RD&D
COMPLETED PROJECTS

JANUARY 2023

SUMMARIES FOR ALL PROJECTS COMPLETED IN THE LAST QUARTER

UCI Low Cost Sensors for Smart Burners Research

Program: Clean Generation
Sub-Program: Distributed Generation

Benefits
Reduced Greenhouse Gas Emissions, Improved Air Quality, Operational Efficiency, Reliability

Start Date
August 1, 2019

End Date
October 30, 2022

Total Project Cost
$136,500

Total SoCalGas Cost
$136,500

Total Co-Funding
N/A

The objectives of this project were to evaluate the robustness and accuracy of low-cost sensors (<$500) for emissions and fuel composition that the industry can integrate into the overall control systems of low-emissions devices (e.g., nitrogen oxides (NOx) from microturbines "smart" appliances). The project team explored two areas of interest: 1) sensors for monitoring exhaust emissions (particularly NOx and O2) and 2) sensors associated with monitoring the hydrogen content of hydrogen-natural gas mixtures. The project team compiled possible sensors that they could use to improve the performance of combustion devices in light of variable fuel composition. The team created a summary of possible sensors, and several candidates for evaluation were selected. Off-the-shelf, low-cost sensors were not available for pipeline measurement of hydrogen content. As a result, components associated with electrochemical and acoustic principles were selected for fuel composition and modified to incorporate them for use in a flowing pipeline. The team identified low-cost automotive sensors for evaluation of NOx and CO monitoring, though the design ranges of the devices available are for relatively high emissions (> 100ppm). The team developed testbeds to evaluate the candidate sensor performance. Regarding fuel composition, both technologies responded appropriately to flowing hydrogen/natural gas mixtures. Electrochemical-assessed sensors were limited to less than 3.5% hydrogen in natural gas. The acoustic sensor did not have limits, but the team did not establish a formal concentration range. The results were promising in general, but additional work is needed to evaluate accuracy and robustness. The group gathered results in a final project report.

SoCalGas™

UCI Fuel Flexible Rotary Engine MicroCHP Development

Program: Clean Generation
Sub-Program: Distributed Generation

Benefits
Reduced Greenhouse Gas Emissions, Operational Efficiency, Reliability

Start Date
July 1, 2019

End Date
September 28, 2022

Total Project Cost
$100,000

Total SoCalGas Cost
$100,000

Total Co-Funding
N/A

The objective of this project was to demonstrate the operations of an existing micro rotary-engine-based (~30kW) combined heat and power (CHP) unit supplied with hydrogen-natural gas mixtures. The project specifically focused on 1) the robustness of operation and 2) the extent of low emissions performance. Demonstrating hydrogen tolerance in distributed generation technologies provides a pathway to decarbonization for flexible and reliable electricity when preserving air quality. This project leveraged prior CEC-supported development of a rotary engine operating on natural gas, integrated with a generator and heat recovery systems. The team tested the engine at the University of California, Irvine. Issues with several system components, including the alternator and heat exchanger, were observed and remedied during durability testing. The project team conducted performance testing on hydrogen blends up to 20% and found that impacts to CO and NOx emissions resulting from the increased hydrogen were typically controllable by adjusting settings on the engine ECU. The team summarized the results in a final report, and UCI is planning to share the results at an industry conference in 2023.

UTD Technical Support for Clean Transportation Testing, Performance, and Safety (2.21.I)

Program: Clean Transportation
Sub-Program: Onboard Storage

Benefits
Improved Air Quality, Public and Employee Safety

Start Date
July 1, 2019

End Date
August 9, 2022

Total Project Cost
$125,000

Total SoCalGas Cost
$2,200

Total Co-Funding
$122,800

The objective of this project was to provide technical support for critical clean transportation testing, performance, and safety efforts. These efforts include (but are not limited to) monitoring and participating in relevant compressed natural gas (CNG) and natural gas vehicle (NGV) developments, as well as continuing to provide technical expertise to the NGV America (NGVA) Technology & Development Committee. The Committee discusses NGV safety incidents and investigates root causes each quarter. Key updates included a Cummins announcement of the industry-changing 15-Liter natural gas engine for North America in November 2021. Safety issues with a Mainstay CNG Module led to a safety bulletin by the Technology and Development Committee. The team released a best practices guidance document for time-fill CNG fueling stations. GTI Energy supported activities related to CSA NGV 5.1 (Technical Subcommittee on Residential Fueling Appliances) and CSA NGV 5.2 (Technical Subcommittee on Vehicle Refueling Appliances. GTI Energy also focused on CSA NGV 4.3 (Temperature compensation guideline for compressed natural gas vehicle fueling). GTI Energy served as vice-chair of the committee. UTD issued a final report in August 2022 documenting these efforts in detail.

UTD CNG Station Methane Measurement Investigation (2.17.H)

Program: Clean Transportation
Sub-Program: Refueling Stations

Benefits
Reduced Greenhouse Gas Emissions, Public and Employee Safety

Start Date
June 1, 2017

End Date
July 31, 2022

Total Project Cost
$75,000

Total SoCalGas Cost
$7,500

Total Co-Funding
$67,500

The objectives of this project were to 1) quantify the leaks and losses of natural gas in the compressed natural gas (CNG) fueling process within a CNG fueling station, 2) evaluate advanced compression technologies, and 3) guide tracking methods to monitor station leakage performance to maximize operational efficiency and minimize leaks and losses. While natural gas vehicles (NGVs) have demonstrated significant reductions in many criteria pollutants and ozone-forming emissions, methane emissions are a potential risk associated with these vehicles. The predominant compound in natural gas is methane, and even relatively small amounts of methane leakage at a CNG fueling station can cause concern. Methane emissions, however, still need to be well regulated, given that the government developed most emissions regulations to target gasoline and diesel-fueled vehicles. As CNG vehicles begin to replace increasing numbers of diesel and gasoline-powered vehicles, it is prudent to understand how they might contribute to criteria pollutants and ozone-forming emissions. Leveraging results from other studies and additional data collection efforts throughout the project, the team identified several sources of methane emissions at CNG stations, with compressor emissions being the most important to address. Other sources included leaks in piping and other equipment, which are easier to identify and handle than the compressor emissions resulting from faulty or worn-out compressor rod seals. The team compiled full project results in a report issued to UTD members.

Composite Repair Wrap for PE - Phase 2 (2.14.a.2)

Program: Gas Operations
Sub-Program: Operations Technology

Benefits
Reduced Greenhouse Gas Emisssions, Improved Air Quality, Operational Efficiency

Start Date
June 15, 2020

End Date
December 31, 2022

Total Project Cost
$140,000

Total SoCalGas Cost
$18,375

Total Co-Funding
$121,625

This project focuses on designing, developing, and testing prototype higher efficiency, lower-emission commercial foodservice appliances using advanced burner concepts proven for other markets and products (e.g., residential furnaces and water heaters). The objective for this phase of the project is to test and develop combustion systems for commercial foodservice (CFS) applications that improve cooking performance, efficiency and/or emissions with an emphasis on developing commercialized units. This phase will take the knowledge acquired on burner performance and characteristics from the previous phases and begin designing and constructing prototype CFS units. The goal is to take CFS burner technology from Stage 4: Technology Development to Stage 5: Product Development for prototype units. At this stage, at least three new prototype units are demonstrated with a manufacturer for commercializing.

Susteon Low Temperature Regeneration Sorbents for Direct Air Capture of CO2 Development

Program: Low Carbon Resources
Sub-Program: Carbon Capture, Utilization, & Sequestration

Benefits
: Improved Air Quality, Improved Affordability, Operational Efficiency

Start Date
October 1, 2020

End Date
September 30, 2022

Total Project Cost
$900,000

Total SoCalGas Cost
$100,000

Total Co-Funding
$800,000

The objective of this project was to further develop high-efficient sorbent materials for Direct Air Capture (DAC) applications. Key optimization parameters include: 1) CO2 selectivity from air, 2) adsorption/desorption kinetics, 3) stability under high humidity conditions, 4) low regeneration temperatures for reduced energy consumption.