Capacity Building

Energy Resources

U.S. DEPARTMENT *of* STATE

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About the Handbook

A ‘how-to’ action guide to empower legislators, ministries, regulators, and NOC officials for understanding the policies, rules, and best practices that countries can adopt and implement for CCUS.

Available here:

cldp.doc.gov/carbon-capture-utilization-and-storage-ccus-resources

About the Handbook (Cont.)

- Sponsored by **U.S. Department of State, Bureau of Energy Resources.**
- Drafted over one week in an intense session with eight expert co-authors.
- Co-written by authors representing:
  - Government
  - NGOs
  - Multilaterals
  - Industry
  - Academia

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Key Takeaways

- Countries will need to ensure that all key actors – policymakers, regulators, project developers, and communities – have capacity. Capacity building is the process of developing and improving the local skills, knowledge, resources, and networks needed to advance the CCUS industry.
- An emerging CCUS industry can create sustainable jobs, but a CCUS workforce needs a broad range of science, engineering, legal, and other skills.
- Capacity-building activities include establishing CCUS testing and training centers, supporting RD&D activities, fostering internships, and facilitating career networks.
- Case studies from the U.S. and Norway show the importance and potential of capacity building facilities.

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CCUS Workforce Needs

The emerging CCUS industry has the potential to create many quality jobs and be an important part of a more sustainable global energy sector:

Workforce Needs for CCUS Projects	
Crosscutting	Project managers; health, safety, and environmental professionals; hydrologists; electrical engineers; civil engineers; economists; lawyers; electricians; welders; pipefitters; truckers; heavy equipment operators; site security; financial analysts; accountants; compliance officers; and community relations specialists.
Capture	Chemical engineers; mechanical engineers; air emission modelers; and process engineers.
Transportation	Rail engineers; rail conductors; dispatchers; pilots; captains; longshoremen; merchant mariners; pipeline construction and maintenance personnel.
Utilization	Chemists; sales and marketing; and materials engineers.
Storage	Geologists; geophysicists; petrophysicists; geomechanics; petroleum engineers; seismologists; hydrogeologists, geochemists, oil and gas service professionals; drillers and drill crews; well-completion engineers; and drill engineers.

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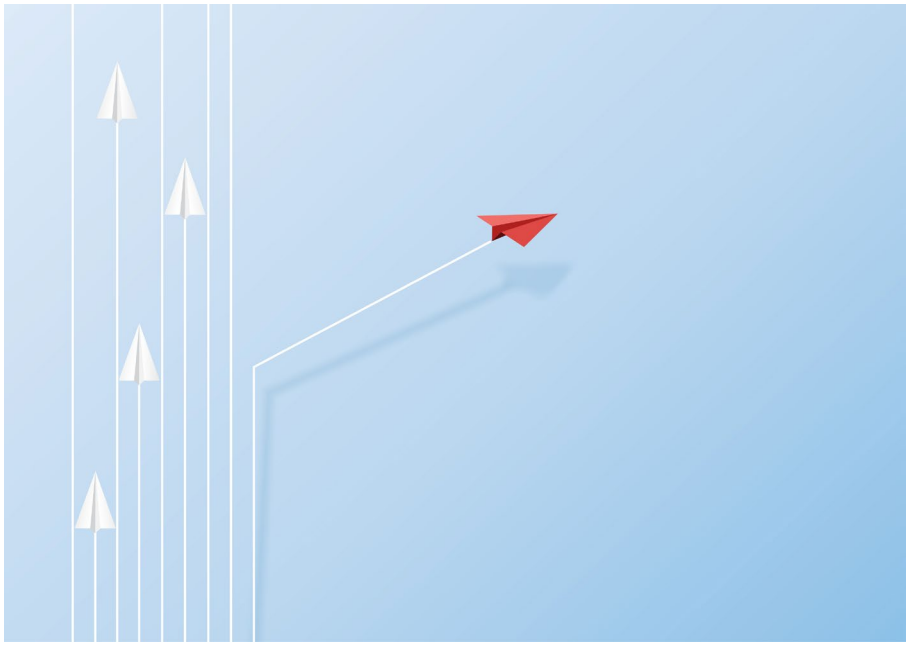
CCUS Workforce Needs: Challenges

- A range of technical and non-technical roles are required for CCUS
- Therefore, it is important to catalyze a CCUS industry that has strong workforce pipelines to universities, community colleges, vocational institutes, and specialty training programs
- Building strong networks is important to ensuring collaboration across complex projects that cut across the CCUS value chain.



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Develop a CCUS Workforce

Embed capacity building into project outreach

- Industry-government partnerships can support the development of know-how and leading practices through the successful implementation of CCUS projects, starting with small-scale field demonstrations and scaling up

Build strong networks

- Importance to build strong networks that support collaboration and communication across all roles required for a CCUS project, and the industry in general

Establish CCUS testing and training centers

- Technology centers offer the opportunity to test and advance CCUS technologies by providing a platform for cost-effective testing and development, and catalyzing larger-scale deployments

Case Study: India's National Centre of Excellence in Carbon Capture and Utilization

In 2021, India's Ministry of Science and Technology established the first National Centre of Excellence (NCoE) at the Indian Institute of Technology (IIT).

NCoE is a multi-disciplinary, long-term research, design development, collaborative, and capacity-building hub for state-of-the-art research for CCUS.

NCoE has developed novel, low-cost sustainable, and scalable methods for CO_2 capture and serves as an advisor and knowledge partner to multiple industries in the Indian government.

On a regular basis, NCoE organizes capacity building programs.

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Develop a CCUS Workforce

Support Academic Research

- Sustained government support for graduate school CCUS research is foundational to CCUS capacity building and workforce development

Develop Focused Training Experiences and Career Networks

- Focused training and education can be an excellent means of targeted learning to provide young professionals with a greater understanding of CCS

Case Study: Research Experience in Carbon Sequestration (RECS) – Capacity Building Model to Develop CCUS Leadership, Talent Pipeline & Career Network

In 2004, US Dept. of Energy supported the launch of RECS with the vision of building a CCUS workforce and creating a community of young professionals to help lead the emerging CCUS industry.

RECS is widely recognized as the premier CCUS education, training experience, and career network.

A core RECS principle is to focus learning activities at CCUS sites and build an understanding of the project lifecycle and commercial deployment considerations.

RECS serves as a successful model for other countries and jurisdictions to consider.

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Research, Development, and Deployment

- ✓ Supporting Technologies at All Stages of Development
- ✓ Continuing and Enhancing Early-Stage Research
- ✓ Broadening Research Scope and Application
  - → RD&D for Carbon Capture: RD&D could optimize and lower costs of existing commercial technologies and help develop second-generation technologies with improved economic and technical performance
  - → RD&D for Utilization Pathways: RD&D in storage and other utilization options is imperative for developing new CO_2 utilization markets and opportunities
  - → RD&D for Transport: RD&D activities can focus on improving safety, lowering costs, discovering new routes, and optimizing modes
  - → RD&D for Storage: Advancement in research is needed to improve upon commercial site characterization techniques, advanced computational tools for handling large volumes of data, and improved monitoring systems
  - → RD&D for Crosscutting Issues: RD&D expenditures can catalyze innovations and breakthroughs in CCUS tech

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Research, Development, and Deployment: Case Studies

National Carbon Capture Center (Courtesy of Southern Company)

Case Study: National Carbon Capture Center (NCCC) in Alabama

US Dept. of Energy and Southern Company operate NCCC, a research facility working to advance technologies to reduce greenhouse gas emissions from fossil-based power plants.

It offers a unique test bed for third-party evaluations of cost-effective CO_2 capture and conversion, bridging the gap between lab research and large-scale demonstrations and deployment.

NCCC has completed three carbon conversion tests to date, and performance data it has generated in its testing has validated lab data, allowing for engineering scale-up and driving breakthroughs in carbon management solutions.

CO_2 Technology Center Mongstad, Norway (Courtesy of Technology Center Mongstad, tcmda.com)

Case Study: Norway's CO_2 Technology Center Mongstad (TCM)

Since 2012, TCM has been available to national and international researchers and technology developers wanting to test and verify CO_2 capture technologies, component testing, and problem-solving.

One of its most important contributions is testing out and verifying technologies before commercialization. To date, 23 test campaigns have been conducted.

TCM has produced many publications to the benefit of industry, regulators, and academia. TCM provides ample opportunity to build capacity for researchers in Norway and abroad.

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