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SoCalGas Comments on FY 2020-2021 RDD NG Initiatives

Additional submitted attachment is included below.

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February 11, 2021
California Energy Commission
Dockets Office, Docket #16-PIER-01
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: SoCalGas Comments on CEC's FY 2021-22 Proposed Natural Gas Research Initiatives, Docket # 16-PIER-01

Dear Staff:

I write on behalf of Southern California Gas Company (SoCalGas) in response to the California Energy Commission's (CEC's) Staff Workshop to Discuss Proposed Natural Gas Research Initiatives for fiscal year (FY) 2021-22 held on January 29, 2021. SoCalGas appreciates the opportunity to comment on the broad research initiatives outlined by CEC and provide responses to the questions raised during the workshop. SoCalGas' Research Development and Demonstration (RD&D) portfolio has a number of completed or on-going projects in the research areas outlined by CEC. To expand CEC's awareness of our projects, we have provided a few examples below. We also invite CEC staff and other stakeholders to review our 2019 RD&D Annual Report[1] for additional information on SoCalGas's RD&D program and our research projects.

Energy Efficiency

Research Initiative#1: Hydrogen and natural gas blending for industrial end-use applications

Current SoCalGas RD&D Projects that could inform development of this initiative:

- UTD High Hydrogen Burner for Large Commercial and Industrial Applications: Develop a commercial/industrial scale fuel flexible burner that is highly efficient and economical utilizing high blends of hydrogen (up to 60%) while minimizing emissions.
- UTD Field Validation of Gas Quality Sensor (GQS) - Phase 3: Hydrogen Sensor: Conduct calibration tests on the GQS with an add-on hydrogen detector so the GQS can be used to monitor natural gas containing hydrogen.

[1] https://www.socalgas.com/sites/default/files/2020-06/2019%20SoCalGas%20RDD%20Annual%20Report_remediated.pdf

- UTD Integrating RE-Derived Hydrogen into Industrial Operations: Assess and evaluate hydrogen production pathway from renewable energy sources and the direct integration of produced hydrogen into industrial operations.
- UTD Ribbon Burner Performance Evaluation with Gases Containing Hydrogen: Evaluate the ribbon burner performance when operating with hydrogen and natural gas/hydrogen mixtures in controlled laboratory environment.
- SMP Low-Cost Carbon Neutral Natural Gas to Hydrogen Production: Evaluate hydrogen production processes from natural gas and perform lab scale testing of the two best technologies.
- SMP Ceramic Matrix Composite Materials for High Hydrogen Combustion End Use: Develop and test a low-cost improved life composite material for high hydrogen applications.
- EAC Testing of Hydrogen/NG Blend Impact on Appliances – Phase 2: Develop a tool that takes gas supply composition data (natural gas, hydrogen, and biogas blends) and generates graphical depictions of the performance characteristic for appliances
- UCI Solid Oxide Electrolysis Cells (SOEC) for Green Steel Production Demonstration: Study, demonstrate, and optimize an integrated high temperature process for the direct reduction of iron with hydrogen produced from a SOEC system.

Questions for the Stakeholders:

1. What should be the targeted industrial sectors and processes? Why?

Energy Futures Initiative (EFI) released a report on pathways for deep decarbonization in California[2]. The report recommends focusing on areas with low electrification potential: petroleum refining & hydrogen production; pulp & paper; stone, clay, stone, clay, glass & cement; chemical & allied products; food products.

2. Are there sectors or process applications to avoid? Why?

Further research and discussions with customers in a number of sectors will be needed to address the concerns raised by the following sectors:
Metals customers (e.g. heat treating, steel forging, aluminum melting), glass and ceramics manufacturers, hydrogen production/refineries:

- Metals industry: concerns about hydrogen effects to heat treating atmosphere, controls, processing; for steel products that have direct contact with the fuel, hydrogen embrittlement may be a concern when using hydrogen blends; concern for hydrogen leading to increased moisture content and oxide formation and their impact to product quality
- Glass and ceramics manufacturers: concern for increased NOx, lower radiative heat transfer, and increased moisture content

[2]https://static1.squarespace.com/static/58ec123cb3db2bd94e057628/t/5ced6fc515fcc0b190b60cd2/1559064542876/EFI_CA_Decarbonization_Full.pdf

- Hydrogen production/refineries: concern that existing piping and measurement equipment are not compatible with hydrogen blends

3. What are specific research needs in the area of natural gas and hydrogen blends in industrial end-use applications?

Impacts to existing equipment (e.g. pipes, orifice plates, valves, burners), operations (e.g. heat up rates, burning temperature, safety, process controls), NOx emissions, quality and safety of molten metal products; hydrogen threshold for existing equipment and processes and/or potential retrofits to accommodate hydrogen blends; determine if customers need to reapply for air permits

4. What are non-technological barriers that hinder the use of hydrogen and natural gas blends?

- Potential fuel cost increases and additional permitting/certification for using a different fuel
- Public awareness, social acceptance, and public perception
- Market conditioning
- Bridge the gap between demonstration stage and commercialization
- Knowledge dissemination not only to the experts, but also value to society so that they understand the technology and their advantages; value proposition for end-users
- More support from regulatory stakeholders on large-scale efforts for expansion on hydrogen infrastructure and distribution network
- Incentives or mandates to support development and manufacturing; supply chain development

5. Are there examples of industries that have successfully used hydrogen natural gas blends? Please provide links.

- AMF Bakery Systems has developed an industrial oven that can run on H2 blends up to 100%: https://bakeryinfo.co.uk/equipment/hydrogen-tunnel-oven-launched-by-amf-bakery-systems/646187.article#:~:text=AMF%20Bakery%20Systems%20unveils%20hydrogen%20tunnel%20oven&text=Its%20Multibake%20Vita%20Tunnel%20Oven,%2C%20hydrogen%20fuelled%20tunnel%20oven%E2%80%9D.
- UK: Baxi Heating and Worcester Bosch have installed Hydrogen Boilers at ‘HyStreet’: https://fuelcellsworks.com/news/uk-baxi-heating-and-worcester-bosch-have-installed-hydrogen-boilers-at-hystreet/.
- Scottish Homes to be the first in the world to use 100% green hydrogen: https://www.theguardian.com/environment/2020/nov/30/scottish-green-hydrogen-fife.

- ATCO to build Alberta's first hydrogen blending project with Emission Reductions Alberta's (ERA) support: https://www.prnewswire.com/news-releases/atco-to-build-albertas-first-hydrogen-blending-project-with-era-support-301096658.html.
- Globally, hotspots for hydrogen innovations project include Saudi Arabia, Denmark, Austria, New Zealand, Australia, Singapore, Germany, Chile, Spain, China, and Japan.

6. What air quality considerations for using blends should we be aware of?

   See response to question #3.

Research Initiative #2: Industrial Carbon Capture and Utilization

Questions for the Stakeholders:

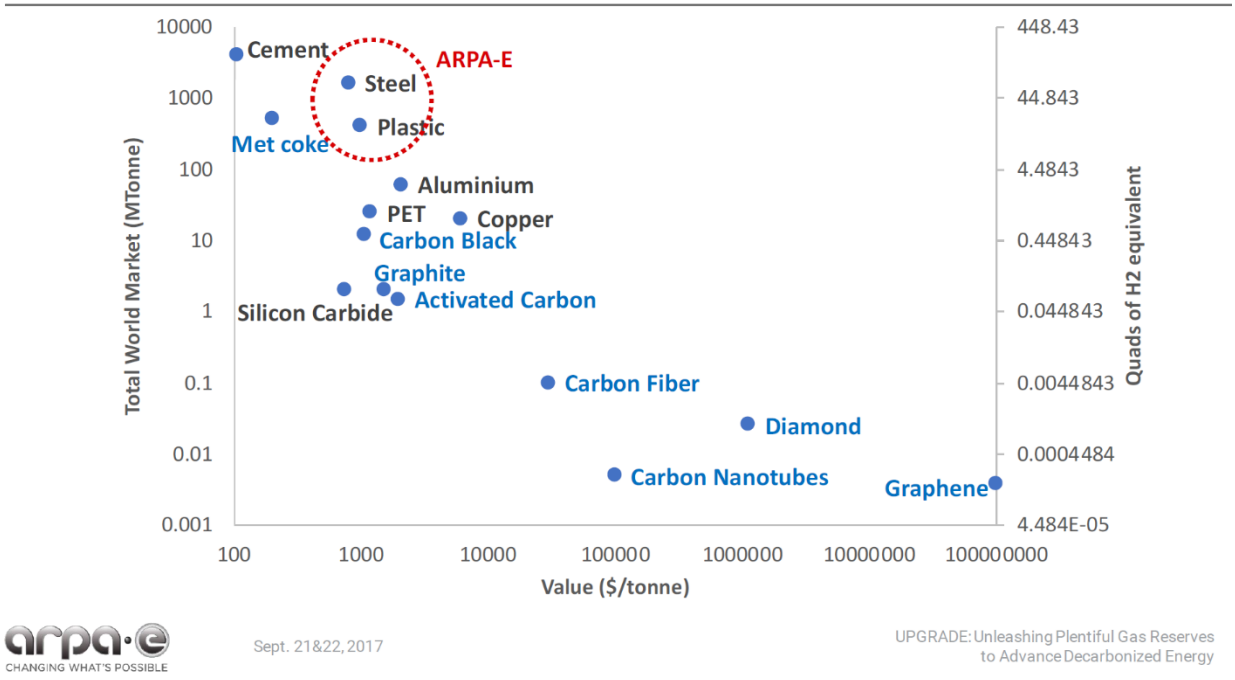
1. What are CO_2 utilization technologies with highest market potential?

Utilization of CO_2 is a function of scale and cost. A 2018 report from National Academy of Sciences (https://www.nap.edu/catalog/25232/gaseous-carbon-waste-streams-utilization-status-and-research-needs) and a 2019 paper in Nature, (Nature 575, 87–97 (2019). https://doi.org/10.1038/s41586-019-1681-6) identify a number of promising technology CO_2 utilization pathways. These pathways include:

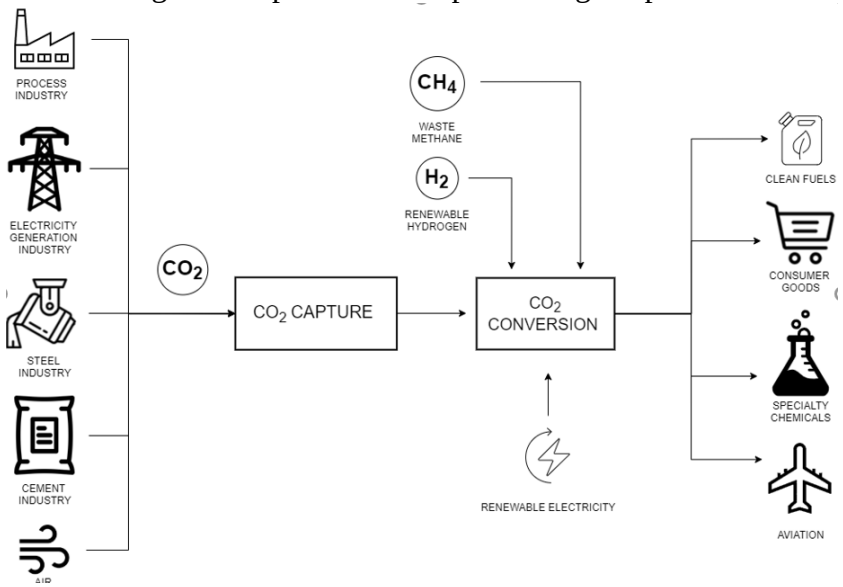
- Conversion into construction materials (concrete, aggregates, etc.)
- Biochemical conversion to make hydrocarbons (RNG, ethanol, butanol, etc.)
- Thermochemical conversion to produce fuels (methanol, Fischer Tropsch, DME, etc.) and chemicals.
- Conversion into specialty polymers
- Electrochemical conversion to products (CO, ethanol, formic acid, etc.) For example: Researchers discover effective pathway to convert carbon dioxide into ethylene (phys.org)

Both fuel production for a circular economy and building materials (see illustration below) are attractive due to the size of their markets.

Construction materials have gained traction as evidenced by strong funding for companies like Solidia, CarbonCure, CO2NCRETE, etc., who have developed technologies for utilization of CO_2 captured from anthropogenic sources. Other CO_2 conversion technologies for chemicals may be limited initially due to the massive quantities of CO_2 that must be converted to make a difference in atmospheric temperature forcing and, if converted into any given commercial chemical, they would overwhelm existing markets.



Long-term, if CO_2-based products can replace petroleum feedstocks using renewable energy, there could generate a strong market pull. A conceptual design is provided below.



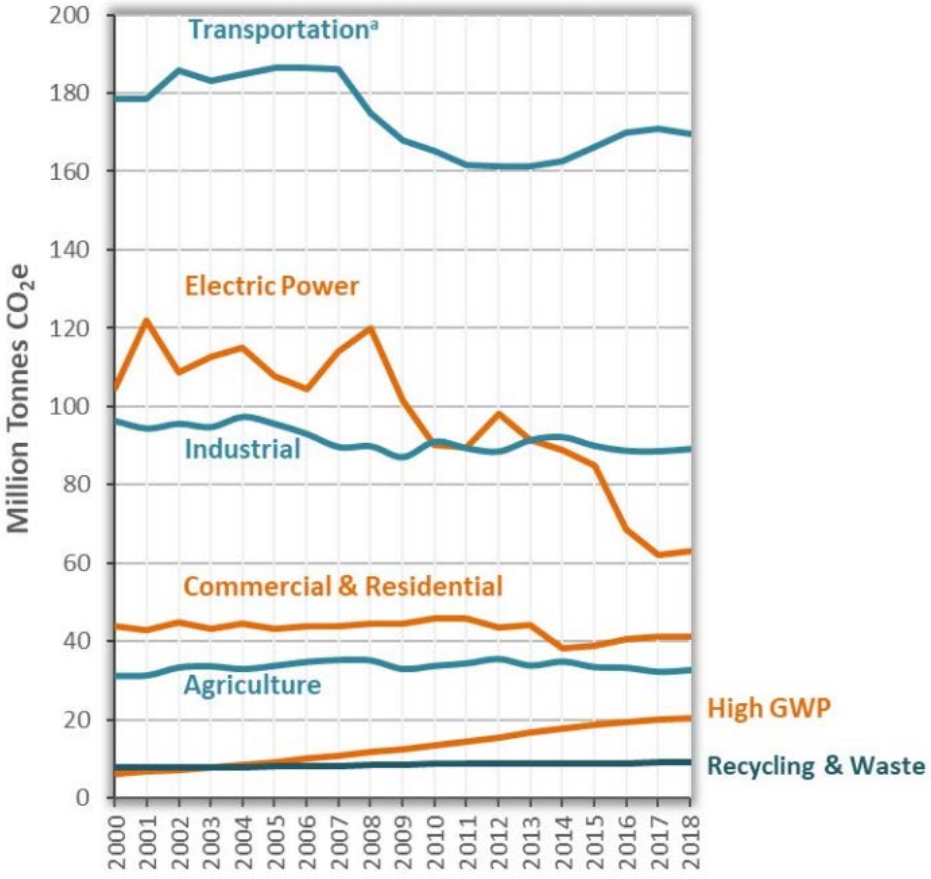
2. What technologies have highest potential for on-site conversion of CO2 at the industrial facilities?

Any CO_2 conversion requires electrons in the form of hydrogen or electricity inputs. With that in mind, on-site CO_2 conversion at an industrial facility with the highest potential may be fuels such as methanol, methane, gasoline, etc.

3. What are specific research needs for industrial carbon capture and utilization in California?

Since significant stationary CO_2 emissions in California are produced in power generation and industrial process heat, there is a need to develop and demonstrate cheaper carbon capture systems for flue gas containing <6% CO_2. Traditional amine-based solvents for these low concentrations of CO_2 have not yet proved to be cost-effective. Some of the technologies being developed for direct air capture could be extended for the flue gas streams generated by natural gas combustion. One example could be electrochemical swing adsorption where renewable electricity could be used for sorbent regeneration.

For high concentrations of CO_2 from industrial sources like cement production, steel production, hydrogen from steam methane reformers, existing/emerging technologies can be used effectively. However, research is needed to support the demonstration of these technologies integrated with various processes and at a variety of facility locations.



Source: Greenhouse Gas Inventory Trends (ca.gov)

4. What are non-technological barriers that hinder adoption of carbon capture and utilization?

Lack of regulatory framework and carbon price is a major barrier. Also, there is state sanctioned CO2 storage facilities nor CO_2 pipeline infrastructure to transport captured CO_2 to designated CO_2 sinks.

5. What industries in California have most potential for carbon capture and utilization?

- Refineries, bioethanol and chemical processing plants
- Landfills and wastewater treatment plants
- Dairies and feedlots

6. What are examples of industrial carbon capture and utilization that would be helpful in our research?
    - Methane pyrolysis (co-production of hydrogen and solid industrial carbon) as a substitute for steam methane reforming at petroleum refineries
    - Reactive CO2 capture and use.
        i. Integrated CO_2 Capture and Conversion to Methanol (ICCCM) -- ORNL
        ii. Integrated CO_2 Capture and Conversion to ethanol (ICCCE) – PNNL

7. What are anticipated co-benefits of carbon capture on air quality (criteria air pollutants and particulates)? Links to supporting literature.

    - Carbon sequestration and biodiversity co-benefits of preserving forests in the western United States - https://esajournals.onlinelibrary.wiley.com/doi/10.1002/eap.2039
    - Environmental co-benefits and adverse side-effects of alternative power sector decarbonization strategies - https://www.nature.com/articles/s41467-019-13067-8
    - Co-Benefits of Carbon Offset Projects: Information for Carbon Offset Procurement - https://secondnature.org/wp-content/uploads/Co-Benefits-Document-Rev5.pdf
    - Co-benefits of greenhouse gas mitigation: a review and classification by type, mitigation sector, and geography - https://iopscience.iop.org/article/10.1088/1748-9326/aa98d2/meta

Natural Gas Infrastructure Safety & Integrity Program

Research Initiative #3: Technologies for Monitoring Ground Movement Around Pipelines and Mitigating Natural Force Damages

Current SoCalGas RD&D Projects that could inform development of this initiative are:

- 3vG Satellite InSAR Monitoring, Pilot Project (SoCalGas)
- Airborne Automated Threat Detection System-Monitoring and Surveillance of Imminent Threats Through Remote Sensing (PRCI ROW-3-1&A)
- Enhancing Strain Capacity of Pipelines Subject to Geohazards (PRCI SBD-1-6)
- Fault Displacement Hazard Initiative (UCLA)
- Fiber Optics Pipeline Integrity Monitoring System at a Creek Bed (SoCalGas)
- Geohazard Land Management JIP (INGAA)
- InSAR Monitoring of Pipeline Geohazards in Vegetated and Very Large Non-Vegetated Areas (PRCI GHZ-2-03&A)
- Guidance on the Excavation and Backfill Procedures in Areas of Geohazards and High Axial Stresses and Strains (PRCI SBD-1-5)

- Modernize the Assessment of Pipeline Water Crossings (PRCI ENV-4-1A)
- Modernize the River X Software (PRCI ENV-4-1)
- Optimal Approach to Cost Effective, Multi-source, Satellite Surveillance of River Crossings, Slope Movements and Land Use Threats to Buried Pipelines (PRCI GHZ-2-02)
- Post Fire Debris Flow Studies (SoCalGas)
- Seismic Risk Assessment and Management of Natural Gas Storage and Pipeline Structure (CEC GFO-18-502)(Group 1) – (Slate/Berkeley & UCLA)

Questions for the Stakeholders:

1. What would be the most suitable technologies for monitoring pipelines and ground movement?
    a. Fiber optics-based pipeline monitoring for new or replacement pipelines. Vibration sensors and strain gauges for existing lines. We are interested to see if there are any projects that have successfully retrofitted existing lines safely while keeping them in service.
    b. Satellite monitoring, drone, and LIDAR.
    c. Areas where research would be beneficial:
        i. With steep hills or mountains, the satellite cannot pick up the information correctly. It is called shadow effect. If CEC can look into the effect of this in State of California based on our unique geography it would be very beneficial.
        ii. Another research project is to use satellite technology that can look through vegetated areas to measure ground movement. The current satellite technologies do not have this capacity.
2. What would be the best approach to integrate monitoring data into utility integrity management systems?
    a. Overlaying the data onto the GIS system, so the impacted areas can be identified and monitored.
    b. Universal dashboard with GIS related data overlaid on top of dig alert and current construction activities may it be 3rd party or internal construction.
3. What are important project considerations in the R&D stage to eventually allow for commercialization and incorporation into utility operations?
    a. Cost. Impact to current processes. Operations and maintenance burden. Interoperability.

Research Initiative #4: Technology Development and Demonstration for Plastic Pipeline Repair and Integrity Improvement

Current SoCalGas RD&D Projects active in 2020 that could inform development of this initiative are: (*Projects in italics were new in 2020).*

- Aldyl-A Mains Failure Rate Analysis (SoCalGas)

- Alternative Caps for PE Service Tees (OTD 5.16.b)
- Applying Heat to Steel Near PE (OTD 5.19.s)
- Composite Repair Wrap for PE - Phase 2 (OTD 2.14.a.2)
- Eclipse Scientific Red/Green Light Tool for NDE of PE Pipe Butt Fusion Joints - Phase 1-a (NYSEARCH M2019-010)
- Enhance Risk Assessment Tools for Decision Making (OTD 9.20.a)
- JIP PE Systems Research Program - Phases 1 and 2 (OTD 5.16.r, 5.16.r.2)
- Material - Suppliers Quality Assurance Program (OTD 5.17.g)
- Modeling and Assessing PE Assets with 3D Scanning Technology
- *NJIT Advanced Terahertz (THz) Imaging & Spectroscopy for Non-Destructive Evaluation of Polyethylene Pipes (NYSEARCH M2018-009 PhII)*
- PE Leak Growth Rate from Slow Crack Growth Research Project (OTD 7.15.c)
- Risk Profile for Aldyl-A Piping System - Phase 3 (OTD 2.13.d.3)
- Rounding Clamp Evaluation (SoCalGas)
- Small PE Diameter Squeeze-Off - Phase 2 (OTD 2.14.c.2)
- Standard Library of PE Joint Samples with Embedded Defects for NDE Tool Validation - Phase I-a (NYSEARCH M2019-009)
- Subsurface Multi-Utility Asset Location Detection (OTD 5.20.a)
- *Validation of NDT Technology for PE Pipe (OTD 5.20.p)*
- *Xray and Terahertz Development for NDE of PE Pipe by Iowa State University (NYSEARCH M2019-007 Phase II)*

Questions for the Stakeholders:

1. What are the most desirable improvements on current technologies or practices for plastic pipelines?

Current technologies for plastic pipelines should be evaluated against the pipe and fitting materials installed in a system along with operating practices of individual utilities. The performance of different plastic pipe materials, construction practices, and operations and maintenance practices can vary widely between utilities. System performance should be assessed based on leak rates and severity of leaks for system pipeline categories. Pipeline categories may need to be stratified by service pressure, average service temperature, and the vintage or types of pipe and fittings installed.

2. Which components of plastic pipeline systems are more vulnerable to aging, degradation or risks, so that the safety enhancements can focus more on these components?

The variables referenced in answer to question #1 will need to be considered. The prevalent vintages of pipe, types of fittings installed and root cause of plastic pipeline system failures will vary widely by utility. Current integrity management programs are designed to identify system threats and systemic issues. With the objective of improving system integrity, it may be necessary to determine whether development of plastic pipeline repair technology is the most important area of focus for California utilities.

3. Are there any additional research areas of interest to improve the overall integrity of plastic pipeline systems?

Locations of leaks on plastic pipelines are highly randomized due to the number and complexity of contributing variables involved. On this basis we suggest the following areas where SoCalGas and SDG&E have interest in additional research:

- Locating Underground Plastic Pipe: A significant amount of vintage plastic pipe is difficult to locate and mark due to long-standing challenges such as original installation without tracer/locating wire, original installations using bare wire, or cases of faulty connections and third-party wire damage. Evaluating non-intrusive plastic pipe locating technologies to effectively locate plastic may prove beneficial especially in reduction of excavation damages locating leaks.
- Determine Temporal Growth Rate of the Leak Flow Rate in Plastic Piping Systems due to slow crack growth: a great deal of research has been conducted to determine how long plastic pipe will last until leaks develop due to the "slow crack growth" failure mechanism of polyethylene. However, the above referenced OTD project (OTD 7.15.c) is the first study of the rate at which the leak flow rate grows once manifested, and more research is needed. Non-hazardous leaks are currently granted longer repair periods with reevaluation every 6 months. Although great strides and effort is being made to replace vintage PE pipe systems, California utilities still operate a significant amount of Aldyl-A PE pipe. It would be beneficial to assess if once identified, small non-hazardous leaks have a high probability to remain non-hazardous for the period between detection and repair. In addition, changes in gas composition such as natural gas/hydrogen blends in the distribution system and its effects in leak flow rate growth could also be studied.

Renewable Energy & Advanced Generation Program
#5: Developing and Demonstrating Hydrogen-Based Power Generation Systems

Current SoCalGas RD&D Projects that could inform development of this initiative:

- UCI Fuel Flexible Microturbine Generator Development – The goal of this project is to increase the hydrogen blending limit in a Capstone C-60 microturbine.
- UCI Effect of Hydrogen Addition into Natural Gas on SCR of NOx Lab Testing - The goal of this project is to determine the effects hydrogen containing fuel has on SCR catalysts, found downstream from gas turbines.
- UCI Flex Fuel Rotary Engine MicroCHP - The goal of this project is to determine the performance impacts hydrogen blending has on the Mazda Rotary Engine mCHP developed by UCI in a previous CEC funded project.
- UCI Hydrogen Energy Storage Integration with Dispatchable Power Generation Study - This DOE funded project will begin designing an integrated hydrogen generation and storage system to be added to UCI's campus microgrid. The hydrogen will be blended with natural gas to fuel UCI's existing 13 MW gas turbine.

Questions for the Stakeholders:

1. Are we effectively targeting research and technological development needs to support California's decarbonization goals and provide natural gas ratepayer benefits?

    - There is room for interpretation, but this research area seems focused on Hydrogen blending in traditional combustion-based generation technologies. It would be extremely valuable to pursue fuel cell demonstration projects, which could have an immediate impact on air quality while helping to improve affordability. If paired with RNG or H2, even SOFC technology could have significant impacts on GHG emissions, in addition to the NOx reduction.
    - There is still a valuable R&D taking place outside of the hydrogen world, developing technologies that can achieve low GHG and NOx with natural and/or renewable gas. Excluding these projects might impact short term benefit opportunities.

2. What are the technological and non-technological barriers to deploying hydrogen power generation that should be prioritized?

    - Blending thresholds for combustion technologies need to be established and warranted by manufacturers.
    - Affordability and public awareness is the biggest hurdle for fuel cells. Fuel cells need regulatory support and/or massive market adoption to drive down costs. Technologically, they can accept up to 50% H2 immediately in some SOFCs, or 100% H2 in PEMFC's.

3. Do you have suggestions for research and development needed to improve the technical and economic aspects of the proposed technologies?

    - It would be valuable to determine which engines and turbines are most ubiquitous in California and work with the manufacturers to determine H2 blend thresholds for existing equipment, as well as retrofit options for higher thresholds.

4. What air quality considerations or benefits using blends should we be aware of?

    - Concern for increased NOx in combustion technologies.
    - Unknown impacts on SCR's (See UCI project in list above).
    - Fuel cell demonstrations will have an immediate reduction in NOx.

Energy-Related Environmental Research Program

Research Initiative #6: Quantify Exposures to Indoor Pollutants in Multi-Family Homes that Cook with Natural Gas or Alternatives

CEC should engage experts in toxicology, epidemiology, and environmental chemistry in developing the scope for this initiative to ensure testing procedures provide meaningful

information towards an understanding of potential residential exposures. The recently published (2020) UCLA Report by Zhu, et al[1] modeled peak concentrations from gas appliances and improperly compared these transient concentrations to 1-hour Ambient Air Quality Standards. Unfortunately, many people have drawn inaccurate conclusions from the UCLA Report based on these findings. CEC should ensure meaningful concentration data, for evaluation against established thresholds based on specific exposure durations, are collected as part of this initiative. The study should also look at emissions from electric stoves for similar populations to reduce potential bias in the study results.

Questions for the Stakeholders:

1. How should the study population be defined? (e.g., multi-family households that include residents vulnerable to air pollution exposures, low-income single-family homes, etc.)

   A study of exposures in communities vulnerable to air pollution must look beyond indoor sources of particulate matter (PM) and oxides of nitrogen (NOx) when establishing the study population. Unless confounding factors, such as proximity to busy roads, smoking, mold, and others are accounted for, the study could have an unintended bias.

2. How to foster cost-effective recruitment of the study population to ensure the research benefits the intended stakeholders?

   Without knowing the study population and objectives, it is difficult to identify recruitment possibilities.

3. Are there ongoing efforts that could be leveraged or otherwise provide fruitful partnerships?

   CEC may want to consider outreach to the AB617 communities through the community steering committees established by the local air districts.

Research Initiative #7: Location-Specific Analysis of Decommissioning to Support Long-Term Gas Planning

The CEC will need to consider a range of issues when looking at decommissioning portions of the natural gas system – service reliability and cost impacts to customers that remain on the system, as well as resiliency and reliability of the energy grid (electric and natural gas). The natural gas system plays an increasingly important role in the reliability of the electric grid as more intermittent resources are added to the grid. The natural gas system continues to be a critical resource for long-term energy storage and for the fast-ramping capability of generating resources to provide low cost reliability for the electric grid.

If the primary focus of this analysis is to look at electrification scenarios, it will be equally important to look at the impacts on the local electric grid for the increased electric load in that

[1] Zhu, et al, Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California. 2020.

region. Further, the analysis should consider the cost to the home-owner for upgrades to their electric panel and replacement of appliances. During a January 2021 update on the pilot projects in the San Joaquin Valley OIR, RH&A noted a majority of homes in disadvantaged communities require evaluation of upgrades to the electric grid. Similarly, PG&E noted 60% of homes in the pilot need electric service upgrades (transformer, secondary wire, etc.)[3]. CEC should include these factors in their electrification studies.

Questions for the Stakeholders:

1. How can California's natural gas IOUs be effectively engaged in this study? What synergies with IOU priorities and planning could be leveraged to enhance the study?

This initiative may be informed by the current Gas Transmission OIR at the CPUC. The utilities have been looking at different planning criteria as part of the proceeding.

2. What other natural gas sector stakeholders (e.g., other state agencies, CCAs, community-based organizations, jurisdictions with electrification ordinances) could serve important roles in ensuring the study delivers useful results?

The participants of the Gas Transmission OIR may be able to provide input for scoping this research initiative.

3. What collaboration opportunities with related efforts could be most fruitful?

CEC will need to work with the electric and natural gas utilities to evaluate the impacts on both systems.

Transportation Research Program

Research Initiative #8: Advanced Hydrogen Refueling Infrastructure Solutions for Heavy Transport

Current SoCalGas RD&D Projects that could inform development of this initiative:

- NREL MC Formula Protocol for H35HF Fueling - This project will tailor the SAE J2601 standard MC Formula protocol structure to 35MPa on-board storage systems for board storage systems for heavy duty vehicles utilizing H35HF (high flow) receptacles.
- GTI H2@Scale Hydrogen Refueling Demonstration - The H2@Scale project will include the demonstration of co-located multiple hydrogen generation and multiple hydrogen use applications. Hydrogen will be used to generate electricity for a data center and refueling a hydrogen fuel cell vehicle fleet.

[3] January 19, 2021 presentations to CPUC on the San Joaquin Valley Pilot programs

- GTI Hydrogen Fuel Cell Yard Truck Port of Los Angeles Demonstration - Development of two hydrogen fuel cell yard trucks at the Port of Los Angeles and hydrogen mobile refueler.

Questions for the Stakeholders:

1. Given the limited research funds, what specific barriers should be prioritized to reduce the cost of high-capacity hydrogen fueling infrastructure for heavy transport?

    - Standardized fueling protocols for light, medium, and heavy-duty transportation.

2. What are some opportunities for this research to inform development of codes and standards to create replicable solutions?

    - Standardization of 700 and 350 bar refueling protocols.
    - DOT standards for hydrogen transport and mobile refueling.

3. How can this research supplement private sector and other public investments in hydrogen fueling infrastructure research, demonstration, and deployment?

    - Wet-hosing and mobile refueling can reduce the initial cost of hydrogen infrastructure needed to demonstrate and advance hydrogen fuel cell vehicle technology.
    - Mobile refueling and infrastructure plays an important role for off-road applications where project locations change

Conclusion

SoCalGas looks forward to continuing our valuable partnership with the CEC, developing new technologies that can help California reach its climate goals. We look forward to additional opportunities to collaborate with CEC, the U.S. Department of Energy, local air districts and the national laboratories. As the CEC looks to further develop their research initiatives for FY 2021/22, we look forward to working with CEC staff to share our experience and research results from our own portfolio.

Sincerely,

/s/ Tim Carmichael

Tim Carmichael
Agency Relations Manager
Southern California Gas Company