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Poor Resiliency with Rooftop Solar

To Whom It May Concern:
For Docket #: 19-BSTD-03 Project Title: 2022 Energy Code Pre-Rulemaking

Please repeal the 2019 Building Code making all-electric residential construction a mandate. Choice for homeowners to use natural gas as an option must be restored to ensure choice and resiliency.

Resiliency is best served by allowing residents to enjoy the services of both gas and electric. The attached April 12, 2021 submission reflects some of the reasons to repeal the rooftop solar mandate, forestall any natural gas bans, and exclude mandates for residential battery systems â€“ Poor Resiliency with Rooftop Solar_RKK_April 12 2021.

Thank you for your consideration,
â€¦Rob

Additional submitted attachment is included below.

Poor Resiliency and Lowered Electric Quality with Rooftop Solar

"The shortcomings of photovoltaic (PV) solar as a DER [Distributed Energy Resource] that actually contributes to resiliency are annoyingly self-evident: Suffice it to say that when the sun doesn't shine, or the grid goes down, PV solar alone isn't contributing much of anything useful toward resiliency."

– Michael Boswell, Concord Engineering, January 2021

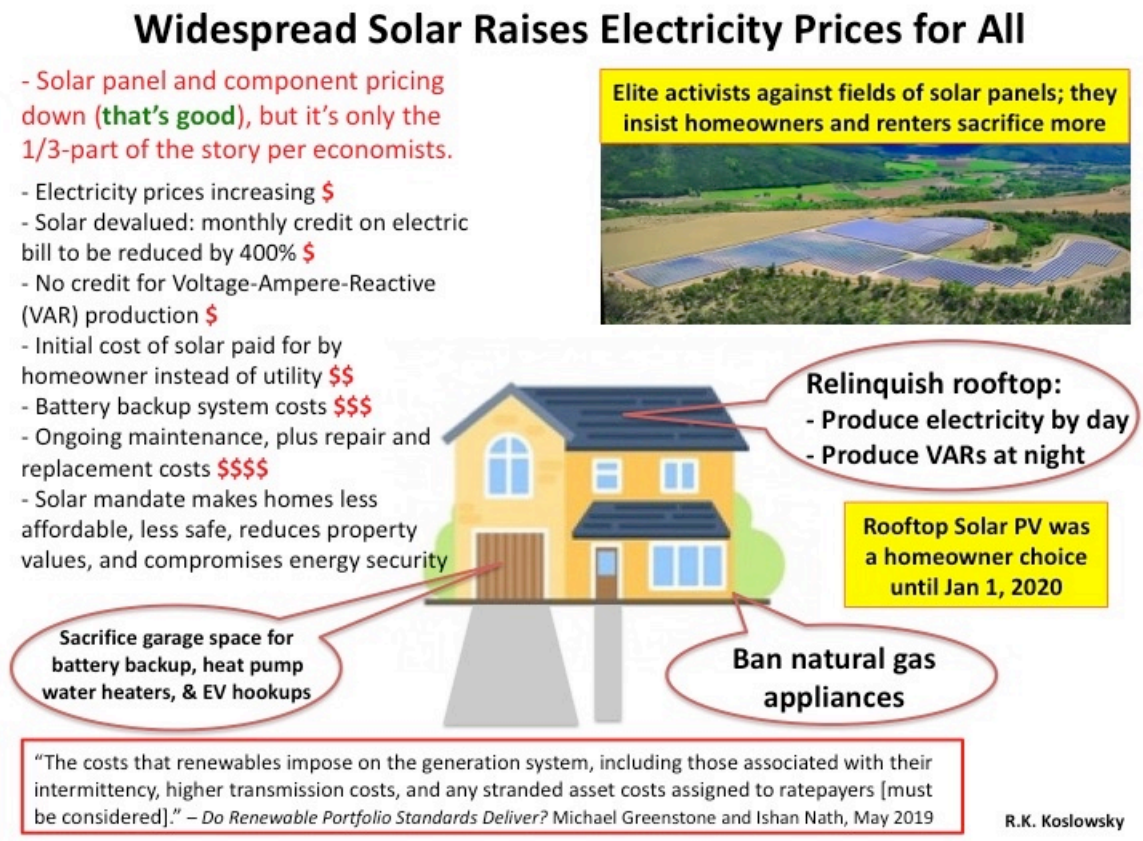
"And what happens with wind is that you can't control the fuel source and the same thing with solar. So if the wind blows strongly, there's more electricity going into the grid. There's some adjustments now you can do to the wind turbines to try to even it out. But essentially, it's up to the wind. And with solar, it's even worse, actually, because for one thing, the sun goes down at night, so there's no solar electricity except for during the daytime."

– Gretchen Bakke interview on NPR's *Fresh Air*, August 22, 2016

"People like to think energy storage will be a battery but it needn't be," argues Gretchen Bakke, author of *The Grid* (p.226). She adds, "In fact, limiting our imagination in this way from the start is probably the worst thing we can do as we move into the twenty-first century." As the anthropologist Akhil Gupta reminds us: "We need to reimagine electricity use in the future that does not simply seek to extend patterns in the present."

Rooftop solar mandates force our hand in this regard. "The solar revolution is already well under way, and its particular failings (solar's diurnal cycle, its minute-to-minute jitter, and its tendency to overload the grid midday) are pushing us right now toward a broader imagination of 'other possible electric futures' for storage, for more efficient design of everything from house walls to clothes dryers, as much as how, where, for whom, and by whom electricity gets made."

The rooftop solar plus coming residential battery back-up systems results in significantly higher housing costs and offers third-rate resiliency as documented previously. Even social justice warriors are against rooftop solar and the associated inequity of net metering rebates. On March 31, 2021, State Senator Steve Bradford (D-Gardena), chair of the California Legislative Black Caucus said, "It should be totally eliminated. It was an incentive for early adopters of solar, and now we have a program that's approaching 20 years. I think it's proven its self-worth, and now it's time to do away with it."



Early Solar Inverters Lacked Support for Quality Electric Power and Many Still Do

One challenge outstanding is to address the quality of electric power received by residences, especially with the constant dips in power supplied by those intermittent electric generators – solar panels or wind turbines. A "fun question," as Geof Syphers, Sonoma Clean Power's CEO, called it, deals with power surges, which have become more frequent lately. I asked, "Does Sonoma Clean Power (or PG&E) ensure end customers use solar inverters with reactive or VAR (Voltage-Ampere-Reactive) compensation to ensure the power factor can be held to as close to 1 as possible? If not, will this become an ancillary service electric customers will pay for ala FERC 888 as extended and applied to the distribution plant? [1]"

Subsequent to our February 2021 interaction, it turns out that at least one solar inverter manufacturer, Enphase Energy, founded in Petaluma, California years ago, started incorporating VAR-compensation into its design. Since 2017, the company's micro-inverter products include the technology to accommodate voltage surges by smoothing out the power to ensure the quality is good for users in their local distribution plant [2].

Since Enphase is only one inverter supplier, the question becomes, "When will there be enough solar-based (or wind-based) VAR-compensation to ensure a stable electric grid offering good quality power free of power surges with their attendant brownouts and blackouts?"

The answer eludes us as of this writing, but electric systems operators, such as CAISO (California) and ERCOT (Texas), are working on it.

It's Too Hard to Save Electricity
"As improbable as it may seem, though we have been making and using electricity for nearly 150 years, there is still no way to put it aside for later use," writes Gretchen Bakke. "One can't loan a cup of watts to a neighbor who is short a few to bake a cake. One can't fill the barrels with the stuff and then load these onto train cars or ocean-going tankers and ship them across continents or overseas."

Time, it turns out, is "the crippling, confounding factor in electricity production, [but time] is almost not a factor at all when thinking about the other things we use to fuel our world."

Instead of mandating the installation of space-consuming battery systems on residents or investing billions in utility-scale solar, it could be more productive to consider pumped hydro to dry lake beds or compressed air (underground storage) to store energy for use when the sun sets or the winds calm. Or better yet, continue to rely on local geothermal supplies, nuclear power, hydro-electricity, or natural gas to ensure a steady baseline of power, 24-7.

Multiple, Mini-outages Put People at Risk
Even with VAR-compensated solar inverters but also without sufficient back-up energy resources, outages will increase as reliance on all-electric is foisted on Californians. Gretchen Bakke explains, "The most common, expensive, and disruptive forms of power outage are not the big storm-blown blackouts, but those of five minutes or less. These are rampant [through 2016 and growing]. Two thirds of the annual cost of outages in the United States are caused by those lasting less than five minutes, because of 'the high frequency of momentary outages relative to the sustained outages.' Lots of little outages are disastrous for any industry that needs constant access to information networks and for which electricity maintains security, including electric door locks, key pads, metal detectors, surveillance cameras, and so on." [4]

It seems the most resilient solutions require a mix of energy sources. These include a selection of electricity, natural gas, propane, gasoline, portable batteries, and diesel, to name the predominant fuel types used in American homes and businesses. Homeowners and renters as well as small businesses should be allowed the choice to choose what works best for them and their family.

"And we use the word storage, but you never store electricity . . . electricity "storage" means you use electricity to do a thing that when you reverse - or create a process that when you reverse it, you get electricity out. And, ideally, the amount that goes in and the amount that comes out are roughly matched. So the thing we do the most often in places where there are hills is we use excess electricity to pump water up a hill into an empty reservoir and then when we need more electricity, we just let gravity pull it back down

and run a turbine at the bottom. There's no electricity stored. There's water stored . . . The battery is the same. It uses electricity to set up a chemical reaction that when you reverse it electricity comes out again. So that's the principle of storage. And there is a lot of ways you can do it. You can do it physically. You can do it chemically."

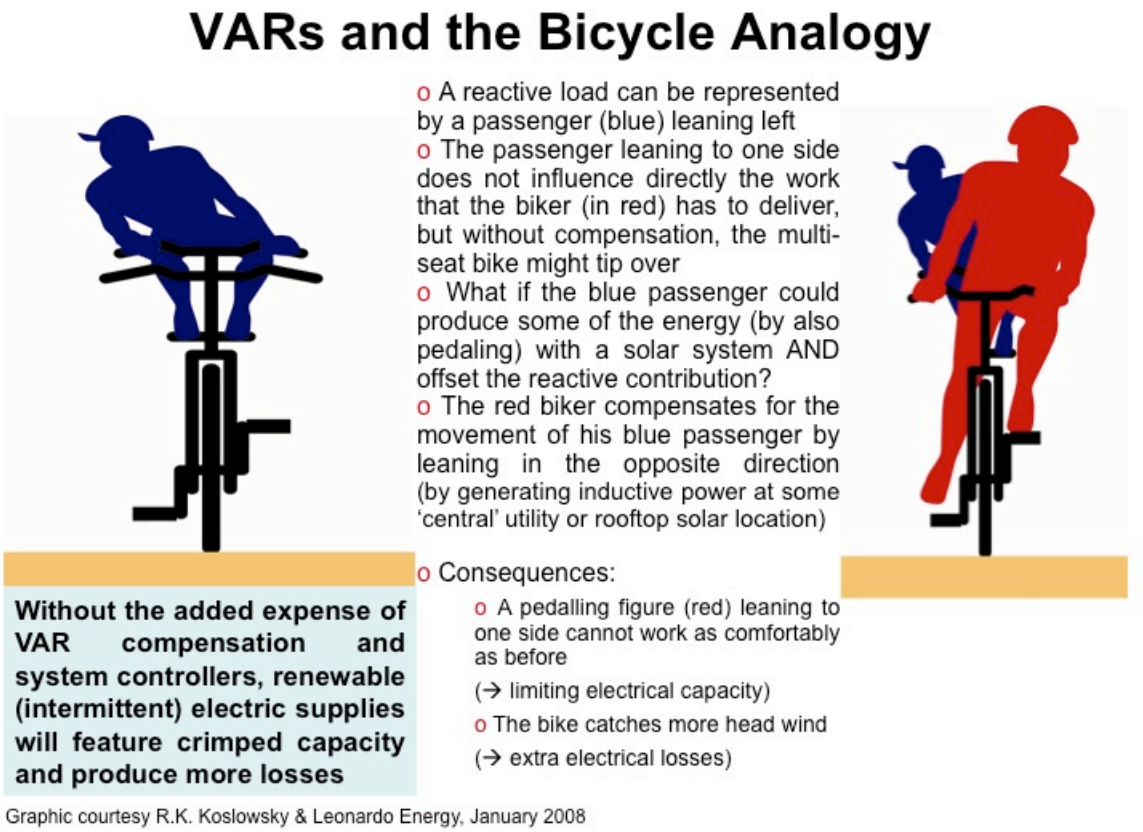
– Gretchen Bakke interview on NPR's *Fresh Air*, August 22, 2016

"A pandemic-era backlash against California's yawning wealth gap is taking aim at the state's pioneering climate policies. The latest target: incentives for rooftop solar panels . . . The generous rewards paid to those who can afford to install them on their roofs amount to subsidies for the rich, utilities and other critics of the program argue."

– Colby Bermel, California's rooftop solar program collides with equity concerns, *Politico*, March 31, 2021

[1] Electric grid problems like power surges (when voltage leads current) or brownouts (when current leads voltage) normally happen in the transmission of electricity, not its production. Producers *don't need* VARs, but utilities, no longer in the business of producing power, reactive or otherwise, *do need* VARs to keep things stable on the distribution lines. Utilities don't, however, want to buy them because they can't be resold or otherwise rendered a viable product; there is no futures market in VARs, for example. SCP-PG&E customers neither know, nor care, if the VARs are present or if they've gone missing – until the power surges begin. The link between these surges (and blackouts and brownouts) and the absence of an invisible non-product from the electric grid is a simple reality about which most electric customers are entirely clueless.
The question for Sonoma Clean Power, "Do you ensure end customers use solar inverters with reactive (or VAR) compensation to ensure the power factor can be held to as close to 1 as possible? If not, will this become an ancillary service users will pay for ala FERC 888 as extended and applied to the distribution plant?"
My "fun question" was rendered moot, when we discovered that Enphase Energy's products already incorporate this feature, which helps to mitigate the increasingly poor quality of power coming from utility operators. Even so, as Geof Syphers points out, "There are two different jurisdictions: CAISO for wholesale power plants, transmission management of the bulk grid; and PG&E for retail customers' interconnection permit and metering. PG&E discounts retail flows onto the grid when there are power factor issues in an effort to credit only the real power [sold to its customers]."
Syphers sums it up, "Most voltage support is managed by CAISO, but there is a growing interest in exploring how it could be provided as a distribution-level and even customer-level service. That could add value to the grid because voltage support must be done locally, while frequency regulation can be done anywhere."
[2] The solar inverter's role is to inject current on to the power grid. The grid voltage is set by the utility consequently the solar inverter is a current source. As a peak current request is received by the solar panel, for example, the control signal is modulated by a sine wave at the grid frequency to facilitate the injection of current in phase with the power grid. A loop compensator amplifies the error between the actual output current and the control current and drives the modulator accordingly.
By augmenting this amplification function with a Cartesian or I/Q multiplier, it is possible to provide two independent controls for the output current injected to the power grid. One controls the real current injection as has been done prior to the widespread deployment of Enphase Energy's micro-inverters starting in 2017. The other controls the reactive current injection in to the power grid. By adjusting the reactive current injection, on demand circulation

of reactive current can be achieved. Note that it is *not* even necessary to have any incoming current from the solar panels. *VAr injection to the power grid can be done even without sunlight.* The only penalty is that a small amount of real power is dissipated in the inverter when VArs are produced. This is not significant. For the utility company, such as SCP or PG&E, this is a new untapped resource enabled by rooftop solar systems that can be used to further grid stability and maintain voltage levels as mandated solar inverters (with VAR-compensation) become more widespread. For the utility customer, there is another opportunity for financial compensation as its solar inverter(s) is (are) activated for its reactive power load in times of need. However, this rebate aspect has yet to be addressed by regulators.



Think of the homeowner as the cyclist in blue and the electricity supplier as the cyclist in red.

[3] "Imagine, if some of that way-too-much wind power from the Colombia River Gorge could be packaged up and sent by rail or interstate to West Virginia where [as of 2016] coal still fuels 98 percent of the local power plants. There it could sit in a warehouse until it was needed and then this entirely aged green power could be emptied into the local substation and sent on its way. It could be a year, or thirty years, later, and the electricity would be just as fresh as when it was plucked from the air. As odd as it sounds, this is precisely how oil and coal work today. It doesn't matter when and where they were extracted, and it doesn't matter how long it takes for us to get around to using them. They can wait."
– From *The Grid* by Gretchen Bakke (2016), p.222.
[4] *The Grid* by Gretchen Bakke (2016), p.205.
[5] Proposed during a discussion on forced all-electric housing: "If you support diversity in the workplace, why not in the home space?"