

2023 DOE Vehicle Technologies Office Annual Merit Review

Project Sila: An Arctic CNG Pilot Test Program

Principal Investigator: Keith Patterson

Presenter: Troy Tempel

Company: ASRC Consulting & Environmental Services, LLC
(ACES)

Date: 4/14/2023

Project ID: TI152



Timeline

- Start: March 2022
- End: July 2025
- Percent Complete: 30%

Budget

- Total Project Funding
 - DOE Share: \$1,064,076
 - Cost Share: \$1,064,076
- Total Expended
 - DOE Share: \$221,880
 - Cost Share: \$221,880

Barriers

- CNG operations in low temp Arctic environment
- High CO₂ content in fuel
- Operator and maintenance acceptance

Partners

- Onboard Dynamics
 - GoFLO Natural Gas Compressor
 - GoFILL CNG Refueler
- PAPE' Kenworth
 - Kenworth T880 Trucks (ISX12-G)
 - Agility Fuel Systems CNG Upfit

Objectives

- Pilot test CNG upfitted HD trucks
- Install Arctic rated CNG fueling station
- Reduce carbon emissions
- Benchmark CNG vs. diesel performance

VTO Technology Integration Goals

- Improves fuel diversity with an underutilized source
- Increased local resiliency with a readily available fuel source
- Potential to reduce greenhouse gas emissions through alternative fuel use

Impact

- Pilot project will document the feasibility of CNG operations in the Arctic Resiliency
- Addresses concerns with a high CO2 fuel source
- Provides training to both operator and maintenance personnel on CNG operation, with the potential to deploy this technology to other parts of the North Slope

Budget Period 1

Procurement & Install:

- Vendor and equipment selections
- Arctic and CNG upfitting
- Factory acceptance testing
- Shipping
- Compression equipment install and tie-in
- Truck delivery

Budget Period 2

First Year Operation:

- Equipment troubleshooting
- Maintenance and shop training
- Operator training
- Data collection

Budget Period 3

Second Year Operation:

- Continue vehicle and equipment operation
- Continue data collection
- Prepare data analytics report regarding CNG vs. Diesel operation
- Assess the project objectives and make recommendations regarding continued operation

✓ Equipment Procurement

- Off-the-shelf designs
- Order submitted March 2023

✓ Compressor Design

- Actively worked with Onboard Dynamics
- Arctic and CO2 barriers

✓ Compressor Location

- Site plan drafted, need to finalize with tie-in locations
- Onboard Dynamics allowed for flexible install

✓ Truck Procurement Cost

- Trucks were within budget
- Go

✓ Truck Procurement

- Order submitted with PAPE' Kenworth March 2023
- Go

Truck Delivery to AK

- Truck delivery not anticipated to be an issue
- Go

Compressor Installation

- Compressors will be tested and staff training will occur at Onboard Dynamic's facility
- Minimal install scope (no electrical or permanent foundation necessary)



Commission Equipment

- Test compressors & fill station
- Test trucks and benchmark

Equipment Operations

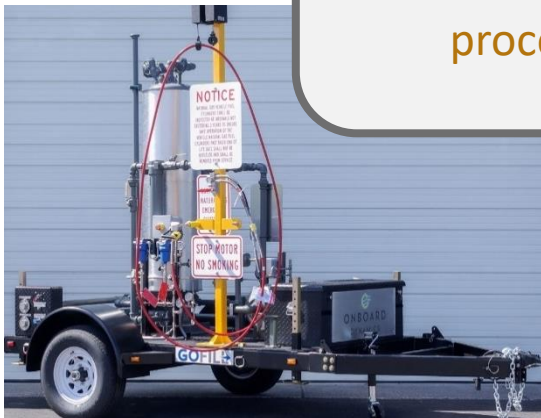
- Begin full time operations
- Includes compressor, refueling station, and trucks

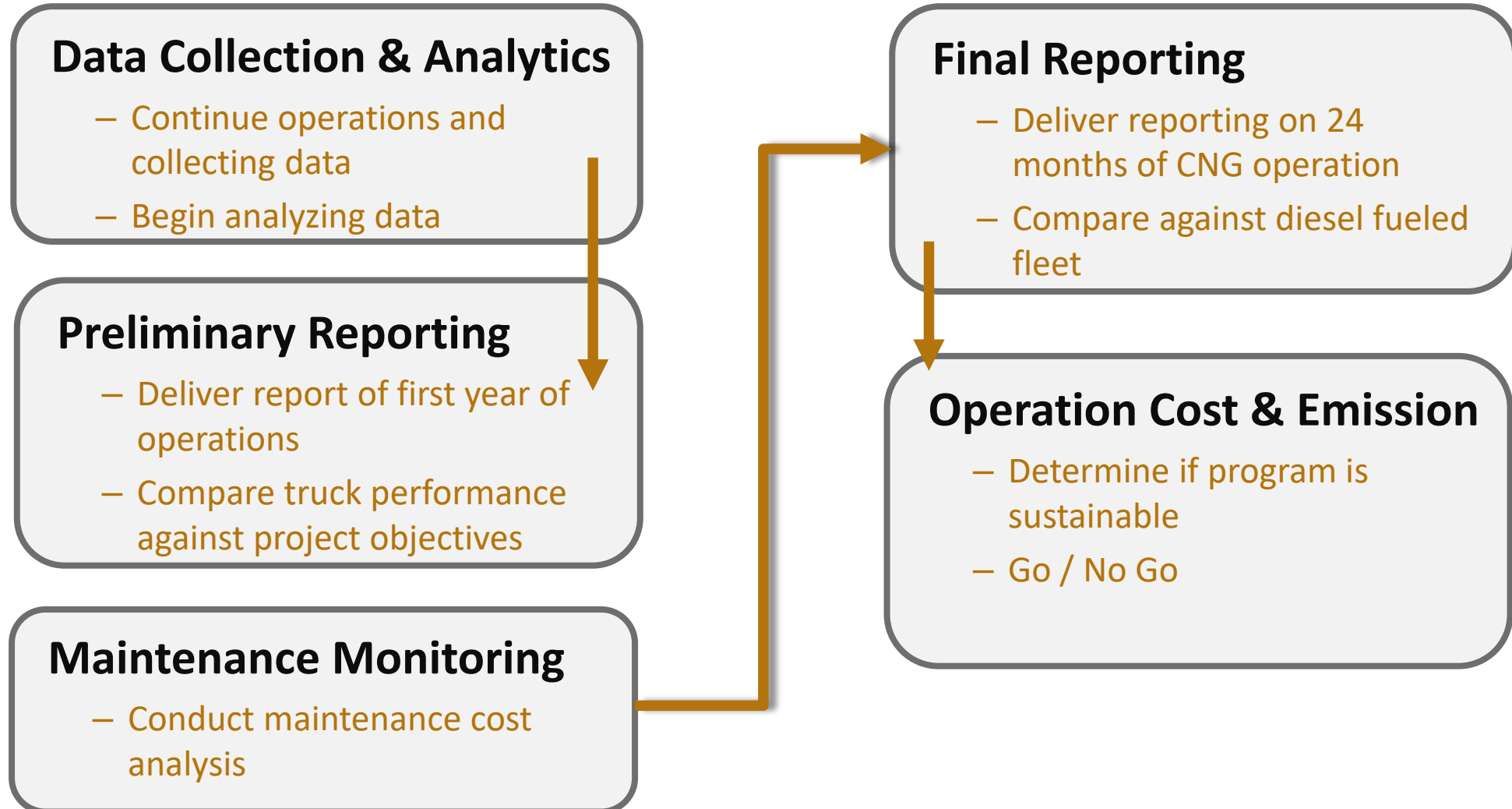
Operator Training

- Compressor training
- Train drivers on filling procedures

Equipment Reliability

- Monitor performance
- Refine best practices for monitoring (fuel consumption, emissions)





Prudhoe Bay natural gas contains high CO₂ content

- 12% CO₂ as produced from the reservoir
- Minimal treatment infrastructure exists
- High compression pressure can cause carbonic acid to form

CNG Compression Vendors

- High CO₂ content was a concern for several CNG vendors
- Most required additional gas scrubbing

Onboard Dynamics

- GoFLO Compressor operates at slightly lesser pressure
- Will utilize corrosion resistant materials
- Operates much differently than traditional gas compressors
- No major electrical demand



Prudhoe Bay design temps down to -40F

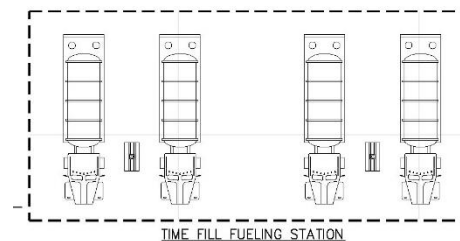
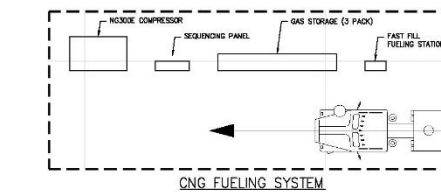
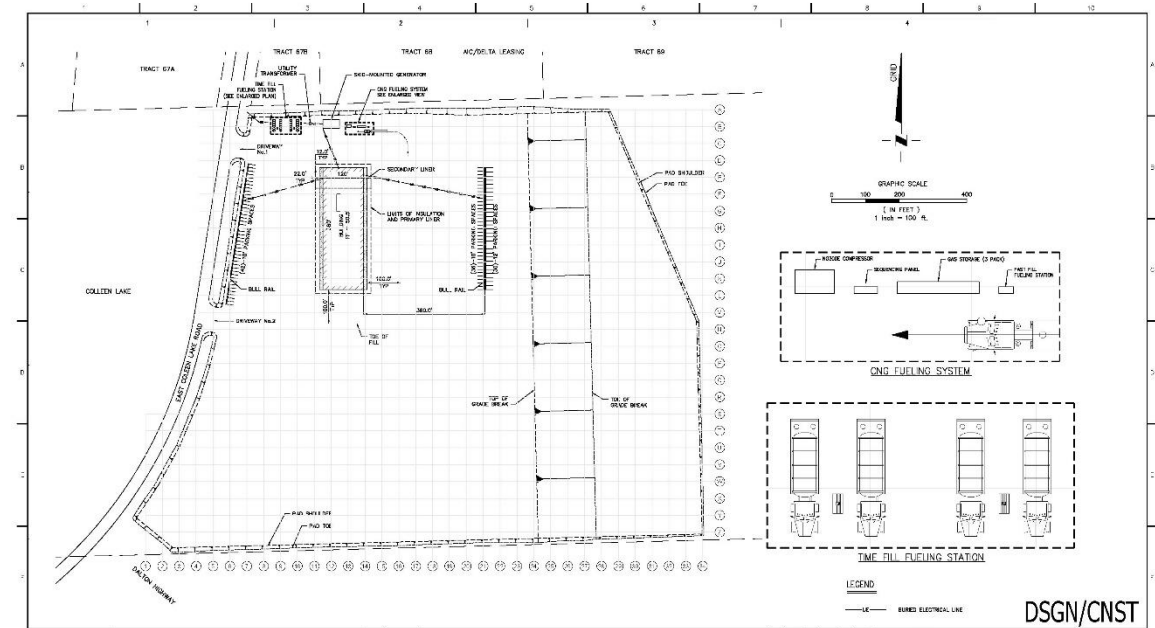
- Majority of CNG compression units would require additional heating to maintain -20F operating temp
- GoFLO compressor design can utilize a traditional block heater and battery blankets, commonly used in Prudhoe Bay

Weather Resistant Enclosure

- GoFLO unit is naturally weather resistant by design, additional insulation and heat trace may be included

Permafrost Install

- GoFLO unit is installed with compact legs
- Minimal heat transfer to the pad and permafrost
- Traditional compressor would require a thermosiphon concrete pad or insulated pilings



Collaboration & Coordination Among Project Team



Lead Organization:

- ASRC Consulting & Environmental Services, LLC



Partner Organizations:

- Onboard Dynamics: CNG compression equipment
- PAPE' Kenworth: CNG trucks
- Agility Fuel Systems: CNG upfitting
- Norgasco Inc: Natural gas utility



Community Partners

- Arctic Slope Regional Corporation



The North Slope of Alaska :

- Arctic Slope Regional Corporation consists of 7 communities, three of which have natural gas sources
 - Barrow, Wainwright, Atqasuk, Nuiqsut, Kaktovik, Pt. Lay, and Pt. Hope
- Utilizing a local fuel source will drastically reduce vehicle fueling costs and emission output
 - Diesel is currently barged up seasonally
- Air quality will be further increased as commercial fleets transition to CNG source



Communities and Fleets Affected: The North Slope of Alaska



Goals

- Pilot test CNG upfitted heavy duty trucks
- Install & operate an Arctic rated CNG fueling station
- Share the emissions & performance info with local communities

Current Progress

- Compression equipment selected and on order
- Trucks on order
- Preliminary install and layout plan

Upcoming

- Compression equipment install
- Truck delivery
- Commissioning and training
- Operation