2019 ANNUAL REPORT

Fostering Breakthrough Innovation

RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROGRAM

SoCalGas

A Sempra Energy utility®

SoCalGas

A Sempra Energy utility®

CONTENTS

OUR VISION

Fostering breakthrough innovation

OUR MISSION

To develop energy solutions that are affordable, reliable, and increasingly renewable

OUR VALUES

CULTIVATE innovation and collaboration

We work closely with universities, national labs, research consortia, businesses, public agencies, and other key stakeholders to maximize the impact of our investment.

DIVERSIFY our energy portfolio

We fund promising, innovative technologies, from bench-scale to demonstration, across the entire energy supply chain.

SHAPE the future

We supplement and complement the research efforts of other R&D organizations by responding nimbly to the latest advancements in science and technology.

"In 2019, we collaborated with research facilities, universities, national labs, and entrepreneurs to support more than 300 RD&D projects in California and beyond. Our investment helps these organizations develop innovative technologies that can lower GHG emissions, improve air quality, and increase the safety of our state's gas infrastructure."

Maryam

Maryam Brown, President
SoCalGas

OPENING STATEMENT

Developing energy solutions that are affordable, reliable, and increasingly renewable

About Us

SoCalGas is taking proactive steps to become one of the cleanest gas utilities in North America, delivering affordable, reliable, and increasingly renewable energy to our customers. Central to this bold vision is the company's plan to replace 20% of its traditional gas supply with renewable fuels by 2030, as well as its work to help California attain carbon neutrality.

The SoCalGas Research, Development, and Demonstration (RD&D) Program plays a key role in this effort. Staffed with experts in science, engineering, energy systems, industrial process technology, and environmental policy, the RD&D Program develops, demonstrates, and deploys new products and technologies that can reduce customer costs, save energy, increase safety and reliability, improve air quality, and reduce greenhouse gas (GHG) emissions. SoCalGas RD&D subject matter experts collaborate closely with universities, research organizations, businesses, national laboratories, public agencies, and customers to move important new technologies from laboratories across the nation to markets in California.

In support of these goals, in 2019 the RD&D Program invested more than $13 million in energy technology projects that could improve safety, reliability, efficiency, energy choices, and resiliency for our customers and energy consumers throughout California.

A Partner in the Fight Against Climate Change

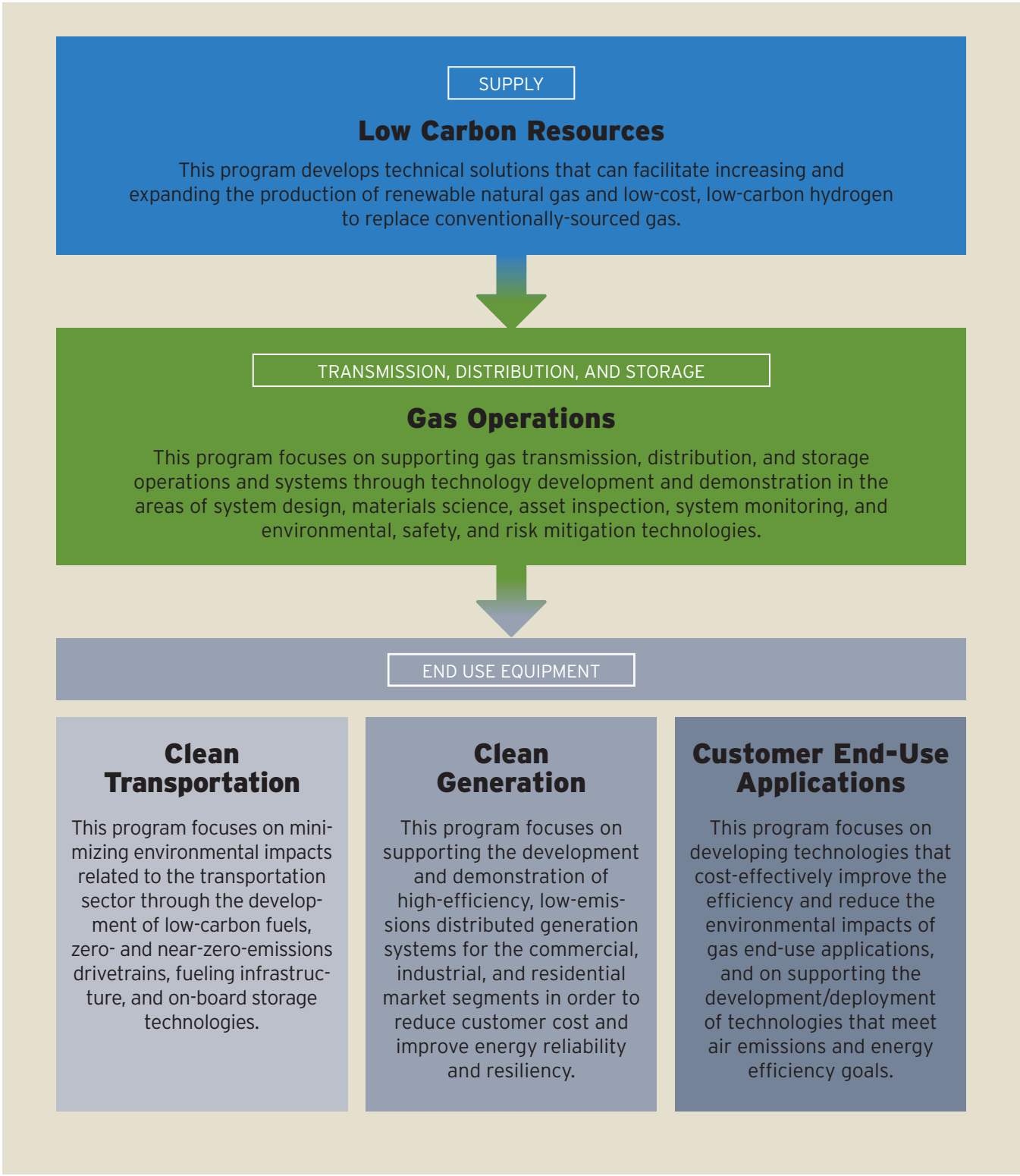
The world's climate is changing. How we use and deliver energy is changing too. California has mandated massive reductions in GHG emissions. Equally as important, our customers are demanding similar changes across the entire energy supply chain, from new non-fossil resources to innovative end-uses and energy conversion technologies. With more than 21 million customers and one of the nation's largest networks of gas distribution and storage infrastructure, as well as a deep network of relevant strategic relationships, SoCalGas is well positioned to play a central role in the ongoing decarbonization of our energy industry and, ultimately, the State of California.

Many of the same resources that have enabled SoCalGas to become the nation's foremost gas utility have direct relevance to the company's plan to deliver cleaner energy over time, while maintaining the integrity and reliability of the pipeline system. These include everything from extensive experience in large-scale engineering and project management to deep expertise in chemical and structural engineering; pipeline design, operations, and maintenance; gas storage; biofuel upgrading, monitoring, and metering; and compressed natural gas vehicle support systems.

Through the RD&D Program, SoCalGas shares this experience and expertise with researchers across the state and nation, supplementing and complementing the work of other public agencies, such as the California Energy Commission (CEC), and research and development (R&D) teams. Support from the RD&D Program provides greater certainty that funded projects will deliver real benefits to SoCalGas customers and achieve our decarbonization goals.

Program Organization and Drivers

In 2019, the RD&D Program allocated funds across five program areas, with each representing core aspects of the gas supply chain:



The RD&D Program reviews a variety of factors when determining how best to allocate funding in any given year. For example, program staff consider state and federal policies and regulations, the company's resource plan, and input from a wide variety of industry stakeholders at our nation's universities, national labs, industry research consortia, and public agencies, including the CEC, the US Department of Energy (DOE), and the South Coast Air Quality Management District.

Key state and federal policies and regulations impacting the RD&D Program include:

Category	Regulations & Policy Drivers
GHG Emissions	**AB32:** Reduce CO2 emissions 40% below 1990 levels by 2030 **SB 100:** Zero carbon electricity by 2045 **EO B-55-18:** Carbon-neutral California economy by 2045 **AB 3232:** Building decarbonization
Pipeline Safety	**CPUC General Order 112F:** Rules governing design, testing, operation, and maintenance of gas transmission and distribution systems **DOT CFR 49 Part 192:** Federal pipeline safety regulations **AB 1900:** Biomethane quality standards
Local Air Quality	**Clean Air Act:** Air quality standards for NOx and PM **AB 617:** Pilot communities for air quality improvements
Methane Emissions	**SB 1383:** Reduce methane emissions from decomposition of organic wastes **CARB Oil and Gas Rule:** Requires new monitoring and repairs to reduce methane emissions **Natural Gas STAR Program:** Encourages adoption of methane-reducing technologies and practices **EPA Methane Challenge Program:** Recognizes oil and gas companies that take comprehensive action to reduce methane emissions
Clean Transportation	**ARB Implementation Plan:** Low-NOx standard for trucks **AB 8:** Development of 100 hydrogen fueling stations in California **EO B-32-15:** Sustainable freight action plan **EO B48-18:** 200 hydrogen refueling stations by 2025 **LCFS:** Reduce carbon intensity of fuels by 10% by 2020 **SB 1275:** One million zero-emission and near-zero-emission vehicles by 2023

To ensure consistency with SoCalGas's internal resource / planning process, the RD&D Program has been designed to align with the company's overall goals and priorities, including six critical SoCalGas energy services pathways: natural gas, renewable natural gas (RNG), liquified natural gas (LNG), distributed energy, hydrogen, and carbon capture and use (CCU). SoCalGas believes that pursuit of these six approaches will ultimately play a pivotal role in the state's transition to carbon neutrality by 2045.

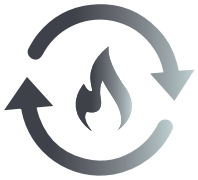
PATHWAYS TO CLEANER, SAFER, AND MORE RELIABLE ENERGY

Realizing the clean energy value of natural gas while enabling new forms of energy and technology

Natural Gas

Continued safety enhancement investments in infrastructure

Affordability and addresses intermittency issue of renewables



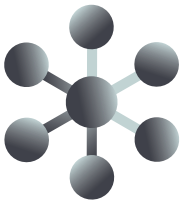
Renewable Natural Gas (RNG)

Deliver 20% RNG in our system by 2030

Partnership with agriculture waste stream sectors for RNG production and pipeline delivery

Liquified Natural Gas (LNG)

Deployment of LNG facility at ports for transportation sector (heavy duty and marine)

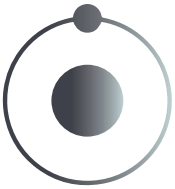


Distributed Energy (DE)

Fuel cell deployment as wildfire mitigation measure

Fuel cell development in transportation (heavy duty)

DE for residential and commercial to address renewable intermittency

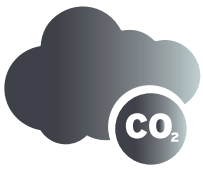


Hydrogen

Electrolytic Hydrogen

Hydrogen vehicle fueling stations

Hydrogen blending into pipeline system



Carbon Capture & Utilization (CCU)

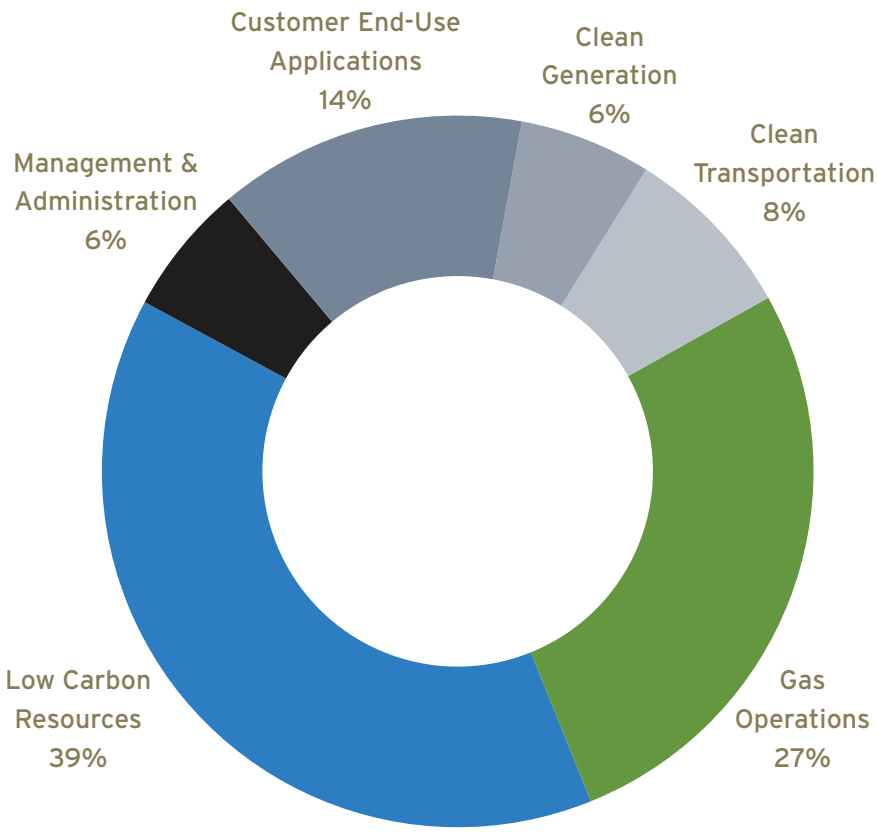
Capture waste carbon dioxide (CO2) and deploy carbon in carbon utilizing industries such as manufacturing

2019 in Review

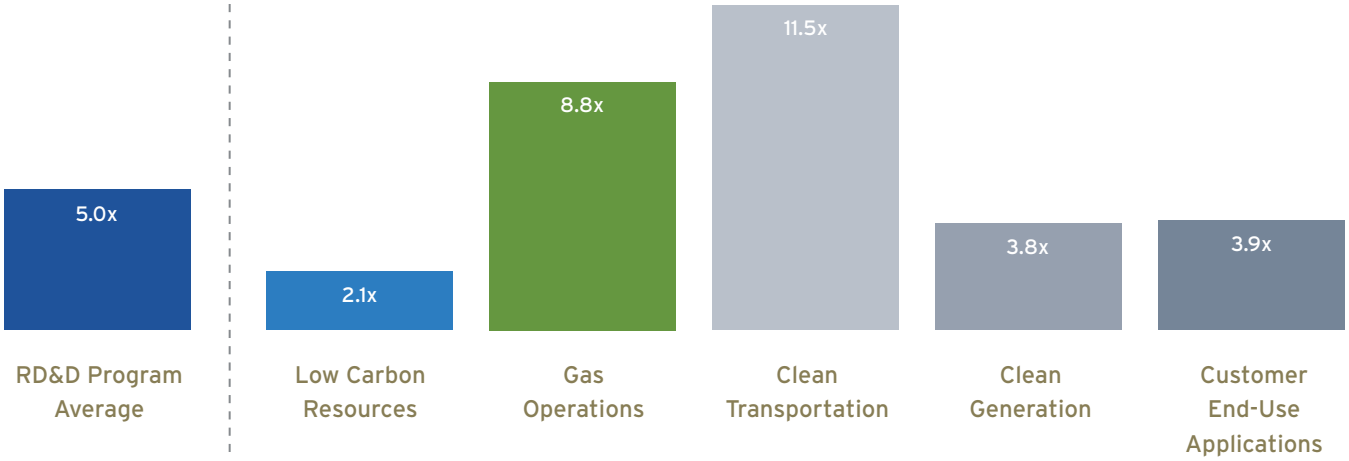
In 2019, the RD&D Program distributed $13,142,010 to more than 300 RD&D projects across the entire gas supply chain in California. In executing these projects, SoCalGas collaborated with many of the most forward-thinking research consortia, universities, national labs, state agencies, and entrepreneurs, which collectively provided significant leveraged funding, as well as invaluable guidance, review, technical expertise, and access to resources and infrastructure.

Split across the five programs, these projects encompassed everything from benchtop research efforts and pilot testing to demonstrations in real-world conditions. Importantly, they achieved substantial progress toward commercializing new safe, reliable, and affordable clean energy technologies.

2019 FUNDING ALLOCATION BY PROGRAM AREA AND ADMINISTRATIVE COSTS



RATIO OF OUTSIDE FUNDING TO SOCALGAS FUNDING



PROGRAM GOALS AND STRUCTURE

PUBLIC UTILITIES CODE (PUC) 740.1.

The commission shall consider the following guidelines in evaluating the research, development, and demonstration programs proposed by electrical and gas corporations:

(a) Projects should offer a reasonable probability of providing benefits to ratepayers.

(b) Expenditures on projects which have a low probability for success should be minimized.

(c) Projects should be consistent with the corporation's resource plan.

(d) Projects should not unnecessarily duplicate research currently, previously, or imminently undertaken by other electrical or gas corporations or research organizations.

(e) Each project should also support one or more of the following objectives:

(1) Environmental improvement.

(2) Public and employee safety.

(3) Conservation by efficient resource use or by reducing or shifting system load.

(4) Development of new resources and processes, particularly renewable resources and processes which further supply technologies.

(5) Improve operating efficiency and reliability or otherwise reduce operating costs.

Program Goals

The goals of the RD&D program are to identify, test, and commercialize new energy technologies that will reduce GHG emissions and criteria air pollutants, increase the affordability of energy, and advance the safety, reliability, and affordability of California's gas delivery networks and systems in an ever-changing operational environment.

Concurrent with the pursuit of those goals, SoCalGas also seeks to decarbonize its pipeline by replacing conventionally-sourced, fossil-based natural gas with increasingly higher amounts of renewable natural gas and low-carbon hydrogen. The RD&D Program focuses on projects that offer a reasonable promise of providing benefits to our customers.

Project Area Selection Process

Consistent with the framework established in Public Utilities Code Section 740.1, when selecting project areas, program staff considers multiple factors, including regulatory and policy drivers, corporate policy and goals—such as 20% renewable fuels by 2030—and input from knowledgeable industry stakeholders. To ensure that achieving customer benefit is reasonably probable and the focus is not unnecessarily duplicative of efforts by other research organizations, RD&D Program staff closely collaborate with professionals at our nation's most prominent universities, national labs, research consortia, businesses, and other research funding sources such as the CEC.

Program Structure

In 2019, the RD&D Program allocated funding across the following five program areas: Low Carbon Resources, Gas Operations, Clean Transportation, Clean Generation, and Customer End-Use Applications. Each of these areas was further divided into additional sub-programs.

2019 RD&D Program Hierarchy

In 2019, the RD&D Program allocated funding across five program areas.

Low Carbon Resources	Biomass Processing & Conversion Power-to-Gas (P2G) Artificial Photosynthesis Carbon Capture & Use Hydrogen Production from Methane
Gas Operations	Environmental & Safety Operations Technology System Design and Materials System Inspection & Monitoring
Clean Transportation	Compression & Refueling Fuel Systems & Storage Near Zero Emissions Engines Compressed Natural Gas & Hybrid Vehicles Off Road (Locomotives, Construction & Marine)
Clean Generation	DG-CHP-MicroCHP Engines & Turbines Fuel Cells Waste Heat Recovery
Customer End-Use Applications	ZNE for Residential Appliance & IAQ Commercial Cooking & Food Service Solar Thermal Heating & Cooling Boilers & Process Heating

RESEARCH COLLABORATORS

Cultivating innovation and collaboration

The RD&D Program works closely with industry professionals and subject matter experts at universities, national labs, public agencies, businesses, and industry research consortia to maximize the impact of its investments in promising technologies and products focused on producing or delivering cleaner, safer, affordable, and more reliable energy.

Working with these organizations has many advantages. These relationships enable SoCalGas to engage with science and technology experts, other utilities, and industry stakeholders to more effectively identify and close knowledge and research gaps, avoid duplication of previous and ongoing research, and reduce technology and commercialization risks in order to achieve our RD&D Program goals.

The RD&D team and its external collaborators share information and research concepts, collaborate on project development, and actively seek public and private funding opportunities, with the ultimate goal of securing additional co-funding and assembling the best team of experts capable of working and succeeding on any particular project.

These collaborative RD&D efforts provide significant financial benefits through cost sharing, while also increasing the probability of technical and commercial success, by tapping into the collective wisdom and experience of all participating organizations. These efforts further result in sharply focused technical approaches and development strategies from project inception through commercialization.

Universities

SoCalGas regularly works closely with some of our nation's most prominent universities, which are staffed with scientists, engineers, and other academics performing fundamental science and valuable lab- and bench-scale applied research in a variety of energy topics, including fuel cell development, hydrogen energy storage, artificial photosynthesis, carbon capture and use, low-carbon/low-cost hydrogen production, and measuring emissions from end-use equipment. University collaborators also possess expertise in modeling, techno-economic and lifecycle analysis, areas of immense importance to the development of cleaner, safer, affordable, and more reliable energy. University campuses often also serve as ideal host sites for demonstration projects due to university ownership and management of campus energy infrastructure and buildings.

National Laboratories

The United States National Laboratories and Technology Centers are a system of facilities and laboratories overseen by the DOE for the purpose of advancing science and technology. Researchers and scientists at the 17 national labs tackle the critical scientific challenges of our time—from combating climate change to discovering the origins of our universe—and possess unique instruments and facilities. National labs are unequalled in their ability to address large-scale, multifaceted, and complex research and development challenges with a multidisciplinary approach that places an emphasis on translating basic science to innovation. SoCalGas regularly engages national lab personnel for subject matter expertise, guidance, and collaboration in developing and executing research projects.

Public Agencies

At the local, state, and federal levels, public agencies play a key role in the RD&D process, driving project solicitations related to regulatory policy objectives and serving as thought leaders that help shape broad energy strategies. For projects focused on early-stage technologies, public funding programs, can significantly reduce many of the risks associated with deploying staff and resources on untested products. This, in turn, can attract high-caliber team members and other leveraged funding. Importantly, if successful, publicly funded projects can serve as springboards to larger demonstration projects, additional public and private funding, and, ultimately, product and technology commercialization.

Businesses

At its core, the RD&D Program is about developing practical applications to overcome challenges facing the gas and energy industries. To help ensure that

the new technologies and products supported by SoCalGas advance to real-world applications and markets, RD&D Program staff work closely with leading equipment manufacturers and global technology developers. Program staff also work with project developers and diversified energy companies to leverage their knowledge and expertise to build forward-thinking, large-scale demonstration projects.

Research Consortia

RD&D Program staff have also developed strong ties with several research consortia focused on the gas energy industry. The membership of many of these organizations consists of utility companies from throughout North America. Typically, these organizations serve member utilities by facilitating technical collaboration and pooling financial and technical resources to collectively address ongoing or anticipated challenges in the gas industry. By working closely with these and other similar organizations, RD&D Program staff can share both knowledge and funding with other utilities and researchers to develop meaningful project concepts and scopes. Coordination of work between these organizations and access to technical libraries also greatly reduce the odds of reproducing previously completed work. Organization memberships include:

Northeast Gas Association (NGA)/NYSEARCH: NGA/NYSEARCH is a collaborative research sub-organization within the Northeast Gas Association that serves gas utility member companies. Members of NYSEARCH, primarily North American gas distribution companies, voluntarily participate in projects focused directly on needs specific to the member companies and the gas industry as a whole.

Operations Technology Development (OTD): OTD is a not-for-profit organization comprising 27 gas utility members that serve over 60 million gas consumers in the United States and Canada, representing 75% of the households served by gas. OTD combines the interests, expertise, and resources of its members to develop advanced operations and pipeline technologies for the gas industry.

Pipeline Research Council International (PRCI): PRCI is a community of the world's leading pipeline companies, vendors, service providers, equipment manufacturers, and other organizations supporting the gas industry. PRCI's research focuses directly on gas and oil transmission pipeline issues.

Sustaining Membership Program (SMP): SMP is a collaborative research and development program with two segments, Utilization and Operations. Its gas utility members support research projects focused on gas delivery, energy utilization, environmental science, and renewable energy. SMP develops the technology through the "proof of concept" phase, at which point the most promising technologies are continued through short- to midterm R&D programs, implemented by organizations such as OTD and Utilization Technology Development (UTD).

Utilization Technology Development: UTD is a 20-member consortium of utilities in the United States and Canada, representing 47 million gas customers in North America. Its goal is to introduce new technologies that help gas consumers save money, reduce emissions, improve efficiencies, and optimize their gas use.

By working closely with these organizations, RD&D Program staff can coordinate work on meaningful projects, share both knowledge and funding, and greatly reduce the odds of reproducing previously completed work

LOW-CARBON RESOURCES

Biomass Processing & Conversion

Power-to-Gas (P2G)

Artificial Photosynthesis

Carbon Capture & Use

Hydrogen Production from Methane

The ultimate goal of the Low Carbon Resources program area is to decarbonize the gas supply without sacrificing the affordability and reliability for which natural gas is known. To accomplish this goal, Low Carbon Resources program staff develops, promotes, and advances new technologies aimed at increasing and expanding the production of RNG and low-cost/low-carbon hydrogen to displace conventionally-sourced pipeline natural gas The program itself is further divided into five distinct sub-programs:

Biomass Processing and Conversion

This sub-program develops and demonstrates commercial-scale biomass gasification technologies capable of converting biomass resources into low-, zero-, or negative-net carbon RNG. Some of the technologies that fall into this project area include anaerobic digestion, pyrolysis, and hydrothermal technologies.

Power-to-Gas (P2G)

This sub-program focuses on developing and demonstrating technologies that can convert excess or dedicated wind and solar power into renewable hydrogen (RH2) or RNG. This hydrogen and RNG energy storage approach enables energy to be injected into the gas pipeline system where it can be stored for later use or distributed as a vehicle fuel.

Artificial Photosynthesis

This sub-program focuses on supporting fundamental laboratory research to identify and optimize catalysts that will produce RNG directly from water, CO2, and sunlight (photons). This technology holds the promise of producing large quantities of zero-carbon RH2 and RNG that can be easily transported through the existing gas grid where it can be stored, converted to electrical power, used for residential, commercial, or industrial heat, or utilized as vehicle fuel.

Carbon Capture and Use

This sub-program develops and demonstrates technologies that can capture CO2 and convert it into either durable materials that provide value and sequester the carbon for long time periods, or back into methane.

Hydrogen Production from Methane

This sub-program focuses on developing and demonstrating small-scale, distributed systems that convert methane to hydrogen via pathways that reduce the carbon intensity of the hydrogen as compared to traditional steam methane reforming. These systems are able to take advantage of the state's nearly ubiquitous gas system to supply low-carbon fuel to fuel cell electric vehicle service stations that are actively being built across the state.

SPOTLIGHT

Using ancient microbes to store wind and solar energy

New bioreactor enables higher penetration of solar- and wind-generated electricity

TOTAL PROJECT COST	$1,400,000
SoCalGas	$700,000
DOE (BETO)	$600,000
DOE (FCTO)	$100,000

As California moves towards greater deployment of intermittent renewables on the electric grid, wider and more severe swings and mismatches between electricity production and demand are all but certain. In this environment, the ability to take advantage of surplus and otherwise curtailable solar- and wind-generated electricity to produce RNG from biogenic sources of carbon-dioxide delivers an elegant, economically attractive, and rapidly scalable solution to multiple challenges facing California, including climate change and poor air quality.

Recently, SoCalGas worked with DOE's National Renewable Energy Laboratory (NREL) and Electrochaea GmbH—a University of Chicago technology spin-off focused on converting low-cost and stranded electricity and carbon-dioxide into pipeline-grade RNG—to build the nation's first scalable renewable hydrogen biomethanation reactor system at the NREL Energy System Integration Facility in Golden, Colorado.

Commissioned in August 2019, the system uses a proton exchange

SoCalGas and Electrochaea GmbH built the nation's first scalable renewable hydrogen biomethanation reactor system at the NREL Energy System Integration Facility in Golden, Colorado.

membrane (PEM) water electrolysis device powered by solar-generated renewable electricity to split water molecules into hydrogen and oxygen, effectively storing the renewable electricity as hydrogen gas. The system then combines this "green" hydrogen with biogenic carbon-dioxide recycled from a variety of sources and pipes the blended gases into a pressurized reactor vessel containing water, and methanogenic microorganisms. These microorganisms consume the hydrogen and carbon-dioxide and emit methane (CH4) in a process known as biomethanation. The methane coming off the reactor can meet natural gas pipeline quality standards for use in homes, businesses, and transportation.

Moving forward, the project will conduct testing and performance evaluations to assess the commercial viability of this approach to energy storage and decarbonization. Ultimately, the project team anticipates gaining useful insights into potential megawatt-scale system designs. For example, more tightly integrating the water electrolysis process with the biomethanation reactor is expected to improve overall efficiency, while reducing capital and operating costs.

This innovative system is expected to boost the technical and economic viability of deploying water electrolysis systems co-located at biogenic CO2-emitting facilities to produce RNG and other products. Ultimately, the new design is expected to reduce energy losses, eliminate expensive components, reduce O&M costs, improve electrolyzer safety, and increase the mass transfer of hydrogen within the bioreactor. The integration of electrolytic hydrogen and biomethanation leverages the existing gas infrastructure to provide long-duration storage capability at a massive scale, with little to no capital cost expenditure to retrofit the natural gas system. It also facilitates the continued build-out of wind and solar resources and enables the capture and recycling of biogenic CO2 from various sources. Finally, it prevents additional CO2 from entering the atmosphere via fossil fuels combustion.

SPOTLIGHT

Harnessing the sun to create carbon-negative fuel

Waste-to-energy system uses novel concentrated solar power technology to convert dairy manure into RNG

In California, state mandates are driving the decarbonization of industrial processes. Many companies seek to reduce their environmental impact by replacing conventional natural gas with low-carbon or carbon-negative RNG. One of the most common technologies for producing RNG is the anaerobic digester. Proven over many decades of commercial use, digesters can reliably produce vast quantities of RNG year in and year out. Yet, many organizations requiring commercial-scale digester solutions cannot afford the high capital costs associated with digester construction.

To address this challenge, the SoCalGas RD&D Program—with co-funding from the CEC—led the design, fabrication, installation, and operation of a small-scale, waste-to-energy bioenergy system that integrates an innovative concentrated solar power (CSP) technology developed by Hyperlight Energy with a hydrothermal processing (HTP) system from Genifuel Corp. The project included optimization of the secondary light concentrator system design by NREL and a

TOTAL PROJECT COST	$2,503,456
SoCalGas	$1,008,720
CEC	$1,494,736

The Hyperlight concentrated solar power system can be integrated into a wide variety of industrial heating processes that are currently reliant on natural gas.

techno-economic analysis prepared by an independent economics firm, Energy Solutions.

The demonstration project was located at a San Diego State University (SDSU) satellite campus in the agricultural community of Brawley, CA. This location facilitated STEM education opportunities and community outreach to nearby disadvantaged communities.

Working in concert, the integrated CSP and HTP technologies successfully extracted up to 80 percent of the energy in the dairy manure feedstock in a fraction of the time a digester would have taken to perform the same task. The result? Low-carbon, high-quality biocrude for use by refineries and RNG ready for immediate injection into the gas pipeline system, with no emissions.

The Hyperlight technology played a vital role in the success of this system. Many solar thermal systems have failed commercially because they are significantly more expensive than natural gas or wind and solar power. By contrast, the Hyperlight system uses water and PVC piping for structural support and requires very little steel and site preparation, and no cement. Operating at full capacity, the system is capable of producing 30,000 therms of energy in a year—enough energy to serve 60 homes for one year in a total footprint of only one acre.

During the demonstration, the Hyperlight system worked as designed, producing temperatures in excess of 300°C for use in the system's integrated HTP process. Importantly, it demonstrated that Hyperlight's CSP technology could be integrated into a wide variety of industrial heating processes that are currently reliant on traditional natural gas. As a result, Hyperlight has begun the process of integrating its technology into the facilities of one of California's largest cheese producers, and is exploring other potential projects in the oil, gas, and geothermal industries.

GAS OPERATIONS

Environmental & Safety

Operations Technology

System Design and Materials

System Inspection & Monitoring

The Gas Operations RD&D program supports pipeline transportation and storage operations through innovations that enhance pipeline and employee safety, maintain system reliability, increase operational efficiency, and minimize GHG impacts to the environment. The program also supports technology development driven by emerging regulatory requirements. Its primary goal is to develop, test, and introduce new gas operations technologies that are beneficial to ratepayers, public safety, and the environment. The program invests in technology development projects that are divided into the following sub-programs:

Environmental and Safety

This sub-program seeks to advance the environmental integrity of the pipeline network and the safety of those who live and work in proximity to it. Environmental projects focus on developing technologies that reduce air emissions. Safety projects are concerned with protecting the pipeline from intentional and unintentional damage and with ensuring the safety of the general public and company employees or contractors working on or around the pipeline.

Operations Technology

This sub-program supports technologies that improve employee training; efficiency of construction; operation, maintenance, and rehabilitation of gas pipelines; and systems that facilitate continued safe and reliable service.

System Design and Material

The objectives of this sub-program are to advance materials and materials science, materials tracking and traceability, and technical tools for designing pipeline systems and infrastructure for safety, reliability, efficiency, and maintainability throughout the lifecycle of an asset. Projects include research to advance engineering design standards and models, developing risk analytical tools to comply with pipeline integrity regulations, modeling operational efficiencies of gas storage and compressor station assets, and assessing the effects of natural gas quality from non-traditional sources (biogas and hydrogen-blend).

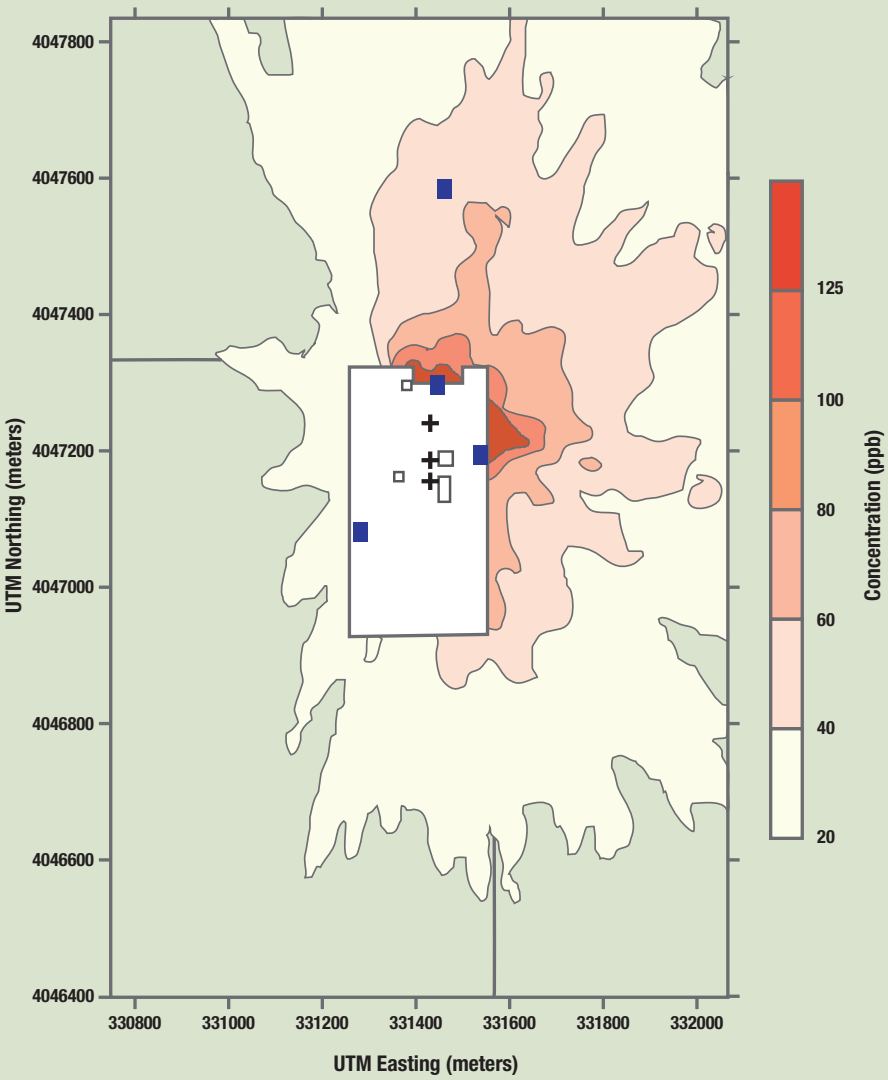
System Inspection and Monitoring

The objectives for this sub-program include developing technologies and methods for inspection, monitoring, and testing of pipelines and pipeline components to assess the condition and performance of the assets. The goal is to improve system performance, reliability, safety and operational efficiencies. Projects in this sub-program area often leverage artificial intelligence, machine learning, and preventive and predictive maintenance technologies, including data analytic models, the Internet of Things, and data lakes.

SPOTLIGHT

Team develops comprehensive dataset and assesses dispersion model performance

Industry collaboration builds robust dataset to gauge accuracy of exhaust plume air dispersion modeling tool



TOTAL PROJECT COST:	$3,172,696
SoCalGas:	$354,310
Multiple Co-Funders:	$2,818,386

Nitrogen oxide (NOx) is a pollutant emitted from combustion, including from natural-gas-fired reciprocating engines, such as those used to drive natural gas compressors. To assess the impact of ground-level and elevated industrial sources of NOx emissions, the United States Environmental Protection Agency (EPA) and the American Meteorological Society (AMS) co-developed AERMOD, which is EPA's required tool for estimating impacts from air pollutant emission sources, including natural gas compressor drivers.

The EPA enacted a new one-hour nitrogen dioxide (NO2) National Ambient Air Quality Standard (NAAQS) in 2010. This standard is considerably more stringent than the longstanding annual standard, greatly reducing the margin for compliance. Critically, AERMOD is expected to conservatively predict

SoCalGas and a variety of trade organizations built a robust emission dataset that could be used to assess the performance of AERMOD and identify modeled bias or inaccuracies.

modeled ambient concentrations higher than actual values, especially for shorter exhaust stacks typical for natural gas pipeline compressor engines. Thus, NO2 NAAQS compliance demonstrations required for permitting that rely on AERMOD may over-predict ambient NO2 concentrations and lead to permitting delays, unnecessary and costly NOx mitigation, or multi-year ambient monitoring. Unfortunately, a robust dataset was not available to assess AERMOD performance for such sources. The dataset requires site meteorological ("met") data, source emissions data, and coincidental ambient monitoring, with data collected at sub-hourly intervals for an extended period.

To evaluate AERMOD performance, SoCalGas collaborated with Pipeline Research Council International (PRCI), the Interstate Natural Gas Association of America (INGAA), the INGAA Foundation, American Petroleum Institute (API), and other trade associations. These organizations set out to build a robust emission dataset that could be used to assess model performance and identify modeled bias or inaccuracies in AERMOD. Further objectives included developing recommendations for the EPA and working closely with EPA modeling staff to improve AERMOD and/or model inputs.

From late 2015 through December 2016, the project team used state of the art methodologies to measure actual ambient NO2 concentrations at a compressor station, and gathered met and engine emission data. This provided the robust dataset needed to assess model performance. The team analyzed and compared ambient data to AERMOD results that relied on the site "met" and emissions data. The model isopleth plot shown confirmed that the four ambient monitors were properly sited. An initial report is being complemented with ongoing analysis that will culminate in 2020. The project team identified several areas of possible improvement, including: 1) alternatives to conservative simulation of emissions that assume sources operate continuously, which far exceeds transmission pipeline actual operations; 2) over-prediction of NO2 formation in the plume as it migrates downwind of the stack; and 3) NO2 over-prediction from plume "downwash" to ground level in proximity to facility structures.

PRCI, SoCalGas, and consultant Innovative Environmental Solutions continue to work with EPA to review analyses and develop a path to improve the model discrepancies identified. Analyses comparing model to observed concentrations have been presented at EPA conferences. The public dataset has also proven valuable to other modelers who are using the dataset to assess other topics on AERMOD performance and improvement.

SPOTLIGHT

Improve pipeline integrity by harnessing the power of flow

NYSEARCH funds development of pipeline robot that taps potential energy in pipeline gas flow to recharge

The gas industry relies upon in-line inspection (ILI) tools to inspect DOT-transmission pipelines as a means of evaluating and ensuring the integrity of the pipeline system for the safety of the public and the environment. SoCalGas is committed to applying in-line inspection tools to as much of its DOT-transmission pipeline system as possible. With Invodane/Pipetel, NYSEARCH has successfully commercialized the Explorer family of robotic platforms and sensors

TOTAL PROJECT COST	$1,631,721
SoCalGas	$171,265
NYSEARCH	$1,460,456

for the in-line inspection of gas pipelines. The Explorer inspection tools play a key role in maintaining pipeline integrity, as they can be utilized on segments of pipeline that are difficult to inspect using traditional ILI tools, such as those with fitting configurations that present tighter turns than the traditional tool is capable of negotiating.

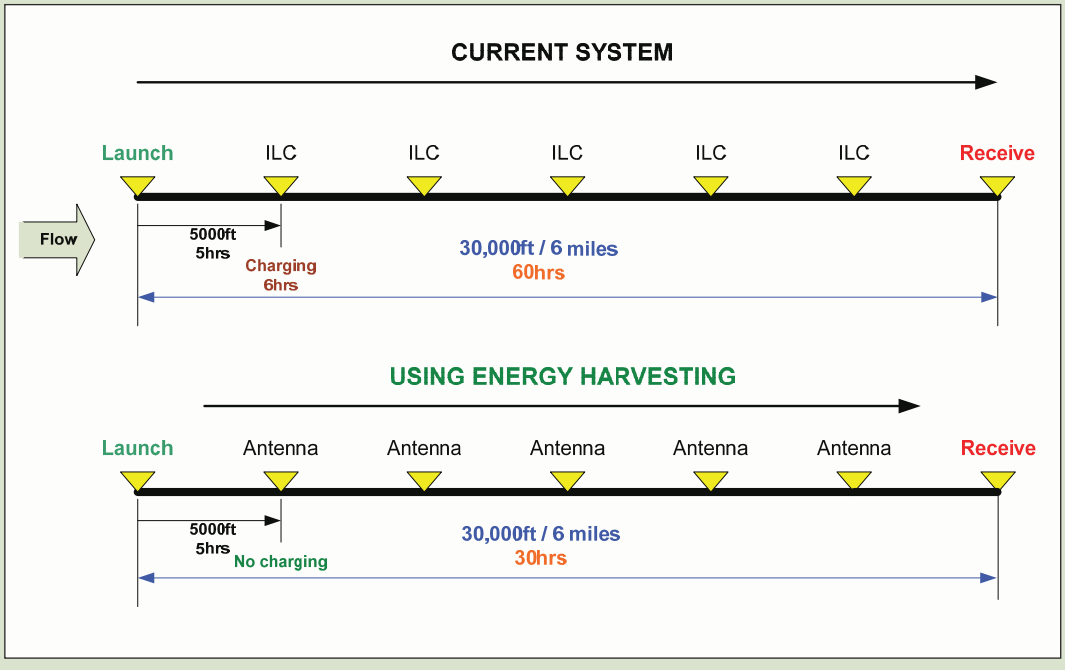
However, the most significant performance limitation for the battery-dependent Explorer platforms is their limited roundtrip range of approximately one mile. Extending the range of the platforms will have a major impact on Explorer performance and will result in a significant cost reduction for inspections of pipeline segments longer than one mile.

At present, recharging requires either the extraction of the robot from the pipeline, replacing the batteries, and relaunching it in the pipeline, or parking the robot in the pipeline for six hours and recharging the batteries at an in-line charging (ILC) station. These processes add time and cost, while increasing risk and pipeline integrity by introducing in-line access points for charging.

To explore a more practical and cost-effective solution, in 2017 NYSEARCH collaborated with Invodane/Pipetel to initiate the "Energy Harvesting for Onboard Re-Charging of EXP Robotic Platforms" project. This project focused on developing and commercializing an onboard energy harvesting module for the Explorer family of robots, with initial efforts targeting the EXP 20/26 platform. The objective was to harvest energy from the gas stream for efficient, on-board thrust and power generation that enabled the robot to be self-powered and achieve major improvements in range and performance.

Phase I of this project resulted in the development of concept and preliminary designs for an on-board power generation system targeted to work in pipelines with pressures exceeding 200 psig and gas flow rates greater than 2 ft/s. The team then developed designs for a tow-assist system that generates a tow force from the gas flow inside the pipeline and a turbine/generator system that extracts flow energy from the gas and converts it to electricity that can charge the batteries or be consumed directly by the robot.

The team initiated Phase II in late 2018 and, in 2019, completed detailed system design, built a prototype module, and performed component and subsystem lab testing. The module was then integrated into the Explorer 20/26 and subjected to full system testing in the laboratory. Following completion of the lab testing, the team carried out a field trial in a live, pressurized pipeline in Northern California. The robot was able to complete the return trip under its own power—demonstrating operational effectiveness. The field tests also identified the need for a number of design changes necessary to increase system robustness and reliability for commercial operations. The project team is targeting completion of these design changes by early 2021.



In 2019, the project team demonstrated an onboard energy harvesting module that enabled an Explorer model in-line inspection robot to avoid the need for in-line charging and dramatically reduce inspection times.

CLEAN TRANSPORTATION

Compression & Refueling

Fuel Systems & Storage

Near Zero Emissions Engines

Compressed Natural Gas & Hybrid Vehicles

Off Road (Locomotives, Construction & Marine)

The Clean Transportation sub-program supports activities that minimize environmental impacts related to the transportation sector through the development of low-carbon fuels, zero- and near-zero-emissions drivetrains, fueling infrastructure, and on-board storage technologies. This program is further divided into five sub-programs:

Compression and Refueling

This sub-program focuses on addressing the inefficiencies and losses that result from incomplete fills, as well as the high capital costs associated with gaseous infrastructure and fueling stations. Its major goals include reducing the capital costs of fueling stations, improving compressor efficiency, and reducing compressor cost.

Fuel Systems and Storage

This sub-program targets new technologies that improve tank safety, reduce materials and manufacturing costs associated with fuel systems and storage, and facilitate alternative options for conforming tank configurations for light-, medium-, and heavy-duty vehicles.

Near Zero Emissions Engines

In this sub-program, RD&D staff support the integration of available natural gas engines into more models and applications and also the development of a broader range of heavy-duty natural gas engines with improved engine economics, efficiency, and emissions profiles.

CNG and Hybrid Vehicles

This sub-program is aimed at the development and demonstration of hybrid compressed natural gas (CNG) technologies for various vocational and heavy-duty vehicles, with the goals of further reducing emissions of GHGs and NOx and providing range extension to electric vehicles.

Off-road (Locomotives, Construction, and Marine)

This sub-program supports the development and demonstration of zero- and near-zero- emission, marine, locomotive, and construction equipment, as well as improving the efficiency of off-road gas engines and technology.

SPOTLIGHT

Nation's first low-NOx medium-duty engine compliant with HD OBD requirements

New natural gas engine complies with heavy-duty on-board diagnostics requirements to reduce NOx and GHG emissions

Beginning in 2018, all medium- and heavy-duty engines sold in California are required to utilize Heavy-Duty On-Board Diagnostics (HD OBD) to monitor engine system or component parameters for the identification of malfunctions or deterioration that can increase engine emissions.

To address this need, SoCalGas and the University of California, Riverside (UCR) College of Engineering Center for Environmental Research and Technology (CE-CERT) collaborated with Cummins Westport Inc. (CWI) and demonstration fleets Blue Water Area Transit (BWAT), Kwik Trip, Walmart, and UPS to design, develop, and demonstrate the first HD OBD-compliant, low-NOx natural gas engine for medium-duty (Class 5 to 7), commercial transportation applications, such as trucks and buses.

Engine and algorithm development were conducted at CWI facilities located in Indiana and British Columbia. UCR CE-CERT provided dynamometer and emissions testing. The fleets demonstrated a total of eight vehicles, including shuttle bus, transit bus, truck, and yard spotter applications. The team collected data over four drive cycles chosen to represent vehicle operation in California's South Coast Air Basin.

During the project, the team identified the required changes to the engine and after-treatment system and communicated them to vehicle OEMs through customer engineering bulletins, computer-aided design models, and other supplemental information sources. This process enabled the vehicle manufacturers to work in parallel with the development of the new engine and ensure commercial vehicle availability once production started.

Completing the project enabled CWI to attain US EPA certification verifying that the new engine had met the Optional Low NOx standard of 0.10 g/bhp-hr and to achieve compliance with US EPA HD OBD regulations for medium-duty fleets. Dynamometer testing proved that the engine maintained its low emissions over the range of realistic duty cycles found in the South Coast Air Basin. In fact, the new engine reduces NOx emissions by more than 50% from the current federal standard for heavy-duty on-road engines and can play an important role in ensuring that a cost-effective, low-emissions engine is available to help achieve the region's aggressive NOx reduction targets ahead of the development of a mandatory low NOx engine standard.

TOTAL PROJECT COST:	$2,651,018
SoCalGas:	$134,375
CEC:	$1,000,000
Cummins Westport:	$1,516,643

Widespread adoption of the low-emission natural gas engine will help reduce NOx emissions and improve California's air quality over time as vehicles are replaced. Reduced emissions provide a wide array of benefits to California's citizens, including improved health, better visibility, and fewer impacts on the environment. When combined with renewable natural gas, the new engine can provide even greater greenhouse gas emissions reductions by reducing the emissions from renewable waste sources.

CLEAN GENERATION

DG-CHP-MicroCHP
Engines & Turbines
Fuel Cells
Waste Heat Recovery

This program targets the development and demonstration of high-efficiency products and technologies that reduce the emissions associated with the generation of power for the residential, commercial, and industrial market segments in order to reduce customer cost and improve energy reliability and resiliency. This program is further divided into the following four sub-programs:

DG-CHP-MicroCHP

This sub-program is focused on developing and demonstrating small-scale emissions control technologies and the manufacture of micro-CHP products that are compliant with California Air Resources Board requirements. Sub-program staff also works to bring more advanced technologies to California from European and Asian markets.

Engines and Turbines

In this sub-program, SoCalGas staff support manufacturers in their efforts to develop and demonstrate novel emissions control strategies, as well as devices that can make renewable fuels compatible with existing systems.

Fuel Cells

This sub-program helps develop and demonstrate small-scale fuel cells for single- and multi-family applications. It also focuses on bringing more advanced technologies to California from European and Asian markets.

Waste Heat Recovery

The goals of this sub-program are to develop new heat extraction methods, materials, and technologies, and to demonstrate them at commercial and industrial facilities. Program staff also seek to lower the capital cost and increase the efficiency of waste heat recovery systems and to monitor the advancement of new technologies, such as solid-state thermoelectric devices.

SPOTLIGHT

Cleaner, more reliable power for data centers

SoCalGas, UC Irvine, and Microsoft team up to integrate fuel cells for low emissions, reliable electricity at power-thirsty data centers.

TOTAL PROJECT COST:	$540,000
SoCalGas:	$190,000
Microsoft:	$350,000

Data centers represent an ever-increasing demand for highly reliable and resilient power. In 2018, data centers consumed an estimated 200TWh of electricity, roughly 1% of global electricity consumption[1]. With the expected growth in connected consumer devices and networks usage, data centers are projected to consume up to 13% of global electricity supply in 2030[2]. Coupled with increasing demand, data center power supplies must comply with stringent reliability and availability requirements to ensure server uptimes of at least 99.9999%.

These large and growing critical infrastructure assets could be served in the most reliable, resilient, and low-emissions manner using fuel cells for on-site power generation.

In 2019, SoCalGas, UC Irvine, and Microsoft joined forces to develop a greater understanding of how gas-fueled solid oxide fuel cells (SOFC) and proton exchange membrane fuel cells (PEMFC) could provide power to data centers and other critical infrastructure with sufficient reliability and resiliency. Researchers are also examining the benefits of utilizing waste heat from fuel cell operation to drive an absorption chiller to cool servers, further reducing electricity consumption and associated emissions for data centers. This research promises to provide GHG and criteria pollutant emissions reductions while satisfying the stringent reliability standards required for data center operations.

Researchers at the UC Irvine National Fuel Cell Research Center have characterized the typical data center power and energy demand dynamics as well as fuel cell capabilities and integrated this data with reliability models to show how SOFC and PEMFC systems could efficiently and reliably power data centers and other critical infrastructure. Modeling efforts are being conducted to inform potential designs of the integrated fuel cell systems to achieve the required reliability and availability. GHG and criteria pollutant emissions of the fuel cell system will be compared to the base case of utility grid supplied power plus back-up energy storage and power generation systems. Finally, researchers will develop techno-economic analyses of all of the fuel-cell-powered data center and critical infrastructure use cases to determine the market potential for this promising resiliency technology.

The UC Irvine research team is led by Prof. Jack Brouwer, who has more than 20 years' experience leading interdisciplinary research teams in the study of electrochemical systems dynamics. Professor Brouwer and his team have access to state-of-the-art facilities and capabilities to test fuel cell use in data centers and critical infrastructure. Microsoft is a world leader in Information Technology and the largest single developer of data centers anywhere in the world. SoCalGas, Microsoft, and UC Irvine have collaborated for a number of years, supporting research and demonstration of fuel cell systems for data centers and other distributed generation applications.

Initial research conducted in 2019 resulted in the development of a concept proposal for a DOE funding opportunity under the H2@Scale program. The research collaboration, representing SoCalGas, UC Irvine, Microsoft, Air Liquide, Ørsted, Southern California Edison, and Hydrogenics, now a part of Cummins Inc., was encouraged by DOE to submit a formal application for funding in 2020.

[1] Jones, Nicola, *How to stop data centres from gobbling up the world's electricity*. Nature 561, 163-166 (2018). URL: https://www.nature.com/articles/d41586-018-06610-y

[2] Andrae, Anders S.G.; Edler, Tomas; *On Global Electricity Usage of Communication Technology: Trends to 2030*. Challenges 2015, 6(1), 117-157; https://doi.org/10.3390/challe6010117

CUSTOMER END-USE APPLICATIONS

ZNE for Residential

Appliance & IAQ

Commercial Cooking & Food Service

Solar Thermal Heating & Cooling

Boilers & Process Heating

This program focuses on developing, demonstrating, and commercializing technologies that cost-effectively improve the efficiency and reduce the environmental impacts of gas equipment used in residential, commercial, and industrial settings. The program is divided into five sub-programs:

Zero Net Energy (ZNE) for Residential Buildings

This sub-program supports manufacturers in the development of new high-efficiency gas appliances. Representative appliances include gas water heaters and space heaters, and gas heat pumps. The sub-program also focuses on demonstrating these new products in ZNE model homes.

Appliance and Indoor Air Quality (IAQ)

This sub-program supports industry in the development and demonstration of new, low-NOx-emission products for water heaters and space heaters, as well as new gas heat pump products and lower-cost water and space heating technologies. Program staff also work with industry to define and validate IAQ concerns in residences and foster development of new combustion technologies using metallic, ceramic, and fiber materials.

Commercial Cooking and Food Service

In this sub-program, RD&D staff perform a variety of activities focused on characterizing the NOx emissions associated with many types of commercial cooking and food service equipment and developing and demonstrating new, low-NOx alternatives. The sub-program also supports industry in the development of methods and equipment to reduce the emissions of particulate matter from commercial food service equipment.

Solar Thermal Heating and Cooling

This sub-program focuses on supporting manufacturers in the development of cost-effective solar thermal solutions for commercial and multifamily applications. This work includes demonstrating concentrated solar arrays featuring increased reliability and low maintenance costs, as well as reducing integration issues associated with systems that produce multiple end use energy products, such as steam, cold water, and/or hot water.

Boilers and Process Heating

In this sub-program, RD&D staff support industry in the development and demonstration of low-NOx industrial process heaters and industrial boilers that can achieve near-zero emissions, as well as new low-NOx process heaters.

SPOTLIGHT

Reducing food processing GHG emissions

SoCalGas and Gas Technology Institute develop breakthrough industrial drying technology

TOTAL PROJECT COST	$3,240,000
SoCalGas:	$400,000
CEC:	$2,600,000
UTD:	$160,000
Wilson Engineering:	$80,000

Food processing is an essential industry to California's economy, generating an annual economic output estimated at $200 billion and employing almost 200,000 people[3]. Yet, the industry also consumes vast quantities of energy—driving up food costs and making it a major source of GHG emissions.

One of the most energy-intensive operations associated with food processing is dehydration. Using conventional drying technologies, this process can consume as much as 60 percent of the total energy required to process and transport a food product.

To address this issue, SoCalGas collaborated with the Gas Technology Institute (GTI), Utilization

The innovative TVD industrial drying system reduced natural gas consumption by as much as 65% and electricity usage by 40%, while recovering substantial amounts of process water.

[3]Cavanaugh, Patrick, *California Food Processing: $200 Billion in Value*. California Today; June 4, 2018; https://californiaagtoday.com/california-food-processing-200-billion-value/

The new technology shows promise in drying or heat processing across a broad spectrum of industrial, agricultural, and commercial applications, while consuming far less energy, reducing GHG emissions, and saving money.

Technology Development (UTD), Wilson Engineering, and the California Energy Commission to field-demonstrate a new high-efficiency drying technology that integrates a gas-fired thermal-vacuum drying (TVD) process. The project team hoped to improve the efficiency of bulk food drying operations by more than 75 percent, while demonstrating the economic feasibility of integrating the TVD system into a variety of industrial drying applications.

GTI and UTD demonstrated the new technology at Martin Feed LLC, a food processor in Corona, California that collects waste bakery material—such as dough, crackers, and pastries—and dries it in fields before selling it to dairy farms for feed. This approach was time-consuming and impacted by wind and rain during the fall and winter.

The TVD system uses heat to generate steam. When steam is released, it generates a vacuum within a drying chamber. Excess heat from the steam-generation process is used to heat the incoming material. The combination of heat and vacuum enable the new system to dry the materials very quickly. In comparison to conventional dryers, the new system lowered natural gas consumption by 61 to 65 percent and electricity consumption by 40 percent. And, in contrast to conventional drying technology, where moisture is released to the atmosphere, the TVD system is capable of recovering a substantial amount of process water.

Critically, the new technology shows promise in drying or heat processing across a broad spectrum of industrial, agricultural, and commercial applications—including drying livestock feed, textiles, and pharmaceutical ingredients—while consuming far less energy, reducing GHG emissions, and saving money. By significantly increasing the efficiency of a key industrial process, this technology could drive cost-effective GHG emissions reductions in a sector that has proven quite difficult to electrify, primarily due to a lack of electric dryers capable of operating at the required scale.

FINANCIAL HIGHLIGHTS

2019 Funds Expended

In 2019, the SoCalGas RD&D Program invested $13,142,010 in more than 300 projects across the entire gas supply chain. The RD&D Program allocated funding across the five programs and multiple sub-programs. Collectively, these projects leveraged significant co-funding from businesses, research consortia, and other participating organizations.

Program	2019 Actuals
Low Carbon Resources	$5,139,915
Gas Operations	$3,533,991
Clean Transportation	$1,093,494
Clean Generation	$714,170
Customer End-Use Application	$1,826,256
Management & Administration	$834,184
TOTAL	$13,142,010

Royalties and Incentives

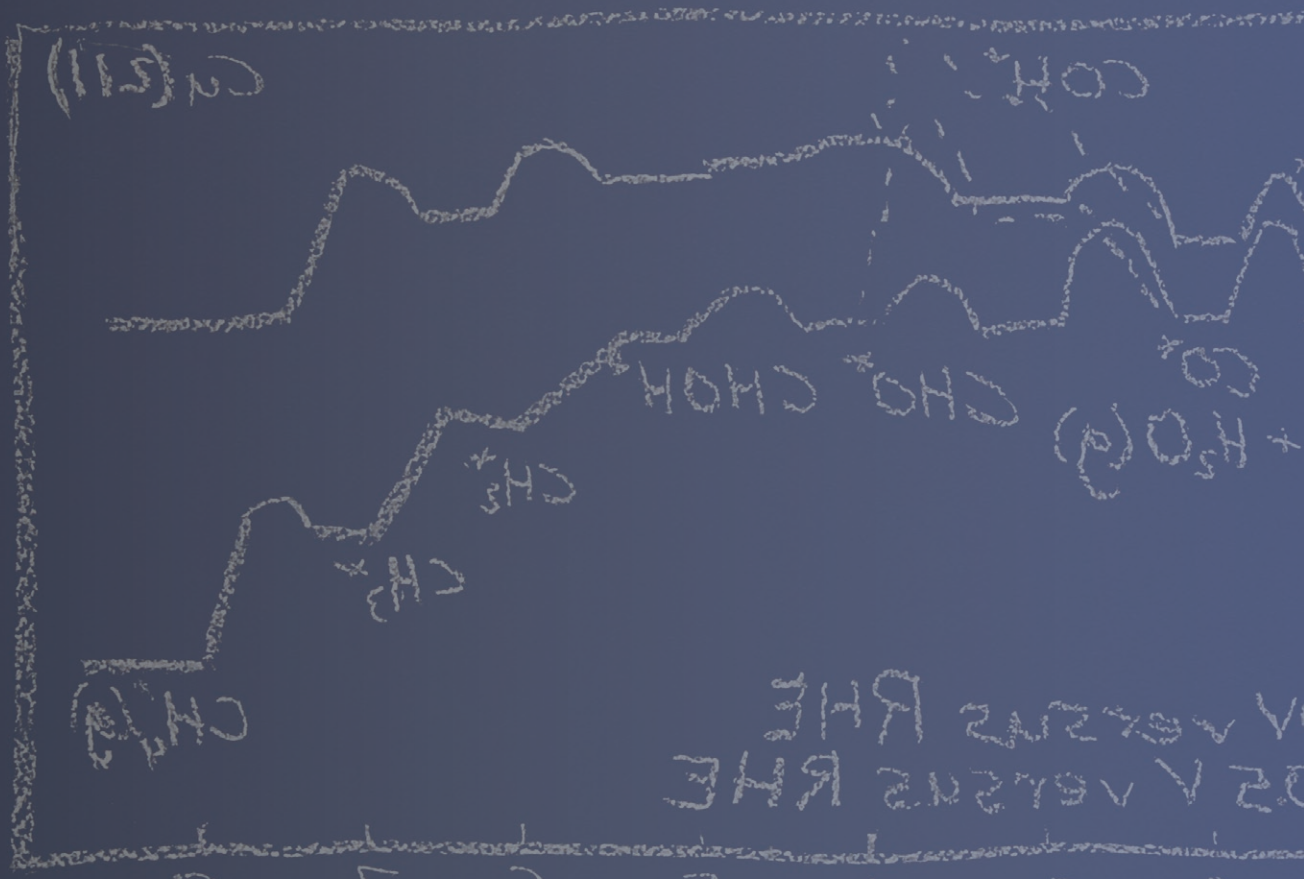
To maximize value, the RD&D Program is authorized to negotiate royalty and equity arrangements with companies participating in the program. For certain products or technologies nearing full commercialization, SoCalGas negotiates product royalty rights or equity interest in companies developing targeted technologies in exchange for RD&D funding that is used to support technology development and demonstration. When appropriate, SoCalGas also obtains preferential pricing on equipment and other technology developed with funding from the RD&D Program.

These arrangements provide an opportunity for SoCalGas ratepayers to receive a direct financial return should the technology development efforts prove successful. In 2019, past RD&D Program investments generated $99,584 in royalties.

Year	Royalties
2015	$99,689
2016	$90,882
2017	$104,398
2018	$100,849
2019	$99,584

Royalties generated by the SoCalGas RD&D Program.

Appendix



2019 FUNDING RECIPIENTS

Aeris Technologies Inc
Agileone
Alexanders Mobility Services
Alliance for Sustainable Energy LLC
Avineon Inc
Barnett Technical Services LLC
Battelle Memorial Institute
Black & Veatch Mgmt Consulting LLC
Blue Frontier LLC
Brillio LLC
Brimstone Energy LLC
C H Robinson Company
California Institute of Technology
California State University Long Beach
Cherokee Nation Office Solutions
Clean Energy Systems Inc
Cleantech Group
Combined Power LLC
Connection
Czero LLC
DE Solutions
DNV GL USA INC
Dragonfly Vision
Electric Power Research Institute (EPRI)
Electrochaea Gmbh
Energy Experts International
Energy Solutions Center
Exponent Inc
Fluor Enterprises Inc
Frontier Energy, Inc.
Gas Machinery Research Council
Gas Technology Institute (GTI)
Genifuel Corporation
Geodetics Inc
Gladstein Neandross & Associates
ICF Incorporated LLC
Ingevity Corporation
Ips-Industrial Procurement Services
Johnson-Peltier
Kore Infrastructure LLC
Lawrence Livermore National Laboratory
Massachusetts Materials Technologies
Mcmaster Carr Supply Co
Michael Naylor
Microdrones Canada Inc
Nemaco Technology LLC
Northeast Gas Association
Nv5 Inc
Onboard Dynamics Inc
Onesource Distributors LLC
Operations Technology Development (OTD)
Opus 12 Inc
Our Powder Coating Inc
Pacific EH&S Services Inc
Parsons Environment & Infrastructure
PCPC Direct Ltd
Pipeline Research Council Intl Inc
Power and Telephone Supply Company
Quest Integrity Usa LLC
Quswami Inc
RM Myers Corporation
Restek Corporation
Ricardo Inc
Ricoh Usa Inc
RR Donnelley
Sierra Energy
South Coast Air Quality Management District
Southwest Research Institute
Steve Cardiff
Summit Fluid Technologies LLC
Susteon Inc
Techcorr Usa Management LLC
Stanford University
The Grant Farm
The Sourcium Group
Transient Plasma Systems Inc
Tri-Pacific Supply Inc
Trussworks International Inc
UC Regents - University of California Irvine
UC Regents - University of California Berkeley
UC Regents - University of California Davis
UC Regents - University of California Riverside
University of Southern California
USAT Corp
Utilization Technology Development (UTD)
Western Office

2019 RESEARCH COLLABORATORS

Universities

California Institute of Technology

California State University, Long Beach

California State University, Los Angeles

Stanford University

University of California, Berkeley

University of California, Irvine

University of California, Davis

University of California, Riverside

Research Consortia

Operations Technology Development

Utilization Technology Development

Sustaining Membership Program

Northeast Gas Association/NYSEARCH

Pipeline Research Council International

Pipeline and Hazardous Materials Safety Administration

National Labs

Lawrence Livermore National Lab

Lawrence Berkeley National Lab

National Renewable Energy Laboratory

Public Agencies

US Department of Energy

US Department of Transportation

California Energy Commission

California Public Utilities Commission

South Coast Air Quality Management District

Research Labs and Consultants

Gas Technology Institute

Det Norske Veritas (U.S.A), Inc.

Electric Power Research Institute

GHD

Innovative Environmental

2019 SUMMARY OF ONGOING AND COMPLETED PROJECTS

LOW CARBON RESOURCES

SUB-PROGRAM: ARTIFICIAL PHOTOSYNTHESIS

Joint Center for Artificial Photosynthesis Industry Advisor Membership
Annual membership fee for Joint Center for Artificial Photosynthesis (JCAP) Industry Advisor Panel. Of specific interest to SoCalGas, JCAP performs work in the area of sunlight-driven hydrogen production from water splitting and has reached record conversion efficiency.

Co-Funders: DOE

Start Date: 1/12/2016
End Date: 1/12/2021
Status: Active
2019 Funds Expended: $100,000
Total Project Cost: $2,480,780
Total SCG Cost: $502,020
Total Co-Funding: $1,978,750
Benefits:

SUB-PROGRAM: BIOMASS PROCESSING AND CONVERSION

CSULA HomeBiogas Demonstration
SoCalGas collaborated with a senior design team at California State University, Los Angeles to demonstrate HomeBiogas residential equipment.

Co-Funders: N/A

Start Date: 8/1/2018
End Date: 3/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $11,000
Total SCG Cost: $11,000
Total Co-Funding: $0
Benefits:

HYPOWERS: Hydrothermal Processing of Wastewater Solids Phase 1
SoCalGas collaborated with Genifuel, Inc. to demonstrate the applicability of its proprietary hydrothermal processing technology to the treatment and conversion of wastewater sludge to renewable natural gas and biodiesel.

Co-Funders: DOE, CEC

Start Date: 9/1/2017
End Date: 6/28/2019
Status: Completed
2019 Funds Expended: $13,227
Total Project Cost: $2,011,281
Total SCG Cost: $300,560
Total Co-Funding: $1,710,721
Benefits:

Kore Biosolids Pyrolyzer Field Test
SoCalGas supported field-testing of Kore Infrastructure's commercial pyrolyzer to convert biosolids to syngas for production of renewable natural gas.

Co-Funders: Kore Infrastructure, South Coast Air Quality Management District

Start Date: 2/13/2017
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $150,000
Total Project Cost: $6,100,000
Total SCG Cost: $1,500,000
Total Co-Funding: $4,600,000
Benefits:

Reducing GHG emissions | Improving air quality | Safety | Reliability | Improving affordability/cost reduction

Momentum GFO-19-901 FPIP Hyperlight Proposal

Momentum supported the development of a proposal to install a hybrid gas-solar thermal energy system for food processing plants.

Co-Funders: N/A

Start Date: 9/6/2019
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $32,211
Total Project Cost: $60,000
Total SCG Cost: $60,000
Total Co-Funding: $0

Benefits: N/A

Sierra Energy Gasifier Technoeconomic Analysis

SoCalGas supported Sierra Energy in the development of a techno-economic analysis for scaling up the company's FastOx® gasifier to a capacity of 1,000 bone dry tons to convert biomass into renewable natural gas.

Co-Funders: PG&E

Start Date: 12/1/2018
End Date: 3/31/2019
Status: Completed
2019 Funds Expended: $50,000
Total Project Cost: $100,000
Total SCG Cost: $50,000
Total Co-Funding: $50,000

Benefits:

UCI Clean Energy Research Center Co-Funding

Funding support for University of California, Irvine research in the areas of energy use and water management (CERC-WET).

Co-Funders: N/A

Start Date: 8/15/2016
End Date: 8/15/2020
Status: Active
2019 Funds Expended: $100,000
Total Project Cost: $500,000
Total SCG Cost: $500,000
Total Co-Funding: $0

Benefits:

UCI Marginal Methane Emissions Model Research

Funding support to help develop a more accurate method for assessing direct methane emissions from the natural gas system.

Co-Funders: N/A

Start Date: 5/16/2016
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $338,615.81
Total SCG Cost: $338,615.81
Total Co-Funding: $0

Benefits:

UCLA Liquid Sulfur Thermal Energy Storage Research

Thermal energy storage using supercritical liquids. 30-kWh pilot-scale demonstration of the sulfur-based thermal energy storage in Brawley, CA.

Co-Funders: CEC

Start Date: 6/19/2015
End Date: 3/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $1,800,955
Total SCG Cost: $303,931
Total Co-Funding: $1,497,024

Benefits:

West Biofuels Renewable Gas Separation System and Techno-Economic Assessment
West Biofuels is developing a renewable gas/alcohols separation system. SoCalGas collaborated with NREL to conduct a study to evaluate the techno-economic merits of this new separation technology and validate its economic viability.

Co-Funders: CEC

Start Date: 10/1/2019
End Date: 10/1/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $2,200,000
Total SCG Cost: $200,000
Total Co-Funding: $2,000,000
Benefits:

SUB-PROGRAM: CARBON CAPTURE AND USE

De-Risking Molten Salt Based Methane Pyrolysis Reactors – Phase 1
SoCalGas and C-ZERO collaborated to further develop and advance C-ZERO's methane pyrolysis technology that utilizes a molten salt solution for the coproduction of hydrogen and solid carbon. The goal is to identify a commercially viable scale-up pathway and carbon separation and end-use application.

Co-Funders: DOE (ARPA-E), PG&E

Start Date: 8/1/2019
End Date: 9/1/2020
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $2,540,000
Total SCG Cost: $115,000
Total Co-Funding: $2,235,000
Benefits:

Hylux Early State Carbon Capture
SoCalGas supported Hyperlight in developing a concept proposal to the US Department of Energy's Advanced Research Projects Agency–Energy (ARPA-E) program. The proposal detailed the use of Hyperlight's concentrated solar power platform for carbon capture.

Co-Funders: N/A

Start Date: 9/9/2019
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $129,657
Total Project Cost: $221,000
Total SCG Cost: $221,000
Total Co-Funding: $0
Benefits:

Opus 12 Methane Conversion System – Phase II
SoCalGas supported work to develop and optimize a process that uses electrical input to convert carbon-dioxide and water into renewable methane.

Co-Funders: PG&E, JPL, SBIR, DOE

Start Date: 1/31/2019
End Date: 1/31/2020
Status: Active
2019 Funds Expended: $125,000
Total Project Cost: $1,025,000
Total SCG Cost: $150,000
Total Co-Funding: $875,000.00
Benefits:

TCF-19-17586 LLNL Composite Sorbents – Enabling Economical Biomethane Production
LLNL proposes to further develop, refine, and demonstrate a new class of sorbents to upgrade raw biogas to biomethane by capturing and converting CO2, which typically makes up ~40% of raw biogas content.

Co-Funders: DOE

Start Date: 10/15/2019
End Date: 10/15/2021
Status: Active
2019 Funds Expended: $250,000
Total Project Cost: $750,000
Total SCG Cost: $600,000
Total Co-Funding: $600,000
Benefits:

TCF-19-17862 Integrated Capture and Conversion of CO2 to Methanol (ICCCM) Process Technology
Development of the Integrated CO2 Capture and Conversion to Methanol (ICCCM) process using PNNL's CO2 Bio-ionic Liquids (CO2-BOLs).

Co-Funders: DOE

Start Date: 10/1/2019
End Date: 10/1/2021
Status: Active
2019 Funds Expended: $600,000
Total Project Cost: $1,200,000
Total SCG Cost: $600,000
Total Co-Funding: $600,000
Benefits:

SUB-PROGRAM: HYDROGEN PRODUCTION FROM METHANE

Clean Energy Systems (CES) Carbon-Negative Hydrogen Energy Facility FEL-1, FEL-2 Development
SoCalGas collaborated with CES to perform front-end engineering for a carbon-negative renewable hydrogen demonstration project using oxy-combustion of green waste.

Co-Funders: N/A

Start Date: 9/3/2018
End Date: 3/29/2019
Status: Completed
2019 Funds Expended: $59,750
Total Project Cost: $738,333
Total SCG Cost: $738,333
Total Co-Funding: $0
Benefits:

Clean Energy Systems (CES) CO2 Injection and Storage Permitting and Site Development
With funding from SoCalGas, CES conducted carbon-dioxide injection well planning and permitting at several sites in the central valley, and also performed a carbon intensity assessment of the CES CNE pathway.

Co-Funders: Schulmberger

Start Date: 5/1/2019
End Date: 11/30/2019
Status: Completed
2019 Funds Expended: $439,482
Total Project Cost: $7,439,482
Total SCG Cost: $439,482
Total Co-Funding: $7,000,000
Benefits:

JPL Catalytic Nonthermal Plasma -- Advanced Methane Reforming Technology Development and Commercialization -- Phase 1
SoCalGas supported Susteon in the development of a techno-economic analysis comparing various hydrogen production technologies, including solar thermochemical advanced reactor system (STARS) and catalytic nonthermal plasma (CNTP) reactors. Susteon then worked with Seaton Hall University to advance and optimize the preliminary JPL CNTP reactor design and build an easily scalable prototype reactor capable of producing around 1kg/day of hydrogen.

Co-Funders: N/A

Start Date: 6/1/2019
End Date: 9/30/2019
Status: Completed
2019 Funds Expended: $143,181.99
Total Project Cost: $292,024
Total SCG Cost: $292,024
Total Co-Funding: $0
Benefits:

Linde HydroPrime HC300 (Distributed Steam Methane Reformer – SMR) Purchase for Integration with STARS and Other Low Carbon Hydrogen Technologies

SoCalGas funded the purchase of a distributed steam methane reformer (SMR) system for integration with balance of plant components of a solar thermochemical advanced reactor system and other similar methane reforming systems to produce distributed, low-carbon hydrogen from methane.

Co-Funders: N/A

Start Date: 11/15/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $2,540,000
Total SCG Cost: $2,540,000
Total Co-Funding: $0
Benefits:

Methane Pyrolysis for Base-Grown Carbon Nanotubes and CO2-Free H2

SoCalGas supported Pacific Northwest National Laboratory and West Virginia University in the development of a new process for producing carbon-dioxide-free hydrogen and solid carbon from natural gas and demonstrating its commercial viability.

Co-Funders: DOE

Start Date: 2/2/2018
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $1,719,000
Total SCG Cost: $698,000
Total Co-Funding: $1,021,000
Benefits:

STARS Manufacturing Supply Chain Development for a Modular Solar-Thermochemical Conversion Platform (PNNL CRADA 387)

SoCalGas worked with Oregon State University (OSU), Pacific Northwest National Laboratory, and STARS for the development of high-efficiency manufacturing methods—through process intensification—to accelerate the commercial adoption of modular methane reforming systems.

Co-Funders: DOE, Oregon State University (RAPID Program)

Start Date: 11/2/2018
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $267,267.75
Total Project Cost: $8,710,729.75
Total SCG Cost: $617,267.75
Total Co-Funding: $8,093,462
Benefits:

STARS Solar Microchannel Steam Methane Reformer Commercialization (PNNL CRADA 380)
Development of a new high-efficiency, low-cost distributed H2 production technology. Modular solar steam-methane reforming technology development and commercialization in support of hydrogen fuel cell vehicle refueling infrastructure development.

Co-Funders: DOE

Start Date: 11/2/2018
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $250,000
Total Project Cost: $1,752,653
Total SCG Cost: $752,653
Total Co-Funding: $1,000,000
Benefits:

SUB-PROGRAM: POWER-TO-GAS (P2G)

Black and Veatch Hydrogen Market Assessment
Black & Veatch conducted an in-depth assessment of hydrogen potential in the SoCalGas service territory.

Co-Funders: N/A

Start Date: 11/1/2018
End Date: 3/31/2019
Status: Completed
2019 Funds Expended: $40,000
Total Project Cost: $120,000
Total SCG Cost: $120,000
Total Co-Funding: $0
Benefits:

Fluor Honor Rancho P2G FEED Study
In collaboration with SoCalGas, Fluor prepared a FEED study to analyze the viability of a power-to-gas demonstration at Honor Rancho.

Co-Funders: N/A

Start Date: 11/1/2018
End Date: 3/31/2019
Status: Completed
2019 Funds Expended: $47,955
Total Project Cost: $470,000
Total SCG Cost: $470,000
Total Co-Funding: $0
Benefits:

Grant Farm Strategic Research Roadmap Development
Development of strategies to enhance RD&D co-funding from federal, state, and local government agencies and private research foundations. Emphasis was on socialization and outreach, public funding partnerships, teaming and collaboration, and strategic and high-impact demonstration projects.

Co-Funders: N/A

Start Date: 5/1/2019
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $26,132.50
Total Project Cost: $67,500.00
Total SCG Cost: $67,500.00
Total Co-Funding: $0
Benefits: N/A

Hydrogen Blending on the Natural Gas System
SoCalGas collaborated with the University of California, Irvine in the development of system specifications and design assumptions for a hydrogen blending system.

Co-Funders: N/A

Start Date: 8/1/2019
End Date: 8/1/2020
Status: Active
2019 Funds Expended: $25,000
Total Project Cost: $150,000
Total SCG Cost: $150,000
Total Co-Funding: $0
Benefits:

LLNL Advanced Manufacturing Reactors for Microbial Electromethanogenesis Phase 2

SoCalGas worked with Lawrence Livermore National Laboratory to build on phase 1 electro-methanogenesis work and address the primary uncertainties that may impact commercial viability by drawing down the risk associated with the ***in situ*** electro-biomethanation technology. The goal of this project is to increase the scale of operation by two orders-of-magnitude over currently achieved targets, while meeting or exceeding the energy efficiency target of 30 g CH4/kWh.

Co-Funders: DOE, NYSEARCH

Start Date: 9/5/2018
End Date: 9/4/2020
Status: Active
2019 Funds Expended: $250,000
Total Project Cost: $1,350,443
Total SCG Cost: $682,385
Total Co-Funding: $668,058
Benefits:

Low-Cost/Low-Energy Hydrogen and Sulfuric Acid Co-Production via Electrolysis

SoCalGas initiated a project with Brimstone Energy to support development of co-generation technology that produces low-cost/low-energy hydrogen (more efficiently than conventional water electrolysis), sulfuric acid, carbon-dioxide, and cement.

Co-Funders: PG&E, DOE

Start Date: 11/1/2019
End Date: 11/1/2020
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $600,000
Total SCG Cost: $50,000
Total Co-Funding: $550,000
Benefits:

NREL – Electrochaea Power-to-Gas Biomethanation Plant Commissioning, Start-up and Operations

SoCalGas supported consultants providing guidance to the National Renewable Energy Lab (NREL) on the commissioning, start-up, and operations of NREL's biomethanation plant.

Co-Funders: N/A

Start Date: 12/10/2018
End Date: 6/28/2019
Status: Completed
2019 Funds Expended: $60,000
Total Project Cost: $135,000
Total SCG Cost: $135,000
Total Co-Funding: $0
Benefits:

NREL CRADA No. CRD-19-809 P2G Systems Integration & Optimization

SoCalGas supported the National Renewable Energy Lab and Electrochaea in the development of patents, systems integration, and optimization for a power-to-gas biomethanation system.

Co-Funders: DOE

Start Date: 5/1/2019
End Date: 6/30/2021
Status: Active
2019 Funds Expended: $500,000
Total Project Cost: $1,400,000
Total SCG Cost: $700,000
Total Co-Funding: $700,000
Benefits:

NREL Multi-Party CRADA No. CRD-18-007755 Biomethanation to Upgrade Biogas to Pipeline Grade Methane

In collaboration with the National Renewable Energy Lab and Electrochaea, SoCalGas helped to develop and de-risk an adaptable biomethanation process to upgrade biogas waste streams to renewable natural gas.

Co-Funders: DOE, Electrochaea

Start Date: 7/31/19
End Date: 7/29/2022
Status: Active
2019 Funds Expended: $0
Total Project Cost: $1,620,100
Total SCG Cost: $0
Total Co-Funding: $1,620,100
Benefits:

NREL Power-to-Gas Biomethane Demonstration CRADA 14-567

Design, build and operate a small-scale P2G system using equipment available at the National Renewable Energy Lab and Energy Systems Integration Facility (ESIF). Advance Solar Baseload Power Generation using the Natural Gas Pipeline in Cooperation with NREL and ESIF.

Co-Funders: DOE

Start Date: 6/29/2014
End Date: 9/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $1,322,998
Total SCG Cost: $872,998
Total Co-Funding: $450,000
Benefits:

UCI Five Points Solar P2G Feasibility Study

Design of a Renewable Gas Energy Storage System to help the University of California achieve carbon neutrality. Explore P2G as a viable alternative to battery storage.

Co-Funders: N/A

Start Date: 4/1/2019
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $35,901
Total Project Cost: $95,901
Total SCG Cost: $95,901
Total Co-Funding: $0
Benefits:

UCI Power-to-Gas Electrolyzer Demonstration

Use UCI's microgrid to generate clean H2, blend H2 with NG, and feed blended gas to NGCC power plant.

Co-Funders: N/A

Start Date: 5/16/2016
End Date: 6/30/2019
Status: Completed
2019 Funds Expended: $1,104
Total Project Cost: $1,344,360
Total SCG Cost: $1,344,360
Total Co-Funding: $0
Benefits:

UCI Power-to-Gas Electrolyzer Demonstration Phase 2

Increase H2 blends for UCI P2G demo and model P2G and underground storage.

Co-Funders: N/A

Start Date: 8/1/2017
End Date: 4/19/2019
Status: Completed
2019 Funds Expended: $29,827
Total Project Cost: $156,109
Total SCG Cost: $156,109
Total Co-Funding: $0
Benefits:

UCI Power-to-Gas Grid Scale Method Development

Investigate and compare the use of P2G as a form of energy storage and a dispatchable load. Compare P2G to battery energy storage and other energy storage forms.

Co-Funders: N/A

Start Date: 5/16/2016
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $20,000
Total Project Cost: $670,000
Total SCG Cost: $670,000
Total Co-Funding: $0
Benefits:

US Hydrogen Study

Develop a more comprehensive hydrogen roadmap for the United States.

Co-Funders: Fuel Cell and Hydrogen Energy Association (FCHEA)

Start Date: 3/4/2019
End Date: 3/1/2020
Status: Active
2019 Funds Expended: $25,000
Total Project Cost: $474,955
Total SCG Cost: $25,000
Total Co-Funding: $449,955
Benefits:

Use of the Natural Gas Grid as a Long Duration Energy Storage Resource

Perform a comprehensive analysis of the requirement for long-term hydrogen energy storage using the California natural gas grid, and suggest modifications to the RESOLVE model, which is used by CAISO for integrated resource planning.

Co-Funders: N/A

Start Date: 8/1/2019
End Date: 7/1/2021
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $300,000
Total SCG Cost: $300,000
Total Co-Funding: $0
Benefits:

GAS OPERATIONS

SUB-PROGRAM: ENVIRONMENTAL & SAFETY

Advanced Leak Detection Technologies for Grading Leaks (7.19.b)

The objective is to explore possibilities for new open path methane detectors to be incorporated into leak classification/grading procedures. Current procedures for classifying underground leaks are based on well-established methods and equipment for leak detection; however, there is an abundance of new methane detection technologies entering the market that have the potential to improve leak detection and classification efficiency.

Co-Funders: OTD Members

Start Date: 3/1/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $5,000
Total Project Cost: $190,000
Total SCG Cost: $9,048
Total Co-Funding: $180,952
Benefits:

Ambient NO2 Modeling for One-Hour Standard (CPS-11-5 & 5A)

SoCalGas worked with Pipeline Research Council International , Interstate Natural Gas Association of America Foundation, American Petroleum Institute , and other trade associations to build a robust emission data set that could be used to assess the performance of AERMOD, the EPA's compliance tool for estimating impacts from air pollutant emission sources. Further objectives included developing recommendations for the EPA and working closely with EPA modeling staff to improve AERMOD and/or model inputs. To date, the publicly available dataset has proven valuable to other modelers, who have begun using it to assess other topics related to AERMOD performance and improvement.

Co-Funders: PRCI Members, INGAA, INGAA Foundation, API

Start Date: 1/1/2014
End Date: 9/16/2020
Status: Active
2019 Funds Expended: $53,429
Total Project Cost: $3,172,696
Total SCG Cost: $354,310
Total Co-Funding: $2,818,386
Benefits:

Applying Heat to Steel Near PE (5.19.s)

This project intends to identify and validate the best practices of applying heat to steel near polyethylene (PE) material. Field welding can transfer heat to PE material and affect its integrity. This study will consider all the possible worst-case scenarios, in the field, and the associated parameters to create a model that will allow the user to simulate field conditions and predict the risk to plastic facilities.

Co-Funders: OTD Members

Start Date: 10/3/2019
End Date: 6/30/2021
Status: Active
2019 Funds Expended: $50,250
Total Project Cost: $188,500
Total SCG Cost: $100,500
Total Co-Funding: $88,000
Benefits:

Assessment of Methane Emission Quantification Techniques for Storage Facilities (US-4-2A)

This project identifies new methane quantification technologies that have recently emerged and demonstrates their capabilities in an underground storage field environment. Results of this project will provide operators with an overview of available technologies and their appropriateness for different applications. The demonstrations will be used to validate near-commercial solution(s) and to define recommendations for their installation and use. The tests and analysis will be used to provide feedback and directions to vendors to improve their systems.

Co-Funders: PRCI Members

Start Date: 7/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $123,900
Total SCG Cost: $9,197
Total Co-Funding: $114,703
Benefits:

Best Practices to Address Odor Fade in High-Rise, Low-Occupancy Buildings (5.17.d)
The goal is to develop best practices on how to odorize gas pipes in high-rise, low-occupancy buildings to prevent odor fade, which occurs via odorant adsorption on rust inside the pipeline. Loss of odorant effectiveness in natural gas is a public safety concern. Odorant is an important safety barrier added to natural gas, which is odorless, to enable people to detect leaks based upon smell.

Co-Funders: OTD Members

Start Date: 4/17/2017
End Date: 4/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $254,643
Total SCG Cost: $24,643
Total Co-Funding: $230,000
Benefits:

Breakaway Disconnect for Meter Risers - Phase 3 (5.11.s.3)
Residential gas meters exposed to vehicle damage or other outside forces can cause gas leaks, fire and property damage. A cost-effective method of shutting off the gas flow is needed when a meter set assembly (MSA) sustains a major impact. The Breakaway Disconnect Fitting was engineered to be the weak link of the MSA and will break, shutting off the gas flow. The test results showed that the Breakaway Fitting functioned as expected and stopped the flow of gas on the utility side of the meter.

Co-Funders: OTD Members

Start Date: 8/1/2016
End Date: 8/30/2019
Status: Completed
2019 Funds Expended: $103,684
Total Project Cost: $301,139
Total SCG Cost: $117,139
Total Co-Funding: $184,000
Benefits:

Center for Methane Research (6.16.a)
The Center for Methane Research (CMR) is acting as a liaison between the natural gas industry, university researchers, government researchers, regulators, and other groups to ensure that important methane studies are made available while fostering collaborations. CMR will disseminate technically accurate information to OTD members, collect and analyze data on methane emission trends and atmospheric concentration levels, conduct new scientific investigations on the role of methane in global warming, and serve as a repository for this information.

Co-Funders: OTD Members

Start Date: 10/1/2016
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $755,000
Total SCG Cost: $50,000
Total Co-Funding: $705,000
Benefits:

CEPM for Turbochargers (CPS-14B-08)
The project team is developing turbocharger performance models from data collected from a variety of past Pipeline Research Council International projects, as well as from new data collected during the project at two compressor stations. Operators will use the model to detect drops in turbocharger performance early, enabling them to schedule maintenance or repairs before the engine is unable to meet emission limits.

Co-Funders: PRCI Members

Start Date: 1/31/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $102,101
Total SCG Cost: $8,653
Total Co-Funding: $93,448
Benefits:

CFD Study of Prechamber Ignition Mechanisms for GHG Reduction (CPS-14-05)

This project represents the first phase of a multi-phase effort to understand Pre-Combustion Chamber (PCC) and main chamber ignition and their impact on NOx and GHG emissions. The ultimate goals are to determine the relative importance of a variety of factors—including temperature, chemistry, and mixing—and to use that understanding to improve PCC system design and reduce emissions, most notably from engines that operate at extremely lean air/fuel ratios to achieve low NOx emissions.

Co-Funders: PRCI Members

Start Date: 12/10/2019
End Date: 7/31/2021
Status: Active
2019 Funds Expended: $25,875
Total Project Cost: $109,740
Total SCG Cost: $25,875
Total Co-Funding: $83,865
Benefits:

Clothing Performance Guidelines to Reduce Heat Stress for Natural Gas Workers (5.18.r)

Improvements in worker safety and health is a top priority for the natural gas industry. Thermal comfort and heat stress are significant concerns for outdoor workers in the industry. There are currently no industry wide requirements or standards to guide the selection of fire resistant clothing to reduce heat strain for workers conducted in hot and stressful working environments. The North Carolina State University team will focus on understanding the effects of heat strain and comfort as it relates to flash suits that all natural gas companies utilize.

Co-Funders: OTD Members

Start Date: 7/1/2018
End Date: 6/30/2021
Status: Active
2019 Funds Expended: $3,182
Total Project Cost: $284,422
Total SCG Cost: $10,022
Total Co-Funding: $274,400
Benefits:

Competency in the Pipeline Industry: An Industry Survey (DP-3-07)

PBOK Technical Training Ltd. designed and distributed an online survey to pipeline operating and service members of the Pipeline Research Council International. The goal of the survey was to understand perceived baseline competency requirements for a number of areas within the pipeline industry (e.g., across the entire pipeline lifecycle) and to identify gaps within the industry in order to develop a roadmap for increasing competency and filling gaps.

Co-Funders: PRCI Members

Start Date: 1/1/2018
End Date: 3/4/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $60,800
Total SCG Cost: $0
Total Co-Funding: $60,800
Benefits:

Evaluation of Commercially Available On-Line Analyzers for Measurement of Multiple Gas Contaminants (MEAS-9-01)

This project will test commercially available analyzers—each measuring moisture, hydrogen sulfide, and carbon dioxide—with two baseline gas mixtures representing typical transmission gas. Project goal is for operators to be able to use a single analyzer for multiple contaminants instead of several analyzers that are each capable of measuring one contaminant. The use of a single analyzer at a biomethane site to "green" natural gas can save $50,000 in capital cost and $10,000/year in O&M expenses.

Co-Funders: PRCI Members

Start Date: 1/31/2018
End Date: 1/31/2020
Status: Active
2019 Funds Expended: $537
Total Project Cost: $141,600
Total SCG Cost: $15,000
Total Co-Funding: $126,600
Benefits:

Evaluation of Oxidation Catalyst Degradation on a 2-Stroke Lean-Burn Engine (CPS-13J)

The project team studied oxidation catalyst degradation in 2-stroke lean burn engines. Project team members conducted laboratory testing on field-aged oxidation catalysts and gathered data will help operators manage compliance as the catalyst degrades. The team also explored the value of catalyst washing to mitigate zinc and phosphorus poisoning and prolong catalyst life. Results helped determine that washing could reduce costs in comparison to catalyst replacement.

Co-Funders: PRCI Members

Start Date: 1/31/2017
End Date: 5/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $355,424
Total SCG Cost: $59,750
Total Co-Funding: $295,674
Benefits:

Fiber Optics Pipeline Integrity Monitoring System at a Creek Bed

SoCalGas will install a fiber-optic-based real-time pipeline monitoring system to test its capability in detecting ground movement (subsidence), pipeline strain, 3rd-party intrusion, and gas leakage. The test environment is located at a creek bed where sections of underground pipeline were exposed during the 2018 rains that caused massive mudslides.

Co-Funders: N/A

Start Date: 1/1/2018
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $84,075
Total Project Cost: $770,000
Total SCG Cost: $770,000
Total Co-Funding: $0
Benefits:

Gas Imaging Technologies (7.16.b)

The detection of natural gas leaks is very important to natural gas utilities as public safety is their first priority. Being able to quickly measure and identify the source of a leak plume and the direction it is traveling are very important, not only to the safety of customers, but also to first responders. The objective of this project is to evaluate the use of optical gas imaging technologies for various applications within the gas industry. Specific applications will include methane emissions quantification (e.g., measuring leak rate) and leak investigation by first responders.

Co-Funders: OTD Members

Start Date: 2/1/2020
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $308,757
Total SCG Cost: $21,757
Total Co-Funding: $287,000
Benefits:

Guidelines for Assessing Indoor Meter Set Relocation Risk (5.17.a)

Replacement of gas service lines occurs more frequently due to regulatory drivers which impact gas main and service replacement efforts, as well as increased customer loads and gas system expansion. Utilities are frequently challenged to find suitable locations to place meter set assemblies that will not pose a safety risk and balance concerns of both regulatory requirements and consumer demands. This project will develop guidelines regarding the placement and risks associated with indoor meter sets. The guidelines will include safety considerations related to sources of ignition, inside regulator venting, confined spaces, and other safety issues.

Co-Funders: OTD Members

Start Date: 4/13/2017
End Date: 9/30/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $182,246
Total SCG Cost: $8,246
Total Co-Funding: $174,000
Benefits:

Implications of Odorant Dispersion in a Natural Gas Pipeline (7.16.d)

The project objective is to determine the minimum distance, downstream of an odorant injection point, where the liquid odorant is completely dispersed (vaporized) and to determine the optimum sampling point to measure odorant concentration. Knowledge of where polymeric materials may be in a pipeline system and not be subject to liquid odorant will improve the integrity and safety of the polyethylene pipeline infrastructure. Integrating this information with odorant sampling point recommendations and knowledge of odorant permeation rates would provide operators with data to make the best decisions regarding odorization dispersion issues for their specific systems.

Co-Funders: OTD Members

Start Date: 8/15/2016
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $30,000
Total Project Cost: $231,709
Total SCG Cost: $51,709
Total Co-Funding: $180,000
Benefits:

Improved Catalyst Regeneration Process (CPS-13-01A)

An optimal oxidation catalyst regeneration technique (washing) will be developed from previous work and evaluated on an exhaust slip stream in the laboratory. This washing technique will be shared with the natural gas industry. Small-scale tests on degraded catalyst samples will be performed to assess whether thermal treatment can be incorporated into the catalyst regeneration process to remove more catalyst poisons than chemical washing by itself. Samples will be processed by thermal treatment followed by chemical washing and vice versa.

Co-Funders: PRCI Members

Start Date: 1/1/2020
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $20,650
Total Project Cost: $41,300
Total SCG Cost: $20,650
Total Co-Funding: $20,650
Benefits:

Intelligent Shutoff Device - Phase 3 (5.12.a.3)

Third-party damage is the number one threat to the natural gas distribution system. Natural gas service lines and meter sets are particularly vulnerable to damage from third-party excavators and vehicular traffic. This project is focused on the development of an intelligent shut-off device (ISOD) to address regulations and risks associated with service and meter set assembly (MSA) damage and associated leaks. The device will be designed to have the ability to detect third-party damage to the service or MSA and, in response, limit the flow of natural gas, thereby, reducing the hazard from the incident and greenhouse gas emissions. Phase 3 will develop and evaluate field-ready prototypes of the ISOD based on the designs and constraints identified in the initial phases of work. After a delay in manufacturing, the project team received samples of the field-worthy casted version of the meter valve and service line valve. Prototype testing is ongoing. Researchers plan to manufacture additional production samples of both valves for pilot projects with utilities. The primary benefit is to enhance public safety with minimal greenhouse gas releases to the environment.

Co-Funders: OTD Members

Start Date: 3/1/2017
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $320,595
Total SCG Cost: $65,595
Total Co-Funding: $255,000
Benefits:

Isolation Valves Scoping Study to Reduce Through-Valve Gas Leakage (CPS-17-04)

The EPA annual greenhouse gas inventory indicates that a primary source of reciprocating compressor leak emissions results from unit isolation and blowdown through-valve leakage, which also poses safety concerns due to presence of gas in workspaces downstream of an isolated portion of the suction or discharge header system, where gas can accumulate. The identification, repair, or replacement of leaking compressor unit isolation valves can be very costly. Thus, cost-effective valve selection, maintenance, repair, and replacement options are needed. In 2019, the project team completed surveys and interviews with member companies of the Pipeline Research Council International. The results did not yield any meaningful correlation between leakage and design characteristics, but did result in recommendations for future projects exploring the improvement of measurement and detection techniques.

Co-Funders: PRCI Members

Start Date: 2/15/2019
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $20,721
Total Project Cost: $80,721
Total SCG Cost: $40,721
Total Co-Funding: $40,000
Benefits:

Itron Valve with Methane Sensor - Phase 2 (5.14.w.2)

This project is intended to evaluate the performance of a methane sensor integrated with a gas shut off valve to provide gas operators with advanced indication of abnormal operating conditions that could result in a gas release inside a building. Because the technology providers identified for this project are no longer in alignment with this project's objective, the project is on-hold pending the identification of other technology collaborators or completion of a needs assessment.

Co-Funders: OTD Members

Start Date: 12/1/2017
End Date: 5/31/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $141,153
Total SCG Cost: $1,653
Total Co-Funding: $139,500
Benefits:

Natural Gas Emissions Detection & Quantification

The primary objectives in this project are to assess advanced technologies to detect and quantify fugitive methane emissions on SoCalGas's aboveground and belowground natural gas transmission, distribution, and underground storage facilities, and to provide priority in mitigating emission sources to comply with new and emerging environmental regulations. The project team prepared a white paper to discuss the implementation and limitations of leak detection and repair programs and field-tested a unique leak centering method using the Joule-Thomson cooling effect.

Co-Funders: N/A

Start Date: 1/1/2018
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $35,227
Total Project Cost: $350,571
Total SCG Cost: $350,571
Total Co-Funding: $0
Benefits:

ORFEUS Obstacle Detection Technology for Horizontal Directional Drilling (5.16.k.2)

The objective is to evaluate an obstacle detection technology for reducing the incidence of third-party damage to existing buried infrastructure when using horizontal directional drilling (HDD) systems in congested subsurface situations. The technology would allow HDD operators to look ahead while drilling in real time.

Co-Funders: OTD Members, DOT/PHMSA, Others

Start Date: 12/1/2017
End Date: 3/31/2021
Status: Active
2019 Funds Expended: $18,673
Total Project Cost: $4,286,446
Total SCG Cost: $62,346
Total Co-Funding: $4,224,100
Benefits:

Performance, Durability, and Service Life of Residential Gas Regulators (5.18.n)
To determine the durability and expected service life of common residential natural gas service regulators. The project consists of two phases. Phase I will perform a study on regulators' reliability and failure modes. Phase II will build a test rig and perform life-cycle testing. Utilities will be provided with results and technical support for a better understanding of the expected service life of regulators. This will result in savings to utilities and avoid costs associated with labor, material, and unnecessary customer service interruption.

Co-Funders: OTD Members

Start Date: 10/31/2018
End Date: 9/1/2020
Status: Active
2019 Funds Expended: $1,865
Total Project Cost: $295,000
Total SCG Cost: $3,865
Total Co-Funding: $291,135
Benefits:

Remote Gas Sensing for First Responders - Phase 4 (7.15.b.4)
The two remote device technologies in this project wirelessly provide real-time information back to first responders, gas company personnel, and others in charge of monitoring and assessing the gas levels at multiple locations adjacent to the leak site. Phase 4 focuses on working with a manufacturer to develop pre-commercial ready units that can be tested by sponsors at actual leak sites.

Co-Funders: OTD Members

Start Date: 9/1/2019
End Date: 6/30/2021
Status: Active
2019 Funds Expended: $13,500
Total Project Cost: $358,000
Total SCG Cost: $27,000
Total Co-Funding: $331,000
Benefits:

Residential Methane Detectors - Phase IV (1.14.g.4)
The project develops a scientifically sound rationale for recommendations on where to place commercially available residential methane detectors. Although these systems are commercially available, their performance must be evaluated to ensure their effectiveness. Placement of these methane detectors can affect their performance in detecting natural gas leaks. The main objective of the project is to develop a scientifically sound rationale for recommendations on where to place commercially available residential methane detectors to enhance customer safety. The findings of this project will be used to support the development of a new standard for methane detection systems for the National Fuel Gas Code led by Gas Technology Institute, International Codes Council, and the National Fire Protection Association.

Co-Funders: OTD Members

Start Date: 11/1/2017
End Date: 1/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $91,893
Total SCG Cost: $5,893
Total Co-Funding: $86,000
Benefits:

Residential Methane Detectors Program, Phase V: Improving LDC Customer Education (1.14.g.5)
Conduct a science-based evaluation of LDC gas safety literature using the lessons learned in the consumer behavior survey work completed in a prior phase of the Residential Methane Detector (RMD) program. The goal is to make technical recommendations on how to incorporate the use of RMDs into gas safety messaging. The primary source of consumer warning that a gas leak may be present is the use of gas odorants as a malodorous warning agent. While these warning agents as currently specified in pipeline safety codes are a solution to gas detection, additional consumer protection would be provided by advocating use of appropriate residential gas detectors.

Co-Funders: OTD Members

Start Date: 9/3/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $69,000
Total SCG Cost: $972
Total Co-Funding: $68,028
Benefits:

Selecting Locating and Excavation Technologies (5.20.b)

Third-party excavation damage to underground natural gas pipeline is a leading cause of property damage and loss of life. The objective of this project is to develop a web-based program and database for end-users to assist in developing communication tools between excavators and pipeline operators for the selection of technologies and best practices for safe excavations of belowground assets. The results should reduce the risks of pipeline excavation damage and provide situational awareness of excavation procedures.

Co-Funders: OTD Members, PHMSA

Start Date: 1/1/2020
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $759,000
Total SCG Cost: $13,872
Total Co-Funding: $745,128
Benefits:

Software Tool to Assess the Human Factors Risk of Pipeline Damage during Pipeline Construction, Operations and Maintenance (DP-3-06)

The Pipeline Assessment Tool for Human Factors (PATH) will be developed and reviewed with a member company (or companies). Once completed, each member company will be given the opportunity to use PATH in the field to identify the Human Factors Risks in their construction, operations and maintenance activities. The operator will have a tool that allows him/her to determine the gap between his/her system performance and the performance that is expected by good industry practices.

Co-Funders: PRCI Members

Start Date: 1/31/2018
End Date: 1/27/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $52,200
Total SCG Cost: $8,000
Total Co-Funding: $44,200
Benefits:

Subsurface Multi-Utility Asset Location Detection (5.20.a)

The project will develop and demonstrate an on-pipe electronic marking system that uses discrete radio-frequency identification (RFID) markers to highlight and identify points of interest, whose locating accuracy will be enhanced by a high-accuracy GPS locating system. The markers will be integrated into the polyurethane pipe manufacturing process. Operators can use the system to document the location of subsurface plastic pipes, provide accurate GPS coordinates for pipe and points of interest, and assign a quality score to the location data that is transferred to an operator's GIS system.

Co-Funders: OTD Members, DOT/PHMSA, Others

Start Date: 1/1/2020
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $0
Total Project Cost: $2,095,383
Total SCG Cost: $30,604
Total Co-Funding: $2,064,779
Benefits:

Thermally-Activated Gas-Shut-Off Devices (5.18.s)

This project analyzed the use of thermally-activated gas shut-off devices to significantly improve fire safety for premises supplied with natural gas. Significant safety can be achieved without the need for expensive actuators, electrical power, heat detectors, or fire detectors. This device is a passive device and only triggers at extreme temperatures. The objective was to conduct a requirement review and performance test of commercially available thermally-activated gas shut-off devices for the natural gas industry that prevent or reduce the release of natural gas. This project identified three manufacturers and developed a reference document with operational parameters and considerations.

Co-Funders: OTD Members

Start Date: 7/1/2018
End Date: 9/12/2019
Status: Completed
2019 Funds Expended: $2,585
Total Project Cost: $143,500
Total SCG Cost: $7,585
Total Co-Funding: $135,915
Benefits:

Trace Constituent Database (7.18.h)

No single database of information on methods, measurement related issues, and actual concentration data for the natural gas industry is currently available for trace constituents. One mission of this project is to use the Gas Quality Resource Center database to aggregate gas quality. A gas quality database would help gas companies to document the measurement technologies they use and their compatibility with standard measurement techniques.

Co-Funders: OTD Members

Start Date: 9/3/2018
End Date: 10/31/2020
Status: Active
2019 Funds Expended: $3,684
Total Project Cost: $162,000
Total SCG Cost: $8,684
Total Co-Funding: $153,316
Benefits:

Virtual Reality (VR) Training: Emergency Response Situations (5.18.t)

This project has successfully developed a realistic and interactive computer-generated virtual reality training module for Natural Gas Emergency Response Situations. Virtual Reality has one of the highest retention rates of all teaching styles as an adult-learning technique. This training module includes over 66,000 random scenarios related to responding to natural gas leaks in the centerline sewer resulting from third-party damage to a gas line causing the uncontrollable release of gas. The developed module will be incorporated into the SoCalGas operator training curriculum following module customization to match SoCalGas procedures.

Co-Funders: OTD Members

Start Date: 7/1/2018
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $27,397
Total Project Cost: $288,500
Total SCG Cost: $30,397
Total Co-Funding: $258,103
Benefits:

Virtual Reality Training Library Development (5.18.t.2)

This project will develop and use realistic, interactive, and immersive virtual reality (VR) training modules that will provide utilities several operational advantages. The use of VR modules will improve learner retention, improve consistency of training delivered, allow training to be conducted on demand by operations, increase the number of real-life training scenarios available for trainees to experience, and reduce the risk of injury to trainees. The goal is to develop a content library that utilities can use to assist in the training of their personnel on operations and maintenance procedures.

Co-Funders: OTD Members

Start Date: 11/1/2019
End Date: 4/30/2021
Status: Active
2019 Funds Expended: $25,000
Total Project Cost: $485,500
Total SCG Cost: $50,000
Total Co-Funding: $435,500
Benefits:

SUB-PROGRAM: OPERATIONS TECHNOLOGY

3vG Satellite InSAR Monitoring, Pilot Project

Project consultant 3vG is using the Japanese satellite ALOS-2 to monitor a section of the SoCalGas transmission service area. ALOS is capable of penetrating vegetation to measure displacement of the underlying ground surface and producing images covering 31 x 43 miles with 3-meter resolution. SoCalGas will compare the performance of this new system and its internal data processing software with existing technology.

Co-Funders: N/A

Start Date: 12/1/2019
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $49,800
Total SCG Cost: $49,800
Total Co-Funding: $0
Benefits:

Automation of the Explorer Series of Robotic Platforms Phase I, II, II-a (M2017-002)
The objective is to reduce the operational complexity associated with deployment of the Explorer robotic platforms, while increasing their overall capability by automating operation/control functions. Phase I focused on evaluating the automation potential of the existing hardware and identified what additions/modifications were required. Phase II implemented software and hardware modifications to enable upstream feature recognition, pipeline mapping capabilities, and autonomous control scripts for simple maneuvers. These features were successfully demonstrated in late 2019 on an empty pipeline segment at a test bed facility in Johnson City, New York. Phase III will focus on refinements needed to adapt the system for commercial deployment in a pressurized pipeline.

Co-Funders: NYSEARCH Members, Invodane

Start Date: 2/28/2017
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $4,212,620
Total SCG Cost: $232,255
Total Co-Funding: $3,980,365
Benefits:

Composite Repair Wrap for PE - Phase 2 (2.14.a.2)
The project's goal is to evaluate a structural reinforcing system for the repair of damaged polyethylene (PE) pipe. A practical PE permanent repair system will save time and money while minimizing service disruptions. Options that currently exist for the in-service repair of damaged pipes, couplings, and joints are often nonexistent, costly, or not reliable. The primary benefit is to reduce O&M costs.

Co-Funders: OTD Members

Start Date: 5/7/2018
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $75,900
Total SCG Cost: $8,576
Total Co-Funding: $67,324
Benefits:

Develop New Criteria for DC Stray Current Interference (EC-6-9A)
Members of Pipeline Research Council International conducted a study on how best to address the challenge of stray DC current interference from parallel pipelines or third-party systems. This interference, which can cause corrosion, required additional investment to ensure adequate protection beyond conventional cathodic protection (CP) and coating systems. The project developed new criteria that improved the decision-making on protective measures, CP operation conditions, and survey intervals. The team published a report with an advanced DC corrosion prediction model.

Co-Funders: PRCI Members

Start Date: 1/31/2018
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $112,100
Total SCG Cost: $4,917
Total Co-Funding: $107,183
Benefits:

Effects of Changing Gas Composition on Flow Measurement Error (MEAS-6-24)
The project developed a process that assessed the requirements for gas composition accuracy and accurate energy flow sampling. The project team examined the influence of measurement errors in gas composition for flow meters based on differential pressure (e.g. orifice, venturi and v-cone), linear volumetric meters (e.g. turbine and ultrasonic), and mass flow meters (e.g. Coriolis). Public webinars are proposed for 2020.

Co-Funders: PRCI Members

Start Date: 1/31/2018
End Date: 6/11/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $75,800
Total SCG Cost: $4,538
Total Co-Funding: $71,262
Benefits:

Gas Quality Resource Center - Phase 1 (7.11.a)

The objective is to establish a center of excellence to provide information and expertise on issues surrounding gas quality, interchangeability, and potential implications from the introduction of new supply sources, such as, renewable and unconventional gas into gas transmission and distribution systems. The results will support the widespread acceptance and safe introduction of renewable and unconventional gas supplies through a thorough understanding of governmental policy and regulations, supply characteristics, and resulting implications to the delivery infrastructure or end-use equipment, or related processes.

Co-Funders: OTD Members

Start Date: 1/1/2012
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $460,000
Total SCG Cost: $60,000
Total Co-Funding: $400,000
Benefits:

Guidance on the Excavation and Backfill Procedures in Areas of Geohazards and High Axial Stresses and Strains (SBD-1-5)

The project provides guidance on the excavation and backfill procedures in areas of geohazards that subject pipelines to high axial stresses and strains. This will reduce the risk of pipeline damage during mitigation work and increase worker safety.

Co-Funders: PRCI Members

Start Date: 1/31/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $236,000
Total SCG Cost: $9,797
Total Co-Funding: $226,203
Benefits:

High Pressure Inflatable Stoppers - Phase II (5.12.g.2)

Pressure control of steel pipelines for maintenance work is accomplished by fully closing inline valves. There are situations where 100% gas shut-off was not achieved and additional steps were required to cease the flow of natural gas into the work area. A secondary backup, downstream of the main valve, was realized for 100% shut-off. Gas Technology Institute collaborated with Mainline Control Systems, which developed an inflatable bag that stopped the flow of natural gas for medium-pressure pipe (e.g. 10"- 16" steel pipe and 10" - 18" plastic pipe). The project was completed and the Kleiss MCS60-1016 system is commercially available.

Co-Funders: OTD Members

Start Date: 10/1/2016
End Date: 5/14/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $118,480
Total SCG Cost: $4,480
Total Co-Funding: $114,000
Benefits:

In-situ Ultrasonic Meter Flow Validation for Gas Meters (MEAS-6-17A)

In this project, ultrasonic meter manufacturers were consulted to determine the capability of commercially available ultrasonic meters to sample and report the sound speed of a natural gas stream at high frequency. An uncertainty analysis of the in-situ proving method was conducted on a selection of ultrasonic meters with results from previous In-situ Proving Project (MEAS-6-5) applied to optimize the injection method. Testing was conducted at Southwest Research Institute's High-Pressure loop with meters in series at different injection distances and flow rates to demonstrate the In-situ Proving Method and determine the accuracy of the method.

Co-Funders: PRCI Members

Start Date: 11/1/2018
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $106,200
Total SCG Cost: $4,396
Total Co-Funding: $101,804
Benefits:

JIP PE Systems Research Program - Phases 1 and 2 (5.16.r, 5.16.r.2)

This project brings the industry together to identify and address issues with the manufacturing, installation, and maintenance of plastic piping. It develops the necessary research, design, standards, and guidelines to enhance the overall integrity of plastic for gas distribution systems.

Co-Funders: OTD Members

Start Date: 10/1/2016
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $20,000
Total Project Cost: $455,100
Total SCG Cost: $70,000
Total Co-Funding: $385,100
Benefits:

New Multi-year Project: Flow Testing of FS500 Meters (MEAS-6-11A)

The goal of this project is to ensure 4" and 6" SICK FS500 flow meters can be installed in existing meter run pipework and not require upstream piping or a flow conditioner. This technology has been identified as a replacement for low-pressure rotary meters. To minimize cost, it would be ideal if the meter could be installed in the existing meter run pipework that generally does not include 20D of upstream piping. Initial testing with 2-inch and 3-inch meters has been positive; this project would extend this work to 4-inch and 6-inch meters. This technology has the potential to address a significant maintenance and reliability issues associated with rotary meters.

Co-Funders: PRCI Members

Start Date: 2/4/2020
End Date: 7/2/2022
Status: Active
2019 Funds Expended: $14,240
Total Project Cost: $109,740
Total SCG Cost: $14,240
Total Co-Funding: $95,500
Benefits:

OIML Test Data Summary for New Generation Ultra Sonic Meters (MEAS-6-21)

The project summarizes and compares the data from the European standard for ultrasonic meters and implements testing programs for new, current, and legacy model multipath ultrasonic meters. Current public data is not presented in a consistent or unbiased manner that makes it simple to compare. The project team compared the results from the various flow meters to determine meter performance relative to various upstream piping configurations.

Co-Funders: PRCI Members

Start Date: 1/31/2018
End Date: 6/30/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $59,000
Total SCG Cost: $4,726
Total Co-Funding: $54,274
Benefits:

Operation & Maintenance Technologies

This project area seeks to develop and deploy new technologies that improve the efficiency of inspecting, operating, maintaining, and rehabilitating gas pipeline infrastructure and to ensure that these systems continue to provide safe and reliable service. New technologies recently evaluated were a low-flow gas meter, a wireless acoustic water well level depth meter, and a handheld gas detection instrument. All the technologies passed their respective performance criteria. Both the water level meter and gas detector were approved for deployment into SoCalGas operations. It was determined that the low-flow gas meter was not suitable for its intended application and the company is investigating another technology.

Co-Funders: N/A

Start Date: 6/1/2013
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $273
Total Project Cost: $40,877
Total SCG Cost: $40,877
Total Co-Funding: $0
Benefits:

Pipeline Purging Program (5.17.m)

The objective was to develop a new web-based version of the 1997 GRI Pipeline Purging Program, which was MS-DOS based. The driver was for utilities to be able to have a tool to assist with planning pipeline purging operations, calculating values associated with purging, or clearing a natural gas pipeline. The project was a success, and the GASPurge program is now commercially available.

Co-Funders: OTD Members, AGA

Start Date: 8/1/2017
End Date: 10/28/2019
Status: Completed
2019 Funds Expended: $9,649
Total Project Cost: $94,649
Total SCG Cost: $15,645
Total Co-Funding: $79,004
Benefits:

Portable Analyzer Lab Tests to Support Simplified Test Method (CPS-11-6B)

In this project, the project team developed simplified portable emission analyzer test methods that the US Environmental Protection Agency (EPA) has agreed to accept with minimal revisions. They will be published on the EPA website as Other Test Methods (OTM): OTM-038 (Periodic Monitoring) & OTM-039 (Compliance). Permit holders and state agencies can reference these methods for periodic monitoring and compliance tests, thereby avoiding more costly Reference Method tests and Continuous Emission Monitoring Systems. EPA has encouraged the Pipeline Research Council International to submit the methods through ASTM. 2020 work includes final revision of OTM methods and reformatting for ASTM submittal.

Co-Funders: PRCI Members

Start Date: 10/1/2018
End Date: 10/1/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $102,200
Total SCG Cost: $5,000
Total Co-Funding: $97,200
Benefits:

Protect Tracer Wires from Corrosion (5.17.k)

Tracer or locating wire is installed next to polyethylene (PE) pipe during construction to allow the gas utility worker to locate the buried pipeline for pipeline maintenance work. An electrical signal is transmitted through the tracer wire and can be detected aboveground with a pipe locator. However, the wire is susceptible to corrosion damage if the protective coating is damaged or at wire connections if the wire is exposed, rendering it inoperable. The project objective is to develop methods or best practices to protect tracer wire from corrosion damage.

Co-Funders: OTD Members

Start Date: 8/17/2017
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $188,273
Total SCG Cost: $21,573
Total Co-Funding: $166,700
Benefits:

RFID Test Program (5.14.a)

This project evaluates three commonly used Radio Frequency Identification (RFID) systems for locating and tracking underground assets. RFID asset tags and locating equipment from three manufacturers were installed on buried plastic and steel pipelines at the GTI pipe farm. They were evaluated for signal strength vs. installed orientation and burial depth and the results were documented in a final report.

Co-Funders: OTD Members

Start Date: 1/23/2014
End Date: 12/2/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $231,701
Total SCG Cost: $33,701
Total Co-Funding: $198,000
Benefits:

Semi-Automated Fusion Equipment - Phase 1 (2.15.a)

The initial phase of this project focused on the development of a steering committee to capture and analyze the technical issues, market requirements, and manufacturing concerns related to semi-automated fusion equipment for common polyethylene fusion operations. This steering committee brought fusion-equipment manufacturers and customers together to generate ideas, develop concepts, and perform business analysis. The project team executed a non-disclosure agreement with a fusion-machine manufacturer in order to gain information on the company's developing fusion platform. Since then, the manufacturer has moved in a different direction, moving forward with a machine that is not "automated" in control, but pairs with a data logger. Due to the lack of further advancement, the project was closed out.

Co-Funders: OTD Members

Start Date: 5/1/2015
End Date: 8/1/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $85,000
Total SCG Cost: $15,000
Total Co-Funding: $70,000
Benefits:

Solvent Cleaning and PE Joining (5.16.a)

The project developed data-driven solvent cleaning best practices to ensure quality polyethylene (PE) fusion connections. This study outlined the proper cleaning steps prior to performing PE fusions. Results of this project show that for a successful PE fusion, proper cleaning and scraping of PE surfaces must be performed to remove any contamination prior to performing fusion operations.

Co-Funders: OTD Members

Start Date: 1/1/2016
End Date: 6/27/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $289,970
Total SCG Cost: $16,262
Total Co-Funding: $273,708
Benefits:

Technology Testing Assessment Facilities

Utilities are frequently challenged to find tools or technology to increase safety, lower O&M costs, and improve accuracy, or to replace existing equipment/tools that are no longer available. Testing facilities have been constructed to simulate the SoCalGas system to enable testing without impacting the system or customers. On this project, team members will evaluate new technologies, tools, and/or equipment at the SoCalGas Gas Meter Test Rack or at Situation City. Technology performance that passes the minimum requirements may be approved and deployed in company operations.

Co-Funders: N/A

Start Date: 1/1/2019
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $27,300
Total Project Cost: $114,300
Total SCG Cost: $114,300
Total Co-Funding: $0
Benefits:

Test Program for HoloLens as Applied to Gas Operator Training (T-779 & M2018-006)

The project evaluated the use of Augmented Reality (AR) applications within Gas Operations Training. An AR Gas Ops Training application was developed to provide a live, hands-free, and heads-up use of 3-D images simulating work activities. The application and technology were demonstrated to SoCalGas Gas Operations Training, so the Hololens could be evaluated for applicability to the Gas Operator Training program.

Co-Funders: NYSEARCH Members

Start Date: 7/1/2017
End Date: 6/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $420,470
Total SCG Cost: $43,635
Total Co-Funding: $376,835
Benefits:

Uniform Frequency Code (5.18.m)

The objective of this project is to create an industry standard, guideline, or best practice uniform frequency code for passive frequency tags/markers used to locate buried utilities. This code would establish a consistent frequency setting for markers based on their respective utility designation such as gas, electric, water, etc. The uniform frequency code would make product evaluation and use of the product a more efficient process as all locating equipment would search for the single frequency related to each specific utility.

Co-Funders: OTD Members

Start Date: 7/1/2018
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $2,322
Total Project Cost: $135,000
Total SCG Cost: $5,322
Total Co-Funding: $129,678
Benefits:

SUB-PROGRAM: SYSTEM DESIGN AND MATERIALS

Aldyl-A Mains Failure Rate Analysis

The project's objective is to determine main contributing factors of Aldyl-A main leaks based on data. This is accomplished by identifying and understanding the relationships of external data sources that are appropriate for Aldyl-A main analysis in order to identify the cause of leaks. Data explored includes, but is not limited to, leakage data from SAP, vegetation condition, soil type, system pressure, temperature, and weather pattern. This analysis will help determine failure rates and inform probability of failure in the risk assessment.

Co-Funders: N/A

Start Date: 6/30/2019
End Date: 12/30/2019
Status: Active
2019 Funds Expended: $67,796
Total Project Cost: $74,939
Total SCG Cost: $74,939
Total Co-Funding: $0
Benefits:

Alternative Caps for PE Service Tees (5.16.b)

The objective of this project is to develop an alternative cap design for polyethylene (PE) tapping tees. The alternate cap design allows the PE cap to be fused on the tapping tee tower rather than having a cap that threads on the tapping tee tower. A threaded cap has more potential for leakage due to inadequate O-ring engagement with the sealing area. When a tapping tee is installed there is never a need to revisit the tapping tee for any operation. Therefore, having a permanently fused tapping tee cap will mitigate the risk of leakage.

Co-Funders: OTD Members

Start Date: 2/15/2016
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $112,400
Total SCG Cost: $32,115
Total Co-Funding: $80,285
Benefits:

Applicability of Existing Metal-Loss Criteria for Low Hardening Steels (EC-2-8)

The goal of this project is to develop metal loss assessment criteria that apply to low-hardening steels (vintage to modern) and will improve the accuracy of assessment outcomes by reducing the uncertainty and scatter in existing criteria. The project builds upon existing criteria and previous work completed to broaden the applicability of metal loss criteria to modern low hardening steels.

Co-Funders: PRCI Members

Start Date: 2/28/2018
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $283,200
Total SCG Cost: $12,588
Total Co-Funding: $270,612
Benefits:

Assessment of Consequences of RNG on Gas Infrastructure/ Appliances (T-783)

The objective of this project is to assimilate past research on potential risks of renewable natural gas (RNG) and combine that information with a study of differences and similarities to North American gas LDC conditions. This state-of-the-art risk assessment served as a platform for an RNG roadmap and identifying technology gaps in North America. By leveraging similar work already completed in Europe, and addressing issues that present risk to existing assets and operating practices, two areas of interest were selected: 1) impact of Siloxanes on gas appliances and engines, and 2) impact of corrosive substances on materials in the LDC gas network. The assessment also considered both steel and plastic pipe networks and gas appliances to provide risk impact ratings. Recommendations were made regarding technology or regulatory gaps that exist. The two risk assessment reports on impact of siloxanes and impact of corrosive substances were finalized in 2019.

Co-Funders: NYSEARCH Members

Start Date: 9/28/2018
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $74,380
Total SCG Cost: $8,042
Total Co-Funding: $66,338
Benefits:

Assessment PE Fittings Shelf Life (5.17.b)

The objective of this project was to measure the shelf life of polyethylene (PE) fittings to ensure quality material is installed in the system. This project was completed with two main findings. The first was that PE fittings tested had sufficient stabilizers in the bulk of their material to slow thermal oxidation and have a shelf-life of at least 10 years at 86°F. The second was that surface oxidation from ultra-violet (UV) exposure on PE fittings tested may impact quality of fusion if shelf-life exceeded 1 to 2 years. SoCalGas reviewed the Final Report and determined that existing policies are not impacted.

Co-Funders: OTD Members

Start Date: 3/1/2017
End Date: 7/18/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $131,862
Total SCG Cost: $10,749
Total Co-Funding: $121,113
Benefits:

Auto Diagnostic for Ultrasonic Flow Meter (MEAS-6-20C)

Develop a process and software to evaluate if changes in ultrasonic meter flow-related diagnostics (e.g., profile factor, asymmetry and swirl) are causing a significant change in the estimated installed measurement uncertainty of the ultrasonic meter station. The new software diagnostics tool will enable gas operators to quantify system imbalances in near real time, thereby reducing lost and unaccounted-for gas volumes. Research results will include a detailed diagnostic method, a model, an associated algorithm, and the source code that performs the artificial intelligence functions.

Co-Funders: PRCI Members

Start Date: 3/1/2019
End Date: 3/3/2021
Status: Active
2019 Funds Expended: $0
Total Project Cost: $118,000
Total SCG Cost: $3,819
Total Co-Funding: $114,181
Benefits:

Biomethane Justification Study for Improved/Accepted Gas Quality Standards (7.18.b)

This project provides justification for setting universally established gas quality acceptance standards for biomethane in order to provide answers to interconnect skeptics and detractors. This knowledge of the risks will increase acceptance. As opportunities for biomethane injection into a distribution or transmission pipeline arise, considerations and requirements regarding safety, reliability, interchangeability, and continuity are needed to keep gas flowing and avoid service interruption.

Co-Funders: OTD Members

Start Date: 3/1/2018
End Date: 2/28/2020
Status: Active
2019 Funds Expended: $27,508
Total Project Cost: $300,000
Total SCG Cost: $57,508
Total Co-Funding: $242,492
Benefits:

Blending Modeling

This project will determine the impact of hydrogen or off-spec renewable natural gas (RNG) blended into SoCalGas pipeline and facilities. The concerns to address are when (time and distance from injection point) will the blending of hydrogen or off-spec RNG be fully mixed, blending station designs, placement of monitoring equipment, and concentration of hydrogen on the internal pipe surface. Computational fluid dynamic models will be developed to allow simulations of various scenarios.

Co-Funders: N/A

Start Date: 12/20/2019
End Date: 12/20/2021
Status: Active
2019 Funds Expended: $74,536
Total Project Cost: $149,536
Total SCG Cost: $149,536
Total Co-Funding: $0
Benefits:

Calif. State University Senior Design Project 2019-2020

The overall objective of this project is to use the creativity, energy, and intellect of top-tier senior engineering students to address important energy technology challenges faced by SoCalGas and its customers. For example, students worked to improve the efficiency and portability of the enclosure utilized at ground level when taking surface flux-rate measurements to quantify below-ground methane emissions from buried natural gas pipelines and facilities. The existing enclosure consisted of a bulky, hard-to-transport 4'x4' frame made from PVC pipes. Its size is also unable to be adjusted, which makes it difficult to adapt to various types of terrain.

Co-Funders: N/A

Start Date: 8/30/2019
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $50,000
Total SCG Cost: $50,000
Total Co-Funding: $0
Benefits:

Cathodic Protection Design Considerations for Facilities with Congested Areas (EC-6-10)

This project's goal is to develop a computer model to estimate Cathodic Protection (CP) current distribution in congested areas with coated and uncoated buried pipelines, screw piles, uncoated ground wired, and copper ground rods. The research work enhances current methods of designing CP systems for facilities in congested areas and will help operators identify deficiencies in existing CP systems. It will also enable them to design and install CP systems to meet protection criteria and regulatory requirements, while optimizing the cost of operating and maintaining the CP system for the life of the facilities.

Co-Funders: PRCI Members

Start Date: 1/31/2018
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $153,400
Total SCG Cost: $5,000
Total Co-Funding: $148,400
Benefits:

Characterization of Mechanical Properties of Vintage Girth Welds (SIA-1-4)

This project provided test data to fill critical gaps in forecasting the behavior of vintage girth welds. Lacking appropriate material property data is a major obstacle in performing accurate structural assessment of pipeline girth welds. The project provided a solid basis for the material property inputs needed in vintage girth weld integrity assessment. Cost-effective maintenance decisions were made when integrity assessments were made with high confidence.

Co-Funders: PRCI Members

Start Date: 10/1/2013
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $601,800
Total SCG Cost: $40,377
Total Co-Funding: $561,423
Benefits:

Correlative Estimation of Hydrocarbon Dewpoint (MEAS-15G)

This study developed and evaluated several methods that provide reasonable estimates of hydrocarbon dewpoint temperature (HCDP) and the phase curve using simplified correlation methods. The project was completed, and the benefits include an efficient and objective real-time measurement of HCDP, with less complexity and a lower operating cost compared to traditional methods. This is desirable in situations with limited processor power / memory or where full gas composition analysis information is not available.

Co-Funders: PRCI Members

Start Date: 1/1/2016
End Date: 8/19/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $59,000
Total SCG Cost: $1,000
Total Co-Funding: $58,000
Benefits:

Deliver Comprehensive Metal-Loss Assessment Criterion (EC-2-10)

The project will develop a Level 1/Level 2 metal-loss assessment criterion that can be simply deployed, is seamless over pipe grade and construction era, indicates the consequences in terms of leak versus rupture, greatly reduces scatter, eliminates maintenance that does not affect risk reduction, would be in-line-inspection (ILI)-compatible and part of the ILI reporting, and would be validated by full-scale tests to facilitate codification. The outcome of this effort will enable full-scale representative assessments of failure pressure in areas of corrosion damage that will have less scatter and conservatism than currently exists in ASME B31G, Modified B31G and other assessment models, without compromising pipeline operational safety.

Co-Funders: PRCI Members

Start Date: 4/1/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $60,048
Total Project Cost: $385,860
Total SCG Cost: $60,048
Total Co-Funding: $325,812
Benefits:

Development of Rational Ovality Limits (CNST-3-1)

This project will develop rational and consistent pipeline ovality limits for ovality formed before the pipelines are put in service. Ovality of the pipe cross section can form during pipeline construction. The acceptance of such ovality is governed by industry standards, such as CSA Z662, or company specifications. Those ovality limits are often found to be inadequate or can be overly restrictive for some pipes. The developed rational ovality limits will enable pipeline operators to reject or accept the ovalized pipes of various dimensions and strengths with a consistent margin of safety. The outcome of this project will help pipeline operators avoid the unnecessary remediation work and save time and cost on pipeline construction.

Co-Funders: PRCI Members

Start Date: 1/8/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $94,400
Total SCG Cost: $5,000
Total Co-Funding: $89,400
Benefits:

Effect of Upstream Piping on Ultrasonic Meter Bias (MEAS-6-5C)

End treatments are often installed on ultrasonic meter runs to allow cleaning, and internal inspection, and to reduce the effects of ultrasonic noise on the ultrasonic flow meter; however, the effects of the end treatments on the velocity profile and the resulting flow measurement performance are unknown. The project goal is to identify end treatments that allow for cleaning and internal inspection while minimizing the effect on velocity profile and overall meter performance. This project will generate an end treatment list that will be modeled using computational fluid dynamics (CFD) software in order to optimize the resulting velocity profile. The results will be compared to baseline testing with no end treatments and CFD modeling results.

Co-Funders: PRCI Members

Start Date: 11/1/2018
End Date: 11/2/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $236,000
Total SCG Cost: $4,971
Total Co-Funding: $231,029
Benefits:

Engine Controller Design Solutions to Address Variable Fuel Composition of Lean-Burn Engines: Field-based Evaluation (CPS-14-03)

The project team used field-based empirical data and a GT-Power simulation tool to computationally predict engine response (power, efficiency, and emissions) as fuel composition changes. Ethane is the primary constituent being studied, but the models could be used for other advanced fuels. Eventually, this research will allow operators to accurately capture fuel variability as part of a modified control method.

Co-Funders: PRCI Members

Start Date: 2/28/2018
End Date: 1/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $117,056
Total SCG Cost: $30,912
Total Co-Funding: $86,144
Benefits:

Enhance Risk Assessment Tools for Decision Making (9.20.a)

Technology advancements in remote sensing and inspection tools are collecting enormous volumes of data that must be screened, normalized, and integrated into assessment tools for actionable decision-making. To manage complex system risk, this process will require state-of-the-art data analytics and a Bayesian network. This project will develop data integration, normalization, quality management, and analytics techniques that will significantly improve risk-informed decision support frameworks in the context of infrastructure integrity assessments and risk reduction.

Co-Funders: OTD Members, DOT/PHMSA, Others

Start Date: 1/1/2020
End Date: 12/31/2022
Status: Active
2019 Funds Expended: $0
Total Project Cost: $1,739,097
Total SCG Cost: $56,567
Total Co-Funding: $1,682,530
Benefits:

Enhancing Strain Capacity of Pipelines Subject to Geohazards (SBD-1-6)

When pipeline segments are or may be subjected to geo-hazards that cause high longitudinal stresses or strains, an engineering critical or risk assessment may be necessary. If strain capacity is suspected to be inadequate, operators may seek viable options to enhance it, particularly the strain capacity of girth welds. In phase 1, the project team will perform a full-scale evaluation of the effectiveness of Type B sleeves and weld cap reinforcement to enhance the strain capacity of girth welds. Phase 2 will focus on investigating the application of Composite Repair Wrap to reinforce girth weld strain capacity.

Co-Funders: PRCI Members

Start Date: 1/31/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $354,000
Total SCG Cost: $14,320
Total Co-Funding: $339,680
Benefits:

Essential Welding Variables for X70 (MATH-1-2)

The objective was to achieve greater reliability and consistency in the mechanical performance of X70 pipeline welds. Essential welding variables for pulsed gas metal arc welding (GMAW-P) were established that optimized consistent mechanical performance while providing fabricators the ability to produce welds of desired quality. By utilizing current technology for welding process controls, and by incorporating the fundamental response of both weld metals and base metals to thermal cycles, the methodology was applied to X70 welds. The welding procedure controls demonstrated their ability to influence weld metal and heat-affected zone properties, improving weld consistency.

Co-Funders: PRCI Members

Start Date: 3/1/2012
End Date: 4/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $271,400
Total SCG Cost: $15,000
Total Co-Funding: $256,400
Benefits:

Evaluate Higher Strength Consumables for Manual Root Beads in X70 Girth Welds (MATH-5-4)

A contributing factor to a number of girth weld failures in newly constructed pipelines in North America is undermatching strength and/or heat-affected zone (HAZ) softening. A contributing factor to undermatching strength is the use of E6010 consumables for the root pass, particularly in thinner materials where the root pass makes up a significant portion of the weld thickness. If shown to be acceptable, the use of higher strength consumables (e.g., E8010 or possible E7010) for root pass welding will contribute to avoiding undermatching strength and may compensate for some degree of HAZ softening. Avoiding girth weld failures, either during pre-service hydrostatic testing or soon after the pipeline is placed in service, would have enormous economic value and would prevent negative public perception about pipelines.

Co-Funders: PRCI Members

Start Date: 1/2/2019
End Date: 1/1/2021
Status: Active
2019 Funds Expended: $3,127
Total Project Cost: $331,025
Total SCG Cost: $8,110
Total Co-Funding: $322,915
Benefits:

Evaluation of Girth Weld Flaws in Vintage Pipelines (SIA-1-7)

This project developed a tensile strain capacity (TSC) estimation tool for vintage girth welds. Although, further validation and refinements would be helpful, the current TSC tool provides a sound framework for the application. The tool can be used for: (1) case-specific assessment after a loading event such as ground movement, and (2) screening of at-risk girth welds for prioritization of mitigation. More analysis and testing can improve the accuracy of the tool and provide greater confidence when the tool is used.

Co-Funders: PRCI Members

Start Date: 1/31/2016
End Date: 6/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $442,500
Total SCG Cost: $9,265
Total Co-Funding: $433,235
Benefits:

Evaluation of Semi-Automatic FCAW-S Welding Process and Implications to Pipeline Girth Weld Integrity (MAT-1-4)

In this project, members of Pipeline Research Council International seek to develop guidelines for better process control by understanding the impact of welding procedure on the factors that directly control weld properties. As first steps, the team worked to identify the primary failure mechanisms responsible for toughness variation and to assess the feasibility of controlling the behavior through changes in welding practice or essential welding variables.

Co-Funders: PRCI Members

Start Date: 1/1/2016
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $834,968
Total SCG Cost: $10,000
Total Co-Funding: $824,968
Benefits:

Expansion of NYSEARCH RANGE Model (M2018-008) - Phase II-a

The objectives of the project are to: 1) improve the ability of the NYSEARCH RANGE™ model to establish interchangeability boundaries for bio-derived Renewable Natural Gas (RNG) by characterizing flame lifting, 2) determine appliance performance with Hydrogen (H2) blends to improve the ability of the NYSEARCH RANGE™ model to establish interchangeability boundaries for Power-to-Gas RNG, and, 3) specify a concentration limit for silicon-containing molecules in RNG that will preclude significant performance and maintenance impacts for combustion equipment. In April 2019, the RNG flame lifting research was completed through residential appliance testing at NYSEARCH member facilities. The RANGE™ model was updated with new correlation coefficients determined from the flame lifting studies. Furthermore, in a separate research effort, SoCalGas completed flashback tests on a residential furnace for hydrogen-blended natural gas and that data was incorporated to implement a flashback correlation or limit in the updated RANGE™ model. The commercially available NYSEARCH RANGE™ model is being upgraded to Version 6 and will be available for purchase via the NYSEARCH website in February 2020. A follow-on project was approved by members in December 2019 to investigate and ascertain from other RNG group activities (e.g. California Council on Science & Technology, engine manufacturers, universities, research entities) a recommended concentration limit for silicon-containing molecules that will preclude significant performance and maintenance impacts for combustion equipment.

Co-Funders: NYSEARCH Members

Start Date: 9/28/2018
End Date: 6/30/2021
Status: Active
2019 Funds Expended: $44,000
Total Project Cost: $543,869
Total SCG Cost: $66,080
Total Co-Funding: $477,789
Benefits:

Expert Review of Past PRCI and PHMSA SCC Studies, Gap Analysis and Road Mapping (SCC-7-1)

Project reports represent a valuable resource to Pipeline Research Council International (PRCI) members, but the sheer volume of work can make it difficult to find critical information. The objective of this project is to produce a summary report that highlights the aims and main conclusions of past project reports and provides a critical review of the current level of understanding that would aid PRCI members in obtaining relevant information for their particular needs and assist the decision making process within PRCI on what future research is required. This study will produce a critical review of PRCI and Pipeline and Hazardous Materials Safety Administration studies in the area of external stress corrosion cracking (SCC) that can be used for updating the associated Corrosion Committee SCC Roadmap and aid member companies in applying the research findings as appropriate.

Co-Funders: PRCI Members

Start Date: 4/1/2019
End Date: 4/1/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $125,977
Total SCG Cost: $10,000
Total Co-Funding: $115,977
Benefits:

Fault Displacement Hazard Initiative (UCLA)

The project develops a suite of robust and reliable models for forecasting the distribution and magnitude of primary and distributed displacements from surface rupture. The models produced by this effort will be familiar to seismic hazard analysis practitioners. Similar to Ground Motion Prediction Equations which predict expected ground motions at a site of interest, this project will produce models to predict the distribution and amounts of displacement from surface fault rupture, which will be referred to as Fault Displacement Prediction Equations.

Co-Funders: Other Project Sponsors

Start Date: 11/20/2018
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $25,000
Total Project Cost: $2,415,000
Total SCG Cost: $150,000
Total Co-Funding: $2,265,000
Benefits:

Feasibility Study of Piggable Plug Technology for Onshore Gas Pipeline Inline Pressure Isolation (PLUG-1-01)

This project will perform full-scale testing of two sizes of plug tools including a 24" tool (e.g., 10" or 12", 16",20", 36" per survey); the evaluation will be conducted on tools provided by selected tool vendors. It will also develop an Excel-Calculator for preliminary maximum stress estimation using parametric FEA Results (Inputs: pipe diameter, wall thickness, material grade, line pressure, differential pressure, clamp, etc.). These plugging tools should allow pipeline repair, maintenance, and strength tests in a safe, expedient, and cost-effective manner. Final Report is under review.

Co-Funders: PRCI Members

Start Date: 2/1/2018
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $354,000
Total SCG Cost: $11,756
Total Co-Funding: $342,244
Benefits:

Field Manual for Spacing Between Pipelines and AC Grounding Equipment (EC-6-8)
The project's objective is to develop a field manual to provide guidance on the minimum safe separation distances between natural gas transmission pipelines and AC grounding systems. This manual will enable operators to determine minimum safe separation distances between pipelines and AC grounding systems without performing a time-consuming and costly grounding study.

Co-Funders: PRCI Members

Start Date: 1/31/2017
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $118,000
Total SCG Cost: $9,759
Total Co-Funding: $108,241
Benefits:

Field Test NeverWet & Other Nano-Tech Coatings to Reduce Aboveground Corrosion (5.17.p)
This project investigates unique and promising coatings for challenging aboveground utility corrosion prevention applications. Corrosion is an ongoing threat to utility asset integrity. For aboveground assets, one cannot rely on cathodic protection to back up coating protection. Therefore, specifying and applying the most appropriate and best performing coating system is of even more importance. These coatings have the potential to substantially reduce wet and dry aboveground corrosion in various areas of application.

Co-Funders: OTD Members

Start Date: 9/6/2017
End Date: 1/31/2021
Status: Active
2019 Funds Expended: $0
Total Project Cost: $187,000
Total SCG Cost: $1,347
Total Co-Funding: $185,653
Benefits:

Full Thickness Weld Tensile Round Robin (API-2-1A)
This project develops a thickness strip test to check a greater percentage of the weld cross section. Developing this new test procedure will provide a better characterization of weld material properties for 12mm and thicker wall pipelines and improve the predictive capabilities of integrity management strain-based design decisions. This project will, through round robin testing, consider the current procedure and refine it to make it as practicable as possible.

Co-Funders: PRCI Members

Start Date: 6/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $212,400
Total SCG Cost: $4,642
Total Co-Funding: $207,758
Benefits:

Full-Scale Surface Loading Testing of Buried Pipes Vibratory Compactor and Temporary Crossing (ENV-6-2)
This project will provide guidelines on the minimum depth of cover and lateral distance at which a vibratory compactor can operate near and over a buried pipeline and the stress cycles that such operation can induce in a pipe. Full-scale surface loading experiments under a vibratory compactor will determine surface loading induced stresses in buried pipelines on construction sites for new buildings and roads. Currently, no established criteria are available to allow pipeline operators the ability to determine the distance which should separate a pipeline from a soil compaction operation to ensure pipeline safety.

Co-Funders: PRCI Members

Start Date: 2/28/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $147,995
Total SCG Cost: $9,899
Total Co-Funding: $138,096
Benefits:

Gas Composition and Quality

This project area covers various aspects of natural gas quality affecting the pipeline infrastructure and end-use combustion equipment. Renewable Natural Gas (RNG) from non-conventional sources contains trace constituents that can impact pipeline integrity and combustion equipment performance. There is a need to measure these trace elements, determine what concentration levels are acceptable, and explore effective methods to remove them prior to receiving the RNG into the natural gas pipeline or delivering it directly to customers. In addition, a unique project has emerged to determine if trained dogs can pinpoint pipeline leak locations using their highly sensitive nose to detect small concentrations (ppb) of trace gas (Dimethyl Sulfide) injected into the pipeline. The HYREADY JIP Program has developed Engineering Guidelines for the preparation of natural gas systems with hydrogen/natural-gas mixtures for transmission and distribution systems. An additional work package covering end-use appliances is expected to be completed in 2020.

Co-Funders: N/A

Start Date: 1/1/2017
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $19,297
Total Project Cost: $175,000
Total SCG Cost: $175,000
Total Co-Funding: $0
Benefits:

GasComm In-Line Sensor (M2001-006)

The goal of this multi-phased project was to design, develop, and test a real-time sensing network of low-cost sensors for monitoring critical information in gas distribution pipelines. The sensor, which can be inserted into existing pipelines, was self-powered and provided wireless measurements of pressure, temperature, humidity, flow volume, and flow direction. The current phase of the project focused on commercializing the GasComm technology. Pre-production units were installed at various utilities for a one-year field evaluation. Upon review of subpar accuracy results, multiple hardware and software upgrades were performed to produce a second iteration prototype, bringing flow measurement accuracy to within <10% error. Upon successful outcome of the testing, the product was launched for commercial sales.

Co-Funders: NYSEARCH Members

Start Date: 9/1/2014
End Date: 11/29/2019
Status: Completed
2019 Funds Expended: $7,400
Total Project Cost: $831,812
Total SCG Cost: $81,715
Total Co-Funding: $750,097
Benefits:

Guidance for Applying Revised AGA Report on Measurement Uncertainly (MEAS-6-25)

The 2017 revision of American Gas Association Report # 8 encouraged adoption of the new GERG2008 EOS (Equation of State) technology but did not provide guidance and tools for users on whether to incur the cost associated with upgrading. This project constructed deterministic and probabilistic models that illustrate the potential impact of EOS upgrades, applying real-world gas composition, pressure, temperature, and flow, along with a step-by-step sequence for evaluating upgrade potential.

Co-Funders: PRCI Members

Start Date: 10/22/2018
End Date: 4/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $70,800
Total SCG Cost: $9,933
Total Co-Funding: $60,867
Benefits:

Guidance for Conducting Strain-Based Assessment of Buried Pipelines Subjected to Ground Movement (SBD-1-2)

The objective of this Strain Based Design (SBD) Program was to integrate the results of the other projects into the program and develop a comprehensive design and analysis methodology. This includes an industry accepted approach to the safety factor, an SBD overview document and guidance, and operational guidelines for the SBD methodology. The report and associated guidance are intended to be used when the damage to a pipeline is unknown or uncertain after a ground movement event. The final report provides guidance on how to respond both short and long term after a ground movement event.

Co-Funders: PRCI Members

Start Date: 8/1/2015
End Date: 5/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $165,200
Total SCG Cost: $5,812
Total Co-Funding: $159,388
Benefits:

Guidance on Predicting Pipeline Strains Induced by Slope Movement (SBD-1-3)

The project developed a compendium of strain demand results for a range of geotechnical events and pipeline operational condition scenarios considered in estimating the strain demand. The final report estimated the pipeline strain based on ground movement measurements and when the pipe is parallel to ground movement.

Co-Funders: PRCI Members

Start Date: 1/1/2016
End Date: 7/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $259,600
Total SCG Cost: $4,000
Total Co-Funding: $255,600
Benefits:

Guidance on the Use, Specification and Anomaly Assessment of Modern Line Pipes (MATH-5-3B)

Girth weld incidents (i.e., leaks or ruptures) have occurred during hydrostatic proof tests and in service of newly constructed pipelines in recent years. For in-service pipelines, this project provides processes and procedures to assess the risk of having similar girth weld incidents. These processes and procedures will enable the effective use of resources for mitigation when needed. They will also enable the production of recommendations to minimize the risk of girth weld incidents for near-term construction projects and pipelines to be constructed in the future. The improved line pipe specifications and welding practice should lead to strain-resistant girth welds and pipelines resistant to anomalies, such as corrosion and mechanical damage.

Co-Funders: PRCI Members

Start Date: 1/31/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $2,297
Total Project Cost: $743,402
Total SCG Cost: $20,292
Total Co-Funding: $723,110
Benefits:

Heavy Hydrocarbon Compound Dew Point in Natural Gas Pipelines (MEAS-15-01)

This project conducted a literature search on the uncertainties associated with measuring heavy-end hydrocarbon compounds and calculating the onset of liquid drop-out. The team then developed a mathematical method for consolidating the uncertainties and producing a graphical representation that maps the statistical confidence of a hydrocarbon compound dewpoint prediction, given information about the measuring system and expected gas composition. The team also developed a simple cost/benefit tool that compared the potential improvements in accuracy associated with C9+ analysis versus potential commercial consequences and operational costs.

Co-Funders: PRCI Members

Start Date: 9/4/2018
End Date: 10/8/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $47,200
Total SCG Cost: $3,905
Total Co-Funding: $43,295
Benefits:

High Voltage DC Interference Risks (EC-6-6)

This project investigated the DC stray current corrosion risk on pipelines by various types of high voltage DC (HVDC) systems to determine the safe distance between natural gas pipelines and HVDC systems. Advanced computational modeling was applied for determining the various parameters such as pipeline properties, HVDC operating conditions, soil conditions, etc. The simulations showed corrosion and safety risks increase with increasing pipeline coating resistance and soil resistivity. A report was issued with guidelines proposed for estimating the risk associated with HVDC lines. The results will be transferred to working committees involved in developing international standards.

Co-Funders: PRCI Members

Start Date: 1/1/2016
End Date: 4/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $94,400
Total SCG Cost: $8,000
Total Co-Funding: $86,400
Benefits:

Hot Tap Branch Connections, JIP

This project develops industry best practices for welding hot tap branch connections onto live gas mains, including a compendium of properly qualified procedures for welding stub-on-type branch connections to in-service pipelines and a guideline that allows the least-complicated procedure to be selected for a given application. The development and use of industry best practices for specifying and installing hot tap branch connections will reduce cost and increase safety and reliability. The results of this project may allow in-service welding in applications where it is currently prohibited. This will allow significant economic and environmental benefits to be realized.

Co-Funders: JIP Members

Start Date: 12/16/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $30,000
Total Project Cost: $1,050,000
Total SCG Cost: $30,000
Total Co-Funding: $1,020,000
Benefits:

Hydrogen Blend into Natural Gas - Phase 2: Metallic Materials (6.14.b.2)

With the introduction of hydrogen into the natural gas pipeline comes the need for extensive study, testing, and possible modifications to existing pipeline monitoring and maintenance practices (e.g., integrity management systems). Safety factors for hydrogen-natural gas blend need to be established based on materials tests performed under relevant and site-specific mechanical, environmental, and material conditions without significant extrapolation. The objective of this project is to conduct physical testing to assess the impacts of 5% hydrogen blended fuel on metallic materials in the natural gas pipeline system.

Co-Funders: OTD Members

Start Date: 4/15/2019
End Date: 6/30/2021
Status: Active
2019 Funds Expended: $28,000
Total Project Cost: $240,000
Total SCG Cost: $53,760
Total Co-Funding: $186,240
Benefits:

Hydrogen Embrittlement and Crack Growth (Phase 1a)

The DNV-GL hydrogen embrittlement study is set to determine fatigue crack growth rates for base metal, longitudinal seam, and girth weld line pipe steel samples in various methane and hydrogen environments. The objective of this study is to characterize the fatigue crack growth rate behavior of these different grades of line pipe steels in a range of methane and hydrogen blend gas mixtures.

Co-Funders: N/A

Start Date: 11/1/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $33,500
Total Project Cost: $195,500
Total SCG Cost: $195,500
Total Co-Funding: $0
Benefits:

Impact of Hoop Stress and Percentage of SMYS on Pipelines (4.20.a)

This project reviews the intent and safety impact of hoop stress and percentage of specified minimum yield stress (SMYS) boundaries on natural gas transmission and distribution steel pipelines to determine if pipe segments operating between 20-30% SMYS are safely operating as distribution lines under the Gas Distribution Integrity Management Program.

Co-Funders: OTD Members, PHMSA

Start Date: 1/1/2020
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $551,902
Total SCG Cost: $10,000
Total Co-Funding: $541,902
Benefits:

Kiefner Interactive Threats Project (T-768)

This project develops spreadsheet style risk models that perform a systematic review of threats that may impact pipeline integrity to identify which threats could potentially interact and under what circumstances. It quantifies the increased likelihood or probability of failure attributable to the interaction of threats and provides a software tool to calculate this increased likelihood. To ensure that the NYSEARCH/Kiefner Interacting Threats model stays current, PHMSA's annual incident and Kiefner's forensic failure databases are incorporated into annual software version upgrades. In January 2020, data for 24 new interacting threat incidents that occurred in 2018 (from the PHMSA database) will be added to the report and risk assessment tool.

Co-Funders: NYSEARCH Members

Start Date: 11/30/2015
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $264,837
Total SCG Cost: $20,740
Total Co-Funding: $244,097
Benefits:

MAOP and Materials Verification - Phase I (4.17.d)

The project objective is to provide a software solution to assist operators to comply with pending Maximum Allowable Operating Pressure (MAOP) and Materials Verification requirements that are part of the Notice of Proposed Rulemaking -Integrity Verification Process (IVP). This includes enabling the use of Engineering Critical Assessments (ECA) in lieu of a hydrotest, derating, or pipe replacement. It will also support pipe surface-based non-destructive measurements in lieu of cut-outs, and minimize the number of destructive tests.

Co-Funders: OTD Members

Start Date: 9/8/2017
End Date: 1/31/2021
Status: Active
2019 Funds Expended: $0
Total Project Cost: $96,000
Total SCG Cost: $4,364
Total Co-Funding: $91,636
Benefits:

Material - Suppliers Quality Assurance Program (5.17.g)

The objective of this project is to assist gas utilities in creating best practice guidelines to develop and manage the material supplier quality assurance programs. Additionally, this project aims to identify and select comprehensive regulatory and technical requirements specific to products utilized in natural gas transmission and distribution systems. A material supplier quality manual was developed which includes several requirements and procedures that contribute to receiving quality materials from suppliers. As part of this project, several generic material specifications were also created.

Co-Funders: OTD Members

Start Date: 12/1/2018
End Date: 12/1/2021
Status: Active
2019 Funds Expended: $5,000
Total Project Cost: $431,000
Total SCG Cost: $5,000
Total Co-Funding: $426,000
Benefits:

Methodology for Assessing Seam Weld Anomalies Using In-Line Inspection Data (SCC-6-3)

The project uses PRCI member in-line inspection (ILI) data to develop a shared knowledge base and systematic approach that benefits all operators and allow all crack ILI tools to be used more appropriately. Many operators have inspected pipelines and, especially where seam weld or manufacturing defects exist, the ILI tools can report a large number of anomalies. Using conventional conservative methods of analyzing these as cracks, it would appear that many of the anomalies are injurious; however, when operators have tested these in the lab, the burst pressures indicate the capacity is not compromised. If each of these investigations are collated and categorized, a set of approaches can be developed for each category.

Co-Funders: PRCI Members

Start Date: 1/1/2016
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $236,000
Total SCG Cost: $4,374
Total Co-Funding: $231,626
Benefits:

NDE Material Strength Verification for an Index of Long Seam Fracture Toughness of ERW Pipes JIP

This Joint Industry Program (JIP) investigates pipeline material strength verification. It expands validation of the Hardness, Strength, and Ductility (HSD) tester which can account for Electro-Resistance Welded pipes. It also initiates new integrity practices based on the use of the nondestructive examination (NDE) material verification data. The JIP will add strategic value to the process of evaluating the steel grade and quality of existing assets by obtaining tighter confidence intervals from NDE of the HSD tester, as well as adding to the same field work a set of validation data for longitudinal welded seams that include an index of fracture toughness.

Co-Funders: JIP Members

Start Date: 1/1/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $400,000
Total SCG Cost: $50,000
Total Co-Funding: $350,000
Benefits:

Odor Detection Threshold Study Phase 1b (M2016-002)

The project team completed a comprehensive review of state-of-the-art methodology to measure natural gas odorants. The measurement of detection and recognition thresholds for commonly used odorants in the natural gas industry was also updated. A panel of 40 individuals was selected for the study based on prescreening results to ensure a representative sample of the population's sense of smell. This representative sample was tested for detection and recognition of commonly used odorants (e.g. mercaptans and blends) in the natural gas industry. The final report indicated that the thresholds were below compared to previous studies.

Co-Funders: NYSEARCH Members

Start Date: 7/1/2017
End Date: 3/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $812,833
Total SCG Cost: $69,305
Total Co-Funding: $743,528
Benefits:

Odor Detection Threshold Study Phase II, Task 1 & 2 (M2016-002)

Phase II of this project focuses on understanding how the introduction of conditional factors such as odor adaptation and odor masking agents affect detection and recognition thresholds. The two phenomena will be studied in parallel; however the results will be provided independent of one another to better understand the effect of each variable.

Co-Funders: NYSEARCH Members

Start Date: 11/16/2019
End Date: 10/1/2021
Status: Active
2019 Funds Expended: $35,000
Total Project Cost: $468,950
Total SCG Cost: $48,100
Total Co-Funding: $420,850
Benefits:

On-Line Biomethane Gas Quality Monitoring - Phase 2, Trace Sensors (7.16.e.2)

The objective is to validate industry technologies, ranked from the most promising, in Phase 1, to monitor unconventional trace contaminants (e.g. siloxanes, volatile organics, sulfur, and hydrocarbons) found upon biomethane (BM) injection. The focus is on constituents that are not routinely monitored by on-line instruments, and that are critical to gas quality. The project will determine if an on-line or mobile analyzer is needed on biomethane supplies delivered, from local gas suppliers directly to customers, to ensure that gas supply meets specification.

Co-Funders: OTD Members

Start Date: 3/1/2018
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $890
Total Project Cost: $125,000
Total SCG Cost: $2,890
Total Co-Funding: $122,110
Benefits:

Peer Review of the Plausible Profile Corrosion Assessment Model (EC-2-9)

In this project, subject matter experts performed a peer review of a new corrosion assessment model developed by TransCanada Pipelines Limited. Metal-loss corrosion is one of the major integrity threats to energy pipelines. The new model utilized a novel approach to characterize the shape of metal loss and improved the accuracy and precision of the predicted burst pressure of pipelines subject to metal-loss corrosion.

Co-Funders: PRCI Members

Start Date: 4/1/2019
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $85,845
Total SCG Cost: $9,982
Total Co-Funding: $75,863
Benefits:

Pipeline Integrity Tool Cloud Based Assessment Software Consortium Project (MAT-8A)

The project's objective is to develop an improved model for seam weld anomalies and to deliver an implementation of the updated model to the participants as a cloud-based software. The consortium cost will entitle each participant to training and access to a cloud-based software. The implementation of a structural reliability model will have improved maintenance benefit quantification, crack front profiles, tip of seam weld flaw fatigue sharpening, uncertainty accounting, and inspectional tool statistical distribution.

Co-Funders: PRCI Members

Start Date: 9/1/2019
End Date: 9/1/2022
Status: Active
2019 Funds Expended: $47,245
Total Project Cost: $519,695
Total SCG Cost: $47,245
Total Co-Funding: $472,450
Benefits:

Post Fire Debris Flow Studies

This project is exploring analysis methodologies and modeling options to help determine the path forward for a risk framework for post-fire debris flow risk assessments. Results from the Flow-R analysis determined that additional study was needed to further develop the approach in determining likely debris flow paths. An additional pilot study using RAMMS software was chosen to assess the likelihood and extent of debris flows across the Montecito region. RAMMS debris flow model parameters will be calibrated using newly released USGS data for the debris flows that occurred in Montecito in January 2018. The USGS data included estimated volume of debris flows from specific basins, peak velocities, and flow properties, and contains shapefiles with the extent of the debris flows. The calibrated model parameters will be used to evaluate the entire Montecito region.

Co-Funders: N/A

Start Date: 2/28/2019
End Date: 2/28/2020
Status: Active
2019 Funds Expended: $44,270
Total Project Cost: $61,420
Total SCG Cost: $61,420
Total Co-Funding: $0
Benefits:

Practical Effects of Rough Walled pipe in Gas Metering Applications (MEAS-6-5D)

The scope of work for this project is to conduct a literature review to assess existing information regarding the influence of upstream pipe with internal surface roughness and flow protrusions as it relates to pipe size. Multiple 8" tubes with varied roughness will be installed in the high-pressure loop at the Southwest Research Institute Meter Test Facility. The effect of changing tube roughness will be quantified by flowing through each meter tube over a range of Reynolds numbers and assessing changes in ultrasonic meter (USM) responses. Flow testing will also be performed to simulate the effect of USM sensors that project into the flow path.

Co-Funders: PRCI Members

Start Date: 11/1/2018
End Date: 11/4/2020
Status: Active
2019 Funds Expended: $8,383
Total Project Cost: $76,700
Total SCG Cost: $5,000
Total Co-Funding: $71,700
Benefits:

Quantification of ILI Sizing Performance for Severe Corrosion Anomalies (EC-4-6A)

The goal of this project is to quantify the sizing error of in-line inspection (ILI) tools as a function of corrosion feature morphology, orientation, and other geometric criteria (e.g., depth, length, width). Completing this process will enable operators to more easily identify critical features and other contributing factors that could lead to pipeline failure. This will increase pipeline safety by addressing the critical features and decrease the number of excavations by reducing the conservatism in the engineering assessment of non-critical features.

Co-Funders: PRCI Members

Start Date: 1/15/2019
End Date: 2/4/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $177,000
Total SCG Cost: $9,709
Total Co-Funding: $167,291
Benefits:

Risk Profile for Aldyl-A Piping System - Phase 3 (2.13.d.3)

The project develops guidelines and easy-to-use instructional procedures for installation of reinforcement clamps on squeezed-off polyethylene (PE) pipes. The clamps' compression strains were analyzed, and finite element stress/strain analysis was conducted to ensure that installation procedure mitigates the stress concentrations caused by squeeze-off operations that could result in initiation of slow crack growth on PE pipe.

Co-Funders: OTD Members

Start Date: 6/15/2015
End Date: 3/30/2020
Status: Active
2019 Funds Expended: $14,500
Total Project Cost: $277,465
Total SCG Cost: $202,965
Total Co-Funding: $74,500
Benefits:

Rounding Clamp Evaluation

The objective of this project is to evaluate the effectiveness of rounding devices to reduce polyethylene pipe ovality for saddle fusions. An oval pipe can make performing saddle fusions difficult due to improper fitment between the pipe surface and the base of the saddle fitting; therefore, a set of rounding inserts can be designed to temporarily round the pipe prior to performing a saddle fusion to ensure quality fusion. A prototype was made and evaluated.

Co-Funders: N/A

Start Date: 9/14/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $17,316
Total Project Cost: $32,816
Total SCG Cost: $32,816
Total Co-Funding: $0
Benefits:

Seismic Risk Assessment and Management of Natural Gas Storage and Pipeline Structure (GFO-18-502) (Group 1)

The goal of this program is to produce an open-source analysis tool that is easily usable by regulators and utilities. The tool will implement updated methodologies for assessment of seismic risk to underground and aboveground natural gas infrastructure. The new tool, which builds upon the widely used Security Engineering Risk Analysis (SERA) software, will have the capability to perform a variety of analyses at a wide range of complexity levels with optimal user functionality. The tool will have the ability to identify areas of highest risk overlaid with population information to help regulators and utilities identify areas of highest risk to prioritize seismic retrofit projects.

Co-Funders: CEC, LBNL

Start Date: 6/1/2019
End Date: 3/30/2022
Status: Active
2019 Funds Expended: $0
Total Project Cost: $5,194,752
Total SCG Cost: $0
Total Co-Funding: $5,194,752
Benefits:

Small PE Diameter Squeeze-Off - Phase 2 (2.14.c.2)

Pressure control on plastic pipe is performed using tools that safely squeeze-off the pipe and shut off the flow of gas. This project will investigate the applicability of minimum squeeze-off distances from fittings and other appurtenances, that would not cause integrity issues at the joint, in small diameter (2" or less) PE pipe. The objective is to develop, and experimentally validate, a model for predicting effects of squeeze-off incurred as a function of pipe diameter, temperature, and squeeze-point location in relation to proximity of fittings and other appurtenances. Study findings may result in recommended changes to existing industry standards with potential efficiency and economic benefits for O&M activities. Final report is in process.

Co-Funders: OTD Members

Start Date: 9/1/2017
End Date: 12/30/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $315,038
Total SCG Cost: $40,838
Total Co-Funding: $274,200
Benefits:

Software Implementation of ECA Procedures for New Construction and In-Service Assessment (API-3-1)

The proposed work developed a software program that allows for consistent application of complex Engineering Critical Assessment (ECA) procedures. It contained the following elements: (1) ECA-based flaw acceptance criteria of API 1104 Annex A, (2) ECA-based flaw acceptance criteria of CSA Z662, (3) application of ABD-1 SBD procedures that produces flaw acceptance criteria and allows users to perform what-if scenarios of various parameters. This software program ensured consistent and accurate application of the new ECA assessment procedures and prompt response to future standard updates.

Co-Funders: PRCI Members

Start Date: 3/20/2018
End Date: 8/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $76,700
Total SCG Cost: $4,953
Total Co-Funding: $71,747
Benefits:

Sulfur Condensation in Pressure Reduction Equipment (MEAS-5-23)

This project will develop a deeper understanding of which regulator styles are less prone to sulfur deposition, assist regulator/control valve manufacturers with design considerations for future models or for current model improvements, and provide operators a lower-cost solution for sulfur mitigation when compared to gas heaters. In July 2019, the project team distributed sulfur sample collection kits to member companies of the Pipeline Research Council International in locations known for heavy sulfur deposits that have impacted regulator operation. The samples will be analyzed to identify the entire chemical composition of the sample.

Co-Funders: PRCI Members

Start Date: 1/31/2016
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $167,560
Total SCG Cost: $19,969
Total Co-Funding: $147,591
Benefits:

Tools for Effective Welding Process and Procedure Development (MAT-1-2)

This project developed an effective welding software to facilitate and accelerate welding procedure development. The team explored using welding thermal cycles in conjunction with material response to thermal cycles to predict the weld properties achievable under various welding conditions. When faced with multiple material and welding process selections, the prediction software can provide critical information on thermal cycles to reduce welding procedure design time and optimize welding trials and associated weld qualification testing. With a user-friendly interface, welders use the software to assist in welding procedure design.

Co-Funders: PRCI Members

Start Date: 1/31/2017
End Date: 1/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $195,071
Total SCG Cost: $30,000
Total Co-Funding: $165,071
Benefits:

Tracking and Traceability for Transmission, Pipe Materials, Phase 4 (Additional Demos) (5.14.d.4)

The ultimate goal is to provide a traceability process that can be used by any operator, pipe mill, coating mill, and distributor to transfer and receive asset traceability information. For this phase, a field study on steel material traceability was conducted in an effort to develop a standard data model and protocols for transferring MTR and Certification of Compliance records electronically from steel asset manufacturers to operators. The sponsor scanned barcodes to create GIS records with material traceability data. The next steps are to submit results of the field test to American Petroleum Institute working groups for incorporation into Recommended Practices for steel pipe.

Co-Funders: OTD Members

Start Date: 2/8/2018
End Date: 11/25/2020
Status: Active
2019 Funds Expended: $22,500
Total Project Cost: $265,000
Total SCG Cost: $31,346
Total Co-Funding: $233,654
Benefits:

Tracking and Traceability Marking Standard for Transmission Components - Phases 1 & 2 (8.17.b, 8.17.b.2)

The objective of this project is to enable the capture of key information required for documenting and geospatially modeling new or repaired gas transmission systems to support the latest PHMSA regulatory requirements. To achieve this, three major developments must take place: (1) develop a machine-readable marking standard for all steel natural gas transmission system components; (2) construct automated field data collection processes linking the required manufacturers' inspections and test documentation and supporting automated definition of each field-installed component in GIS; and (3) gain required industry acceptance for publication of the standard under one or more standards organizations. Phase 2 was incorporated into the project to pilot test the process and software on two construction pilots. The pilot is expected to demonstrate the value expectations of the use of GS1 standards and marking guidelines developed in this project, as well as the production of a very complete record for the documentation of the components installed and in compliance with the newest Pipeline and Hazardous Materials Safety Administration regulations.

Co-Funders: OTD Members

Start Date: 1/1/2017
End Date: 11/15/2021
Status: Active
2019 Funds Expended: $8,992
Total Project Cost: $645,000
Total SCG Cost: $58,707
Total Co-Funding: $586,293
Benefits:

Universal Analytical Technique for Siloxane - Phase 2 (7.16.g.2)

The project objective is to develop a universal industry-wide sampling and analysis procedure for measuring siloxanes in biomethane. It is being developed in conjunction with ASTM Committee D03 on Gaseous Fuels. Phase 2 will validate the procedure by various labs, the next step in the ASTM process.

Co-Funders: OTD Members

Start Date: 5/1/2019
End Date: 3/31/2021
Status: Active
2019 Funds Expended: $30,000
Total Project Cost: $253,000
Total SCG Cost: $49,608
Total Co-Funding: $203,392
Benefits:

USC BioGas Study Phase I & II

The goal of this project is to investigate the effect of ammonia, at various concentrations, during the exposure of typical pipeline materials to renewable natural gas (RNG)—which is derived from biogas and processed to meet pipeline natural gas quality specifications (> 92% CH4)—or during its combustion for power and energy production. Phase I of this project focused on pipeline brass-alloy containing materials and devices and the impact of their exposure to ammonia as a potential constituent of RNG and biogas. The phase II study will evaluate the impact that ammonia presence in RNG may have on appliance and/or equipment performance, as well as investigate the impact on emissions (CO, NOx) of combusting ammonia/RNG mixtures in various devices.

Co-Funders: N/A

Start Date: 8/1/2018
End Date: 5/30/2020
Status: Active
2019 Funds Expended: $76,291
Total Project Cost: $209,765
Total SCG Cost: $209,765
Total Co-Funding: $0
Benefits:

Validation of the AC Corrosion Criteria Based on Real-world Pipeline Measurements (EC-6-2A)

The project objective was to extend the validation process to long-term AC corrosion on real pipelines by collecting and analyzing additional real-world data and running an improved simulation model for long term calculations. The data consolidated and refined the AC corrosion criteria/guidelines. The predictions of the model have combined with field data from electrical resistance (ER) probes. Both the simulation and the ER probe technology are limited to initial corrosion rates, and the AC criteria found in literature are based on the short-term behavior. Therefore, a long-term AC corrosion behavior could not be validated in the previous project but is important for real-life pipeline operations.

Co-Funders: PRCI Members

Start Date: 1/1/2016
End Date: 5/28/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $176,500
Total SCG Cost: $12,500
Total Co-Funding: $164,000
Benefits:

SUB-PROGRAM: SYSTEM INSPECTION AND MONITORING

AC Earth Faults (9.16.d)

Gas Technology Institute (GTI) is developing methods to measure below-ground pipes that are affected by earth faults. GTI will integrate their risk model with a physics model and test its Application Programming Interface (API) to ensure that: (1) the Matlab script can be recalled to populate GTI's risk model, and (2) it generates results identical to the AC Power Toolbox.

Co-Funders: OTD Members

Start Date: 10/1/2016
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $289,200
Total SCG Cost: $70,000
Total Co-Funding: $219,200
Benefits:

Advanced Computed Tomography for Pipeline Inspection (PHMSA) (NDE 2-11)

The project team is working to deliver a validated data set and process that confirms the use of computed tomography (CT) as a non-destructive evaluation technology system that can be used to measure crack and seam anomalies in steel pipe. Validating the CT technology system will enable the pipeline industry to establish a set of reference standards that can be used for a wide range of purposes, including technology development and qualification, personnel training, and competency testing. These reference standards will not require destructive testing to confirm the crack profile and can be used on a repeated basis. This is a significant step for the pipeline industry and will advance training, technology development, and integrity management programs.

Co-Funders: PRCI Members, PHMSA

Start Date: 9/30/2019
End Date: 9/29/2021
Status: Active
2019 Funds Expended: $10,000
Total Project Cost: $500,000
Total SCG Cost: $10,000
Total Co-Funding: $490,000
Benefits:

Airborne Automated Threat Detection System-Monitoring and Surveillance of Imminent Threats Through Remote Sensing (ROW-3-1&A)

The goals of the project are to develop, demonstrate, and validate remote sensing systems for automated pipeline patrol and surveillance technologies to enhance detection of third-party activities, ground movement, and interferences that could potentially affect pipeline infrastructure. Project results will provide pipeline operators with performance data and information on the capabilities and limitations of remote sensing systems for automated pipeline patrol and surveillance. Project activities will include testing of remote sensors and systems for imminent and emergent/urgent threats to pipeline integrity and development of algorithms for data analysis and processing.

Co-Funders: PRCI Members

Start Date: 11/30/2018
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $5,000
Total Project Cost: $371,700
Total SCG Cost: $5,000
Total Co-Funding: $366,701
Benefits:

Alternate Crack Sensor (M2016-004 Phase 1, 2, 3)

This project developed and commercialized a sensor probe system for crack detection of longitudinal seam welds in 20"-26" diameter natural gas pipelines. Phase 1 developed a concept for the crack sensor probe and its integration with the Explorer robotic inspection platform. The overall concept involved the use of two probes, one of which will be used for locating the seam weld and the other for scanning. A prototype was built and field-tested in Phase II in November 2018. The sensor was able to identify cracks in all seam welds with the exception of electric resistance welds (ERW). Phase III was initiated in July 2019 to address issues with ERW weld seam performance, as well as other issues identified during field testing. These issues are: (1) reducing the weight and size of the modules, (2) integrating the crack sensor GUI to that of the Explorer robot, and (3) integrating the defect analysis software to the one for corrosion and mechanical damage defects. The Phase III work scope includes another field test at the NYSEARCH Test Bed at the conclusion of the work outlined above to validate the final system.

Co-Funders: NYSEARCH Members

Start Date: 7/1/2016
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $80,000
Total Project Cost: $1,632,690
Total SCG Cost: $203,894
Total Co-Funding: $1,428,796
Benefits:

AMR Eddy Current Crack Detection Sensor (M2013-002)

The objective was to develop, test, and commercialize an Anisotropic Magneto Resistive (AMR)-based Eddy Current (EC) sensor system for the live, in-line crack inspection of natural gas pipelines. The developed sensor was integrated onto the existing Explorer 8 robotic platform and tested on manufactured cracks demonstrating promising results. However, in the final phase of the project when testing was performed in a pipe joint with natural cracks, the cracks could not be detected. Results indicate the sensor may be detecting stresses or other variations in material properties surrounding cracks (as would be the case with manufactured cracks) as opposed to the cracks themselves. Additional efforts to resolve this phenomenon were unsuccessful and it was determined the sensors are not commercially viable. A final report was prepared to explain the results but there will not be a follow-on phase as commercialization will not be pursued.

Co-Funders: NYSEARCH Members

Start Date: 6/1/2015
End Date: 6/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $2,593,691
Total SCG Cost: $196,910
Total Co-Funding: $2,396,781
Benefits:

Analysis of ILI Technology Performance Specification for Corrosion Features (NDE-4-5)

The objectives of this project include: Providing materials for in-line inspection (ILI) pull testing for corrosion performance specifications and provide a basis for comparing performance on manufactured versus real-world corrosion morphologies. Improved understanding of ILI tool performance for challenging features like pitting corrosion, which should target resources on repairing the anomalies that represent an immediate or impending integrity threat. The value of the impact of having that data cannot be qualified as it is unique to every tool run and every operator based on their pipe materials and operating conditions.

Co-Funders: PRCI Members, Pipeline Inspection Co.'s

Start Date: 1/1/2016
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $435,000
Total SCG Cost: $0
Total Co-Funding: $435,000
Benefits:

Cathodic Disbondment Detector - Phase 2 (4.12.c)

The utility industry needs tools to perform assessments of underground metallic pipes from aboveground. Excavation is expensive and has potential risks. Any technique that provides insight prior to excavation will help to optimize utility resources. This particular technology addresses the assessment of coated steel pipe with the goal of identifying areas with disbonded coating. Phase 2 will conduct additional field tests of a technology that can assess features in coated steel pipe from aboveground to gather the additional data. The technology will be validated with confirming excavations after the features are identified.

Co-Funders: OTD Members

Start Date: 3/24/2017
End Date: 9/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $261,000
Total SCG Cost: $40,031
Total Co-Funding: $220,969
Benefits:

Demonstrate ILI Tool for Small Diameter (<6") Gas Storage Piping

The project will demonstrate the ability of the Quest Integrity InVista in-line inspection tool that uses ultrasonic sensors to accurately measure pipe wall loss and other anomalies and can negotiate through tight pipeline bends. This is especially relevant in small-diameter steel pipelines associated with storage field natural gas wells which are difficult to inspect using conventional in-line Magnetic Flux Leakage (MFL) integrity inspection technologies. The InVista tool was successfully deployed in segments of 2", 3" and 4" pipeline at Goleta Storage Field. The final report will be release in 2020.

Co-Funders: N/A

Start Date: 1/1/2017
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $340,000
Total Project Cost: $603,000
Total SCG Cost: $603,000
Total Co-Funding: $0
Benefits:

Detection Capabilities of MFL ILI Tools (NDE-4-1)

The project evaluated the in-line inspection magnetic flux leakage (MFL) technologies from various service providers and determined their capabilities of detecting commonly found and potentially injurious Close Metal Objects (CMOs). The project team determined that MFL will detect CMOs that are close to the pipeline and have sufficient mass to disrupt the magnetic field. The smaller the object, and the farther away from the pipeline, the less likely it was to be detected.

Co-Funders: PRCI Members

Start Date: 9/1/2019
End Date: 9/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $1,188,517
Total SCG Cost: $15,000
Total Co-Funding: $1,173,517
Benefits:

Determine the Impact of Human Factors in the Performance of In-Service NDE (NDE-2-7)

This research assessed the potential impact of human factors (i.e., transfer of knowledge, teaching, and learning) on the performance of in-service nondestructive examination (NDE) of pipeline integrity. Accurate damage assessments cannot occur when the accuracy or variability of the NDE is not well understood, and especially in the presence of a human operator. This work delivered an impartial assessment of the variabilities that may be involved when humans perform NDE, as well as standard procedures for the assessment of NDE operator performance.

Co-Funders: PRCI Members

Start Date: 1/31/2017
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $437,878
Total SCG Cost: $25,000
Total Co-Funding: $412,878
Benefits:

Eclipse Scientific Red/Green Light Tool for NDE of PE Pipe Butt Fusion Joints - Phase 1-a (M2019-010)

The objective is to develop an automated non-destructive evaluation (NDE) red/green light tool to inspect the integrity of polyethylene (PE) pipe butt fusion joints that can be operated by properly trained, but non-NDE, gas industry workers. NYSEARCH members have invested considerable resources into NDE development for PE pipe through extensive testing with The Welding Institute to establish the acceptance of NDE criteria which will be incorporated into the tool resulting in an automated tool that would provide an NDE platform for PE pipe butt fusion joints containing known defect acceptance criteria.

Co-Funders: NYSEARCH Members

Start Date: 1/31/2020
End Date: 9/30/2020
Status: Active
2019 Funds Expended: $12,000
Total Project Cost: $153,790
Total SCG Cost: $13,670
Total Co-Funding: $140,120
Benefits:

EMAT Sensors for Small Diameter and Unpiggable Pipe & Remaining Wall Thickness (4.13.c.2a & 4.13.c.3a)

The objective of these projects is to develop a bench-scale electromagnetic acoustic transducer or EMAT sensor that can be used to assess the wall thickness of small-diameter, unpiggable pipelines containing reduced diameter fittings and other restricting features to improve steel pipeline integrity and to enhance safety. Using conventional magnetic flux leakage technology, these defects typically cannot be detected.

Co-Funders: OTD Members, DOT/PHMSA, Others

Start Date: 4/1/2018
End Date: 9/11/2020
Status: Active
2019 Funds Expended: $3,144
Total Project Cost: $2,059,337
Total SCG Cost: $9,644
Total Co-Funding: $2,049,693
Benefits:

Energy Harvesting for Recharging of Explorer Robotic Platforms Ph II (M2016-009)

The goal is to develop and commercialize an on-board module that extracts energy from the gas flow inside the pipeline to generate the power to run the Explorer family of inspection platforms, thus extending their inspection range capabilities. The initial Phase I effort focused on the energy extraction module while Phase II focused on iterations of the power generating module prototype. Successful power generation results were achieved in a laboratory flow chamber and a live pipeline test was performed in Q4 2019. Power generation and management appears to be working as designed; however, modifications still need to be implemented to ruggedize the system for commercial deployment.

Co-Funders: NYSEARCH Members

Start Date: 10/1/2016
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $30,000
Total Project Cost: $1,631,721
Total SCG Cost: $171,265
Total Co-Funding: $1,460,456
Benefits:

Energy Harvesting in Gas Industry Applications (M2016-006) - Phase II

The goal is to carry out a feasibility study to identify technologies that generate 3-5 watts of power by harvesting energy from available "background" resources (e.g. vibration, flow, temperature differences, etc.). This would power sensory and related devices in areas where power supply is limited or non-existent. Phase I identified potential technologies. Phase II focuses on the evaluation of these technologies for practicality and commercial availability.

Co-Funders: NYSEARCH Members

Start Date: 12/1/2016
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $13,000
Total Project Cost: $293,235
Total SCG Cost: $27,931
Total Co-Funding: $265,304
Benefits:

Fracture Toughness via in-Ditch Non-Destructive Testing-Validation (NDE-2-9)

The objective was to establish the relationship between new nondestructive evaluation (NDE) test measurements with established standardized tests for fracture toughness. This research will validate new technology that determines material fracture toughness through NDE testing in-ditch. This data could be combined with the "binning" of pipe joints that is currently performed using in-line inspection tools, thereby, reducing the need to perform costly cut-outs and associated shut-down of the pipelines for laboratory Charpy-V notch tests.

Co-Funders: PRCI Members

Start Date: 10/23/2018
End Date: 11/7/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $149,270
Total SCG Cost: $4,972
Total Co-Funding: $144,298
Benefits:

Hardness Testing via Robotics Platform, Phase IX (M2011-006)

This project developed and tested a new module for the Explorer Robotics Platform that performs hardness testing to estimate pipe yield strength properties from inside a live pipeline. Upon completion of the feasibility study in Phase I, Phase II was initiated to construct and demonstrate prototype iterations of the hardness testing device. Laboratory testing, as well as, field testing of modules, in the most recent iteration, proved that the system and the process is capable of accurate hardness measurements. The project was completed, and the module is now ready for a limited commercial rollout for 20" to 24" pipelines.

Co-Funders: NYSEARCH Members, PHMSA

Start Date: 6/1/2015
End Date: 12/3/2019
Status: Completed
2019 Funds Expended: $3,000
Total Project Cost: $1,040,627
Total SCG Cost: $91,450
Total Co-Funding: $949,177
Benefits:

ILI Crack Tool Reliability and Performance Evaluation (NDE-4-7)

Project team members sought to improve statistical modelling from updated in-line inspection (ILI)/nondestructive evaluation data to characterize ILI tool performance with respect to rate of detection, probability of identification, false discovery rate, and sizing accuracy to reduce the uncertainty of both detected and undetected features. Updating existing data provides additional confidence that the results of the statistical performance review are based on a wide sample of industry experience and will improve the ability of operators to measure crack ILI performance using a consistent approach.

Co-Funders: PRCI Members

Start Date: 10/1/2016
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $259,600
Total SCG Cost: $9,811
Total Co-Funding: $249,789
Benefits:

ILI Technology Comparative Testing Casing Corrosion Logging Tool (US-3J)

Many storage field operators have a preferred technology, such as ultrasonic or magnetic flux leakage, to inspect and manage the integrity of well casings. However, there is no clear understanding of the benefits or advantages of one technology over the other. The objective of this project is to define the differences and advantages associated with each inspection technology currently available for storage field applications. This study will utilize the characterized pipe from a previously funded project (US-3H).

Co-Funders: PRCI Members, PHMSA

Start Date: 4/1/2019
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $324,035
Total SCG Cost: $50,000
Total Co-Funding: $274,035
Benefits:

Improve Dent/Cracking Assessment Methods (PHMSA) (MD-5-2)

This project enhances previously developed tools being adopted by industry recommended practices (API RP 1183). These are meant to improve the ability to support pipeline mechanical damage integrity assessment and management by considering three main gaps: 1) improvement of indentation crack formation strain estimates, 2) impact of ILI dent and interacting feature sizing variation, and 3) dent fatigue life assessment safety quantification.

Co-Funders: PRCI Members, PHMSA

Start Date: 9/30/2019
End Date: 9/29/2021
Status: Active
2019 Funds Expended: $643
Total Project Cost: $456,430
Total SCG Cost: $1,667
Total Co-Funding: $458,097
Benefits:

Improve ILI Sizing Accuracy (PHMSA) (NDE-4-19)

The goal is to understand the probability of detection by in-line inspection for immediate conditions, where the industry aspiration is 100% detection of critical integrity conditions. It is important to understand the probability of identification to minimize the number of missed defects without increasing the number of false indications, optimizing the number of excavations needed for operation pipeline safety, and better utilization of resources.

Co-Funders: PRCI Members, PHMSA

Start Date: 9/30/2019
End Date: 9/29/2021
Status: Active
2019 Funds Expended: $5,000
Total Project Cost: $406,188
Total SCG Cost: $5,000
Total Co-Funding: $401,188
Benefits:

InSAR Monitoring of Pipeline Geohazards in Vegetated and Very Large Non-Vegetated Areas (GHZ-2-03&A)

Approximately 8% of pipeline incidents are related to geohazards, and these incidents often result in devastating consequences. InSAR is a cost-effective remote sensing technology that can help detect and monitor these geohazards across large geographic areas to reduce risk. The project will demonstrate recent advances in InSAR that allow 3vGeomatics (3vG) to offer InSAR monitoring services of geohazards in vegetated areas and very large non-vegetated areas at very low cost. Based on the results of the analyses in both the Appalachians and the Permian basin, 3vG will provide an outline on how an operator can utilize InSAR to monitor their pipeline networks in different parts of the country.

Co-Funders: PRCI Members

Start Date: 1/1/2019
End Date: 3/20/2020
Status: Active
2019 Funds Expended: $5,000
Total Project Cost: $253,228
Total SCG Cost: $14,950
Total Co-Funding: $238,278
Benefits:

Integrity Assessment Guidelines for Difficult to Inspect Pipelines (NDE-3-3)

The project compiled and analyzed alternative technologies for difficult to inspect pipelines. A white paper was prepared that presents an overview of the current technology and/or state of the art technologies that are either deployed or under development. This helped pipeline operators in selecting cost effective technologies.

Co-Funders: PRCI Members

Start Date: 12/29/2017
End Date: 6/19/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $150,000
Total SCG Cost: $3,538
Total Co-Funding: $146,462
Benefits:

Integrity of Crack Colonies with the Aid of Advances in Nondestructive Evaluation including EMAT and Ultrasonic Imaging (NDE-4-10)

Using in-line inspection (ILI) tools is more economical than hydrotesting and provides the ability to monitor pipeline anomalies before they become defects that can grow to failure. However, limitations of current technologies force operators to make conservative assumptions regarding the "effective crack length" to be used for failure pressure calculations, leading to unnecessary digs and repairs. This project seeks to develop and validate methods for obtaining more accurate estimates for effective length and failure calculations using electromagnetic acoustic transducer ILI. This project would also develop techniques and processes to use ultrasonic imaging for obtaining necessary in-ditch measurements using non-destructive means.

Co-Funders: PRCI Members

Start Date: 2/1/2017
End Date: 1/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $750,000
Total SCG Cost: $0
Total Co-Funding: $750,000
Benefits:

Modernize the River X Software (ENV-4-1)

When pipelines at river crossings become exposed, such as during flooding, there is an urgent need to perform an integrity assessment. The pipe may see high loads due to free spans and may be subjected to vortex-shedding induced oscillations that can lead to fatigue failure. The River-X software is a popular tool and is widely used in the industry for integrity assessment of the exposed pipelines in the river crossings. However, the software has become outdated over time and requires modernization and upgrades. This project will update the software and thus give member companies a tool to perform the necessary integrity assessments in a timely manner, thereby giving information for urgently needed operational decisions.

Co-Funders: PRCI Members

Start Date: 1/31/2017
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $282,209
Total SCG Cost: $46,620
Total Co-Funding: $235,589
Benefits:

Modernize the Assessment of Pipeline Water Crossings (ENV-4-1A)

This project will expand and improve the capabilities of existing engineering assessment tools, streamflow monitoring techniques, and risk tools used today for managing the integrity of pipelines crossing water bodies and planning the locations of new crossings. These advances may also allow pipeline operators to discover which crossings may require operational or engineering controls to minimize the probability of future flooding hazards leading to loss of containment and can be used to screen locations for future crossings. Results of this research will supplement guidance from API RP 1133 ("Managing Hydrotechnical Hazards for Pipelines Located Onshore or Within Coastal Zone Areas") by building upon the 'how to' of this guidance through development of industry best practices and the use of emerging approaches and technologies.

Co-Funders: PRCI Members, PHMSA

Start Date: 1/1/2019
End Date: 11/30/2021
Status: Active
2019 Funds Expended: $10,709
Total Project Cost: $593,407
Total SCG Cost: $15,691
Total Co-Funding: $577,716
Benefits:

New Extended Evaluation of Large Stand Off Magnetometry (NDE-3-4)

Confirming the integrity of 'challenging-to-inspect' pipelines and flow lines (e.g., both onshore and offshore), where the internal insertion of a tool is not possible, remains a significant hurdle for the industry. Numerous stakeholders, including regulators, are demanding greater assurances of system integrity. For onshore applications, standoff methods will either simplify or avoid excavation altogether. This project will undertake an assessment of the science behind large stand-off magnetometry, which will include aboveground assessment of pipeline condition, no additional magnetic field applied, and analysis of variations to determine physical cause.

Co-Funders: PRCI Members

Start Date: 4/18/2018
End Date: 4/8/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $537,001
Total SCG Cost: $35,424
Total Co-Funding: $501,577
Benefits:

Numerical Modeling and full-scale testing to evaluate the performance of large standoff magnetometry (NDE-3-5)

The purpose of the research program is to evaluate the performance of Large Standoff Magnetometry (LSM) technology using a test rig that introduces various combinations of loading into a pipe sample including internal pressure, axial tension/compression, and bending. The intent is to introduce loading representative of what might be encountered in a geohazard condition. The challenge with the current state-of-the-art is lack of validation data and fundamental research to support the use of LSM technology. In addition, to the full-scale testing, this proposed scope of work integrates a phase of work involving numerical modeling and laboratory testing. Once completed, pipeline operators will better understand the range of measurement capabilities associated with current LSM technology, thus allowing them to determine the best means for deploying LSM technology to the field.

Co-Funders: PRCI Members, Technology Providers

Start Date: 6/12/2019
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $9,126
Total Project Cost: $177,000
Total SCG Cost: $9,126
Total Co-Funding: $167,874
Benefits:

Optimal Approach to Cost Effective, Multi-source, Satellite Surveillance of River Crossings, Slope Movements and Land Use Threats to Buried Pipelines (GHZ-2-02)

Regulations require pipeline operators to mitigate geohazard and land use threats to pipeline integrity, particularly on slopes near river and stream crossings. In addition to applicable regulatory requirements, detecting and mitigating geohazard motion and rights-of-way (ROW) land use encroachment threats are primary elements of pipeline operators' damage prevention strategies and programs. This project will develop improved methods for satellite-based tools and technologies to enhance detection of natural changes, seasonal flooding, erosional effects, channel dynamics, and ground movement affecting pipelines near river crossings. Successful completion of this project will identify three leading classes of satellites available in the market to support pipeline integrity programs, enhancing operators risk mitigation programs through more frequent higher-resolution detection, and surveying the ROW.

Co-Funders: PRCI Members

Start Date: 1/31/2018
End Date: 1/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $330,814
Total SCG Cost: $10,267
Total Co-Funding: $320,547
Benefits:

Performance Capabilities Evaluation of ILI for Long Seam Features in ERW Pipe (IM-3-1)

The objective of this project is to provide performance data for in-line inspection (ILI) technologies identifying and characterizing anomalies in the longitudinal seam of electric resistance welding (ERW) pipe. The project will produce performance qualification data of ILI technologies for detecting and sizing features, anomalies, and defects in long seams, with emphasis on ERW Pipe. Testing will be performed on a set of well characterized test samples that will provide an objective basis for measuring ILI technologies and defining areas for improvements to ILI systems for detecting and sizing ERW seam anomalies.

Co-Funders: PRCI Members

Start Date: 7/1/2017
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $0
Total Project Cost: $707,000
Total SCG Cost: $15,000
Total Co-Funding: $692,000
Benefits:

Performance Evaluation of ILI Systems for Detecting and Discriminating Metal Loss, Cracks, and Gouges in Geometric Anomalies (MD-1-13)

Pipeline Research Council International's Mechanical Damage program is focused on the development of models that allow the user to understand the failure mechanism of plain dents, associated with gouge, and dents associated with welds. These models depend significantly on feature characterization (e.g., dent physical shape, length, width and depth and dimensions of closely spaced and/or coincident features: gouges, corrosion, cracking) and strain measurements as input data for the analysis of the effects of mechanical damage features on pipeline integrity. The accuracy of these models will be linked to the accuracy associated with feature characterization. Since operators rely heavily on ILI tools to manage the different threats in their pipeline system, the effectiveness of their management programs will depend on the reliability and effectiveness of the ILI tools. More detailed analysis of ILI systems performance is required to evaluate dents interacting with other indications/coincident features and define the applicability, accuracy and validation of the developed models.

Co-Funders: PRCI Members, DOT

Start Date: 9/28/2018
End Date: 3/31/2022
Status: Active
2019 Funds Expended: $12,673
Total Project Cost: $1,387,543
Total SCG Cost: $17,673
Total Co-Funding: $1,369,870
Benefits:

Pipeline Defense (1.15.c) - CEC (PON-14-503)
This project demonstrated a monitoring system to alert operators to the presence of threats, natural or human-caused, in pipeline rights-of-way. The system included multiple, off-the-shelf, in-ground and on-pipe sensors that wirelessly monitor vibration, soil conditions, and electrical currents. These sensors measured vibration, soil moisture, temperature, and electrical currents, and communicated the data wirelessly to a central command center.

Co-Funders: CEC

Start Date: 10/3/2017
End Date: 9/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $1,300,000
Total SCG Cost: $10,000
Total Co-Funding: $1,290,000
Benefits:

Precise Location, Measurement, and Evaluation of DC Stray Currents Affecting Transmission Pipelines (EC-6-9)
The project evaluated stray DC currents using multiple indirect survey tools. It used test pipelines in different electrical configurations to create and measure static and dynamic stray current conditions. While the results identified strengths and weaknesses of individual indirect inspection tools, integrating results of multiple tools provide enhanced understanding of stray DC current interference. The final report provided a review of industry-wide techniques for location, evaluation, and measurement of DC stray current on pipelines.

Co-Funders: PRCI Members

Start Date: 1/1/2017
End Date: 3/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $118,000
Total SCG Cost: $10,000
Total Co-Funding: $108,000
Benefits:

Qualification of NDE Methods for In-ditch Analysis of ERW Pipe Weld Anomalies (IM-3C)
The pipeline industry has several nondestructive evaluation (NDE) inspection technologies that are currently used to characterize long seam anomalies in the ditch. However, in-ditch measurement protocols do not exist in the natural gas industry. The project objective was to document and demonstrate the performance of the current in-ditch NDEs for screening analysis and detailed anomaly sizing with an emphasis on electric resistance welded pipes and long seams. Also, the project investigated advanced and emerging NDE technologies to support the development of new technologies by identifying the limitations of the current sensor arrays for characterizing anomalies in pipe long seams.

Co-Funders: PRCI Members

Start Date: 9/1/2015
End Date: 6/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $177,000
Total SCG Cost: $7,532
Total Co-Funding: $169,468
Benefits:

Remaining Life Model and Assessment Tool for Dents and Gouges (MD-4-16)
The objective of this project is to produce a level 1-2 assessment model for fatigue crack growth analysis and fatigue life prediction of mechanical damage with dents and gouges due to cyclic pressure. The outcome of this project will provide a meaningful outlet for assessing gouges and dents on steel pipelines. The deliverable will be a platform that identifies defects to support Operations.

Co-Funders: PRCI Members

Start Date: 2/4/2019
End Date: 2/8/2021
Status: Active
2019 Funds Expended: $0
Total Project Cost: $351,232
Total SCG Cost: $4,679
Total Co-Funding: $346,553
Benefits:

Small Diameter Acoustic Resonance (ART) ILI Tool Feasibility Study and Concept Design (NDE-4-15)

The project assesses the ability of using acoustic resonance technology (ART) in smaller diameter pipelines. ART has been successfully developed for in-line inspection of larger, 16"- 48" size heavy wall gas and waxy liquid lines. The goal of the initial phase of this project will be to provide detailed technical understanding of the challenges of inspections in the given pipeline sizes, to evaluate present ART Scan system components against identified challenges, and concept engineering of new packaging to meet the technical requirements of typical pipelines described.

Co-Funders: PRCI Members

Start Date: 11/1/2018
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $210,040
Total SCG Cost: $10,000
Total Co-Funding: $200,040
Benefits:

Standard Library of PE Joint Samples with Embedded Defects for NDE Tool Validation - Phase I-a (M2019-009)

The objective of this program is to produce a polyethylene (PE) pipe butt fusion joint sample library with known defects that can be used to validate any current and future nondestructive evaluation (NDE) technology claiming to be capable of detecting PE butt fusion defects applicable to the gas industry. NYSEARCH members have invested considerable resources into NDE development through extensive testing with The Welding Institute. A sample library would provide a resource to validate any NDE tool purported to be capable of identifying defects relevant to the gas industry. Further, the library would provide a screening process for validation related to known specific acceptance criteria.

Co-Funders: NYSEARCH Members

Start Date: 10/10/2019
End Date: 9/30/2021
Status: Active
2019 Funds Expended: $47,000
Total Project Cost: $545,200
Total SCG Cost: $48,465
Total Co-Funding: $496,735
Benefits:

Structured Light Scanning Tool for Distribution Pipeline Inspection - Phase 1 (4.18.a)

This project will advance the development of a structured light scanning tool for internal inspection of plastic and metallic pipes. Inspection of internal pipe (steel and plastic) geometry and surface conditions of distribution mains will provide the operators with knowledge of joints, laterals, internal corrosion, roundness, dents, and cracks which are difficult to detect by current technologies in steel distribution pipe systems and are the primary sources of stress intensifications that cause damage to propagate through the pipe wall. Additionally, inspection of the plastic pipe surface condition would be important to monitor the cross-sectional deformations resulting from pipe squeeze-off which have been shown to be the main causes of slow crack growth in plastic pipes.

Co-Funders: OTD Members, PHMSA

Start Date: 7/1/2018
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $875
Total Project Cost: $150,000
Total SCG Cost: $1,875
Total Co-Funding: $148,125
Benefits:

Systemize 20 years of Mechanical Damage Research (PHMSA) (MD-5-1)

The project provides a summary of work supporting the current state of knowledge related to mechanical damage. A focus is on formation and behavior, detection and characterization, assessment and management, remediation and repair, and recommended practices and standards. The summary will provide a consolidated review of previous research over the past 20 years characterizing the achievements made as well as opportunities for improvement.

Co-Funders: PRCI Members, PHMSA

Start Date: 9/30/2019
End Date: 9/29/2021
Status: Active
2019 Funds Expended: $1,033
Total Project Cost: $492,229
Total SCG Cost: $1,789
Total Co-Funding: $494,018
Benefits:

Technology Development Center (TDC-1-1 & 1A)

The project provides support for the Pipeline Research Council International which opened its new Technology Development Center (TDC) in Houston, Texas in the summer of 2015. TDC will provide the industry with an independent third-party site to fully understand the capabilities of current pipeline inspection tools and to guide the development of new technologies needed to push toward the goal. The benefits to the industry have already been realized.

Co-Funders: PRCI Members

Start Date: 1/1/2015
End Date: 12/30/2020
Status: Active
2019 Funds Expended: $7,358
Total Project Cost: $3,440,727
Total SCG Cost: $42,709
Total Co-Funding: $3,398,018
Benefits:

Unmanned Aerial System RD&D

Aviation Services (AS) is beginning to evaluate a new drone to perform accurate ground surveys. It uses Light Detection and Ranging technology, a state of the art, 3D mapping tool. This new technology is extremely technical and has an extensive learning curve. AS is currently processing and assessing the data for accuracy on the first test flights that were performed at Pico Rivera facility.

Co-Funders: N/A

Start Date: 1/1/2018
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $67,923
Total Project Cost: $415,113
Total SCG Cost: $415,113
Total Co-Funding: $0
Benefits:

Validate In-Line Inspection (ILI) Capabilities to Detect/ Characterize Mechanical Damage (PHMSA) (NDE-4-18)

This project expands the current state of knowledge for in-line inspection (ILI) system performance to detect and characterize corrosion, welds, gouges, and crack features interacting with dents. Understanding current performance of ILI systems will support technology enhancements and identify requirements for new technologies. The project will generate data supporting the development of revised dent response criteria being pursued in Pipeline Research Council International R&D projects and address recommendations issued to the Pipeline and Hazardous Materials Safety Administration by the National Transportation Safety Board to promulgate new regulations that address dent acceptance criteria.

Co-Funders: PRCI Members, PHMSA, Others

Start Date: 9/30/2019
End Date: 3/21/2022
Status: Active
2019 Funds Expended: $8,073
Total Project Cost: $3,012,542
Total SCG Cost: $25,722
Total Co-Funding: $2,986,820
Benefits:

Validating Non-Destructive Tools for Surface to Bulk Correlations of Yield Strength, Toughness, and Chemistry (4.14.c.2)

The objective is to facilitate the use of non-destructive surface testing including micro-indentation, micro-machining, in-situ chemistry, and replicate microscopy analysis as accurate, efficient, and cost-effective tools for material property confirmation on steel pipe. This work will provide benefits to pipeline safety, energy continuity, and integrity assessment programs since the developed techniques and models and validated testing technology will not require a line to be taken out of service or destructively cut out samples from the in-service pipeline.

Co-Funders: OTD Members, DOT/PHMSA, Others

Start Date: 9/3/2018
End Date: 6/7/2021
Status: Active
2019 Funds Expended: $17,687
Total Project Cost: $1,054,516
Total SCG Cost: $57,874
Total Co-Funding: $996,642
Benefits:

CLEAN TRANSPORTATION

SUB-PROGRAM: COMPRESSION & REFUELING

OnBoard Dynamics CNG Mobile Compressor Lab Test/Field Demonstration

The purpose of this project was to optimize product design and test performance of Onboard Dynamics, Inc.'s novel CNG compressor technology for deployment in both on-board vehicle and off-board trailer compressor applications. This technology seeks to overcome the cost barrier of smaller on-site CNG refueling systems, leading to accelerated adoption of CNG and further reducing NOx/GHG emissions.

Co-Funders: ARPA-E, ONAMI, OSU, Private Investors

Start Date: 8/31/2016
End Date: 7/31/2019
Status: Completed
2019 Funds Expended: $75,000
Total Project Cost: $7,845,000
Total SCG Cost: $375,000
Total Co-Funding: $7,470,000
Benefits:

UTD CNG Dispenser Tank Communication (2.19.G)

The objective of this project is to design, build, and demonstrate a prototype smart compressed natural gas (CNG) station that includes a smart CNG dispenser and a smart natural gas vehicle (NGV). The team will develop pre-commercial prototype hardware and protocols that enable the vehicle and station to communicate information about the vehicle's fuel system such as real-time pressure and temperature, tank volume, and age of the CNG fuel system. This information will allow safer, fuller fills of their NGVs while also enabling fleets to more accurately track vehicle fuel consumption.

Co-Funders: UTD, DOE, CSA

Start Date: 9/1/2019
End Date: 9/30/2022
Status: Active
2019 Funds Expended: $17,100
Total Project Cost: $2,785,000
Total SCG Cost: $40,714
Total Co-Funding: $2,744,286
Benefits:

SUB-PROGRAM: FUEL SYSTEMS & STORAGE

Fluor 1000kg Hydrogen Production Station Feasibility Study

SoCalGas is conducting a feasibility study to analyze potential methods of hydrogen production using commercially demonstrated technologies at rates between 800 and 1,200 kg/day. The targeted production rate will be 1,000 kg/day. The hydrogen generated will be stored and dispensed for vehicle use at an adjacent on-site hydrogen fueling station that serves both light-duty and heavy-duty vehicles.

Co-Funders: N/A

Start Date: 8/5/2019
End Date: 2/28/2020
Status: Active
2019 Funds Expended: $141,350
Total Project Cost: $220,000
Total SCG Cost: $220,000
Total Co-Funding: $0
Benefits:

GNA Tri-Generation Feasibility Assessment – Phase 1

SoCalGas worked with Gladstein, Neandross & Associates (GNA), FuelCellEnergy (FCE), and South Coast Air Quality Management District (SCAQMD) to perform a high-level economic and feasibility assessment of the tri-generation refueling concept.

Co-Funders: N/A

Start Date: 6/30/2018
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $28,250
Total Project Cost: $48,000
Total SCG Cost: $48,000
Total Co-Funding: $0
Benefits:

GTI CNG Smart Station Demonstration

Gas Technology Institute (GTI) and the University of Texas at Austin Center for Electromechanics (UT-CEM) are proposing to develop a smart compressed natural gas (CNG) station to eliminate issues associated with CNG underfilling. The goal of this project is to demonstrate an advanced control algorithm in a smart vehicle and dispenser, as well as a simple and cost-effective method for conditioning gas as it is dispensed into a natural gas vehicle in order to effectively manage the temperature and density changes currently preventing vehicles from getting a full fill.

Co-Funders: UTD, NREL

Start Date: 1/31/2019
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $26,875
Total Project Cost: $1,500,000
Total SCG Cost: $268,754
Total Co-Funding: $1,231,246
Benefits:

Ingevity ANGP Ford F-150 Medium Duty Truck Demonstration

Ingevity seeks to test, validate, and expand the adsorbed natural gas (ANG) vehicle and private refueling model through a demonstration fleet of ANG trucks. Four 2018 Ford F-150 bi-fuel vehicles outfitted with the ANG system will be field demonstrated along with modified versions of the BRC Fuelmaker FMQ 2.5 refueling appliances set to a slow-fill charge of natural gas to 900 psi.

Co-Funders: N/A

Start Date: 10/16/2018
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $225,000
Total Project Cost: $250,000
Total SCG Cost: $250,000
Total Co-Funding: $0
Benefits:

SoCalGas Coriolis Meter Total Flow Test

The purpose of this project is to track non-transportation usage of CNG at SoCalGas Bases and to exclude this usage from the main NGV meter.

Co-Funders: N/A

Start Date: 8/19/2019
End Date: 10/31/2020
Status: Active
2019 Funds Expended: $10,997
Total Project Cost: $30,000
Total SCG Cost: $30,000
Total Co-Funding: $0
Benefits:

UTD CNG Station Methane Measurement Investigation (2.17.H)

The objectives of this project are to quantify the leaks and losses of natural gas in the compressed natural gas (CNG) fueling process within a CNG fueling station, evaluate advanced compression technologies, and provide guidance on tracking methods to monitor station leakage performance to maximize operational efficiency and minimize leaks and losses.

Co-Funders: N/A

Start Date: 6/1/2017
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $2,500
Total SCG Cost: $2,500
Total Co-Funding: $0
Benefits:

UTD Cost Effective CNG Pre-Cooling Technologies (2.18.I)

The objective of this project is to investigate and design a compressed natural gas (CNG) precooling system to condition CNG prior to being dispensed into a natural gas vehicle (NGV) to achieve full fills.

Co-Funders: CEC, UTD

Start Date: 7/1/2018
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $15,000
Total Project Cost: $200,000
Total SCG Cost: $45,000
Total Co-Funding: $155,000
Benefits:

UTD Cost-Effective CNG Pre-Cooling Technologies – Phase 2: Free Piston Gas Expander (2.18.I.2)
This project will design, build, and demonstrate a novel expander to pre-cool compressed natural gas (CNG) in order to achieve full fills of CNG storage tanks on natural gas vehicles (NGVs) and thus increase effective storage capacity by 20-25%. This will reduce the cost and improve the range of NGVs, leading to increased NGV adoption and greater customer savings and satisfaction.

Co-Funders: DOE, UTD

Start Date: 9/1/2019
End Date: 9/30/2021
Status: Active
2019 Funds Expended: $10,000
Total Project Cost: $2,650,000
Total SCG Cost: $20,000
Total Co-Funding: $2,630,000
Benefits:

UTD Distributed Generation for EV Charging (2.19.H)
The objective of this project is to assess if state-of-the-art gas technologies (i.e. advanced genset, turbine, fuel cell, CHP opportunities) can be cleaner, more flexible, more feasible in certain locations, or provide other benefits than the grid or other options for EV charging site infrastructure.

Co-Funders: UTD, PERC

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $8,800
Total Project Cost: $50,000
Total SCG Cost: $8,800
Total Co-Funding: $41,200
Benefits:

UTD Test and Validate Small-Scale Compressor Fill Devices (2.16.P)
This project will test and validate the performance of a Scroll Labs Small-Scale Scroll Compressor Fill Device and a similar sized Hygen liquid piston compressor. The objective of this project is to validate the manufacturer's claims of performance and to perform a review for CSA/ANSI NGV5.1 compliance potential.

Co-Funders: UTD, HYGEN

Start Date: 6/27/2016
End Date: 11/11/2019
Status: Completed
2019 Funds Expended: $5,882
Total Project Cost: $120,000
Total SCG Cost: $25,882
Total Co-Funding: $94,118
Benefits:

Sub-Program: Near Zero Emissions Engines

GTI 6.7L Natural Gas Engine in Medium Heavy-Duty Vehicles Development and Demonstration
Gas Technology Institute (GTI) and Cummins Westport, Inc. proposed utilizing the CWI ISB6.7 G spark ignited natural gas engine and further developing an advanced version of this engine with heavy-duty on-board diagnostics (HD OBD) to meet 2018 EPA and CARB regulations for alternative-fueled heavy-duty vehicles. The project team also addressed integration issues currently preventing utilization of the ISB6.7 G in specific vocational vehicles, including street sweepers and shuttle buses. This project opened up the expansion of natural gas into more Class 5 to 7 vehicle markets and has led to the next step: deployment in up to 18 vehicles, including street sweepers, shuttle buses, and school buses.

Co-Funders: CEC, CWI

Start Date: 4/1/2016
End Date: 3/31/2019
Status: Completed
2019 Funds Expended: $4,058
Total Project Cost: $2,651,018
Total SCG Cost: $134,375
Total Co-Funding: $2,516,643
Benefits:

SCAQMD Ford 7.3 NZE Development

The purpose of this project is the development and commercialization of the Ford 7.3L CNG Near-Zero Emission Engine for medium duty trucks. Three developers, Landi Renzo, Agility Power Systems, and A-1 Alternative Fuels, will be developing a CNG NZE variant of the Ford 7.3L CNG engine for medium-duty trucks. These will be the first engines in the medium-duty class to reach near-zero emission and to be widely adopted into Ford medium-duty truck platforms.

Co-Funders: SCAQMD, Ford, Landi Renzo, Agility Fuel Systems, US Gain

Start Date: 11/30/2019
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $0
Total Project Cost: $4,379,747
Total SCG Cost: $900,000
Total Co-Funding: $3,479,747
Benefits:

SCAQMD In-Use Emission Study

The purpose of this project is to conduct in-use emissions testing, fuel usage profile characterization, and an impact assessment of current technology and alternative fuels on fuel consumption and in-use emissions from heavy-duty vehicles in various vocations.

Co-Funders: SCAQMD, CEC, CARB

Start Date: 11/1/2015
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $250,000
Total Project Cost: $3,285,000
Total SCG Cost: $500,000
Total Co-Funding: $2,785,000
Benefits:

SWRI Research and Development of Natural Gas D-EGR Engine for Improved on Highway Efficiency

In this project, SwRi is developing a natural gas dedicated exhaust gas recirculation (D-EGR) engine for improved efficiency using a Cummins ISX-12G engine.

Co-Funders: CEC, Woodward

Start Date: 1/1/2018
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $100,000
Total Project Cost: $1,141,580
Total SCG Cost: $200,000
Total Co-Funding: $941,580
Benefits:

Transient Plasma Systems – Advanced Ignition System Testing

The goal of this project is to develop a production-intent prototype of a transient plasma ignition system by using existing non-thermal plasma ignition technology and demonstrating an increase in combustion repeatability at high-pressure, high-Exhaust Gas Recirculation (EGR) conditions across a wider operating range relative to Natural Gas Spark Ignited internal combustion (IC) engines.

Co-Funders: CEC

Start Date: 6/1/2018
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $23,606.44
Total Project Cost: $925,811
Total SCG Cost: $26,672
Total Co-Funding: $899,139
Benefits:

UC Davis STEPS Program

The Sustainable Transportation Energy Pathways Program at the UC Davis Institute of Transportation Studies is a four-year multidisciplinary research consortium that brings together the world's leading auto and truck OEMs, energy firms, new mobility companies, foundations and government agencies to understand sustainable vehicle and energy solutions.

Co-Funders: N/A

Start Date: 12/1/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $80,000
Total Project Cost: $80,000
Total SCG Cost: $80,000
Total Co-Funding: $0
Benefits:

SUB-PROGRAM: COMPRESSED NATURAL GAS & HYBRID VEHICLES

CALSTART Zero Emission Cargo Transport II Demonstration

CALSTART is working with BAE Systems to demonstrate the performance of a CNG plug-in hybrid-electric truck with catenary capability. CALSTART will also develop a commercial roadmap to enhance the attractiveness of advanced CNG vehicles as a low-carbon transportation option.

Co-Funders: SCAQMD, DOE, Others

Start Date: 6/16/2015
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $20,009,820
Total SCG Cost: $250,000
Total Co-Funding: $20,009,820
Benefits:

GTI ZANZEFF Hydrogen Fuel Cell Yard Truck Demonstration

The objective of this project is to develop and deploy a hydrogen fuel cell yard truck fleet at the Port of Los Angeles. This deployment is the first of its kind and will demonstrate the reliability, performance, durability, and total cost of ownership of these alternative energy vehicles, paving the way for similar future technologies in this space.

Co-Funders: CARB, BAE, REV Group, HTEC, ZEN, Ballard

Start Date: 1/1/2019
End Date: 3/31/2021
Status: Active
2019 Funds Expended: $22,874
Total Project Cost: $12,055,413
Total SCG Cost: $322,500
Total Co-Funding: $11,732,913
Benefits:

Ricardo Commercial Zero Emission Vehicle Extended Work Road Map

The objective of this project is to provide additional details to the SCAQMD Commercial Zero Emission Vehicle Roadmap to produce a technology and economics-based roadmap for the adoption of advanced commercial vehicle technologies to reduce NOx and GHG emissions through 2050.

Co-Funders: SCAQMD

Start Date: 5/1/2017
End Date: 6/1/2019
Status: Completed
2019 Funds Expended: $10,000
Total Project Cost: $40,000
Total SCG Cost: $20,000
Total Co-Funding: $20,000
Benefits:

SCAQMD Commercial Zero Emission Vehicle Roadmap

The objective of this project is to develop a detailed technology and economics-based roadmap for the adoption of advanced commercial vehicle technologies (BEV, HFCEV, catenary systems, and CNG and LNG, ICE, and gas turbines) to reduce NOx and GHG emissions through 2050.

Co-Funders: SCAQMD

Start Date: 7/1/2015
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $500,000
Total SCG Cost: $250,000
Total Co-Funding: $250,000
Benefits:

UCR RNG and HD Truck Pathways to Achieve Climate Goals Study

With the purpose of informing future RD&D investments in the overlap of low carbon resources and clean transportation sectors, this study will identify challenges to and opportunities for meeting key energy and environment targets in California's medium/heavy duty transportation sector. It will also evaluate the optimum pathways towards achieving major air quality, climate and energy goals, laws, and standards, particularly in relation to the potential role of RNG.

Co-Funders: N/A

Start Date: 11/1/2018
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $176,000
Total SCG Cost: $176,000
Total Co-Funding: $0
Benefits:

UTD NGV America Technology Committee Participation and Representation - Phase 3 (2.16.0.3)

NGVAmerica is a national organization dedicated to the development of a growing and sustainable market for vehicles powered by natural gas or biomethane to benefit consumers and the environment. It represents more than 230 companies, environmental groups, and government organizations and its members come from all sectors of the natural gas and renewable natural gas market across the country.

Co-Funders: UTD, GTI

Start Date: 7/1/2018
End Date: 9/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $90,000
Total SCG Cost: $24,200
Total Co-Funding: $65,800
Benefits:

UTD NGV America Technology Committee Participation and Representation – Phase 4 (2.16.0.4)

NGVAmerica is a national organization dedicated to the development of a growing and sustainable market for vehicles powered by natural gas or biomethane to benefit consumers and the environment. It represents more than 230 companies, environmental groups, and government organizations and its members come from all sectors of the natural gas and renewable natural gas market across the country.

Co-Funders: UTD, GTI

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $10,000
Total Project Cost: $70,000
Total SCG Cost: $10,000
Total Co-Funding: $60,000
Benefits:

UTD NGV Codes & Standards Monitoring – Phase 4 (2.16.N.4)

The objective of this project is to monitor relevant natural gas vehicle (NGV) codes and standards developments such as ANSI/CSA NGV 4.1, NGV 4.3, NGV 5.1, NGV 5.2, NGV 6.1 standards, along with NFPA 52 and ICC codes.

Co-Funders: UTD, CSA

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $10,000
Total Project Cost: $95,000
Total SCG Cost: $10,000
Total Co-Funding: $85,000

Benefits:

SUB-PROGRAM: OFF ROAD (LOCOMOTIVES, CONSTRUCTION & MARINE)

Michael Naylor Market Survey of On-Board CNG Storage for Construction Equipment

This project seeks to address the competitive and regulatory pressures that diesel fleet owners are facing to meet Tier 4 emissions standards for heavy-duty vehicles.

Co-Funders: N/A

Start Date: 11/19/2019
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $19,715
Total Project Cost: $38,807
Total SCG Cost: $38,807
Total Co-Funding: $0

Benefits:

CLEAN GENERATION

SUB-PROGRAM: DG-CHP-MICROCHP

GTI Marathon/EC Power MCHP Testing and Demonstration

The objective of this project is to test and demonstrate two micro combined heat and power (mCHP) systems, a 4.5 kW Marathon and an 25 kW EC Power, with the intent of applying for CARB Distributed Generation certification. Operating the systems in a lab environment will allow GTI to confirm the performance and emissions of the two systems prior to deploying in a field demonstration. Once the systems are confirmed to meet emissions requirements, they will be installed at customer facilities within SoCalGas territory.

Co-Funders: CEC, Marathon Engine Systems, A.O. Smith Corporation

Start Date: 7/1/2018
End Date: 5/31/2021
Status: Active
2019 Funds Expended: $50,511
Total Project Cost: $1,720,278
Total SCG Cost: $153,272
Total Co-Funding: $1,567,006
Benefits:

UCI Flex Fuel Rotary Engine MicroCHP

The objectives of this project are to demonstrate the robustness of operation and the extent of low-emission performance of a rotary-engine-based microCHP system operating on varying levels of hydrogen blended fuel, up to 100%. This project leverages the CEC-supported development of a rotary engine operating on natural gas, integrated with a generator and heat recovery systems. The engine will be operated and monitored in the lab, with the goal of potentially installing the unit at the campus recreation center in a future phase.

Co-Funders: N/A

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $100,000
Total SCG Cost: $100,000
Total Co-Funding: $0
Benefits:

UTD CHP System with Integrated Particle Thermal Energy Storage (2.17.F)

The objective of this Utilization Technology Development, NFP, project is to prove the ability of capturing and storing at least 50% of the thermal energy available in micro-turbine exhaust gas for on demand reuse. The ultimate goal is to commercialize a high-efficiency micro combined heat-and-power (CHP) system with integrated heat storage that is more economically and operationally attractive to the end users than current CHP systems.

Co-Funders: DOE, UTD, Thermal Transfer Corporation, PSRI

Start Date: 6/16/2017
End Date: 1/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $791,677
Total SCG Cost: $22,500
Total Co-Funding: $769,177
Benefits:

UTD Cost Optimization of 3D Printing of Advanced Burners for CHP and Distributed Generation (2.18.A)

The objective of this project is to provide to manufacturers a low-first-cost, high-efficiency, low-emissions 3D-printed advanced nozzle burner (previously conceived under 2.15.D) with improved performance and economy, by optimizing the design, material selection, processing and other factors.

Co-Funders: UTD

Start Date: 7/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $5,000
Total Project Cost: $140,000
Total SCG Cost: $20,000
Total Co-Funding: $120,000
Benefits:

Reducing GHG emissions | Improving air quality | Safety | Reliability | Improving affordability/cost reduction

UTD CYSORE 24kW mCHP and Chiller System – Lab Test (2.19.F)

The objective of this project is to evaluate the CYSORE 24kW micro-Chiller in GTI's laboratory, and support development of the technology by validating performance and other competitive analysis benchmarking.

Co-Funders: UTD, CYSORE

Start Date: 7/1/2019
End Date: 10/31/2020
Status: Active
2019 Funds Expended: $9,000
Total Project Cost: $205,000
Total SCG Cost: $16,714
Total Co-Funding: $188,286
Benefits:

UTD DG/CHP for Electric Demand Response (2.19.C)

The objective of this project is to develop a technical, economic, and regulatory assessment of opportunities for peak electric demand response (DR) that can be achieved from distributed generation (DG) and combined heat and power (CHP) installations.

Co-Funders: UTD

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $32,000
Total Project Cost: $100,000
Total SCG Cost: $32,000
Total Co-Funding: $68,000
Benefits:

UTD Enhanced Gas Space Conditioning for Greenhouse and Vertical Farming (1.19.G)

The objective of this project is to conduct a techno-economic assessment of integrating added-value features for gas- and propane driven space conditioning and power systems for use in greenhouse and indoor/vertical farming.

Co-Funders: UTD, PERC

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $13,000
Total Project Cost: $100,000
Total SCG Cost: $13,000
Total Co-Funding: $87,000
Benefits:

UTD EnviroPower 6kW SmartWatt and BRASH 3kW STRAUM mCHP Boilers – Lab Test (2.19.E)

The objective of this project is to evaluate the 6kW EnviroPower and 3kW BRASH STRAUM Micro-CHP (mCHP) self-powered hydronic HVAC boiler systems in the laboratory, and support their development by validating performance and other competitive analysis benchmarking.

Co-Funders: UTD, BRASH, EnviroPower

Start Date: 7/1/2019
End Date: 1/31/2021
Status: Active
2019 Funds Expended: $12,000
Total Project Cost: $190,000
Total SCG Cost: $22,588
Total Co-Funding: $167,412
Benefits:

UTD Integrating Micro-CHP and PV in Advanced Gas/Renewable Homes (2.18.G)

The objective of this project is to expand the MicroCHP (mCHP) and photovoltaic (PV) capabilities in the Virtual Test Home (VTH) in GTI's laboratory, in order to more rapidly develop, test and optimize mCHP and PV in system-based solutions that increase energy efficiency and reliability, reduce energy costs, and better integrate natural gas with renewable energy in homes in all climates.

Co-Funders: UTD, Aisin

Start Date: 6/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $14,000
Total Project Cost: $190,000
Total SCG Cost: $31,500
Total Co-Funding: $158,500
Benefits:

UTD Long Term Performance and Reliability of CHP and DG Systems Study (2.17.E)

This project studies the long-term performance and reliability of distributed generation/combined heat-and-power systems (DG/CHP) by building on earlier studies which developed a methodology for recording and analyzing data to establish baseline operating reliability for DG/CHP systems. These studies quantified operational reliability for various market segments and technology groups and found natural gas CHP had higher reliability than previously reported.

Co-Funders: UTD

Start Date: 7/1/2017
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $150,000
Total SCG Cost: $13,333
Total Co-Funding: $0
Benefits:

UTD Micro-CHP Characterization and Demonstration (2.18.H)

The objective of this project is to characterize key mCHP technologies and determine regional technical and economic viabilities of those technologies in residential and commercial applications. Also increase market adoption of mCHP by providing an influential California market with qualified, well-established, and cost-effective systems.

Co-Funders: UTD, CEC

Start Date: 7/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $1,474
Total Project Cost: $1,730,000
Total SCG Cost: $105,474
Total Co-Funding: $1,624,526
Benefits:

UTD M-Trigen Micro-CHP System Demonstration – Phase 2 (2.16.H.2)

The objective of this project is to further develop and test two M-Trigen micro-combined heat-and-power systems to evaluate overall performance, including power output, emissions, efficiency, and functionality.

Co-Funders: UTD, New Jersey Natural Gas, M-Trigen

Start Date: 7/1/2019
End Date: 1/31/2021
Status: Active
2019 Funds Expended: $12,000
Total Project Cost: $260,000
Total SCG Cost: $22,737
Total Co-Funding: $237,263
Benefits:

UTD On-Site Electrical Generation – Phase 2: Thermal PhotoVoltaic CHP (2.15.A.2)

Design, build and demonstrate a compact low-emission Thermal PhotoVoltaic (TPV) concept for a Combined Heat and Power (CHP) system that can provide high power generation efficiencies and allow wide variations in the amount of power and thermal energy (hot water) generated.

Co-Funders: UTD, MicroLink Devices

Start Date: 7/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $11,100
Total Project Cost: $200,000
Total SCG Cost: $22,200
Total Co-Funding: $177,800
Benefits:

UTD Ultra-High Efficiency Natural Gas Fired Combustion Systems for mCHP (2.18.F)

The objective of this project is to develop and validate an optimized Thermochemical Heat Recovery (TCHR) hybrid recuperator and burner, key components of a combustion system with ultra-high combustion efficiency (90%) and ultra-low emissions (<5ppmv NOx and <2ppmv CO at 3% O2).

Co-Funders: UTD, DOE, Qnergy, AMSC

Start Date: 7/1/2018
End Date: 4/30/2020
Status: Active
2019 Funds Expended: $3,701
Total Project Cost: $975,000
Total SCG Cost: $25,701
Total Co-Funding: $949,299
Benefits:

SUB-PROGRAM: ENGINES & TURBINES

EtaGen Linear Generator Demonstration

In this project, SoCalGas collaborated with EtaGen and leveraged funding from the California Energy Commission to demonstrate the EtaGen linear generator at a California-based telecommunications site. This generator utilizes a low-temperature reaction of air and fuel to drive magnets through copper coils to efficiently produce electricity. The patented design and adaptive control enable high efficiency, near-zero NOx emissions, full dispatchability, and seamless switching between renewable fuels such as biogas and nonrenewable fuels such as natural gas and propane.

Co-Funders: CEC, EtaGen, CoreStates Group

Start Date: 1/1/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $2,381,725
Total SCG Cost: $100,000
Total Co-Funding: $2,281,725
Benefits:

Scaled Power Lightweight 40kW Turbine Generator Testing

The goal of this project was to design, construct, and test a small, lightweight turbine generator operating on natural gas. The project leveraged funds from NASA to develop a Gearless Electric Auxiliary Power Unit, which eliminated the need for a gearbox. This critical component contributes to the robustness and portability of the unit. The generator used commercially available, off-the-shelf automotive components to minimize cost and maximize reliability.

Co-Funders: NASA, BAAQMD, Private Investors

Start Date: 9/8/2017
End Date: 9/8/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $700,000
Total SCG Cost: $100,000
Total Co-Funding: $600,000
Benefits:

UCI Fuel Flexible Microturbine Generator Development

The objective of this project is to demonstrate low-emissions operation of a hydrogen-tolerant microturbine-based CHP system. UCI will modify a Capstone C-60 microturbine to accept hydrogen-blended fuel. This project builds upon previous work performed by UCI and Capstone with the support of the CEC and DOE. UCI will work with Capstone to modify the injectors in order to achieve low emissions at varying levels of hydrogen blended fuel, up to 100%.

Co-Funders: N/A

Start Date: 5/1/2019
End Date: 9/30/2020
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $100,000
Total SCG Cost: $100,000
Total Co-Funding: $0
Benefits:

UCI Low Cost Sensors for Smart Burners

The goal of this project is to evaluate the robustness and accuracy of low-cost emissions and fuel composition sensors that can be integrated into control systems of high-performance natural gas equipment (microturbines, smart appliances, smart heaters, etc.). Low-cost real-time sensors have the ability to maintain the high performance characteristics of equipment while adapting to increasingly renewable fuels.

Co-Funders: N/A

Start Date: 8/1/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $50,000
Total Project Cost: $115,000
Total SCG Cost: $115,000
Total Co-Funding: $0
Benefits:

UTD Capstone C200S Microturbine Laboratory Evaluation (2.18.E)
The objective of this project is to evaluate and characterize the performance of the newly-launched Capstone C200S 200 kW Signature Series microturbine.

Co-Funders: UTD, Power Flame

Start Date: 7/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $9,900
Total Project Cost: $185,000
Total SCG Cost: $19,800
Total Co-Funding: $165,200
Benefits:

UTD Reliability of Natural Gas for Backup Power Generation – Phase 3 Study (2.12.F.3)
The overall goal of this project is to reduce market and regulatory barriers for natural gas backup power generation by gathering technical information showing that standby generation using natural gas by pipeline can be as or more reliable than on-site diesel fuel storage.

Co-Funders: UTD

Start Date: 8/1/2018
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $90,000
Total SCG Cost: $1,000
Total Co-Funding: $89,000
Benefits:

SUB-PROGRAM: FUEL CELLS

QSI Nano-Power Generation System Proof-of-Concept
This project will test a novel nano-dimensioned Electricity Emitting Diode (EED) operating on methane, which generates power via gas-phase catalytic reactions on the EED surface.

Co-Funders: N/A

Start Date: 11/27/2019
End Date: 5/31/2020
Status: Active
2019 Funds Expended: $25,000
Total Project Cost: $50,000
Total SCG Cost: $50,000
Total Co-Funding: $0
Benefits:

UCI Advanced Power & Energy Program and CaSFCC Industry Advisory Council
Membership in the University of California, Irvine, Advanced Power & Energy Program and California Stationary Fuel Cell Collaborative Industry Advisory Council.

Co-Funders: N/A

Start Date: 7/1/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $45,000
Total Project Cost: $45,000
Total SCG Cost: $45,000
Total Co-Funding: $0
Benefits:

UCI Fuel Cells in Data Center

The objective of this project is to advance the understanding of how gas-fueled solid oxide fuel cells (SOFC) and proton exchange membrane fuel cells (PEMFC) may be able to provide power to data centers and other critical infrastructure with sufficient reliability and resiliency. It will also evaluate the environmental and economic benefits of fuel cell system use in comparison to alternatives. The project will leverage funding from Microsoft to demonstrate fuel cells directly powering server racks, while utilizing waste heat for data center cooling or dehumidification.

Co-Funders: Microsoft

Start Date: 10/1/2019
End Date: 3/31/2021
Status: Active
2019 Funds Expended: $38,000
Total Project Cost: $540,000
Total SCG Cost: $190,000
Total Co-Funding: $350,000
Benefits:

UCI Integrated SOFC, Solar, and Storage System in ZNE Residential Nanogrid

The purpose of this project is to design and analyze a residential nanogrid that integrates solid oxide fuel cells, CHP, PV solar, and energy storage. The goal will be to dynamically operate the system in order to meet typical residential heating and power demands, while simultaneously achieving zero net energy. The economic, environmental, and resiliency benefits of the system, in comparison with alternatives, will also be analyzed in this project.

Co-Funders: N/A

Start Date: 10/1/2019
End Date: 9/30/2021
Status: Active
2019 Funds Expended: $65,000
Total Project Cost: $325,000
Total SCG Cost: $325,000
Total Co-Funding: $0
Benefits:

SUB-PROGRAM: WASTE HEAT RECOVERY

Blue Frontier Fuel Cell Powered HVAC Development

This project will investigate the integration of a fuel cell with Blue Frontier's Enhanced Liquid Desiccant Energy Storage Air Conditioning. This technology recovers and stores the waste heat from the fuel cell in order to provide on demand cooling.

Co-Funders: N/A

Start Date: 11/1/2019
End Date: 3/31/2021
Status: Active
2019 Funds Expended: $300,000
Total Project Cost: $540,527
Total SCG Cost: $540,527
Total Co-Funding: $0
Benefits:

EPRI ORC Waste Heat Recovery Demo

The goal of this project is to demonstrate the technical and economic feasibility of a cost-effective organic rankine cycle (ORC) package to recover very low-grade waste heat from natural gas industrial processes. The project team will install a commercially available ORC system at a SoCalGas customer site for monitoring and verification. This will represent the state's first application of ORC technology in an industrial setting. When complete, the project will identify key factors dictating project economics, lifecycle costs, and opportunities for improvement and optimization that could lead to further market adoption and better economics.

Co-Funders: CEC, EPRI

Start Date: 12/1/2015
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $25,000
Total Project Cost: $1,146,739
Total SCG Cost: $150,000
Total Co-Funding: $996,739
Benefits:

UTD Energy Recovery Heat Exchanger – Phase 2 (2.16.G.2)
The objective of this project is to demonstrate an advanced recuperator with secondary inserts to preheat combustion air and increase overall system efficiency on an aluminum melting die-casting furnace.

Co-Funders: UTD, CEC

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $10,500
Total Project Cost: $730,000
Total SCG Cost: $10,500
Total Co-Funding: $719,500
Benefits:

UTD Thermal Ejector for Water Capture from Humid Exhuast Demonstration (2.17.A)
This project, in collaboration with the California Energy Commission, is demonstrating the first practical technology that can recover room-temperature water that can immediately be returned to an industrial plant and used for process cooling.

Co-Funders: CEC, UTD, USG

Start Date: 4/1/2019
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $16,250
Total Project Cost: $546,667
Total SCG Cost: $16,250
Total Co-Funding: $530,417
Benefits:

CUSTOMER END-USE APPLICATIONS

SUB-PROGRAM: ZNE FOR RESIDENTIAL

UTD Integrating Gas Heating and Cooling in Advanced Gas/ Renewable Homes (1.18.G)

The objective of this project is to expand the advanced gas heating and cooling capabilities in the Virtual Test Home (VTH) in GTI's laboratory, in order to more rapidly develop, test, and optimize advanced gas heating and cooling options in system-based solutions that increase energy efficiency and reliability, reduce energy costs, and better integrate natural gas with renewable energy in homes in all climates.

Co-Funders: UTD

Start Date: 6/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $10,000
Total Project Cost: $150,000
Total SCG Cost: $25,000
Total Co-Funding: $125,000
Benefits:

UTD Integrating Thermal Energy Storage in Advanced Gas/ Renewable Homes (1.18.D)

The objective of this project is to expand the thermal energy storage capabilities in the Virtual Test Home (VTH) in GTI's laboratory, in order to more rapidly develop, test, and optimize thermal energy storage options in system-based solutions that increase energy efficiency and reliability, reduce energy costs, and better integrate natural gas with renewable energy in homes in all climates.

Co-Funders: UTD

Start Date: 7/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $9,545
Total Project Cost: $180,000
Total SCG Cost: $24,545
Total Co-Funding: $155,455
Benefits:

UTD Investigating Multifamily Infrastructure Challenges – Phase 3 (1.14.J.3)

The objective of this project is to build upon the findings from Phases 1 and 2. Phase 1 provided national trends regarding gas and electric multifamily market shares, economics of energy services, building codes, and installation practices. In Phase 2, GTI provided regional multifamily market paths forward for targeted building types, code compliance approaches, gas product portfolio, and utility initiatives. The project explored local competitiveness issues and presented technology solutions. Phase 3 will move beyond research and into implementation of these recommendations for specific regions or utilities.

Co-Funders: UTD

Start Date: 10/1/2017
End Date: 1/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $120,000
Total SCG Cost: $11,188
Total Co-Funding: $108,812
Benefits:

UTD Investigating Multifamily Infrastructure Challenges – Phase 4 (1.14.J.4)

The objective of this project is to develop concrete market transformation implementation tools and action plans to properly connect with new development decision-makers improve natural gas affordability in new multifamily construction.

Co-Funders: UTD

Start Date: 7/1/2019
End Date: 7/31/2021
Status: Active
2019 Funds Expended: $1,000
Total Project Cost: $127,000
Total SCG Cost: $1,984
Total Co-Funding: $126,000
Benefits:

UTD High Performance Building Initiative (1.16.C)

The objective of this project is to develop an approach for supporting mixed-fuel, high-performance buildings, covering several fronts, including: zero net energy, renewables, clean power, modeling engines, application guidelines, demonstration houses, and case studies. Project work focuses on the methodologies and analysis tools for high-performance homes and home designs that meet the goals of the leading methodologies and case studies from selected climate zones.

Co-Funders: CEC, UTD

Start Date: 6/1/2018
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $4,545
Total Project Cost: $405,000
Total SCG Cost: $9,545
Total Co-Funding: $395,455
Benefits:

SUB-PROGRAM: APPLIANCE & IAQ

EAC Evaluation of Methane Emissions from Residential Homes, Appliances, and Pilots

This study will examine gas usage and unburnt methane emissions during both pilot/idle mode and high fire operation of several appliances and to determine through the evaluation of AMI data and the development of algorithms the volume of gas used to maintain a standard residential water heater pilot flow.

Co-Funders: N/A

Start Date: 6/4/2018
End Date: 8/2/2019
Status: Completed
2019 Funds Expended: $24,429.98
Total Project Cost: $85,000
Total SCG Cost: $85,000
Total Co-Funding: $0
Benefits:

EAC SMTI Gas Heat Pump Res Water Heater Lab Testing

This study assesses Stone Mountains Technologies, Inc.'s (SMTI's) 4th prototype residential gas-fired heat pump water heater (GFHPWH) in a laboratory environment. As part of the study, the team will monitor the performance, thermal efficiency, and emissions (CO, CO_2, NO_x, O_2 and unburned hydrocarbon). In addition, staff will evaluate durability using an accelerated lifecycle test performed at the Engineering Analysis Center (EAC) in Pico Rivera, California.

Co-Funders: N/A

Start Date: 8/1/2017
End Date: 7/1/2019
Status: Completed
2019 Funds Expended: $26,584.27
Total Project Cost: $120,100
Total SCG Cost: $120,100
Total Co-Funding: $0
Benefits:

EAC Testing of Hydrogen/NG Blend Impact on Appliances – Phase 2

NYSEARCH RANGE™ Tool (Range of Acceptability for Natural Gas Equipment) takes gas supply composition data from a given area and generates graphical depictions of the performance characteristic for appliances in that service area. In phase 2, the project team plans to incorporate existing hydrogen and biogas data into the program and test multiple appliances that are calibrated/pre-programed to extreme parameters with hydrogen-blended natural gas. In this way, the team will determine appliance characteristics at extreme conditions and populate the program database for future usage.

Co-Funders: N/A

Start Date: 10/26/2018
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $20,867.31
Total Project Cost: $24,000
Total SCG Cost: $24,000
Total Co-Funding: $0
Benefits:

GTI Advanced High Efficiency, Low Capacity HVAC Systems

The goal of this project is to demonstrate that measured home performance or above-code practices coupled with high-efficiency, low-capacity heating/cooling systems in single family homes will show an energy savings in excess of 30% compared to a Title 24 compliant or existing home with standard equipment. The project team is producing 24 months of data from five homes where advanced low capacity systems were installed replacing existing equipment with at least twice the capacity of Title 24 compliant or existing systems.

Co-Funders: CEC

Start Date: 10/1/2017
End Date: 7/1/2020
Status: Active
2019 Funds Expended: $60,000
Total Project Cost: $900,000
Total SCG Cost: $150,000
Total Co-Funding: $750,000
Benefits:

GTI Gas Heat Pump Water Heating and Space Cooling in Restaurants Demonstration

In this project, Gas Technology Institute (GTI) is conducting a field demonstration of an advanced pre-commercial gas heat pump (GHP) for commercial hot water and space cooling as applied to two restaurants. With data generated, the project team will a) develop tools to extrapolate results to other restaurant- types, other light-commercial facilities, and California climate zones, and b) quantify the barriers to adoption of this advanced technology.

Co-Funders: CEC

Start Date: 4/17/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $123,050
Total Project Cost: $1,090,294
Total SCG Cost: $226,000
Total Co-Funding: $864,294
Benefits:

GTI Improving Efficiency of Wall Furnaces in CA Homes Demonstration

Gas Technology Institute (GTI) is seeking to accelerate the availability and adoption of higher efficiency retrofit options for atmospherically vented wall furnaces prevalent in California's affordable multifamily housing. GTI anticipates that the retrofit packages will result in 10-20% annual savings with a 10-year payback over existing replacement technologies. To accelerate adoption, the project team will conduct market outreach and technology transfer to property owners, installers, manufacturers, and utilities.

Co-Funders: CEC

Start Date: 7/31/2019
End Date: 8/15/2022
Status: Active
2019 Funds Expended: $33,000
Total Project Cost: $1,110,000
Total SCG Cost: $110,000
Total Co-Funding: $1,000,000
Benefits:

GTI Residential Gas Heat Pump Demonstration

Gas Technology Institute (GTI) seeks to advance the commercialization of a residential Gas-fired Heat Pump Water Heater (GHPWH) through a five-site field demonstration, extended-life laboratory testing, development of modeling tools, analysis of codes and standards, definition of market barriers for this new product category, and stakeholder outreach events. With assistance from GTI and major water heater manufacturers, Stone Mountain Technologies Inc. designed the GHPWH.

Co-Funders: CEC

Start Date: 4/17/2017
End Date: 3/30/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $1,272,355
Total SCG Cost: $188,125
Total Co-Funding: $1,084,230
Benefits:

GTI Technical Assistance and Assessments

In this project, Gas Technology Institute (GTI) provides technical support to SoCalGas on a broad range of topics connected to end use applications of natural gas and renewable energy. GTI is developing quick turnaround technical assistance and assessments that support SoCalGas' efforts to address critical customer issues such as emissions equivalency, energy efficiency, carbon emission reduction, and cost-effectiveness. To ensure effective coordination of efforts between SoCalGas and other parties, this information will be complemented by tracking SoCalGas' current and future research, development, and demonstration (RD&D) activities.

Co-Funders: N/A

Start Date: 4/2/2017
End Date: 4/2/2021
Status: Active
2019 Funds Expended: $12,650.45
Total Project Cost: $250,000
Total SCG Cost: $250,000
Total Co-Funding: $0
Benefits:

GTI Trane Residential Combi Heat Pump Field Demonstration

In this project, Gas Technology Institute (GTI) is leading a demonstration of a low-cost thermal combi heat pump developed by Stone Mountain Technologies, Inc. (SMTI) and Trane.

Co-Funders: Enbridge, Intermountain Gas, NEEA, Nicor Gas, Spire

Start Date: 8/31/2019
End Date: 10/31/2020
Status: Active
2019 Funds Expended: $190,000
Total Project Cost: $1,100,000
Total SCG Cost: $200,000
Total Co-Funding: $900,000
Benefits:

ICF Commercial Building Methane Leak Study

The primary goal of this project is to inform California public policy as regards the volume of fugitive methane emissions and the need for potential regulation of natural gas/methane emissions from commercial buildings. Secondary objectives include identifying specific opportunities to reduce natural gas leakage, improve safety from natural gas explosions or carbon monoxide poisoning, increase public awareness of this and other air pollutant emissions, and advance of the science of emissions detection and quantification.

Co-Funders: N/A

Start Date: 6/30/2018
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $189,899.75
Total Project Cost: $210,000
Total SCG Cost: $210,000
Total Co-Funding: $0
Benefits:

Lantec Development of Ultra Low NOx Forced Air Residential Furnace

The goal of this SCAQMD-funded project is to achieve the design, development, performance and operational testing, certification, and commercialization of residential condensing and non-condensing forced air furnaces utilizing Lantec Products' novel MicroNOx ultra-low NOx combustion technology.

Co-Funders: SCAQMD

Start Date: 5/1/2019
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $0
Total Project Cost: $432,500
Total SCG Cost: $92,500
Total Co-Funding: $340,000
Benefits:

SMTI Heat Pump Commercialization

The purpose of this project is to support the commercialization of Stone Mountain Technologies, Inc.'s novel gas absorption heat pump technology. This technology significantly increases the efficiency of gas-fired space and water heating, achieving a COP of 1.3.

Co-Funders: N/A

Start Date: 11/14/2018
End Date: 12/31/2021
Status: Active
2019 Funds Expended: $0
Total Project Cost: $250,000
Total SCG Cost: $250,000
Total Co-Funding: $0
Benefits:

UCI Heterogeneous Oxidation for Zero NOx Heat Study

The purpose of this project is to identify and evaluate the feasibility of "heterogeneous" reaction strategies for replacing water heaters or other appliance burners currently in use. The project will first survey and research available heterogeneous reaction technologies and then produce a technology evaluation report with recommendations for any viable candidate technologies.

Co-Funders: N/A

Start Date: 6/1/2019
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $35,444.60
Total Project Cost: $50,000
Total SCG Cost: $50,000
Total Co-Funding: $0
Benefits:

UTD Advanced Gas Technology Codes and Standards Monitoring – Phase 6 (1.13.D.6)

This program monitors standards development and testing, building code requirements and enforcement, and performance information for analytical tools used for energy code compliance.

Co-Funders: UTD

Start Date: 7/1/2018
End Date: 10/31/2019
Status: Completed
2019 Funds Expended: $3,600
Total Project Cost: $150,000
Total SCG Cost: $21,600
Total Co-Funding: $128,400
Benefits:

UTD Advanced Gas Technology Codes and Standards Monitoring – Phase 7 (1.13.D.7)

This program monitors standards development and testing, building code requirements and enforcement, and performance information for analytical tools used for energy code compliance.

Co-Funders: UTD

Start Date: 7/1/2019
End Date: 9/30/2020
Status: Active
2019 Funds Expended: $10,000
Total Project Cost: $150,000
Total SCG Cost: $10,000
Total Co-Funding: $140,000
Benefits:

UTD Advanced Systems for Self-Powered Water Heating – Phase 2 (1.14.K.2)

This project will leverage Two-Phase Thermo-Syphoning (TPTS) technology and ultra-low power gas water heater control technology to develop a prototype high efficiency residential water heater (0.75EF); compliant with Energy Star® and 2015 NAECA efficiency minimums for large storage volumes; and able to meet SCAQMD water heater emission requirements.

Co-Funders: UTD, A.O. Smith

Start Date: 7/1/2017
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $160,000
Total SCG Cost: $36,000
Total Co-Funding: $124,000
Benefits:

UTD Advanced Systems for Self-Powered Water Heating – Phase 3 (1.14.K.3)

This project will build, test and evaluate a TPTS system (surface combustor-heater, evaporator and condenser) for a high-efficiency (0.75 UEF) self-powered 40- or 50-gallon storage water heater with plastic tank, rapid startup, and long-life, with minimal stand-by heat loss and scaling.

Co-Funders: UTD, Rheem

Start Date: 1/1/2014
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $45,000
Total Project Cost: $165,000
Total SCG Cost: $45,000
Total Co-Funding: $120,000
Benefits:

UTD Commercial Gas-Fired Heat Pump Water Heater – Phase 2 (1.16.I.2)

The purpose of this project is to demonstrate a new gas-fired heat pump water heater for commercial customers, providing the option of even higher efficiencies and lower emissions on a source energy basis.

Co-Funders: CEC, UTD

Start Date: 6/1/2017
End Date: 1/31/2020
Status: Active
2019 Funds Expended: $2,035
Total Project Cost: $1,072,800
Total SCG Cost: $22,935
Total Co-Funding: $1,049,865
Benefits:

UTD Commercial Gas Fired Heat Pump Water Heater – Phase 3 (1.16.I.3)

The purpose of this project is to demonstrate a new gas-fired heat pump water heater for commercial customers, providing the option of even higher efficiencies and lower emissions on a source energy basis.

Co-Funders: UTD, A.O. Smith

Start Date: 7/1/2019
End Date: 1/31/2021
Status: Active
2019 Funds Expended: $16,600
Total Project Cost: $180,000
Total SCG Cost: $26,211
Total Co-Funding: $153,789
Benefits:

UTD Comparative Assessment of Heat Pump Water Heaters in the Virtual Test Home (1.19.D)

The objective of this project is to compare gas/LPG water heating and electric heat pump water heating on a level basis by characterizing equipment part-load performance in GTI's Virtual Test Home (VTH).

Co-Funders: UTD, PERC, A.O. Smith

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $1,000
Total Project Cost: $107,000
Total SCG Cost: $1,750
Total Co-Funding: $105,250
Benefits:

UTD Comparative Assessment of Space Heating Systems in Virtual Test Home (1.19.I)

The objective of this project is to compare gas/LPG space heating and electric heat pump space heating on a level basis by characterizing equipment part-load performance in GTI's Virtual Test Home (VTH).

Co-Funders: UTD, PERC

Start Date: 7/1/2019
End Date: 10/31/2020
Status: Active
2019 Funds Expended: $3,000
Total Project Cost: $105,000
Total SCG Cost: $5,252
Total Co-Funding: $99,748
Benefits:

UTD Economical High-Efficiency Residential Gas Absorption Heat Pump with Integrated Cooling (1.18.H)

The objective of this project is to add cost-effective cooling to the low-cost gas absorption heat pump (GAHP) pre-commercial product developed in UTD project 1.13.F with Stone Mountain Technologies Inc. (SMTI) that currently only provides whole-house heating and domestic hot water (DHW).

Co-Funders: UTD, SMTI, NGIF

Start Date: 7/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $6,200
Total Project Cost: $400,000
Total SCG Cost: $18,600
Total Co-Funding: $381,400
Benefits:

UTD Economical High-Efficiency Residential Gas Absorption Heat Pump with Integrated Cooling – Phase 2 (1.18.H.2)

The objective of this project is to finalize the design, fabrication, debugging, commissioning, and testing of a complete working "alpha" prototype unit that adds cost-effect cooling to the low-cost gas absorption heat pump (GAHP) precommercial product developed in UTD project 1.13.F with Stone Mountain Technologies Inc. (SMTI).

Co-Funders: UTD, SMTI, NGIF

Start Date: 7/1/2019
End Date: 1/31/2021
Status: Active
2019 Funds Expended: $17,000
Total Project Cost: $370,000
Total SCG Cost: $24,324
Total Co-Funding: $345,676
Benefits:

UTD Elevated Gas Pressure Water Heating Appliances – Phase 2 (1.16.Q.2)

The objectives of this project are to (1) define the current market opportunities and barriers to operating elevated gas pressure appliances in residential and commercial buildings; and (2) prove the technical feasibility and benefits by operating both non-condensing and condensing gas storage and tankless water heaters at elevated gas pressures.

Co-Funders: UTD, A.O. Smith, Rinnai

Start Date: 7/1/2017
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $97,000
Total SCG Cost: $38,500
Total Co-Funding: $58,500
Benefits:

UTD Field Evaluation of Central Condensing Tankless Water Heaters for Energy Savings (1.18.E)

The objective of this project is to perform a field demonstration of the central condensing tankless water heating system (CCTWH), an emerging technology for high-efficiency generation of service hot water (SHW).

Co-Funders: UTD, State of Minnesota

Start Date: 6/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $4,000
Total Project Cost: $495,000
Total SCG Cost: $14,000
Total Co-Funding: $481,000
Benefits:

UTD Gas Absorption Heat Pump for Space Conditioning Beta Field Demo – Phase 3 (1.13.F.3)
This project builds upon prior UTD phases for the development of a low-cost Gas Absorption Heat Pump (GAHP) by building a beta prototype and demonstrating/testing the unit in the field.

Co-Funders: UTD, SMTI, Trane

Start Date: 6/1/2017
End Date: 10/1/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $177,500
Total SCG Cost: $29,304
Total Co-Funding: $148,196
Benefits:

UTD Gas Engine Heat Pump Modeling – Phase 3 (1.12.U.3)
The objectives of this project are to develop new models based on the laboratory and field performance of the recently introduced Yanmar gas engine-driven heat pump (GHP), and provide a more accurate prediction of seasonal performance for different climates.

Co-Funders: UTD

Start Date: 7/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $1,800
Total Project Cost: $95,000
Total SCG Cost: $3,800
Total Co-Funding: $91,200
Benefits:

UTD Gas-Fired High Efficiency Liquid Desiccant Air Conditioning and Humidity Control – Phase 2 (1.15.E.2)
The goal of this project is to develop a gas-fired liquid desiccant dedicated outdoor air system (LDDOAS) that addresses many of the critical issues now facing the HVAC industry. In this project, a research team is collaborating with a manufacturer to compare the current state-of-the-art LDDOAS technology to other advanced systems and then to design and experimentally evaluate a breadboard LDDOAS test rig rated at approximately 100 CFM capacity using a novel non-corrosive, non-toxic desiccant.

Co-Funders: UTD, NYSERDA

Start Date: 6/1/2018
End Date: 6/30/2020
Status: Active
2019 Funds Expended: $2,000
Total Project Cost: $415,000
Total SCG Cost: $4,000
Total Co-Funding: $411,000
Benefits:

UTD Gas Heat Pump Combination Space/ Water Heating System Design – Phase 1 (1.17.C)
This project will extend the analysis, evaluation, and development of combined space and water heating systems ("combi systems") for residential and multifamily applications to an emerging class of residential-sized gas heat pump products. From a system view, including controls, installation practices, and hardware (storage tank, fan coil, etc.), this project will develop a set of best practices for the breadth of gas heat pumps nearly or currently commercialized, including absorption, adsorption, vapor compression (engine), and other technologies.

Co-Funders: UTD

Start Date: 6/1/2017
End Date: 9/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $150,000
Total SCG Cost: $18,150
Total Co-Funding: $131,850
Benefits:

UTD Gas Heat Pump Combination Space/Water Heating System Design – Phase 2 (1.17.C.2)
The objective of this project is to develop a smart combi controller that infers the properties of a heat pump and/or water heater and hydronic air handler, and then optimizes system performance for efficiency and comfort.

Co-Funders: UTD

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $14,400
Total Project Cost: $150,000
Total SCG Cost: $24,000
Total Co-Funding: $126,000
Benefits:

UTD High Efficiency Thermo Vacuum Commercial Clothes Dryer – Phase 1 (2.17.C)
The objective for this project is to develop an advanced concept of a natural gas-fired commercial clothes dryer and demonstrate the technical and economic benefits over the state-of-the-art technology in a controlled laboratory environment.

Co-Funders: UTD, Wilson Engineering Technology, ORNL

Start Date: 6/1/2017
End Date: 6/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $185,000
Total SCG Cost: $26,667
Total Co-Funding: $158,333
Benefits:

UTD High Efficiency Thermo Vacuum Commercial Clothes Dryer – Phase 2 (2.17.C.2)
The objective for this project is to develop and test a prototype high-efficiency, natural gas-fired thermo-vacuum clothes dryer (TVCD) and demonstrate the technical and economic benefits over the state-of-the-art dryer.

Co-Funders: DOE, UTD

Start Date: 7/1/2019
End Date: 7/31/2021
Status: Active
2019 Funds Expended: $8,700
Total Project Cost: $1,975,000
Total SCG Cost: $15,225
Total Co-Funding: $1,959,775
Benefits:

UTD Integrated, Self-Powered, High-Efficiency Burner System (1.19.C)
The objective of this project is to develop and demonstrate a grid resilient, self-powered, fuel-flexible, high-efficiency Advanced Burner Thermoelectric Generator (ABTEG) as an integrated system that can be dropped into many types of residential and commercial building space and water heating systems.

Co-Funders: UTD, DOE, A.O. Smith, Sheetak, II-VI Marlow

Start Date: 7/1/2019
End Date: 7/31/2022
Status: Active
2019 Funds Expended: $12,200
Total Project Cost: $1,060,000
Total SCG Cost: $36,600
Total Co-Funding: $1,023,400
Benefits:

UTD Low Capacity Heating Systems Portfolio – Phase 2 (1.16.E.2)
This project will address the technology gaps and market barriers identified in Phase 1 through continued technology development, dialogue with OEMs, and field demonstrations. Researchers will compare demonstrated performance of gas and electric heating systems and quantify the potential benefits.

Co-Funders: UTD, NYSERDA

Start Date: 8/1/2017
End Date: 3/15/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $330,000
Total SCG Cost: $22,285
Total Co-Funding: $307,715
Benefits:

UTD Next Generation Residential Gas Dryer Development – Phase 2 (1.15.C.2)

In this project, researchers are investigating next generation gas dryer technologies to exceed Energy Star efficiency levels and develop an early-stage prototype with the most promising technology. The goal will be to find a technology to achieve a 5-15% boost over standard efficiency gas dryers. If any proprietary technologies are discovered during the project, then a UTD invention disclosure will be submitted as well.

Co-Funders: UTD

Start Date: 7/1/2018
End Date: 1/31/2020
Status: Active
2019 Funds Expended: $10,706
Total Project Cost: $150,000
Total SCG Cost: $24,706
Total Co-Funding: $125,294
Benefits:

UTD Residential Cooking Pollutants and Indoor Air Quality (1.17.H)

In this project, researchers are conducting an analytical and laboratory investigation on the pollutants (NOx, acrolene, 2.5-micron particles) contributed by gas and electric residential cooking, the impact on indoor air quality, and the implications for range hood design. This large field demonstration provides a next key step to commercialize this unique technology.

Co-Funders: UTD

Start Date: 7/1/2017
End Date: 3/31/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $80,000
Total SCG Cost: $32,000
Total Co-Funding: $48,000
Benefits:

UTD Residential Gas Absorption Heat Pump Water Heater – Phase 2 (1.11.H.2)

The objective of this project is to eliminate a major cost hurdle for some installations and enhance reliability/efficiency diagnostics of the high-efficiency residential Gas Heat Pump Water Heater (GHPWH).

Co-Funders: UTD, SMTI

Start Date: 7/1/2019
End Date: 1/31/2021
Status: Active
2019 Funds Expended: $25,000
Total Project Cost: $170,000
Total SCG Cost: $42,491
Total Co-Funding: $127,509
Benefits:

UTD Residential Kitchen Cooking Ventilation Effectiveness – Phase 2 (1.15.G.2)

Despite most home kitchens having a ventilation system above the stove, most home owners do not use the system unless excess smoke is being produced and many existing systems are are ineffective at capturing food and combustion emissions. The objective of this project is to quantify the emissions from residential cooking that impact indoor air quality (IAQ) and generate a comparison of gas vs. electric cooking.

Co-Funders: UTD

Start Date: 7/1/2019
End Date: 1/31/2021
Status: Active
2019 Funds Expended: $22,200
Total Project Cost: $70,000
Total SCG Cost: $31,080
Total Co-Funding: $38,920
Benefits:

UTD Sequestering Non-Condensable Gases for Enhanced Gas Absorption Heat Pump Reliability (1.19.E)
The objective of this project is to design and develop Non-Condensable Gas Isolation (NCGI) Modules and provide research and development support to employ novel, low-cost aluminum heat exchangers (HX) to increase system reliability and safe operation, and reduce the cost of any absorption-type heat pump (AHP), but demonstrate their performance in a prototype gas-fired absorption Gas Heat Pump (GAHP) being developed with Stone Mountain Technologies Inc. (SMTI).

Co-Funders: UTD, DOE

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $51,500
Total Project Cost: $800,000
Total SCG Cost: $93,637
Total Co-Funding: $706,363
Benefits:

UTD SuperPerm Burner for Water Heaters – Phase 2 (1.16.L.2)
The objective of this project is to develop a ceramic coated foam metal matrix burner design for application in a commercial water heater (down-fired firetube HX) in both un-humidified and humidified combustion air conditions.

Co-Funders: UTD

Start Date: 7/1/2017
End Date: 8/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $115,000
Total SCG Cost: $25,556
Total Co-Funding: $89,444
Benefits:

UTD Thermoelectric Generator for Self-Powered Water Heater – Phase 2 (1.17.B.2)
The objective of this project is to validate that a Thermoelectric Generator Heat Exchanger (TEG-HX) device can generate enough electric energy to power a tankless natural gas water heater.

Co-Funders: UTD, Solid Cell

Start Date: 7/1/2018
End Date: 8/31/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $140,000
Total SCG Cost: $10,000
Total Co-Funding: $130,000
Benefits:

UTD Thermoelectric Generator for Self-Powered Water Heater – Phase 3 (1.17.B.3)
Develop and prove the concept of a novel self-powered natural-gas-driven tankless (instantaneous) water heater with ultra-low emissions <5 ppm NOx, and with excess power capability or a primary COP of >1.0, by incorporating a novel new heat pump configuration with a Thermoelectric Generator-Heat Exchanger (TEG-HX) design.

Co-Funders: UTD, Rheem

Start Date: 7/1/2019
End Date: 7/31/2021
Status: Active
2019 Funds Expended: $40,000
Total Project Cost: $320,000
Total SCG Cost: $80,000
Total Co-Funding: $240,000
Benefits:

UTD ThermoLift Combined Heating/Cooling System Development – Phase 2 (1.17.F.2)
The objective for this project is to support the continued development and testing of the Gas Vuilleumier Heat Pump (GVHP) prototype, which if commercialized, would represent a step-change in efficiency over the current gas heat pumps.

Co-Funders: UTD, ThermoLift

Start Date: 7/1/2019
End Date: 1/31/2021
Status: Active
2019 Funds Expended: $27,000
Total Project Cost: $225,000
Total SCG Cost: $47,250
Total Co-Funding: $177,750
Benefits:

UTD Triathlon 2030 5-ton Cold Climate Gas Heat Pump (2.19.D)

The objective of this project is to assist in prototype design of a new 5-ton natural gas engine-driven cold climate heat pump. The project will involve developing market and functional design requirements, detailed design review, and energy and economic modeling of the proposed design.

Co-Funders: UTD, NYSERDA

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $3,487
Total Project Cost: $994,368
Total SCG Cost: $3,487
Total Co-Funding: $990,881
Benefits:

SUB-PROGRAM: COMMERCIAL COOKING & FOOD SERVICE

EAC Venancio VT Burner Efficiency Test

The purpose of this project is to develop a test plan to measure the energy efficiency of a commercial range top burner, the "VT Burner," manufactured by Venancio. With no ANSI standard in place, subject matter experts at the EAC will develop an appropriate test protocol.

Co-Funders: N/A

Start Date: 6/24/2019
End Date: 10/10/2019
Status: Completed
2019 Funds Expended: $433.13
Total Project Cost: $3,500
Total SCG Cost: $500
Total Co-Funding: $0
Benefits:

GTI Commercial Food Service Electrification Cost Analysis

In this phase-1 project, Gas Technology Institute (GTI) seeks to quantify the actual costs of and potential issues associated with replacing gas-fired equipment in a commercial kitchen with electric equipment. The project will perform a cost analysis for both sit-down, full-service restaurants and fast food restaurants, with the goal of determining the cost at which fuel-switching to renewable natural gas would be competitive with replacing natural gas equipment with electric equipment.

Co-Funders: N/A

Start Date: 7/8/2019
End Date: 12/31/2020
Status: Active
2019 Funds Expended: $1,656.05
Total Project Cost: $50,000
Total SCG Cost: $50,000
Total Co-Funding: $0
Benefits:

GTI SCAQMD HE/Low-NOx EcoZone Burner Kroger Demonstration

This project will demonstrate a high-efficiency low-NOx ribbon burner at a commercial baking facility located within a South Coast Air Quality Management District environmental justice area. The goal is to demonstrate at least 25% NOx emission reduction and at least 10% energy savings.

Co-Funders: SCAQMD, Kroger, SoCalGas Energy Efficiency

Start Date: 11/1/2019
End Date: 1/31/2023
Status: Active
2019 Funds Expended: $200,000
Total Project Cost: $2,052,000
Total SCG Cost: $200,000
Total Co-Funding: $1,852,000
Benefits:

UTD Advanced Nozzle Burner for Commercial Water Heaters (1.18.C)

The objective of this project is to develop and demonstrate an advanced nozzle burner for commercial water heaters (200,000 Btu/hr. capacity) offering improved efficiency, turndown, emissions, stability and compactness by testing the prototype in an AO Smith BTH 0199 commercial water heater.

Co-Funders: UTD, ORNL

Start Date: 7/1/2018
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $21,000
Total Project Cost: $400,000
Total SCG Cost: $42,000
Total Co-Funding: $358,000

Benefits:

UTD CFS Codes & Standards – Phase 4 (1.16.B.4)

The main objective of this project is to monitor developments and changes in codes and standards for gas-fired, commercial foodservice (CFS) equipment to maintain an understanding of the current and future codes and standards landscape and identify research needs.

Co-Funders: UTD

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $9,000
Total Project Cost: $75,000
Total SCG Cost: $9,000
Total Co-Funding: $66,000

Benefits:

UTD Commercial Foodservice Equipment Demonstrations – Phase 4 (1.14.B.4)

This project conducted demonstrations of gas-fired commercial foodservice (CFS) equipment to quantify the benefits of the equipment in real-world situations. These demonstrations addressed the reluctance of CFS operators to replace existing equipment with newer models due to concerns with cost and the uncertainty of comparable performance with standard models.

Co-Funders: UTD

Start Date: 7/1/2017
End Date: 9/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $75,000
Total SCG Cost: $938
Total Co-Funding: $74,062

Benefits:

UTD Commercial Foodservice Equipment Demonstrations – Phase 5 (1.14.B.5)

This project is conducting demonstrations of gas-fired commercial foodservice (CFS) equipment to quantify the benefits of the equipment in real-world situations. These demonstrations will address the reluctance of CFS operators to replace existing equipment with newer models due to concerns with cost and the uncertainty of comparable performance with standard models.

Co-Funders: UTD

Start Date: 7/1/2018
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $1,750
Total Project Cost: $75,000
Total SCG Cost: $3,750
Total Co-Funding: $71,250

Benefits:

UTD Commercial Foodservice Equipment Demonstrations – Phase 6 (1.14.B.6)

This project is conducting demonstrations of gas-fired commercial food-service (CFS) equipment to quantify the benefits of the equipment in real-world situations. These demonstrations will address the reluctance of CFS operators to replace existing equipment with newer models due to concerns with cost and the uncertainty of comparable performance with standard models.

Co-Funders: UTD

Start Date: 6/17/2019
End Date: 7/16/2021
Status: Active
2019 Funds Expended: $13,000
Total Project Cost: $190,000
Total SCG Cost: $24,700
Total Co-Funding: $0
Benefits:

UTD Commercial Food Service Tool and Calculators – Phase 6 (1.13.B.6)

The focus of this project is on the creation of web- and mobile-based tools for usage in the commercial food service (CFS) industries. These tools will combine the information available from various sources to calculate the economic and environmental benefits of using new, more advanced CFS equipment, including the potential energy and cost savings.

Co-Funders: UTD

Start Date: 7/1/2018
End Date: 10/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $72,000
Total SCG Cost: $4,500
Total Co-Funding: $67,500
Benefits:

UTD Commercial Food Service Tool and Calculators – Phase 7 (1.13.B)

The focus of this project is on the creation of web- and mobile-based tools for usage in the commercial food service (CFS) industries. These tools will combine the information available from various sources to calculate the economic and environmental benefits of using new, more advanced CFS equipment, including the potential energy and cost savings.

Co-Funders: UTD

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $9,000
Total Project Cost: $70,000
Total SCG Cost: $9,000
Total Co-Funding: $67,500
Benefits:

UTD Gas Fired Warewasher (1.19.B)

The objective of this project is to develop a working prototype of a gas-fired door-type or conveyor-type warewasher in GTI's laboratory, and leverage this effort to gain strong interest from a manufacturer.

Co-Funders: UTD, Hobart

Start Date: 7/1/2019
End Date: 7/31/2021
Status: Active
2019 Funds Expended: $18,000
Total Project Cost: $180,000
Total SCG Cost: $29,000
Total Co-Funding: $151,000
Benefits:

UTD High Efficiency Smart Convection Oven (1.19.A)

The objective of this project is to develop a prototype high-efficiency smart convection oven that increases efficiency by at least 5%, and that integrates superior smart operating controls to maximize food preparation quality and consistency.

Co-Funders: UTD, Blodgett

Start Date: 7/1/2019
End Date: 7/31/2021
Status: Active
2019 Funds Expended: $27,000
Total Project Cost: $180,000
Total SCG Cost: $44,471
Total Co-Funding: $135,529
Benefits:

UTD Low NOx Ribbon Burner – Phase 3 (2.12.M.3)

The objective of this project is to perform technology transfer activities that result in the introduction of a commercial product from one or more major baking industry manufacturers that uses the technology developed and patented in prior phases of UTD project 2.12.M.

Co-Funders: UTD, Flynn Burner, Selas Heat Technology

Start Date: 7/1/2019
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $33,000
Total Project Cost: $125,000
Total SCG Cost: $33,000
Total Co-Funding: $92,000
Benefits:

UTD Next Generation Commercial Foodservice Burners – Phase 4 (1.14.A.4)

The purpose of this project is to test and develop burner concepts for commercial foodservice (CFS) applications that improve cooking performance, efficiency and/or emissions with an emphasis on improving efficiency and emissions of existing burner designs and adapting existing technology to CFS applications.

Co-Funders: UTD

Start Date: 7/1/2017
End Date: 9/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $150,000
Total SCG Cost: $44,000
Total Co-Funding: $106,000
Benefits:

UTD Next Generation Commercial Foodservice Burners – Phase 5 (1.14.A.5)

The purpose of this project is to test and develop burner concepts for commercial foodservice (CFS) applications that improve cooking performance, efficiency and/or emissions with an emphasis on improving efficiency and emissions of existing burner designs and adapting existing technology to CFS applications. For this phase, the specific goal will be to develop burner technology that meets NOx emission standards in parts of California.

Co-Funders: UTD

Start Date: 7/1/2018
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $18,526
Total Project Cost: $175,000
Total SCG Cost: $40,526
Total Co-Funding: $134,474
Benefits:

UTD Next Generation Infrared Burner – Phase 2 (2.16.A.2)

The objective of this project is to design, build and test a prototype high-efficiency, high-performance, fast-start-up, uniform temperature-profile, low-emission Infrared (IR) burner while working closely with Solaronics, Inc. a leader and manufacturer of gas-fired IR technology and Alantum Corporation, a leader in metal foam materials.

Co-Funders: UTD, Solaronics, Alantum Corp

Start Date: 7/1/2019
End Date: 7/31/2021
Status: Active
2019 Funds Expended: $8,000
Total Project Cost: $250,000
Total SCG Cost: $16,000
Total Co-Funding: $234,000
Benefits:

SUB-PROGRAM: SOLAR THERMAL HEATING & COOLING

GTI Solar Thermal Heat Exchanger with Innovative Particle Thermal Storage

The goal of the project is to successfully demonstrate technology comprising a solar thermal collector, 50 kW direct-contact gas-fired cyclone particle heater, and a novel particle thermal storage medium in an industrial heating application. The demo will verify the performance, energy savings, and emissions benefits of the integrated technologies at the USG plant in the Imperial Valley.

Co-Funders: CEC, DOE, UTD

Start Date: 7/1/2019
End Date: 7/31/2021
Status: Active
2019 Funds Expended: $170,000
Total Project Cost: $3,440,000
Total SCG Cost: $390,000
Total Co-Funding: $3,050,000
Benefits:

SUB-PROGRAM: BOILERS & PROCESS HEATING

GTI Gas-Fired Rotary Dryer Demonstration

SoCalGas collaborated with Gas Technology Institute (GTI) to demonstrate and bring to the marketplace a natural-gas-fired drying technology providing both cost and environmental benefits in a broad range of agricultural and industrial applications. The proposed effort targets the development and demonstration of the advanced high-efficiency drying technology that integrates GTI's patented gas-fired rotary drum dryer with an innovative heat pump technology.

Co-Funders: CEC, UTD, Wilson Engineering Technologies

Start Date: 2/24/2015
End Date: 12/31/2019
Status: Completed
2019 Funds Expended: $45,771.08
Total Project Cost: $3,050,000
Total SCG Cost: $250,000
Total Co-Funding: $2,800,000
Benefits:

GTI Industrial Steam Boiler Heat Recovery Demonstration

In this project, Gas Technology Institute (GTI) sought to identify and overcome the operational and technical hurdles that could arise during a real-world, field-demonstration of the emerging SideKick heat recovery technology for use in steam applications, providing valuable insight which will guide decisions as the project team moves towards impending deployment efforts. GTI anticipates that the technology will deliver increased fuel efficiency, reduce greenhouse gas emissions, and lower operating costs. Upon completion of the demonstration, GTI will disseminate project findings and conduct technology transfer to industrial users in California.

Co-Funders: CEC

Start Date: 6/30/2016
End Date: 6/29/2019
Status: Completed
2019 Funds Expended: $24,725
Total Project Cost: $832,550
Total SCG Cost: $247,250
Total Co-Funding: $585,300
Benefits:

UTD Advanced Immersion Tube Burner (2.18.B)

The objective of this project is to design, build and demonstrate a low-cost, high-efficiency, uniform-heat-flux, simple-to-control, and low-emissions immersion tube burner at a 100,000 Btu/hr laboratory scale. The burner will be capable of meeting increasingly stringent environmental regulations and be an easy to operate technology for the estimated 25,000 immersion tubes applications in the U.S.

Co-Funders: UTD

Start Date: 7/1/2018
End Date: 7/31/2020
Status: Active
2019 Funds Expended: $18,600
Total Project Cost: $180,000
Total SCG Cost: $37,200
Total Co-Funding: $142,800
Benefits:

UTD Carbon Management Information Center Annual Membership

The Carbon Management Information Center (CMIC) is an ongoing GTI collaborative program that includes natural gas industry members as well as the Propane Education and Research Council (PERC). Since CMIC was formed in 2007, GTI has developed an online information resource, source energy and emissions analysis tool, energy planning analysis tool, and energy estimating modules for residential, commercial, industrial, and transportation markets (Task 1); conducted scenario analyses on benefits of direct gas and propane use (Task 2); and provided technical input to voluntary standards and regulatory initiatives developed and promulgated by other stakeholders (Task 3) – including ASHRAE, DOE, EPA, ICC, NARUC, the National Academy of Sciences, and RESNET. GTI is using a combination of in-house resources, consultants, and publicly available information.

Co-Funders: N/A

Start Date: 1/1/2019
End Date: 12/31/2019
Status: Active
2019 Funds Expended: $25,000
Total Project Cost: $172,500
Total SCG Cost: $25,000
Total Co-Funding: $147,500
Benefits:

UTD Field Validation of Gas Quality Sensor for Natural Gas – Phase 2 (2.14.0.2)

The objective of this project is to field demonstrate pre-production gas quality sensors that were developed in earlier phases of this project. GTI will test up to fifteen C-series gas quality sensors at customers sites (primarily operators and manufacturers of stationary engines).

Co-Funders: UTD, CMR Group

Start Date: 7/1/2018
End Date: 12/28/2020
Status: Active
2019 Funds Expended: $0
Total Project Cost: $152,000
Total SCG Cost: $16,000
Total Co-Funding: $136,000
Benefits:

UTD Gas Fired Rotary Dryer with Heat-Pump for Food Processing Applications (2.17.B)

The goal of this project is to demonstrate in the field and bring to the marketplace an advanced high-efficiency drying technology that integrates a gas-fired thermal-vacuum drying process with an innovative heat pump technology. Specific objectives include improving efficiency of bulk food drying operations to over 75% and proving the cost-effective feasibility of successful integration of the advanced technology into industrial drying operations.

Co-Funders: CEC, UTD, WET

Start Date: 6/19/2017
End Date: 6/30/2019
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $2,840,000
Total SCG Cost: $10,667
Total Co-Funding: $0
Benefits:

UTD High Efficiency Ultra-Low NOx Commercial Boiler Burner (2.17.I)

The objective for this project is to field test and deploy a commercial prototype high-efficiency, low-emission, natural-gas-fired burner to meet current requirements in California as well as expected future requirements in non-attainment areas throughout the world. The ultimate goal is to commercialize a high-efficiency commercial burner.

Co-Funders: UTD, CEC, Mission Linen Supply, Power Flame, Inc.

Start Date: 6/16/2017
End Date: 1/15/2020
Status: Completed
2019 Funds Expended: $0
Total Project Cost: $1,660,000
Total SCG Cost: $520,588
Total Co-Funding: $1,139,412
Benefits:

UTD Sheet Metal Surface Burner Evaluation (2.18.C)
The objective of this project is to evaluate a novel European technology for a sheet metal burner surface combustion burner design being introduced to the commercial condensing boiler markets in the United States.
Co-Funders: UTD

Start Date: 7/1/2018
End Date: 1/31/2020
Status: Completed
2019 Funds Expended: $9,500
Total Project Cost: $120,000
Total SCG Cost: $28,500
Total Co-Funding: $91,500
Benefits:

UTD Zero CO2 Emission Combustion at Commercial or Industrial Scale (2.19.B)
The objective of this project is to Identify and evaluate methods to cost-effectively capture CO2 from commercial and industrial processes. The goals of this project include evaluating processes suited for commercial and industrial scale, determining if costs of existing approaches can be lowered, and identifying new processes with lower dollar and energy costs.
Co-Funders: UTD

Start Date: 7/1/2019
End Date: 1/31/2021
Status: Active
2019 Funds Expended: $10,000
Total Project Cost: $125,000
Total SCG Cost: $16,666
Total Co-Funding: $108,334
Benefits:

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ACRONYMS

ABTEG	Advanced Burner Thermoelectric Generator
AERMOD	American Meteorological Society/ Environmental Protection Agency Regulatory Model
AGA	American Gas Association
AHP	Absorption-Type Heat Pump
AMI	Advanced Metering Infrastructure
AMR	Anisotropic Magneto Resistive
AMSC	American Superconductor Corpora
ANG	Adsorbed Natural Gas
ANSI	American National Standards Institute
API	American Petroleum Institute
AR	Augmented Reality
ARPA-E	US Department of Energy's Advanced Research Projects Agency-Energy
ART	Acoustic Resonance Technology
AS	Aviation Services
ASME	American Society of Mechanical Engineers
ASHRAE	American Society of Heating and Air-Conditioning Engineers
ASTM	American Society for Testing and Materials
BAAQMD	Bay Area Air Quality Management District
BAE	British Aerospace Systems
BEV	Battery Electric Vehicle
BM	Biomethane
CAISO	California Independent System Operator
CARB	California Air Resources Board
CaSFCC	California Stationary Fuel Cell Collaborative
CCTWH	Central Condensing Tankless Water Heating System
CEC	California Energy Commission
CEPM	Continuous Equipment Performance Monitoring
CERC-WET	US-China Clean Energy Research Center Water-Energy Technologies
CES	Clean Energy Systems
CFD	Contract for Difference, Computational Fluid Dynamics
CFM	CFM International
CFS	Commercial Foodservice
CHP	Combined Heat and Power
CMIC	Carbon Management Information Center
CMOs	Close Metal Objects
CMR	Center for Methane Research
CNE	Carbon Negative Energy
CNG	Compressed Natural Gas
CNTP	Catalytic Nonthermal Plasma
CP	Cathodic Protection
CPS	City Public Service
CRADA	Cooperative Research and Development Agreement
CSA	Compliance, Safety, Accountability
CSULA	California State University, Los Angeles
CT	Computed Tomography

CWI	Certified Welding Inspector
D-EGR	Dedicated Exhaust Gas Recirculation
DG	Distributed Generation
DG/CHP	Distributed Generation/Combined Heat-and-Power Systems
DHW	Domestic Hot Water
DOE	US Department of Energy
DOT	US Department of Technology
DR	Demand Response
EAC	Engineering Analysis Center
EC	Eddy Current, Electric Charge
ECA	Engineering Critical Assessment
EED	Electricity Emitting Diode
EMAT	Electromagnetic Acoustic Transducer
EPA	US Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	Electrical Resistance
ERW	Electric Resistance Welding
ESIF	Energy Systems Integration Facility
EV	Electric Vehicle
FCE	FuelCell Energy
FCHEA	Fuel Cell and Hydrogen Energy Association
FEED	Front End Engineering Design
FEL	Front End Loading
FOA	Funding Opportunity Announcement
FPIP	Food Production Investment Program
GAHP	Gas Absorption Heat Pump
GFHPWH	Gas-Fired Heat Pump Water Heater
GHPWH	Gas-Fired Heat Pump Water Heater
GFO	Grant Funding Opportunity
GHG	Greenhouse Gas
GHP	Gas Heat Pump
GIS	Geographic Information System
GMAW-P	Gas Metal Arc Welding
GNA	Gladstein, Neandross & Associates
GTI	Gas Technology Institute
GVHP	Gas Vuilleumier Heat Pump
H2	Hydrogen
HAZ	Heat-Affected Zone
HCDP	Hydrocarbon Dewpoint Temperature
HDD	Horizontal Directional Drilling
HD OBD	Heavy-Duty On-Board Diagnostics
HFCEV	Hydrogen Fuel Cell Electric Vehicles
HSD	Hardness, Strength, and Ductility
HTEC	Hydrogen Technology and Energy Corporation
HVAC	Heating, Ventilation, and Air Conditioning
HVDC	High Voltage DC
HX	Heat Exchangers
HYGEN	HYGEN Industries
HYPOWERS	Hydrothermal Processing of Wastewater Solids
IAQ	Indoor Air Quality
ICC	International Code Council
ICCCM	Integrated Capture and Conversion of CO2 to Methanol
ICE	Intercontinental Exchange
ICF	ICF Incorporated LLC
ILI	In-line Inspection

INGAA	Interstate Natural Gas Association of America Foundation
IR	Infrared
ISOD	Intelligent Shut-Off Device
IVP	Integrity Verification Process
JCAP	Joint Center for Artificial Photosynthesis
JIP	Joint Industry Project
JPL	Jet Propulsion Laboratory
kW	Kilowatt
LBNL	Lawrence Berkeley National Laboratory
LDC	Local Distribution Company
LDDOAS	Liquid Desiccant Dedicated Outdoor Air System
LLNL	Lawrence Livermore National Laboratory
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LSM	Large Standoff Magnetometry
MAOP	Maximum Allowable Operating Pressure
mCHP	Micro Combined Heat and Power Systems
MEAS	Measure
MFL	Magnetic Flux Leakage
MSA	Meter Set Assembly
MTG	Microturbine Generator
NARUC	National Association of Regulatory Utility Commissioners
NASA	National Aeronautics and Space Administration
NCGI	Non-Condensable Gas Isolation
NDE	Nondestructive Examination
NEEA	Northwest Energy Efficiency Alliance
NFP	Not For Profit
NG	Natural Gas
NGIF	Natural Gas Innovation Fund
NGV	Natural Gas Vehicle
NOX	Nitrogen Oxide
NREL	National Renewable Energy Laboratory
NYSEARCH	Northeast Gas Association
NYSERDA	New York State Energy Research & Development Authority
NZE	Near-Zero Emission Engine
O&M	Operations and Maintenance
OIML	International Organization of Legal Metrology
ONAMI	Oregon Nanoscience and Microtechnologies Institute
ORC	Organic Rankine Cycle
ORNL	Oak Ridge National Laboratory
OSU	Oregon State University
OTD	Operations Technology Development
OTM	Other Test Methods
P2G	Power-to-Gas
PATH	Pipeline Assessment Tool for Human Factors
PCC	Pre-Combustion Chamber
PE	Polyethylene
PERC	Propane Education and Research Council
PG&E	Pacific Gas and Electric
PHMSA	Pipeline and Hazardous Materials Safety Administration

PNNL	Pacific Northwest National Laboratory
PON	Program Opportunity Notice
PRCI	Pipeline Research Council International
PSRI	Particulate Solid Research Inc.
PV	Photovoltaic
QSI	QSI Corporation
RAMMS	Rapid Mass Movements
RANGE Tool	Range of Acceptability for Natural Gas Equipment (NYSEARCH)
RAPID	Rapid Advancement of Process Intensification Deployment
RD&D	Research, Development, and Demonstration
RESNET	Residential Energy Services Network
RESOLVE	Renewable Energy Solutions Model
REV	REV Group
RFID	Radio-Frequency Identification
RMD	Residential Methane Detector
RNG	Renewable Natural Gas
ROW	Rights-of-Way
RP	Recommended Practices
SAP	Systems, Applications and Products
SBD	Strain Based Design
SBIR	Small Business Innovation Research
SCAQMD	South Coast Air Quality Management District
SCC	Stress Corrosion Cracking
SERA	Security Engineering Risk Analysis
SHW	Service Hot Water
SME	Subject Matter Expert
SMR	Steam Methane Reformer
SMTI	Stone Mountains Technologies, Inc.
SMYS	Specified Minimum Yield Stress
SOFC	Solid Oxide Fuel Cell
STARS	Solar Thermochemical Advanced Reactor System
SWRI	Southwest Research Institute
TCHR	Thermochemical Heat Recovery
TDC	Technology Development Center
TEG-HX	Thermoelectric Generator Heat Exchanger
TPTS	Two-Phase Thermo-Syphoning
TPV	Thermal Photovoltaic
TVCD	Thermo-Vacuum Clothes Dryer
UCI	University of California, Irvine
UCR	University of California, Riverside
USG	United States Gypsum Corporation
USGS	United States Geological Survey
USM	Ultrasonic Meter
UT-CEM	University of Texas at Austin Center for Electromechanics
UTD	Utilization Technology Development
UV	Ultra-Violet
VR	Virtual Reality
VTH	Virtual Test Home
WET	Water Enhancing Technologies
ZANZEFF	Zero and Near Zero-Emission Freight Facilities
ZNE	Zero Net Energy

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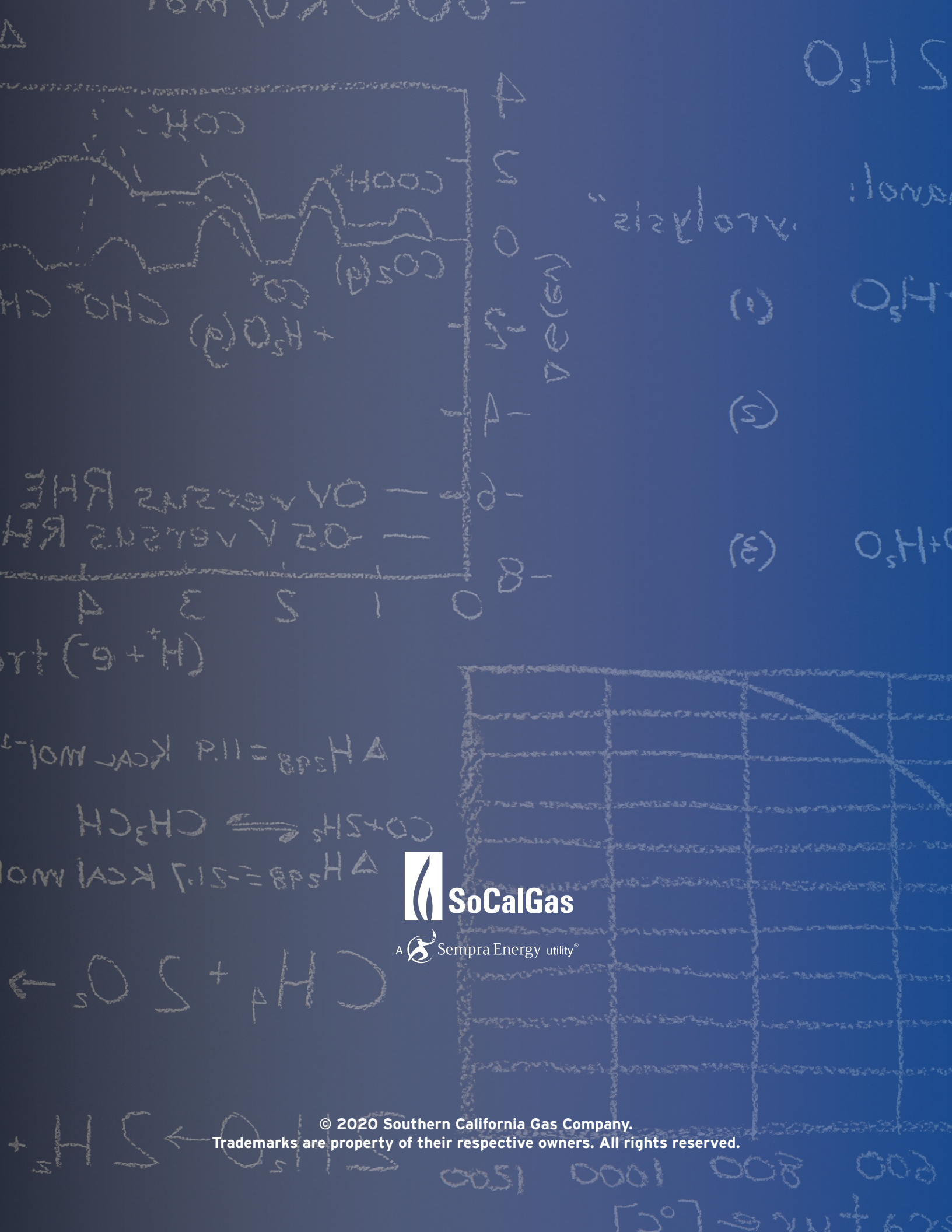

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