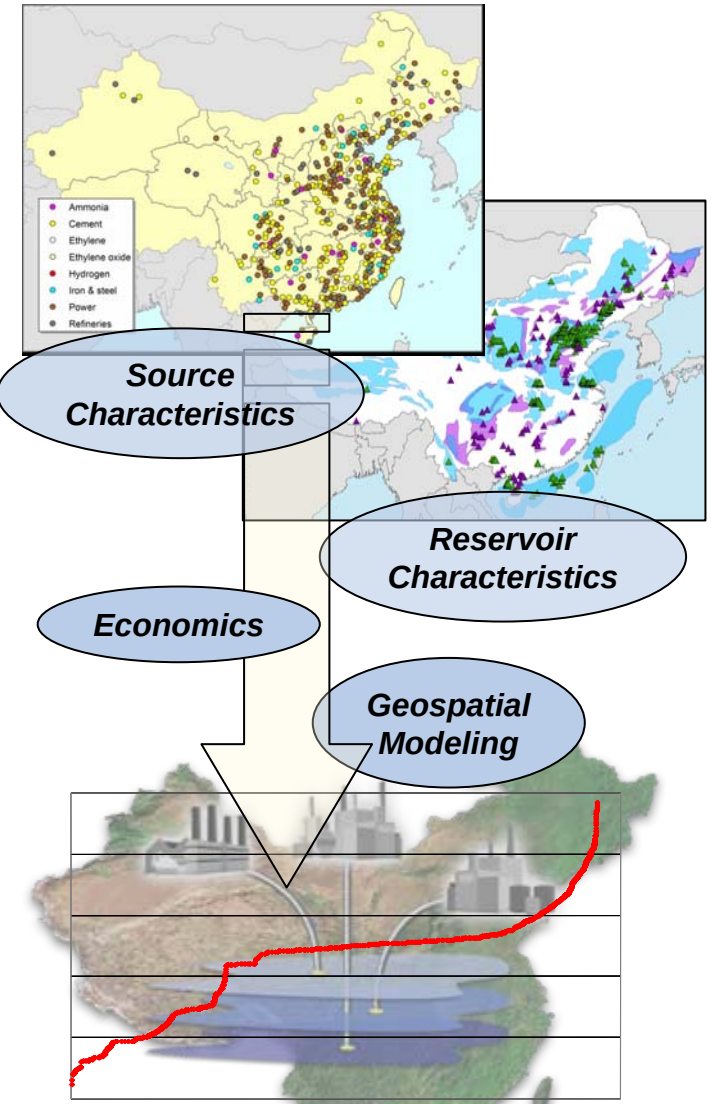
Pacific Northwest
NATIONAL LABORATORY

MONTANA
STATE UNIVERSITY

Project Objectives

- Develop the first ever bottom-up cost assessment of the potential to utilize carbon dioxide capture and storage (CCS) across the Chinese economy
- Assess the potential and costs for CCS technologies to deploy across regions of China
- Inventory large anthropogenic CO_2 point sources from power plants and other industrial sources
- Identify potential candidate geologic CO_2 storage reservoirs/basins which could be used for the safe, long-term storage of CO_2
- Examine the economics of CCS and develop cost curves for CO_2 transport and storage via optimized source-reservoir matching

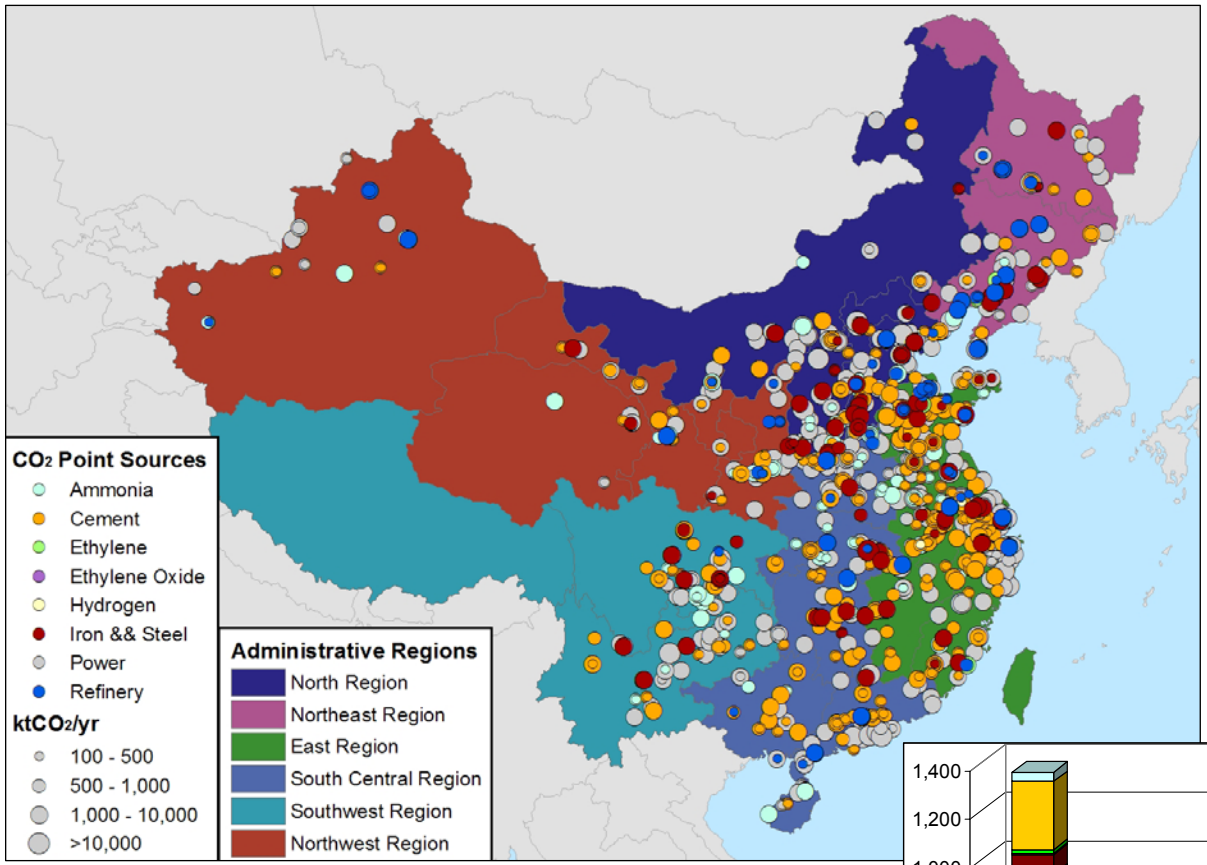
Project Overview



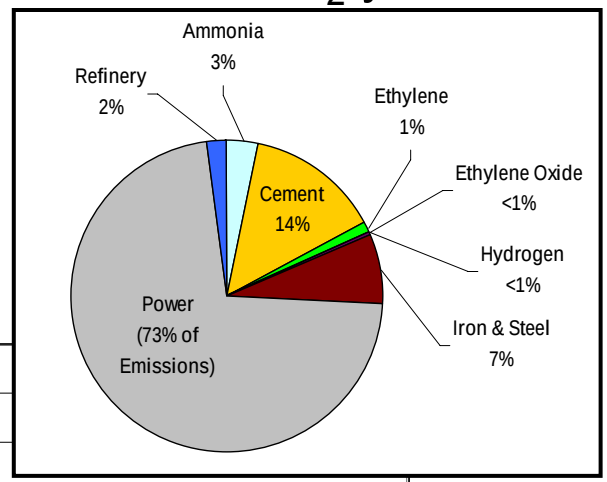
Sources + reservoirs + economics + analysis ⟶ cost curves

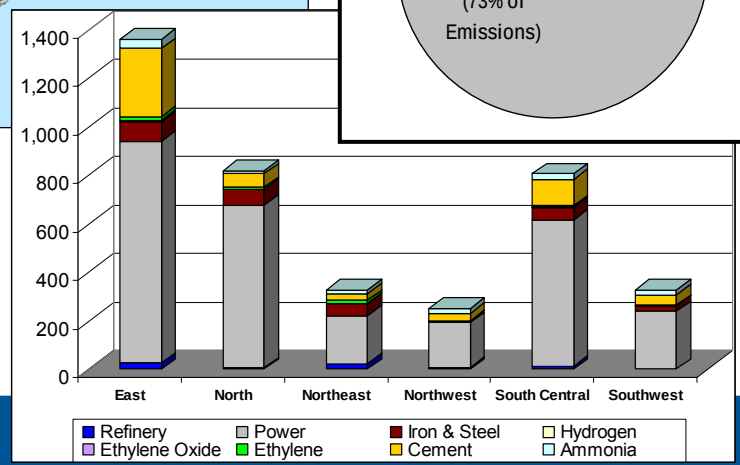
- A cataloging of existing CO_2 point sources and the following types of candidate CO_2 storage reservoirs:
  - Deep saline formations
  - Deep unmineable coal seams
  - Depleted oil and gas fields
- Incorporate data integrated into GIS modeling framework to enable integrated spatial and economic analyses
- Build CO_2 cost curve describing CCS potential versus cost
- Examine regional opportunities, economics, and technical constraints
- Collaborative effort drawing on wealth of team experience

Large CO_2 Point Sources in China

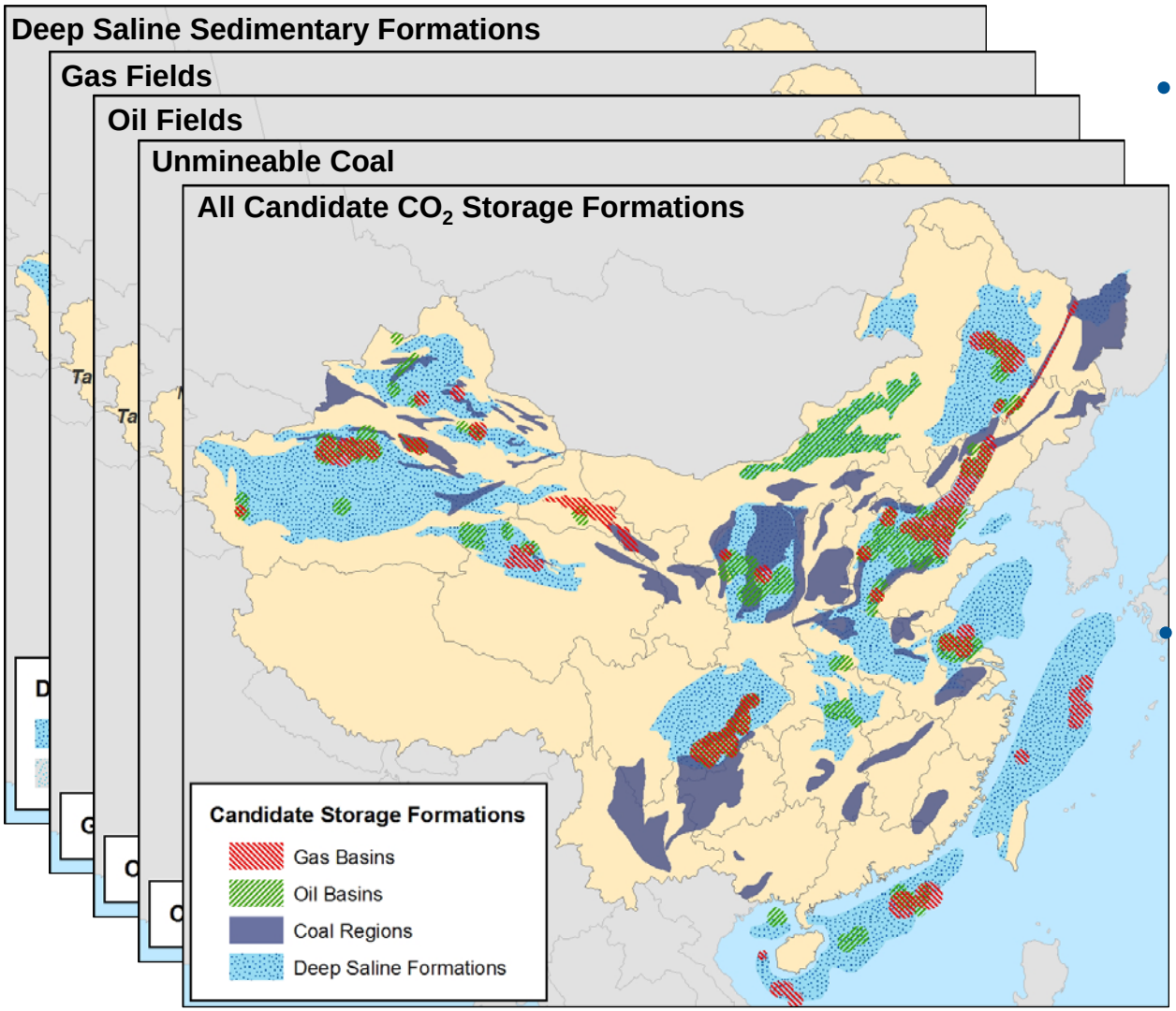


- Over 1,600 CO_2 sources (100+ $ktCO_2$/yr each)
- Total estimated CO_2 emissions from these large stationary sources: 3,890 $MtCO_2$/yr





Geologic CO_2 Storage Capacity



- Estimated Onshore Storage Capacity, $MtCO_2$:

DSF:	2,288,000
Gas:	4,280
Oil:	4,610
Coal:	11,970
TOTAL:	**2,309,000**

- Potential Offshore Storage Capacity:

780,000 $MtCO_2$

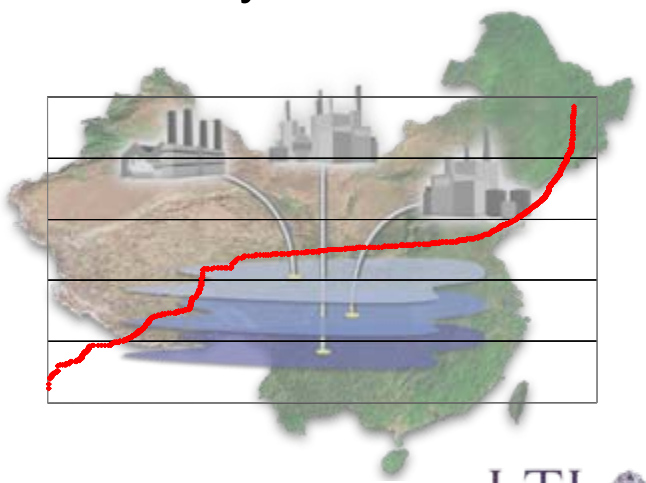
Cost Curves for CO_2 Transport & Storage

- Applied cost-minimizing optimization process developed and used previously for North American study
- Updated cost assumptions based on more recent published cost estimates
- Net Storage Cost =

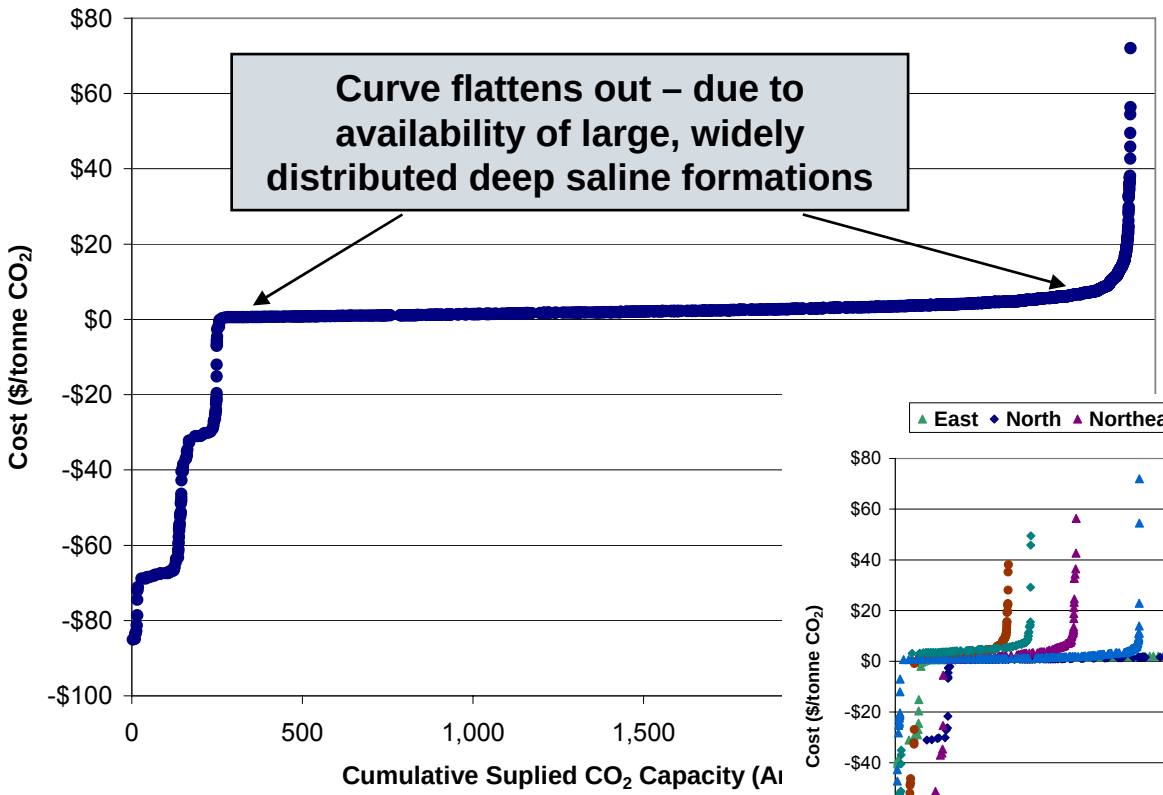
  Cost of Transport (via pipeline from plant gate)

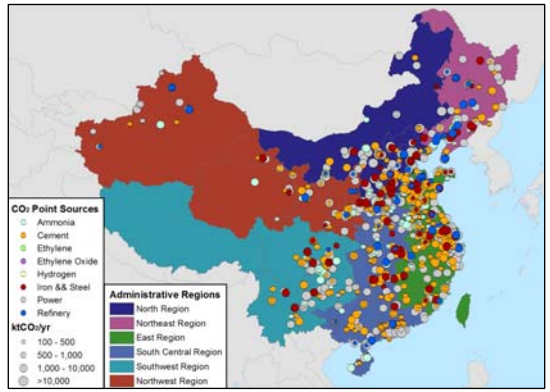
  + Cost of Injection (site characterization, capital, operating, & MMV)

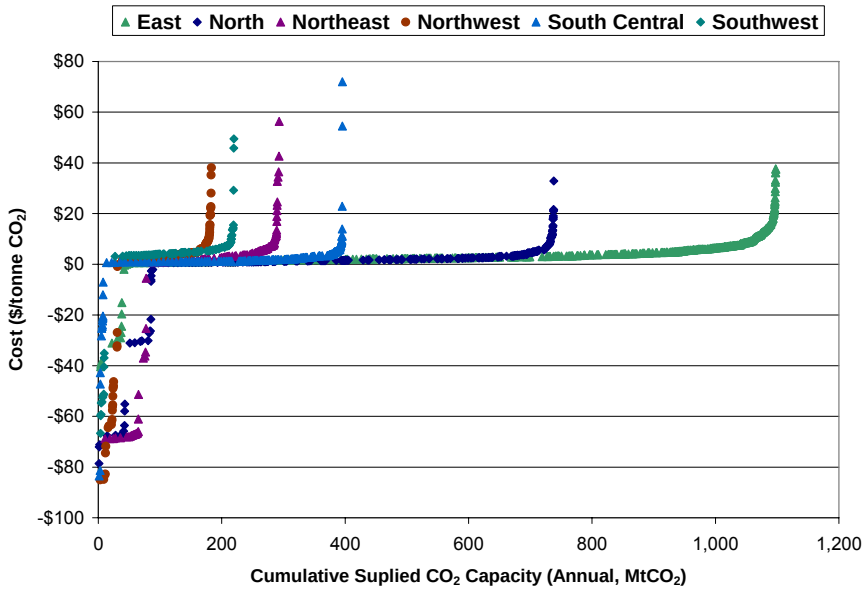
  - Revenue from Value-Added Hydrocarbon Recovery
- The cost curve methodology computes thousands of source-reservoir cost pairs for these point sources and candidate storage reservoirs, i.e., many CO_2 point sources will have many candidate storage options available within a reasonable distance.



Preliminary Cost Curve for CO_2 Transport & Storage in China







Summary of Results to Date

- Over 1620 large CO_2 point sources → 3890 $MtCO_2$/yr
- 2300 $GtCO_2$ potential storage capacity in onshore reservoirs
- There is strong potential for CCS technologies to offer significant emissions reductions in China, at transport and storage costs of up to about \$10/tCO_2
- Deep saline formations offer significant storage potential and 90% of the CO_2 stored in this analysis is injected into one of these
- This work represents an initial step; follow-on research is critical to further understand the technical and economic potential and challenges for CCS to help reduce the carbon emissions from the growing Chinese economy

Possible Next Steps

- Continue U.S. / China collaboration
- Expand and refine CO_2 point source inventory
- Further CO_2 storage reservoir evaluations and data collection
- Assess and refine costs and methodology
- Incorporate capture and compression costs
- Examine more closely the economics of offshore storage
- Look at challenges / potential technical and economic barriers to CCS deployment
- Start identifying potential candidates for more detailed evaluation / demonstration project
- More…