Overview of Carbon Utilization Analysis at NETL

2019 Carbon Capture, Utilization, Storage, and Oil & Gas Technologies Integrated Review Meeting

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Systems Engineering and Analysis
Outline

• Systems Engineering and Analysis

• Carbon Utilization Techno-Economic Analysis Overview
  • Performance Metrics Establishment / Evaluation
  • TEA Guidance Document

• Carbon Utilization Life Cycle Assessment
  • LCA Guidance Document / Toolkit
Systems Engineering and Analysis
at the National Energy Technology Laboratory
Systems Engineering and Analysis

Role of SEA Directorate at NETL

• How do research and development efforts at NETL contribute to enabling carbon utilization technology?

• Systems Engineering and Analysis
  • Informs program of technology potential
  • Assists in setting programmatic goals
  • Assess markets

• Research and Development Efforts
  • Directly addresses programmatic goals
  • Direct interaction with commercial developers
  • Multi-disciplinary, collaborative effort
Carbon Utilization Techno-Economic Analysis
Performance Metrics Establishment / Evaluation
Carbon Utilization Technologies

Metrics Assessment

• Purpose:
  • To examine a specific utilization technologies with respect to Program- and project-level metrics
  • Perform sensitivities to provide guidance on technology specific parameters/targets
Carbon Utilization Performance Metrics

Example of Potential Metrics

• **Required Purchase Price:**
  • Maximum Price purchaser is willing to pay for CO₂ [$/ton]

• **Notional Energy Penalty:**
  • Energy required to convert CO₂ into end product [kJ/mol CO₂]

• **Cumulative Market Value:**
  • Projected annual market value of CO₂-derived product [$/y]
Carbon Utilization Performance Metrics
On-going NETL Efforts

• Apply specific carbon utilization performance metrics as part of a screening assessment on:
  
  • Electrochemical-based CO₂ conversion technology
  
  • Algae-based CO₂ conversion technology
  
  • Mineralization-based CO₂ conversion technology
Carbon Utilization Techno-Economic Analysis
Guidance Document
NETL TEA Guidance Document

Objectives

• Develop a consistent method for evaluating the relevant technical and economic parameters of carbon utilization technologies

• Generate a public guidance document (addition to the Quality Guidelines for Energy System Studies [QGESS] report series) for conducting techno-economic analyses on carbon utilization technologies

• Maintain consistency with other TEA guidance documents (e.g. Global CO₂ Initiative TEA Guidance) and NETL’s Life Cycle Analysis guidance document / toolkit for carbon utilization technologies
• Currently, no consistent method exists for evaluating carbon utilization technologies found within the Department of Energy portfolio

• Majority of studies use an adaptation of cost development and scaling documents for power plants
  ◦ Limited based on applicability to the system being evaluated
  ◦ Wide variability can ensue based on assumed scaling parameters

• Metrics developed for cost and performance of the carbon utilization system are available, NETL metrics to follow
Complementary Documents

- **QGESS: Cost and Performance Metrics Used to Assess Carbon Utilization and Storage Technologies**
  - Includes 5 performance metrics, 3 cost metrics, 2 emissions metrics, and 1 market metric

- **QGESS: Cost Estimation Methodology for NETL Assessments of Power Plant Performance**
  - Summarizes financial parameters selected for various power, chemical, and fuels applications used for NETL system studies

- **QGESS: Capital Cost Scaling Methodology**
  - Summarizes cost scaling method used for NETL system studies
The NETL CO₂U LCA Guidance Toolkit

Overview

• Supports funding recipients with their LCA requirements
• Simplifies the process of LCA
• Improves consistency in communicating results
• Toolkit site: netl.doe.gov/LCA/CO2U
The NETL CO₂U LCA Guidance Toolkit

Guidance and Support

GUIDANCE DOCUMENT
Analysis requirements and instructions for using the supporting data and tools

Starting point for understanding LCA requirements

OPENLCA MODEL TRAINING
Provided to funding recipients to aid in modeling an LCA in openLCA

Training videos and live webinars will be available as developed at netl.doe.gov/LCA/CO2U

SUBJECT MATTER EXPERT SUPPORT
Available to funding recipients for all phases of the LCA from conception to documentation

Contact us with questions at LCA@netl.doe.gov
The NETL CO₂U LCA Guidance Toolkit

Summary

GUIDANCE DOCUMENT
Analysis requirements and instructions for using the supporting data and tools

DOCUMENTATION SPREADSHEET
Excel file that can be used to document data when not using openLCA

TRAINING RESOURCES
Provided to funding recipients to aid in modeling an LCA

openLCA LCI DATABASE
openLCA database that includes NETL unit process data and an example CO₂U LCA

openLCA CONTRIBUTION TOOL
Excel template that translates openLCA results into required charts

LCA REPORT TEMPLATE
Word report template for summarizing data and results

NETL CO₂U LCA GUIDANCE TOOLKIT

SUBJECT MATTER EXPERT SUPPORT
Available to funding recipients for all phases of the LCA from conception to documentation

visit netl.doe.gov/LCA
email LCA@netl.doe.gov
download toolkit netl.doe.gov/LCA/CO₂U

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Carbon Utilization Analysis

Future Efforts

• Expand upon screening analyses with full techno-economic (and life cycle) analyses

• Public dissemination of NETL carbon utilization metrics

• Release of NETL Carbon Utilization TEA guidance document (est. March-April 2020)

• Release of NETL Carbon Utilization LCA toolkit (est. before December 2019)
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