SolarCity

March 24, 2016

Chairman Mary Nichols
California Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: Aliso Canyon Draft Mitigation Program

Dear Chairman Nichols,

SolarCity respectfully submits the following comments on the draft Aliso Canyon mitigation program.

Background

SolarCity is a full service solar power provider for homeowners and businesses – a single source for engineering, design, installation, monitoring, and support. At present, the company has more than 6,000 California employees, based at more than 30 facilities around the state and has installed solar energy systems for over 230,000 customers nationwide as of December 31, 2015.

In addition to rooftop solar, SolarCity develops and deploys other non-solar distributed energy resources (DER) for both residential and commercial applications. Specifically, SolarCity offers smart thermostats and battery energy storage systems to help customers manage their energy use. Accordingly, SolarCity has a strong interest deploying technologies that help reduce the state's greenhouse gas (GHG) emissions and meet its climate and clean energy goals.

Overall Comments

SolarCity commends the leadership of the California Air Resources Board (ARB) and staff in developing the Aliso Canyon mitigation program in a timely and efficient manner. We therefore appreciate the opportunity to comment in particular on the secondary areas of program emphasis recommended by ARB including promoting sustainable energy infrastructure and the value of electric water heating paired with renewables in achieving the GHG emission reduction goals.

Promoting Sustainable Energy Infrastructure – electric water heating

As part of the "Promoting Sustainable Energy Infrastructure" as a secondary area of emphasis of the draft mitigation program, ARB incudes several examples of projects that would decrease reliance on fossil fuels, reduce greenhouse gases, and promote energy efficiency and renewable energy resources. One example cited is to include "new or enhanced incentives or subsidies to replace appliances that consume fossil fuels (e.g. gas water heaters and furnaces) with devices that or systems that rely on renewable energy." [1] Furthermore, ARB recommends that the emission reductions under the mitigation program occur within the next five to 10 years, which recognizes that it may take some time to get certain projects started, but also implies the need for a relatively near term solution.[2] SolarCity agrees with ARB that providing incentives for replacing fossil fuel appliances is an essential strategy for moving California toward its long term GHG emission goals. In particular, we believe that incentivizing consumers to switch

[1] Aliso Canyon draft mitigation program, p. 11 *available at* http://www.arb.ca.gov/research/aliso_canyon/draft_aliso_canyon_mitigation_program_03142016.pdf
[2] *Id.,* p.7

SolarCity

to electric water heating powered by carbon-free solar electricity is a near term strategy that will not only provide the desired emission reduction benefits but also prove cost effective.

More than ten million California homes burn natural gas to heat their water today[3], consuming over 150 trillion BTUs of fossil energy pear year.[4] By switching the heating fuel source from natural gas to solar-generated electricity in these homes, over 8 million metric tons of greenhouse gas emissions could be avoided annually, yielding societal benefits of $550 million per year based on the Environmental Protection Agency's (EPA) societal cost of carbon ($36 per metric ton).[5] Over the life of these water heaters, more than $11 billion of nominal greenhouse gas benefits could be created.

As important, these electric water heaters could significantly increase California's capability to cost-effectively integrate additional solar energy, further decarbonizing California's energy sector. Widespread electrification of water heating with controls could unlock an additional 20 gigawatts (GW) of solar hosting capacity on California's grid, more than the total amount of solar installed in California today. In addition to reducing California's greenhouse gas emissions another 11.5 million metric tons per year[6], 20 GW of solar-enabled electric water heating would produce enough energy for 5 million California homes and avoid $3 billion annually in energy purchases from conventional resources, among other benefits.[7] Further benefits would be delivered by these systems in the form of peak demand capacity, conservation voltage reduction, and reactive power support, among others. Additional details on the full benefits of rooftop solar can be found at www.solarcity.com/gridx.

Solar-paired electric water heaters materially reduce natural gas consumption in homes and can enable significantly more solar energy to connect to California's electric grid in the future. We believe that Aliso Canyon mitigation presents an important opportunity to begin the work of electrifying California's residential water heating – a task critical to ensuring California can meet its long term decarbonization goal of reducing GHG emissions level to 80% below 1990 levels by 2050.[8]

Electric Water Heating Paired with Solar PV

In 2015, California residents installed roughly 1,000 MW of rooftop solar Photovoltaic (PV) systems, eliminating or substantially reducing the use of carbon-intensive grid electricity at around 200,000 homes. While this achievement in itself significantly reduced the state's natural gas consumption, those households could have reduced natural gas use even further for a small additional cost if they had added extra solar PV panels and switched from natural gas to electric water heaters programmed to heat water in the daytime using solar-generated electricity.

The idea of using rooftop solar PV to heat water using an electric resistance water heater – which effectively acts as a battery, storing the solar-generated energy – is not novel. In Hawaii, where electricity prices are high, the practice of installing programmable electric water heaters to store solar energy is beginning to gain traction. While abnormally low natural gas prices in California make the economics of switching away from natural gas water heating a challenge for residential customers, a relatively small

---

[3] U.S. Energy Information Administration, Residential Energy Consumption Survey, Water Heating in U.S. Homes, 2009.
[4] Based on average water heater usage (64 gallons per day) and typical natural gas heater efficiency (60%) across 10.3 million homes in California relying on natural gas for water heating.
[5] Based on the EPA's 2015 Societal Cost of Carbon with a 3% societal discount rate. https://www3.epa.gov/climatechange/EPAactivities/economics/scc.html
[6] Based on a California grid-electricity emissions rate of 360 kg CO2/MWh.
[7] Assuming 1600 kwh/kw-year average solar production and 6,500 kwh/year average residential consumption based on EIA California residential data.
[8] CA Executive Order B-30-15.

state rebate would likely kick-start this market and bring the practice of pairing solar PV with electric water heating more into the mainstream.

Grid Services

In addition to pairing electric water heaters with solar PV to eliminate natural gas use for water heating, switching to electric water heaters even without solar PV can be an effective strategy for reducing natural gas use, as long as those water heaters are able to respond to grid needs and heat water at times when the carbon content of electricity is low. As California increases its supply of large-scale solar PV resources, there will be an increasing need for end-uses that can shift consumption into the daytime hours. Technologies like grid-enabled electric water heating can not only absorb excess renewable power at certain times of the year, but they can also provide grid services and reduce the need for certain types of flexible fossil generation.[9]

In its basic form, grid enabled electric water heating allows the water in the tanks to be heated at times when renewables are powering the grid and the cost of generating power is low, storing the hot water in the tank for when households need to use it. With regard to grid-wide value, grid enabled electric water heaters can be operated in a dynamic manner that provides a firm resource to decrease or completely eliminate electric water heater power consumption during peak demand periods as well as offering firm capacity and ancillary services that can be managed directly by the grid operator with no adverse impacts to customer comfort or costs. Deploying electric resistance water heaters enabled as grid integrated electric water heating at scale has the ability to positively impact grid operations and reduce the overall cost to deliver energy to customers. These strategies can be extended beyond the usual critical or high grid load demand response events and applied on a daily basis, which helps to reliably flatten demand and supply peaks on the electric grid.

Sequencing and Prioritization

In the medium term, as California approaches a 50% Renewable Portfolio Standard (RPS) by 2030 and renewable integration challenges become more acute, the state should seek to promote stand-alone grid enabled electric water heating, which can help the state integrate larger amounts of variable renewable power and help with grid balancing issues. In the immediate term, however, the state should focus its efforts on electric water heating paired with solar PV in order to take advantage of the economies of scale and opportunity to "kill two birds with one stone" by replacing natural gas water heating at the same time the customer is installing solar PV for electric needs.

Need for Incentives

California currently seeks to reduce natural gas use in water heating through the California Solar Initiative (CSI)-Thermal program, which offers rebates for solar thermal water heating systems that use solar thermal collectors with heat exchangers to reduce (but not completely eliminate) the amount of natural gas used in domestic water heating.

While solar thermal systems have a place in California's energy mix, there are likely instances where it would be more cost-effective to use solar PV and electric water heating to eliminate natural gas use. For example, in cases where a homeowner is already installing solar PV to reduce electric demand, the customer could leverage the economies of scale from the solar PV installation by adding an additional 5-

[9] NRDC and NRECA, "The Hidden Battery Opportunities in Electric Water Heating," available at http://www.nreca.coop/wp-content/uploads/2016/02/The-Hidden-Battery-01-25-2016.pdf

SolarCity

10 panels and switching the natural gas water heater to an electric water heater with controls that allow it to charge with daytime solar energy.

Under the CSI-Thermal program, residential customers can earn rebates of up to $4,366 for installing a solar thermal water heater that costs roughly $9,000[10] and reduces natural gas usage in water heating by 50 - 80%.[11]By contrast, there are no incentives available for electric water heaters paired with solar PV, which can eliminate 100% of the home's natural gas used for water heating.

It is also important to note that due to limited roof space, a customer might not be able to install both a solar PV system and a solar thermal system, and thus the installation of a solar PV system might preclude the customer from installing a solar thermal system. SolarCity feels the state is missing a critical opportunity to address natural gas in domestic water heating that could be captured at the time customers install a solar PV system, simply by sizing the PV system slightly larger and switching to controllable or grid-enable electric water heating.

In spite of the favorable economics for solar PV paired with electric water heating, the state's extraordinarily low natural gas prices provide relatively little incentive for customers to make the investment in an electric water heater and in general, do not provide a competitive environment for electric water heaters. Thus, in order to overcome market barriers in the near term and foster market transformation of this technology, SolarCity recommends the state offer residential customers rebates for electric water heaters paired with solar PV and designed to work using solar-produced electricity.

SolarCity estimates that with a rebate of $3,000 to $4,000 per water heater customers would be sufficiently motivated to replace their natural gas water heater with electric at the same time they install a solar PV system. This rebate should not be taken from CSI-Thermal program funds, as SolarCity feels the development of the solar thermal market is important and should have a dedicated source of funding. Instead, SolarCity recommends using cap and trade funding, which is specifically intended to incent technologies that reduce greenhouse gas emissions.

Utilize Cap and Trade Proceeds

While this mitigation program of switching from natural gas to PV-powered electric water heating directly addresses a response to Aliso Canyon, it also serves the larger purpose of moving the state away from natural gas resources in favor more reliable, cleaner energy sources. It is widely acknowledged that many end uses currently relying on fossil fuels will need to be electrified in order to meet the state's 2050 climate goals. In addition to transportation, some switching of building end uses from natural gas to electricity will be an important measure needed to meet these goals.[12]Therefore, we believe there is a larger opportunity to utilize cap and trade program proceeds to establish a program to incentivize electric water heating.

---

[10] CSI-Thermal Program data: http://csithermalstats.org/

[11] U.S Department of Energy: http://energy.gov/energysaver/estimating-cost-and-energy-efficiency-solar-water-heater

[12] CARB's First Update to the Climate Change Scoping Plan, finalized in May 2014, notes that academic studies of achieving the 2050 goal have concluded that reaching this goal "will require energy demand reduction through efficiency and activity changes; large-scale electrification of on-road vehicles, buildings, and industrial machinery; decarbonizing electricity and fuel supplies; and rapid market penetration of efficiency and clean energy technologies that requires significant efforts to deploy and scale markets for the cleanest technologies immediately." See CARB, First Update to the Climate Change Scoping Plan (May 2014), at p. 32, available at http://www.arb.ca.gov/cc/scopingplan/document/updatedscopingplan2013.htm.

SolarCity

To address the Aliso Canyon gas leak, the state could implement an emergency program as soon as this summer offering rebates to customers in the affected area who switch to electric water heaters designed to work in concert with a solar PV system. Lessons learned from this limited program could then be applied to creation of a statewide program for PV + electric water heating designed to help meet the state's long-term climate goals. At some point in the future, the state will likely want to begin incentivizing stand-alone grid-enabled electric water heating to help with renewable integration.

Disadvantaged Communities

Disadvantaged communities can directly and indirectly benefit from water heating paired with solar PV through elimination of natural gas bills. A successful incentive program for this technology could easily be incorporated into the state's existing low-income solar programs and potentially into new programs currently under consideration at the California Public Utilities Commission (CPUC).

Conclusion

It is important that the secondary areas of emphasis proposed by ARB in the mitigation program are given consideration. The state should strongly consider a program in the near term to promote electric waters heaters paired with solar PV in order to take advantage of the opportunity to eliminate an additional source of natural gas use when homes install rooftop solar systems. In the medium term, the state should pursue strategies to promote renewables and incentivize grid enabled electric water heating to reduce reliance on natural gas and provide renewable integration benefits. This has the potential to move the state towards a cleaner, less expensive and more resilient electric grid that achieves California's ambitious climate goals in a cost-effective manner.

SolarCity thanks the Air Resources Board for the opportunity to comment on the draft Aliso Canyon mitigation program. We look forward to providing any additional details that may be helpful as you evaluate the mitigation program in the broader context of reducing California's greenhouse gas emission.

Respectfully submitted,

Damon Franz
Director, Policy and Electricity Markets
SolarCity