Overview of Carbon Utilization Analysis at NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

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

Gregory A. Hackett, Ph.D. NETL Research and Innovation Center August 30, 2019

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

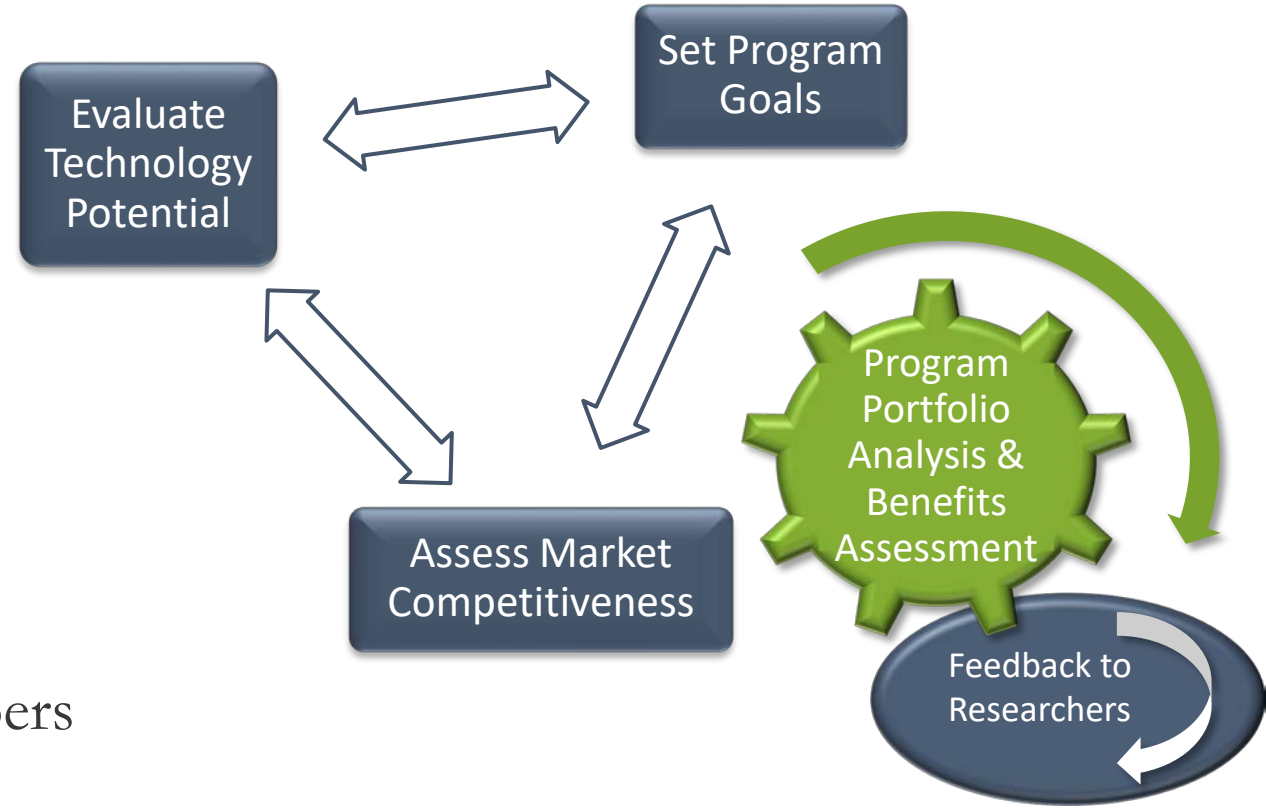
Systems Engineering and Analysis

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 CO_2 [$/ton]
- **Notional Energy Penalty:**
  - Energy required to convert CO_2 into end product [kJ/mol CO_2]
- **Cumulative Market Value:**
  - Projected annual market value of CO_2-derived product [$/y]

Carbon Utilization Performance Metrics

On-going NETL Efforts

- **Apply specific carbon utilization performance metrics as part of a screening assessment on:**
  - Electrochemical-based CO_2 conversion technology
  - Algae-based CO_2 conversion technology
  - Mineralization-based CO_2 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 CO_2 Initiative TEA Guidance) and NETL's Life Cycle Analysis guidance document / toolkit for carbon utilization technologies

NETL TEA Guidance Document

Background

- **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**

NETL TEA Guidance Document

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

NETL QGESS Document Access

Carbon Utilization Life Cycle Assessment

LCA Toolkit

The NETL CO_2U 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 CO_2U 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

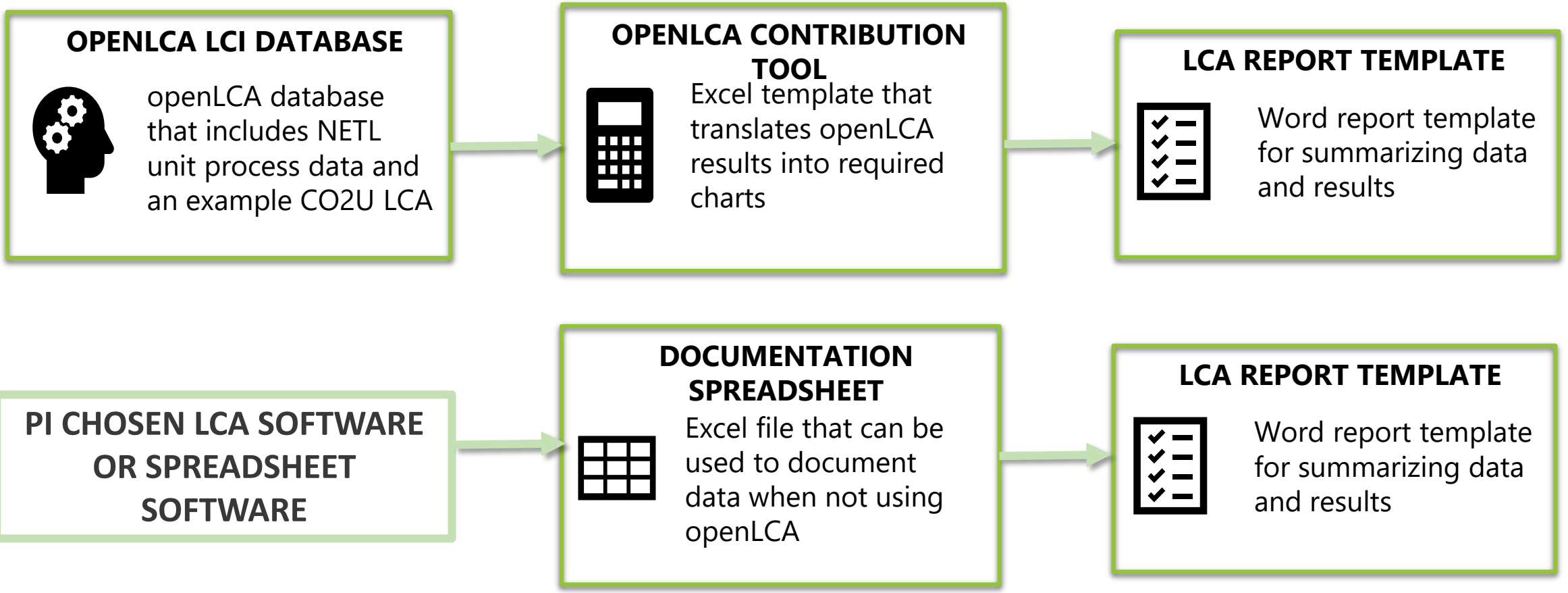
SUBJECT MATTER EXPERT SUPPORT

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 CO_2U LCA Guidance Toolkit

Tools and Pathways to Complete LCA



The NETL CO_2U LCA Guidance Toolkit

Summary

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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  - Alex Zoelle, Matt Adams, Alex Eggleston [TEA]

Contact Information

Gregory A. Hackett
National Energy Technology Laboratory
Gregory.Hackett@netl.doe.gov
304-285-5279