

**DOCKETED**

<b>Docket Number:</b>	19-SB-100
<b>Project Title:</b>	SB 100 Joint Agency Report: Charting a path to a 100% Clean Energy Future
<b>TN #:</b>	230274
<b>Document Title:</b>	Mark Meldgin Comments - Decarbonizing California's electricity supply
<b>Description:</b>	N/A
<b>Filer:</b>	System
<b>Organization:</b>	Mark Meldgin
<b>Submitter Role:</b>	Public
<b>Submission Date:</b>	10/18/2019 9:43:05 AM
<b>Docketed Date:</b>	10/18/2019

*Comment Received From: Mark Meldgin*  
*Submitted On: 10/18/2019*  
*Docket Number: 19-SB-100*

## **Decarbonizing California's electricity supply**

Dear Joint Agencies, here are comments on decarbonizing California's electricity supply and implementing SB100.

My Starting Position:

Unchecked carbon emissions will likely cause warming, sea level rise, and net loss of arable land, leading, within a few generations, to food shortages, unrest, and the premature deaths of hundreds of millions or perhaps billions of people.

No voting majority, in any country, seems likely to support more than a modest decrease in its current living standard to counter this seemingly distant threat.

China and India together have more than one-third of the world's people. They want living standards like ours, which will require large amounts of (hopefully non-fossil) energy for air conditioning, heating and transportation.

I support policies to reduce carbon emissions, such as SB100, as well as research into any technology that might provide energy economically competitive with fossil fuels, including politically toxic technologies like the "traveling wave" nuclear technology supported by Bill Gates.

Comments on Implementation of SB100:

Decarbonizing California's electric generation is a desirable goal, to be balanced with other goals:

To encourage electric vehicles, we probably want electricity to be cost-competitive with liquid transportation fuels.

We probably want hospitals to have backup electric generators even if they run on fossil fuels. We may want to allow "microgrids" to use fossil-fueled generators to maintain electricity service during wildfire-related grid blackouts.

The obvious path to SB100's goal--100% carbon-free retail sales of electricity by 2045--is to apply and extend the calculation method already used by the California Energy Commission's Power Source Disclosure (PSD) program. This is a bad, bad path, because it provides the wrong incentives:

A fable: Suppose that I want 100% carbon-free electricity for my home. I put one solar panel on my roof, and, on an annual basis, find that it meets 10% of my electricity use. By the CEC's PSD calculation method, my supply is now 10% carbon-free. So far so good, so now I add nine more panels, for a total of ten. By the PSD method, my supply is now 100% carbon-free. Hooray! But in reality, at night I am buying the grid's mix of electricity, which includes electricity from fossil-fueled generators, while during the day my ten solar panels are supplying my needs and putting

excess solar electricity into the grid, where it is used instantaneously by others. (The grid instantaneously combines the power from all generators, similar to the way the chain on a tandem bicycle instantaneously combines the power of both pedalers.)

In sum, by the CEC's PSD method I can claim "100% carbon-free electricity" merely by adding solar panels, but I am still relying on fossil-fueled generators at night. If I want 100% carbon-free electricity for my house in reality, not just on paper, I can add carbon-free generators that run at night, which is difficult, or some form of energy storage, such as batteries, which is easy but expensive.

I wish this fable were fictitious, but it's not. For marketing purposes, California's sellers of electricity to retail customers (called Load-Serving Entities or LSEs) want to claim 100% carbon-free electricity. Solar electricity is the cheapest carbon-free source, so California LSEs support lots of it. As a result, at times California now has excess solar electricity. California's grid operator handles the excess by paying LSEs in neighboring states to accept electricity from California. "This seems crazy, so let me spell it out. To claim 100% carbon-free electricity supply under the PSD method, California's LSEs must generate carbon-free electricity, regardless of who actually uses it. At times, California's LSEs pay California's grid operator to accept electricity. The grid operator, in turn, uses that money to pay LSEs in neighboring states to curtail their generators, including solar panels, in order to accept electricity from California. (In industry terminology, this is a negative wholesale price.) Occasionally the grid operator even disconnects solar panels because LSEs collectively cannot accommodate the full amount of available solar electricity. This is nuts, and will get worse if California uses the CEC's PSD method to determine compliance with the goal of SB100.

How can California decarbonize its grid? California needs more nighttime carbon-free electricity. The cheapest source, given current prices, is probably solar plus energy storage, such as batteries. Energy storage is expensive, however, so LSEs are unlikely to build storage unless forced to do so. (Geothermal, hydro, and wind resources provide nighttime carbon-free electricity, but are largely already utilized.)

To decarbonize the electricity supply, California could set a target for each LSE to develop nighttime carbon-free electricity supply in proportion to its customers' nighttime electricity use (minus adjustments for carbon-free nighttime supply or energy storage that each LSE already has).

I respectfully suggest that California adopt a mandate for nighttime carbon-free electricity supply.

Thank you,

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Notes:

1. A protester against increasing fossil-fuel taxes in France carried a sign capturing the conflict between climate change and current living standards. Translated, it read "œ[French President] Macron is worried about the end of the world. I'm worried about the end of the month.œ"
2. Wikipedia has an entry titled "œtraveling wave reactorœ". Information on Bill Gates's interest can be found using search terms "œBill Gatesœ" and "œTerraPowerœ".
3. The analogy between an electricity grid and a tandem bicycle is elegantly presented at: <http://www.gonder.org.tr/wp-content/uploads/2015/04/ElectricityTandem.pdf>
4. Under the CEC's Power Source Disclosure method, each LSE's supplies of carbon-free electricity are summed, and compared to its retail sales, regardless of any timing misfit between electricity supply and electricity use by that LSE's customers. This method produces absurd results, such as the notion that MCE serves its "œDeep Green Power Mixœ" customers exclusively with solar (50%) and wind (50%). It deceives customers by concealing MCE's reliance on the grid's mix of electricity, which includes electricity from fossil-fueled generators, when there is not enough solar or wind power. (I don't mean to single out MCE"it happened to be the first I clicked on. Other LSEs have similarly misleading reports. The problem is the CEC's PSD method.) MCE's power supply, as calculated by the CEC's PSD method, is at this link: [https://ww2.energy.ca.gov/pcl/labels/2017\\_labels/MCE\\_2017\\_PCL.pdf](https://ww2.energy.ca.gov/pcl/labels/2017_labels/MCE_2017_PCL.pdf)
5. It is a safe bet that SB100, as currently phrased, will allow roughly 9% of California's generation to continue to use fossil fuels. Why? SB100 sets the carbon-free goal as 100% of retail sales. However, to cover losses in electric transmission and distribution, each LSE must procure an amount of electricity about 9% greater than its retail sales.