NATIONAL FUEL CELL RESEARCH CENTER
April 10, 2017 Comments on the 2017 Climate Change Scoping Plan Update
The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target
Issued January 20, 2017

The National Fuel Cell Research Center (NFCRC) submits these updated comments on the Proposed Strategy to affirm and emphasize the importance of recognizing fuel cells as a major and critical resource in the California Air Resources Board's (CARB) strategy for a low-carbon future. It is vitally important that this forthcoming update to the Climate Change Scoping Plan includes GHG-reducing fuel cells as a unique technology needed to complement and manage the high penetration of intermittent solar and wind, cornerstones in achieving the California 40% GHG emissions reduction goal by 2030.

Fuel cells address simultaneously the mitigation of CO_2, criteria air pollutants, and short-lived climate pollutants – co-benefits which are all direct or indirect goals of the Scoping Plan. [1]

For CO_2 reduction, the high fuel-to-electrical efficiency of fuel cells significantly reduces the carbon emitted per megawatt-hour, and fuel cells have the capability to be configured for the capture, concentration, and storage of the resulting CO_2. The unusually high operating temperatures of fuel cells enables the cogeneration of heat, steam, or chilled water, thereby displacing conventional carbon emitting sources such as grid electricity, natural gas boilers, and natural gas furnaces. Fuel cells are operating today on biogas, further contributing to the management of carbon. This represents an immediate benefit that may be further expanded as the market for biogas evolves to make cost-effective and accessible renewable biogas supplies widely available. Particularly important, as supply evolves, fuel cells will operate in the future on renewable hydrogen, as the principal strategy to capture and store energy that would otherwise be curtailed. In this mode, the fuel cell will be a firm (24/7) 100% load-following renewable generator.

For criteria air pollutant reductions, fuel cells have the distinct attribute of emitting virtually zero criteria pollutants.

For short-lived climate pollutant reductions, fuel cells are an ideal technology to mitigate emissions because fuel cells:

- Can generate electricity and heat from methane sources otherwise vulnerable to seepage such as landfills, water resource recovery facilities, refineries and dairies.
- Are today capturing and using the exhaust heat to produce chilled water, thereby displacing traditional chlorofluorocarbons (CFC)-based systems and the associated leakage.

[1] In New York the social cost of the pollutants have been estimated at $56/MWh for SO_2 and $5/MWh for NOx in addition to $24/MWh for the social cost of carbon. These estimates were published in the July 1, 2015 Staff White Paper on Benefit-Cost Analysis in the Reforming Energy Vision Proceeding and available online here: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={168B59A0-14A9-4DE3-8B97-DFE25A067CF9}

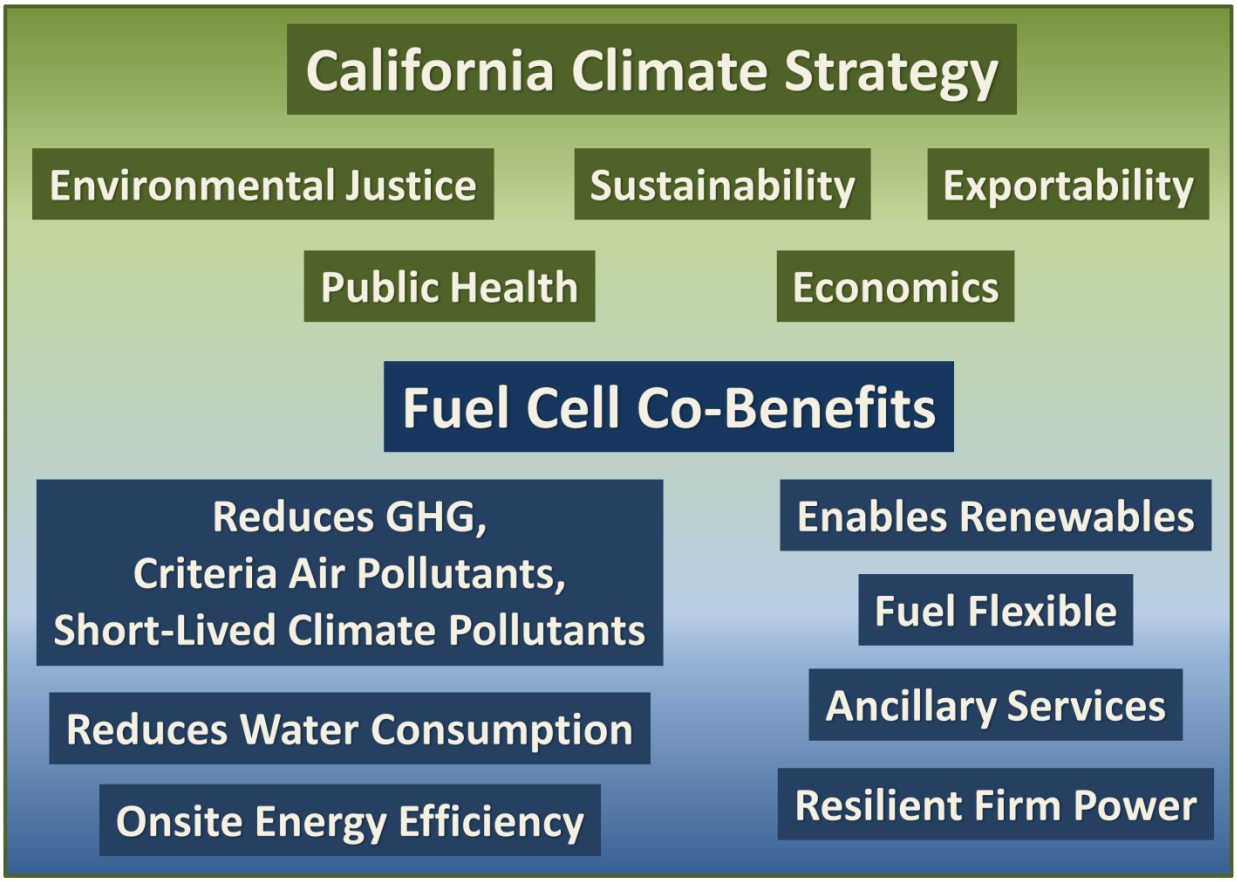

Figure 1: Climate Change Co-Benefits of Fuel Cells

Recommendations

The NFCRC presents the following recommendations to incorporate into the Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target.

IV. KEY SECTORS

A. LOW CARBON ENERGY (page 89)

NFCRC Recommendation: The statement: "*Some power plants may operate more flexibly to balance renewables, emerging resources (including storage) will become more prevalent, and aging facilities may retire and be replaced*" should include "*GHG-reducing fuel cells*" as an example of a flexible power plant that can easily balance renewables.

Cross-Sector Impact: Low Carbon Energy, Water, Natural and Working Lands

Fuel cells have highly dynamic dispatch capabilities to (1) manage the diurnal variation, constrained capacity factor, and intermittencies associated with solar and wind power generators, and (2) increase the maximum penetration of renewable resources that can be accommodated in the utility grid network. These capabilities will result in maximum

sustainability and additional GHG reductions through the integration of renewables and transportation electrification.

GHG-reducing fuel cells are considered the cleanest, most efficient distributed energy resource for utility procurement and firm power. Power generation produced through natural gas combined cycle (NGCC) turbine power plants today meets the majority of electricity demand, but with the concomitant emission of criteria pollutants (e.g., NOx) and efficiencies limited by heat engine constraints. When using natural gas, fuel cells reduce GHG compared to generation from the current grid and generate virtually zero criteria pollutant emissions. Fuel cells operate in a virtual water balance, with no significant consumption of water in normal operations. To illustrate, the use of a 400kW fuel cell system to generate combined heat and power for a building can save over one million gallons of water annually, compared to the water required to generate the same amount of electricity at a central power plant.

Fuel cell systems should be installed expressly to support capacity needs throughout the utility grid network, and rate structures developed to compensate this clean, load-following resource for providing increasingly valuable ancillary services (e.g., ramping, capacity, voltage and frequency support) to the utility grid network. The purpose for installing and operating fuel cell systems in a highly dynamic environment is to directly complement intermittent renewable power generation throughout the state, and improve the reliability and stability of the utility grid network's high use of renewable power generation. [2,3] These attributes of stationary fuel cell technology serve as another primary example of exportability.

Fuel cells also operate on biogas, with over 30% of the power generated by fuel cells in California today produced from biogas. When operated on biogas, fuel cells generate electricity and heat (and bio hydrogen if appropriately configured), with zero net carbon emitted. Fuel cells are also capable of operation on renewable hydrogen in response to the evolution of a supply associated with the generation, storage, and utilization of wind energy that would otherwise be curtailed. As a result, the exportability of stationary fuel cell technology is ubiquitous across a spectrum of applications associated with a zero-carbon grid. In addition, the energy density of fuel cell systems significantly reduces the land footprint required for onsite generation allowing for deployment in high density areas and increased acreage available for habitat restoration and preservation.

Distributed Resource Planning allows for GHG-reducing fuel cells to be included in bidding for all utility-scale procurements. As part of Distributed Resource procurements, fuel cells can provide unique co-benefits. As yet another example of exportability, large-scale fuel cell systems are deployed today on the utility side of the meter to create grid support solutions where transmission is constrained or increased reliability is sought. Referred to as "Transmission Integrated Grid Energy Resource" or "TIGER" stations, these resources are

[2] Maton, Jean-Paul, Zhao, Li, and Brouwer, Jacob, *Dynamic modeling of compressed gas energy storage to complement renewable wind power intermittency*, International Journal of Hydrogen Energy, Volume 38, pp. 7867-7880, 2013.

[3] Shaffer, Brendan, Tarroja, Brian, Samuelsen, Scott, *Dispatch of fuel cells as Transmission Integrated Grid Energy Resources to support renewables and reduce emissions*, Applied Energy, Volume 148, 15 June 2015, Pages 178-186.

providing clean, 24/7, load-following power generation to complement the increasing deployment of intermittent solar and wind resources and support grid reliability in locations where it is most needed – including in disadvantaged communities. Examples range from a 15MW system in Connecticut, to a 30MW system in Delaware, to a 59MW system in Seoul, Korea.

IV. KEY SECTORS

B. INDUSTRY

3. Efforts to Reduce Greenhouse Gases

***Potential Additional Actions* (pages 97-98)**

<u>NFCRC Recommendation:</u> Support tariffs for onsite clean heat and power generation and efficiency upgrades by adding "tariffs" to the statement: "*Identify new funding for grants <u>and tariffs</u> for onsite clean technology or efficiency upgrades*."

Cross-Sector Impact: Low Carbon Energy, Industry

Page 98 of the Discussion Draft suggests that the State "*Identify new funding for grants for onsite clean technology or efficiency upgrades*" as a Potential New Measure for the Industry Sector to reduce GHG emissions. To help ensure a reliable source of funding, rather than seeking to identify only grant funding, the NFCRC recommends instituting tariffs that facilitate the use of onsite clean and efficient energy generation and replicating these tariffs across the State. As a premier clean technology, combined heat and power programs should identify fuel cells as the cleanest, most efficient method to produce on-site heat and power. In addition to generating electrical power, stationary fuel cells have the capability to cogenerate a thermal product. This option, referred to as Combined Cooling, Heat, and Power (CCHP), is to capture and utilize the heat produced by the fuel cell for the provision of cooling, heat, hot water, or steam. This results in overall fuel cell system efficiencies (electrical power generation and use of the captured thermal energy) ranging from 55% to 80%[4] and, with a judicious design, exceeding 90%.[5] This attribute also displaces the fuel and emissions that would otherwise be associated with (1) boilers when using the thermal energy as heat, and (2) the displaced electricity to drive chillers when using the thermal energy for cooling. The resultant effect is to dramatically reduce CO_2 emissions, criteria pollutant emissions, and the demand on fuel reserves. In contrast to combustion heat engines, fuel cells are unique in providing high fuel-to-electricity efficiency and high quality (i.e., high temperature) heat, as well as producing virtually zero emission of criteria pollutants.[6]

[4] Darrow, K., et al., Catalog of CHP Technologies 2015: Available at http://www.epa.gov/sites/production/files/2015-07/documents/catalog_of_chp_technologies.pdf (Accessed January 12, 2015).

[5] Ellis, M.W., M.R. Von Spakovsky, and D.J. Nelson, *Fuel cell systems: efficient, flexible energy conversion for the 21st century.* Proceedings of the IEEE, 2001. 89(12): p. 1808-1818.

[6] *Supplemental Report: The Science of Fuel Cells; Assessment of Fuel Cell Technologies to Address Power Requirements at the Port of Long Beach.* MacKinnon, M and Samuelsen, S. Advanced Power and Energy Program, University of California Irvine, April 31, 2016.

Stationary fuel cells can be used to improve the quality of power provision and infrastructure where it is truly needed, while also contributing to cleaner air and improved health of citizens. In fact, fuel cells are suitable for citing near or even inside buildings, due to virtually zero pollutant emissions and being acoustically benign, and the avoidance of the challenges related to permitting and zoning.

IV. KEY SECTORS

A. LOW CARBON ENERGY

3. Efforts to Reduce Greenhouse Gases

***Potential Additional Actions* – Electricity (page 92)**

NFCRC Recommendation: Add the retirement of diesel generators to the phrase: *"Accelerate the deployment of fuel pumps and the retirement of diesel generators."*

IV. KEY SECTORS

B. INDUSTRY

3. Efforts to Reduce Greenhouse Gases

***Potential Additional Actions* (pages 97-98)**

NFCRC Recommendation: Include incentives for the retirement of existing diesel backup generators in the phrase: *"Identify new grants or tariffs* (see previous recommendation) *for onsite clean technology, efficiency upgrades and the retirement of diesel generators."*

NFCRC Recommendation: Apply the low emission diesel standard to diesel generators.

Cross-Sector Impact: Low Carbon Energy, Industry, Natural and Working Lands Including Agricultural Lands, Water

As stated previously, fuel cells can significantly reduce GHG emissions, short-lived climate pollutants and criteria air pollutant emissions, while increasing the resiliency and reliability of the electricity supply to consumers. The ability of fuel cells to provide constant, high quality power in a primary or backup role has increasing importance due to reliance on electronics by many essential industries that include banking, communication, and telecommuting. There are additional concerns that the vulnerability of an aging electrical grid in many locations could result in increasing susceptibility to outages. Because grid outages cause significant costs and other detriments, the ability of fuel cells to generate backup power independent of the grid or to operate as a building's primary source of power is particularly beneficial to consumers who must have constant availability of high quality power to maintain critical operations. Examples of such entities include data centers, banks, hospitals, grocery stores, and government agencies. Fuel cells have successfully demonstrated this ability during recent regional grid outages (e.g., September 2011 San Diego county) and major natural disasters (e.g., Superstorm

Sandy and Hurricane Irene) by providing power to essential telecommunication technologies, grocery stores, and storm shelters.[7]

The Distributed Generation (DG) model has the potential to introduce new sources of pollutant emissions into urban airsheds with large populations and thereby raising concerns for human health in areas of California that include the South Coast Air Basin (SoCAB), and San Joaquin Valley[8]. SoCAB currently suffers from poor air quality and faces major challenges in achieving clean air for the many citizens that live and work within its boundaries. This is particularly true for economically disadvantaged communities that are often disproportionately burdened by air pollution. Therefore, DG technologies such as fuel cells that can provide clean, efficient energy conversion for many different industries and applications can also provide a wide range of energy, environmental, and economic benefits that have significant value to the State.

In addition to accelerating the retirement of gas furnaces and gasoline vehicles, the Plan should accelerate the retirement of diesel generators that are often used in industrial and agricultural operations. Beyond the existing waiver of permitting requirements for fuel cell systems, the California Air Districts should incentivize the replacement of diesel backup generators with fuel cells. Recognizing the superior co-benefits of fuel cells, a program should be created to both limit new permitting of diesel generators for primary generation and to encourage the adoption of fuel cell systems instead of diesel generators for onsite and backup power.

IV. KEY SECTORS

C. TRANSPORTATION SUSTAINABILITY

3. Cross-Sector Interactions (pages 103-104)

<u>NFCRC Recommendation:</u> Replace the phrase *"Hydrogen fuel cell vehicles can help expand renewable energy production, but may require additional electric generation capacity to accommodate the energy demand associated with hydrogen production and may require more fuel storage and pipeline infrastructure."* (Page 104)

With the phrase:
"Hydrogen fuel cell electric vehicles at the ports can mitigate both the emission of greenhouse gases and criteria pollutant emissions. The integration of stationary fuel cell systems could enable the local production of renewable hydrogen and thereby enable a self-contained sustainable energy and transportation system at the ports, and support the fueling of imported hydrogen fuel cell electric vehicles that are processed through the ports today, and the growing volume expected in the future."

[7] *Supplemental Report: The Science of Fuel Cells; Assessment of Fuel Cell Technologies to Address Power Requirements at the Port of Long Beach.* MacKinnon, M and Samuelsen, S. Advanced Power and Energy Program, University of California Irvine, April 31, 2016.

[8] Carreras-Sospedra, M., et al., *Central power generation versus distributed generation-An air quality assessment in the South Coast Air Basin of California*. Atmospheric Environment.

Cross-Sector Impact: Transportation Sustainability, Low Carbon Energy, Industry, Natural and Working Lands

Ports are mentioned in the overall discussion of the Sustainable Transportation Sector on page 98 of the Proposed Strategy and should be specifically addressed with potential measures. The ports of California face both challenges and opportunities in managing and meeting future energy and public health requirements. The available fuel cell technologies can facilitate meeting future energy requirements and contribute co-benefits to port energy and environmental goals,[9, 10] and goals of the environmental justice community. Power generation can be provided at various magnitudes by solid oxide fuel cells (SOFC), molten carbonate, and phosphoric acid fuel cell systems, while combined cooling, heat, and power applications from the same systems can further enhance environmental and energy benefits, and reduce costs. Tri-generation systems that produce on-site hydrogen, electricity, and high quality recoverable heat represent a system and application that can support both port operations and customer requirements. In contrast to other combustion-based self-generation technologies, fuel cells have the benefits of zero local pollutant emissions, very low GHG emissions, and virtually net zero water consumption.[11]

As an example, the Port of Long Beach (POLB), located in the South Coast Air Basin of southern California, generates high levels of health damaging air pollution that leads to degraded air quality in the region. The deployment of GHG-reducing stationary fuel cell systems provides a means of distributed self-generation for the POLB without additional emissions from port operations.[12] This key co-benefit is unique to fuel cells because other combustion-driven self-generation methods such as natural gas turbines and reciprocating engines have pollutant emissions which produce air quality and permitting challenges. The use of fuel cells for stationary power provides a path for the POLB to secure its resilient energy island future while reducing local criteria pollutant emissions that provide improvements in regional air quality with health benefits to disadvantaged communities in the surrounding area. Specifically, reductions in pollutants will assist the POLB in meeting goals established under the San Pedro Bay Ports Clean Air Action Plan[13] and the Green Port Policy. [14, 15]

In summary, this NFCRC recommendation refocuses the statement on page 104 to the opportunities and possibilities of the integration of hydrogen fuel cell electric vehicles and stationary fuel cell systems at the ports to both mitigate GHG and criteria pollutant emissions.

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[9] *Requirements at the Port of Long Beach.* MacKinnon, M and Samuelsen, S. Advanced Power and Energy Program, University of California Irvine, April 31, 2016.

[10] Assessment of Fuel Cell Technologies to Address Power Requirements at the Port of Long Beach. MacKinnon, M and Samuelsen, S. Advanced Power and Energy Program, University of California Irvine, June 28, 2016. http://polb.com/environment/energyisland.asp

[11] *Assessment of Fuel Cell Technologies to Address Power Requirements at the Port of Long Beach.* MacKinnon, M and Samuelsen, S. Advanced Power and Energy Program, University of California Irvine, June 28, 2016.

[12] Ibid.

[13] http://www.cleanairactionplan.org/

[14] http://www.polb.com/environment/green_port_policy.asp

[15] *Assessment of Fuel Cell Technologies to Address Power Requirements at the Port of Long Beach.* MacKinnon, M and Samuelsen, S. Advanced Power and Energy Program, University of California Irvine, June 28, 2016.

The issue of requiring additional electric generation capacity is therefore resolved with a system level proposal for a self-contained sustainable energy and transportation system at the ports, and support for the fueling of hydrogen fuel cell electric vehicles.

IV. KEY SECTORS

E. WASTE MANAGEMENT

3. Efforts to Reduce Greenhouse Gases

***Potential Additional or Supporting Action* (page 125)**

<u>NFCRC Recommendation:</u> The NFCRC supports the use of available capacity at wastewater treatment plants that have digesters to process food waste.

F. WATER

2. Cross-Sector Interactions (page 128)

<u>NFCRC Recommendation:</u> Hydrogen should be added to the list of useful byproducts produced at wastewater treatment plants.

F. WATER

3. Efforts to Reduce Greenhouse Gases

***Potential Additional or Supporting Action* (page 130)**

<u>NFCRC Recommendation:</u> In the section: "*In support of the Short-Lived Climate Pollutant Strategy, encourage resource recovering wastewater treatment projects to help achieve the goal of reducing fugitive methane by 40 percent by 2030, to include:*"

add an additional bullet with the phrase:
***"Fuel cells that are integrated into Wastewater Treatment Plants for both onsite heat and power generation and the production of renewable hydrogen."* (page 130)**

<u>NFCRC Recommendation:</u> "*Hydrogen production"* should be included in the action to incentivize methane capture systems at wastewater treatment plants. (page 130)

Cross-Sector Impact: Water, Waste Management, Transportation, Natural and Working Lands

Fuel cells at wastewater treatment plants are an ideal nexus of the energy, water and waste sectors. Stationary fuel cells, fueled by biogas from these facilities that would otherwise be flared, produce 24/7 renewable electricity that is used to power the facility, and heat that is directly used to heat the digester, resulting in a sustainable, zero emission system. The provision of a capability to tri-generate and dispense hydrogen has been successfully demonstrated at the Orange County Sanitation District. In addition to virtually zero emission of criteria pollutants, regardless of fuel source, fuel cell systems consume net-zero water in the production of power.

The use of fuel cells at wastewater treatment plants additionally sets a precedent for the expansion of fuel cells powered by anaerobic digester gas in other industries, such as wineries, breweries, confined animal feeding operations (CAFOs), food processing facilities[16], and other sites processing organic waste through anaerobic digestion.

II. THE PROPOSED SCENARIO

A. PROPOSED SCOPING PLAN SCENARIO

20 Percent Reduction in GHGs at Refineries (page 38)

<u>NFCRC Recommendation:</u> "*GHG-reducing fuel cells"* should be included in the list of potential actions and energy efficient technologies to address the need for refinery facilities to be more efficient and reduce emissions, facilities that would be identified in consultation with local air districts and ARB.

Cross-Sector Impact: Industry, Natural and Working Lands

GHG-reducing stationary fuel cells can seamlessly integrate in multiple ways to support on-site processes at refineries. These devices provide a high efficiency, synergistic, and modular means of producing clean electricity and high quality heat to meet the myriad of 24/7 electric and thermal loads associated with refinery operations. In addition: (1) fuel cells that are configured for tri-generation can provide throttled levels of hydrogen as input into distillation processes, and support hydro-desulfurization and hydrocracking operations, (2) because fuel cells have the ability to utilize renewable biogas sources such as anaerobic digester gas from the digestion of sewage bio-sludge, food waste, or landfill gas, they can provide an avenue for refineries to credit a portion of their fuel production operations and the fuel itself as renewable, and (3) with regard to the refinery waste stream, fuel cells have the capability of efficiently separating CO_2 from flue gas of refinery boilers for sequestration or transportation to a dedicated industrial use.

IV. KEY SECTORS

C. TRANSPORTATION SUSTAINABILITY

1. Looking to the Future (page 103)

The Clean Fuel Goals include: "*Promote research development and deployment of low carbon fuels such as RNG and renewable hydrogen*."

<u>NFCRC Recommendation:</u> The sources of and infrastructure for biogas should be researched and developed throughout the state. The promotion of research,

[16] *Fuel Cells at Wastewater Treatment Plants,* Fuel Cell and Hydrogen Energy Association. www.fchea.org

development and deployment of low carbon fuels should not be limited to transportation, and should include stationary uses as well.

IV. KEY SECTORS

A. LOW CARBON ENERGY

3. Efforts to Reduce Greenhouse Gases

***Ongoing and Proposed Measures – Natural Gas* (page 91)**

E. WASTE MANAGEMENT

3. Efforts to Reduce Greenhouse Gases

***Ongoing and Proposed Measures* (page 124)**

<u>NFCRC Recommendation:</u> The NFCRC supports the measure for the CEC to develop recommendations for the development and use of renewable gas as part of the 2017 Integrated Energy Policy Report, and to ultimately adopt policies and incentives to significantly increase sustainable production and use of renewable gas in both the transportation and energy sectors.

Cross-Sector Impact: Low Carbon Energy, Transportation Sustainability, Waste Management

The NFCRC supports the recommendation to increase the utilization, and thus availability, of renewable natural gas from biogas (page 92). One of the major attributes of fuel cells is the capability to operate on biogas sourced from water resource recovery facilities, landfills, food processing plants, confined animal feeding operations (CAFOs), and other sites processing organic waste via anaerobic digestion. An important component to a sustainable future is the availability of biogas, and the infrastructure to utilize the biogas in the state of California. A recent report from the California Energy Commission has mapped the biogas resources in the state and the pathways for the utilization of the biogas[17] and its many associated co-benefits. Fuel cells represent a key clean technology for the utilization of the biogas and the production of renewable electricity and heat, and (as appropriate) the generation of bio hydrogen. New research and development initiatives, focused on the development of biogas resources and infrastructure, should be implemented.

As the grid evolves, California will not reach a 100% renewable goal without a technology that provides clean, firm, renewable, and load-following power. While electric battery technology will be valuable, power-to-gas and hydrogen storage battery technology will be the anchor to capturing the vast majority of otherwise curtailed renewable resources for later use. Fuel cells are the one technology that has evolved to utilize the renewable hydrogen and provide the clean, 24/7 load-following capability to manage and buffer the dynamics of solar and wind.

[17] *Air Quality and Greenhouse Gas Emissions Impact Assessment from Biomass and Biogas Derived Transportation Fuels and Electricity and Heat Generation, California Energy Commission*, CEC-500-2016-022, March, 2015.

IV. KEY SECTORS

A. LOW CARBON ENERGY

3. Efforts to Reduce Greenhouse Gases

***Ongoing and Proposed Measures* – Electricity (pages 90-91)**

<u>NFCRC Recommendation:</u> The Scoping Plan should reiterate support for continued inter-agency collaboration in streamlining the interconnection process, as stated in the previous Scoping Plan.

Cross-Sector Impact: Low Carbon Energy, Water, Natural and Working Lands

Fuel cell systems continue to experience barriers to adoption in the interconnection process. In order to realize the significant co-benefits of GHG and criteria air pollutant reduction, streamlined processes for interconnection in utility territories statewide should be developed.

The First Update to the Scoping Plan called for:

> *A CPUC proceeding to continue to streamline state jurisdictional interconnection processes to create a ministerial low-cost interconnection process for distributed generation completed by the end of 2015. The CEC to explore similar streamlined processes for interconnecting distributed generation in publicly owned utility systems. The CPUC and CEC consult as appropriate with the CAISO as part of these proceedings.*[18]

This recommendation to streamline the interconnection process for distributed generation remains relevant and continues to require interagency cooperation. The NFCRC requests that the Scoping Plan Update again include this interconnection recommendation, to enable the vast deployment of clean technologies in the Electricity Sector, as outlined in the Plan.

<u>Summary</u>

The NFCRC works with Bloom Energy, Doosan Fuel Cell America, Fuel Cell Energy, GE-Fuel Cells, and LG Fuel Cell Systems, Inc. These organizations request the inclusion of fuel cells in the Climate Change Scoping Plan through the above recommendations:

Sincerely,

Dr. Scott Samuelsen, Director
National Fuel Cell Research Center
Professor of Mechanical, Aerospace, and Environmental Engineering
University of California, Irvine

[18] *First Update to the Climate Change Scoping Plan, Building on the Framework, Pursuant to AB 32 The California Global Warming Solutions Act of 2006*, May 2014. California Environmental Protection Agency, Air Resources Board.