Funding Opportunity:

Developing Pathways for Integrating Low-Carbon Solutions into Existing Infrastructure for a Net-Zero Emissions Economy

Announcement Details

The Net Zero Infrastructure Program (NZIP) is seeking responses to a funding opportunity for the exploration of various decarbonization scenarios, including baseline trends, renewable natural gas (RNG) production, synthetic natural gas (SNG) with carbon capture utilization and storage (CCUS), and low-carbon hydrogen production, in alignment with federal goals of emissions reduction[1]. The work will elucidate the specific infrastructure needs of the 5 major regions in the US to achieve stated decarbonization goals (Figure 1). Including the impact of recently announced initiatives, like Hydrogen Hubs, is crucial to distinguish this study from others. The first region to be studied is the Gulf Coast, which includes Arkansas, Louisiana, New Mexico, Mississippi, Alabama, and Texas.

Responding entities should submit full proposals for the project by **09/15/2024**. One **$250,000** award will be made for a one-year project**.**

Background

The Net-Zero Infrastructure Program (NZIP) is a GTI-Energy-led three-year research collaboration that aims to provide insights on how to best utilize natural gas (NG) infrastructure to accelerate the transition to net-zero energy systems and achieve ambitious, economy-wide decarbonization. As part of this program, case studies for five U.S. regions will be performed to compile available data related to regional gas infrastructure characteristics and provide actionable recommendations on potential pathways for achieving net-zero emissions by 2050 (**Figure 1**). These case studies will include a range of techno-economic and life cycle analyses in addition to scenario modeling to provide data and insights in support of a holistic roadmap for decarbonization. The selection of decarbonization pathways for the Gulf Coast Region was informed by this policy summary and in the first NZIP white paper, *Natural Gas Infrastructure in the United States: Evolving Towards a Net-Zero Emissions Future*[2]. These pathways include renewable natural gas (RNG), low-carbon hydrogen, and synthetic natural gas (SNG) with and without carbon capture, utilization, and storage (CCUS).

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[1] 2030: Overall emissions reductions of 50-52% compared to 2005
2035: Achieve zero carbon electricity generation
2050: Net zero overall emissions

[2] NZIP, 2023. Natural Gas Infrastructure in the United States: Evolving Towards a Net-Zero Emissions Future. Source.

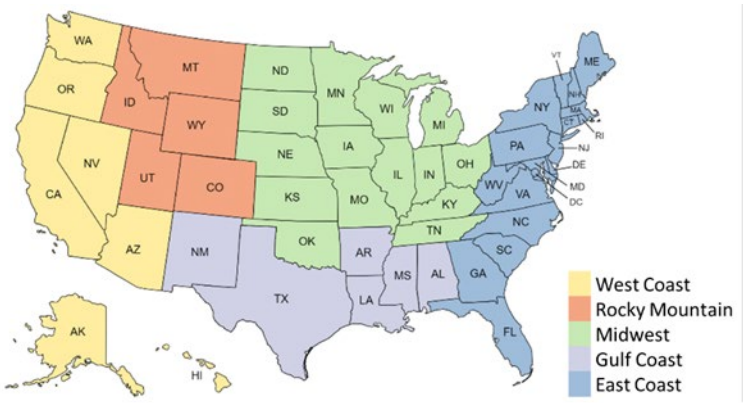


***Figure 1**: Regions of the United States to be examined in the NZIP Regional Case Studies.*

Primary Study Objectives

The funded work shall achieve the following three primary objectives for each of the 5 U.S. regions, beginning with the Gulf Coast Region:

- **Regional Infrastructure:** Develop detailed mapping and an assessment of existing energy infrastructure in the region, including pipelines, storage facilities, and production units.
    - Please elaborate on capability to incorporate infrastructure data provided by GTI Energy.
- **Region-Specific Infrastructure Assessment**: Develop a detailed assessment of the existing infrastructure for NG, hydrogen, RNG/SNG, and CCUS as well as a detailed feasibility of retrofitting existing infrastructure.
    - Please elaborate on the pipeline and facilities data available for use for this project.
- **Locational Optimization within the Region:** granular (GIS-based mapping and locational optimization) approach for major pipeline and storage infrastructure, along with production and demand clusters.

Project Work Requirements

Data Sources

A number of data types need to be solidified in order to provide a strong base for the modeling.

- Detailed assessment of the feasibility of retrofitting existing infrastructure (pipelines, storage facilities, production units)
    - Hydrogen
    - NG
    - Carbon dioxide (CO2)
- Resource availability analysis, including evaluation of locally available natural resources (natural gas, biomass, etc.) and the availability of feedstocks to produce RNG and SNG (e.g. landfill, dairies)
- Assessment of renewable energy production potential (solar, wind) and nuclear
- Demand estimates
    - Hydrogen
    - NG

    - CO_2
- Security of supply and reliability indicators (for all pathways): compile and report explicit security of supply and reliability indicators of alternate pathways in comparison to NG. The aim of these indicators is to provide an understanding that supply of end users will not be endangered due to repurposing.

Analysis

Techno-economic analysis (TEA)

Complete TEA models that incorporate local market conditions, resource availability, and infrastructure constraints in the region.

- Resource costs (inputs)
    - NG
    - Fossil electricity (coal, NG)
    - Renewable electricity (wind, solar, biomass, hydroelectric)
    - Nuclear
- Synthetic fuel costs (results)
    - Hydrogen (steam methane reforming (SMR), autothermal reforming (ATR), partial oxidation (POX), pyrolysis, with/without CCS, electrolysis)
    - RNG (manure, landfill, municipal solid waste (MSW), wastewater)
    - SNG

Life cycle analysis (LCA)

- Synthetic fuel pathway emissions
    - Hydrogen (SMR, ATR, POX, pyrolysis, with/without CCS, electrolysis)
    - RNG (manure, landfill, MSW, wastewater)
    - SNG

Cost-Benefit Analysis (CBA)

This analysis compares the costs and benefits of repurposing an existing NG network asset with the construction of new hydrogen/RNG/SNG/CCS network infrastructure and compares with the cost of decommissioning.

Modeling Assumptions and Approaches

The modeling structure will be specific to the NZIP. A detailed description of this model, including its assumptions, strengths and weaknesses, must be included in the deliverables. Please elaborate on if the assessment model can be shared as a deliverable.

The analysis will be conducted using cradle-to-grave (CTG) life cycle boundaries. The boundaries include all the upstream feedstock and fuel supplement, onsite NG/RNG/SNG or hydrogen production, NG/RNG/SNG and hydrogen transportation, and end use of NG/RNG/SNG or hydrogen.

Segment assumptions:

- Upstream feedstock and fuel supplement includes all the costs and emissions for the feedstock and fuel supplement;
- Onsite NG or hydrogen production includes all the costs and emissions for NG, RNG, SNG, or hydrogen production;
- NG and hydrogen transportation includes costs and emissions for NG, RNG, SNG, and hydrogen transportation using existing pipeline, retrofit pipeline, greenfield pipeline;
- End use of NG or hydrogen includes the application of NG, RNG, SNG, or hydrogen in industrial, power generation, transportation, residential, and commercial buildings.

Scenarios

The scenarios generated for this case study will explore the effect of bolstering individual fuel types.

1. ***Business As Usual (BAU) case***

Developed in collaboration with GTI Energy, includes detailed pipeline lengths and locations, leakage, market price, and future projection. As described in Data Sources, incorporate data on the state of current infrastructure collected by GTI Energy as applicable, and combine additional data sources as needed.

   - Sub-scenario #1: Annual Energy Outlook 2023 Reference case with no Inflation Reduction Act considerations
   - Sub-scenario #2: Low Oil and Gas Supply case to simulate scenario with high success of low-carbon technologies reducing gas supply
   - Sub-scenario #3: High Economic Growth-High-Zero-Carbon Technology Cost case to represent a restricted ability to sequester CO2

2. ***Renewable natural gas (RNG) case***

This scenario will use two or three most available feedstock types in each region to evaluate the production cost and transported using existing gas pipelines.

3. ***Low carbon hydrogen case***

This scenario will compare five low-carbon hydrogen production technologies of:

- SMR and ATR w/NG with CCS;
- SMR and ATR w/RNG without CCS;
- SMR and ATR w/RNG with CCS;
- Pyrolysis;
- Electrolysis with low carbon electricity (solar, wind, nuclear, hydro, bioelectricity).
   - Please elaborate if hydro and bioelectricity cost information is available for use on this project.

The applicant will need to supply data for hydrogen production capacity, cost, and life cycle GHG emissions. An additional area of research will be the cost of hydrogen transportation in existing gas pipelines and greenfield hydrogen pipelines.

4. ***Synthetic natural gas (SNG) case***

In this case, SNG will be produced from hydrogen (solar, nuclear wind, hydro, bioelectricity electrolysis) and CO2 sources from industrial processes and power generation plants. SNG production capacity, cost, and life cycle GHG emissions according to the availability of CO2 sources including the cost for CO2 transportation and storage will be evaluated.

Deliverables

Deliverable 1 (3 months)

There must be a concrete deliverable by the end of Month 3. This will be *a report/memo* on intermediate progress on finalization of data sources and other calculations. The discussion can also include future strategies for incorporating this data into the optimization model. This deliverable will not be a final summary of one or more case scenarios. Milestones include:

- The current state of regional infrastructure and resource availability.
- An overview of techno-economic considerations specific to the Gulf Coast
- Demand estimates by sub-regional zone (by state or other sub-regions)
- Completed scoping of BAU case, evaluate cost and emissions from fuel production and delivery in each state
- Evaluate the costs of low-carbon hydrogen, RNG, and SNG in each state (with state-specific details)
- Evaluate the cost and emissions of current, retrofit, and greenfield pipelines in the Gulf Coast
- Evaluate cost and emissions of NG and hydrogen utilization in various end-use applications
- Using the state-specific data, build scenarios for RNG, SNG and low-carbon hydrogen to eliminate potential options for decarbonization
- Map the data in the region to show the regional integration potential of hydrogen demand and supply
- Provide recommendations on investments that help support adoption of RNG, SNG, hydrogen, and CCUS
    - Recommendation and conclusion on the operational possibility or net benefit (cost vs emission reduction) of repurposing existing infrastructure for particular demand sector using particular pathways (for example: for hydrogen pathway in industrial sector).

Deliverable 2 (6 months)

The final deliverable of modeling findings will cover the described set of regional infrastructure scenarios with detailed outlook and analysis of opportunities aligned with local utilities. Modeling results will describe options for regional infrastructure buildout, highlighting the strengths, weaknesses, gaps, and future extensions of each scenario. This deliverable will include:

- Report/memo detailing data sources, modeling approach, model findings, and recommendations
- Presentation summarizing report/memo
- Data files with results of optimization models (generation, consumption, cost, and emission results)
- Identify multiple infrastructure corridors and scenarios for hydrogen, RNG, SNG
- Identify regional-level infrastructure corridors from production to consumption and the type of infrastructure buildout required, incremental to existing NG infrastructure.

Specific milestones for this deliverable include:

- Implement the regional optimization model to find the most economic supply chain in Gulf Coast
- Map all the data in U.S. maps to guide future investments

Deliverable 3 (12 months)

- Extend all the work in the Gulf Coast to the rest of the U.S. (the other four regions)
- Provide region-specific recommendations on investments that help support the adoption of RNG, SNG, hydrogen, and CCUS

Eligibility Criteria

The solicitation is open to public and private entities. A multi-disciplinary research team comprising two or more entities is acceptable, however, the project will be contracted to the "lead- entity." The ideal team will combine skills, experience, and demonstrated expertise in:

- Net-zero energy system modeling and optimization
- Infrastructure (pipeline and storage) assessment for low-carbon fuels
- Techno-Economic Assessment (TEA) and Life-Cyle Analysis (LCA)

Important Information for Applicants

RFP Release Date: 08/08/2024

Deadline to submit proposals: 09/15/2024

Anticipated Award Date: 10/01/2024

Anticipated Project Start Date: 11/01/2024

Anticipated Period of Performance: 12 months

Submit proposals to: nzip@gti.energy

Available Funding: $250,000 (no matching funds are required)

Contacts

For additional information on the program and to access the informational public webinar please visit https://nzip.gti.energy/

Questions on the funding opportunity should be directed to:

Hon Xing Wong
NZIP Executive Director
nzip@gti.energy

Proposal Package Requirements

Proposals should not exceed 20 pages in length and must include the following:

- Point of Contact (name, title, business address, phone, email)
- Executive Summary (project description, team members)
- Scope of Work (goals, objectives, technical approach and methods to be used, task level descriptions, deliverables and milestones)
- Budget (breakdown by task, labor, M&S, subcontractors, consultants). The contract will be fixed-priced based, labor rates should be included in the proposal
- Schedule
- Team Qualifications (include relevant work and publications, similar project experience, resources and capabilities)