ATTACHMENT 1: SoCalGas Feedback on CARB 2021-2024 Triennial Research Plan and September 16, 2020 Research Roundtable

Area of Interest	Title	Concept	Importance	CARB Research Initiatives
Forest Management	Distributed forest waste pyrolysis or torrefaction feasibility study	Thermal conversion of forest waste into dense carbon for efficient transport to centralized refining facilities for production of energy, agricultural land applications and carbon products.	California's forests are in crisis. The impacts on health, safety and climate cannot be overstated. Conversion of waste from forest management into useful products can play an important role in preventing fire related air pollution and GHG. emissions.	Greenhouse Gas Inventories & Mitigation - Mitigation Options
Grid Management	Artificial Intelligence (AI) to minimize electric grid curtailment of wind and solar energy	Technoeconomic assessment of AI software models for integration and optimization of wind, solar and storage resources.	In 2020, curtailment of wind and solar energy in California has exceeded 22 GWh through August. At the current marginal cost of $26.43/MWh, that's a loss of $60 million.	Greenhouse Gas Inventories & Mitigation - Tracking Progress & Refining Emissions Estimates
Methane Pyrolysis	Economic viability of large-scale methane pyrolysis in California	Technoeconomic assessment of centralized methane pyrolysis facilities to produce hydrogen and solid carbon for domestic manufacturing and export markets. Carbon black is used in tires and electrical equipment. Graphite is a high-value product used in lithium-ion batteries. Carbon fiber is a premium product used in carbon-reinforced composite materials. Nanotube carbons are high-value products used in polymers, plastics, and batteries. Needle coke is used in graphite electrodes for electric arc steel furnaces.	Rather than simply consume methane for energy and emit CO2, methane can be converted into hydrogen and solid carbon for use in a variety of industries such as the manufacturing tires, batteries and structural fibers. A commercial pilot plant is being completed in Nebraska by a California based start-up, Monolith Materials. Methane pyrolysis plants could create a source of low-cost, carbon free hydrogen and lead to profitable new markets for solid carbon.	Greenhouse Gas Inventories & Mitigation - Mitigation Options

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Hydrogen Economy	System benefits of hydrogen production and use	Technoeconomic and environmental assessment of green and low-carbon blue hydrogen in California for decarbonized gas, electric power, transportation and industrial sector co-optimization.	Existing studies of the nascent hydrogen economy in California are narrowly focused. A comprehensive assessment and strategy options are now needed to guide public policy.	Sustainable Transportation & Communities - Evaluating and Mitigating GHG Emissions from VMT, Land-Use & Buildings
Hydrogen Economy	California hydrogen economy blueprint	A comprehensive, multisector hydrogen economy development guide.	A hydrogen economy is developing in California. Now is the time to prepare a comprehensive hydrogen plan for the California economy.	Air Quality-Mobile Sources - Potential of Advanced Technology AND Sustainable Transportation & Communities - Evaluating and Mitigating GHG Emissions from VMT, Land-Use & Buildings
Hydrogen Economy	California hydrogen pipeline system feasibility	Technoeconomic assessment of a potential hydrogen pipeline network in California using the existing natural gas system rights of way.	As the natural gas system is decarbonized, transporting low carbon hydrogen will become increasingly important. At this juncture, it is important to understand the opportunities, costs, benefits and environmental impacts of a new hydrogen transmission and distribution system.	Sustainable Transportation & Communities - Evaluating and Mitigating GHG Emissions from VMT, Land-Use & Buildings

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PM-10 Pollution Abatement	PM-10 abatement via linear Fresnel concentrated solar farms	Technoeconomic and environmental assessment of using large linear Fresnel concentrated solar power farms to cover areas of the Owens Lake playa as a method for minimizing dust storms. CEC has supported the development of a low-cost linear Fresnel CSP system that simply rests on low-profile, sheets of water enclosed in UV resistant polymer sheets. This system is currently being demonstrated San Diego State University's Brawly campus.	Owens Lake is the largest single source of PM-10 pollution in the United States. It has caused on average about 19 violations of the standard every year at Keeler during the 18 years that the Great Basin Unified Air Pollution Control District has been measuring particulate matter. Using linear Fresnel CSP systems to cover areas of the basin could mitigate dust storms while producing renewable power and chemicals from local resources.	Air Quality-State Implementation Plans - Emission Reduction Strategies
Combined Water and CO2 Direct Air Capture System	Technoeconomic assessment of Hybrid Direct Air Capture system (HDAC) that effectively captures both CO2 and water cycle.	In HDAC, air is passed over a CO2 selective sorbent using chemisorption principles to remove ≥85% of the CO2 from the air stream. The atmospheric water extraction (AWE) section of the unit involves a novel isothermal pressure swing regeneration cycle. Integrating CO2 sorption and AWE cycles eliminates large thermodynamic inefficiencies of thermal swing regeneration cycles performed in typical AWE designs.	DAC and carbon sequestration will be important to achieving GHG emissions goals. Integrating DAC and AWE into a single overall process may make DAC technology deployable in many more locations with limited water resources, improves financial returns, and reduces risks from volatility in CO2 price.	Greenhouse Gas Inventories & Mitigation - Mitigation Options

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Geological Sequestration	Creating a geological sequestration resource for California	Further development of the 2017 Integrated Carbon Capture and Storage (CCS) Pre-Feasibility assessment of the Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative led by the Electric Power Research Institute, Inc. and DOE. This project will develop an implementation plan for the SSJV area in order to determine the most economical approach to capturing, transporting, and storing large quantities of CO2 in large capacity storage reservoirs (from sources that generate more than 200,000 tons of CO2).	Geological CO2 sequestration is widely recognized as a potential tool for achieving California's GHG emissions goals. A core benefit of the project is the further development of cost-effective storage solutions that improve reservoir storage efficiency while also determining reservoir capacity to within ±30 percent, which is a DOE Carbon Storage Program goal. As part of this effort, C2SAFE will work toward safe, reliable containment of CO2 in geological formations with a goal of 99% storage permanence. The C2SAFE project will also support the Carbon Storage Program mission to develop and advance CCS technologies, for widespread commercial deployment in the 2025-2035 timeframe, that will ensure safe, secure, efficient, and cost-effective CO2 containment in diverse geologic formations.	Greenhouse Gas Inventories & Mitigation - Mitigation Options
CO2 Transportation & Sequestration	Pipeline systems for CO2 transportation and sequestration.	In connection with the Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative, this effort will assess options for transporting CO2 from major point sources by pipeline to CarbonSAFE facilities.	Geological CO2 sequestration is widely recognized as a potential tool for achieving California's GHG emissions goals. This study will initiate the development of a cost-effective CO2 pipeline transportation system in California	Greenhouse Gas Inventories & Mitigation - Mitigation Options