

**DOCKETED**

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*Comment Received From: Rezwan Razani*  
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**Keep Diablo Canyon Running, to zero carbon and beyond**

*Additional submitted attachment is included below.*



8 Farrington Plaza • Somerset, NJ 08873 • (626) 675-5080  
fp2w.org • rezwan@fp2w.org

August 9, 2022

To: Honorable Members of the California Legislature

**In Support of Continued Operation of the Diablo Canyon Nuclear Power Plant in the Upcoming Environmental Trailer Bill (EBT)**

Honorable California Legislators,

Thank you for all you are doing to accelerate California's transition to a decarbonized economy. It will not be easy for a State to swap out the bulk of its fossil fuel power for zero carbon energy. Even harder if it is forced to remove one of its most reliable zero carbon sources of energy, Diablo Canyon. Please do all you can to hold on to Diablo Canyon nuclear power plant while you can, this is a serious matter.

Thank you for hosting the call on August 12 for citizens to voice their concerns. I learned a lot from the call and appreciate all the hard work you and CAISO are doing to maintain energy reliability. There were many excellent points made in support of nuclear during the call. There were also many concerns raised. It was clear there is not a shared understanding of basic facts.

If you're going to have a "Laird/Marshall Plan" as discussed on the call – make sure to use the opportunity to clarify to the good citizens of California what the zero carbon endgame is.

Footprint to Wings is a 501c3 that is turning the "Race to Zero Carbon<sup>1</sup>" into a national pastime (literally) and coaching each state to win. When it comes energy options, we find most citizens are not aware of just how far we need to go to get there. This is seriously impeding collective decision making. If it helps, here's how we illuminate the endgame for states:

As you may know, if the goal is to decarbonize your economy, **the tasks on the consumption/demand side of energy use** are to reduce use; increase efficiency; and electrify the things that run on combustion (such as switching from gas to electric in cars, heating and cooking). **The endgame goal on the demand side** is an economy that satisfies its citizen's need

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<sup>1</sup> You can think of the "Race" as more of a "tournament of transformation" with many fields of play to win.

for a great quality of life, using less energy, most of which can be supplied by electricity. Plus carbon removal to offset the remainder.

**The tasks on the energy supply side** are to meet this total new demand for electricity from decarbonized sources, swapping out fossil power and swapping in zero carbon power. A supporting task is to balance the load with demand response and storage that “flattens the curve. In short, **the endgame requires a complete transformation and replacement of energy supply** infrastructure (“The Big Swap”) including a fundamental transformation of the grid (solving the grid riddle, aka “The Griddle”).

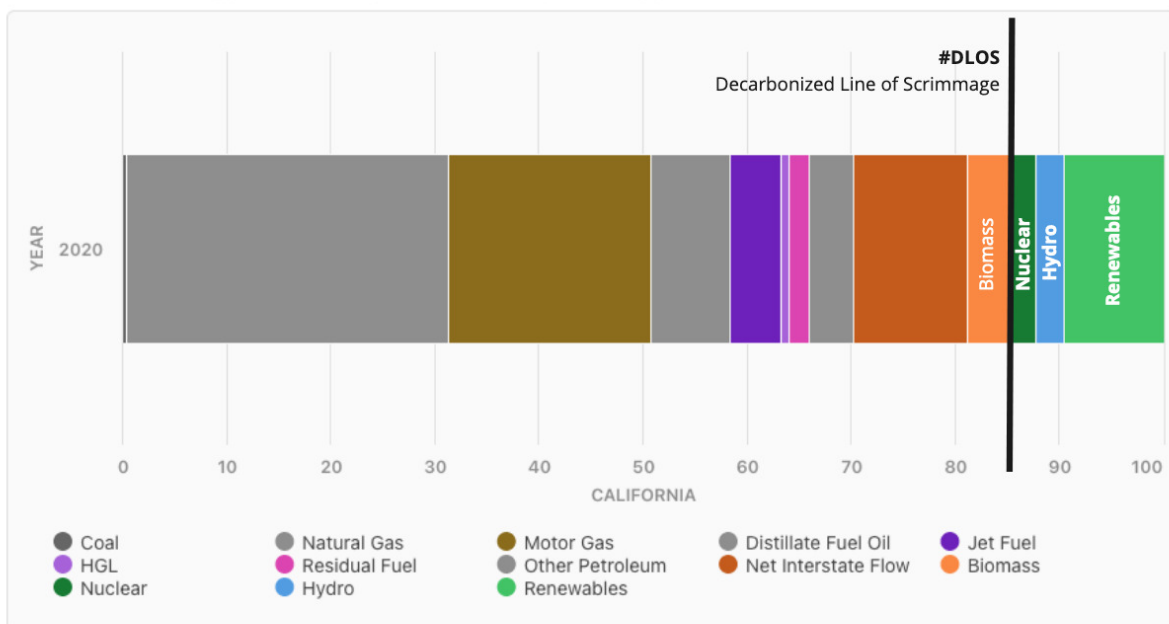
And it must all be done in a vanishingly short period of time, to scale.

*The challenge is unprecedented. Maybe impossible. Failure results in catastrophic existential...let’s not think about that.*

Unfortunately , dealing with this situation tends to be approached as a policy and governance issue, with a surreal air of business as usual. It desperately needs to be understood by everyone because the solutions ultimately require bottom-up and localized consent and action. With that in mind, government & experts need to do all they can to clarify the SCALE of the problem.

To help with that, here are some infographics related to California. The first is the baseline energy supply field with the **The Decarbonized Line of Scrimmage (DLOS)** shown.

**California Energy Consumption 2020 by fuel type**



Successful decarbonization means swapping out ALL the fossil fuels, not just present electricity. Citizens need to know, if we're having this much trouble just getting present electricity use to work – the endgame is doomed.

The goal is full, 24/7 decarbonization. It's a matter of executing a graceful transition to a post-decarbonized world with enough zero carbon energy supply to meet your citizen's energy needs. With wiggle room to spare.

The chart above takes data from the EIA<sup>2</sup>, arranged as a bar chart. If energy supply were a football field, the "Decarbonized Line of Scrimmage" (DLOS) is at the "15 yard line."

Decarbonized renewables, hydro and nuclear are on one side, fossils and biomass (under probation) and interstate flow (ambiguous) on the other.

Note this chart is **all energy use**, not just present electricity use. This is what California needs to decarbonize. The full energy supply endgame.

Looking at the energy supply like a football field, and knowing that you can't just pass the ball down the field to a receiver in this game- you have to get one inch down at a time with great struggle against all sorts of permit processes and NIMBY ("Not In My Back Yard") resistance – would you set yourself back 3 yards this deep into your own endzone?

Perhaps you would take that risk. Especially when you see this abstract graph on paper. But the spreadsheet game is different from the ground game. It might help to illuminate this.

**The "spreadsheet game"** involves estimating how much energy you're going to need to satisfy your citizens, how many power plants you'll need on the supply side to deliver that power; plus grid, transmission and storage support infrastructure. **The "ground game"** involves actually getting these new power plants up and running, on the ground, in people's "backyards".

### **From First Gigawatt Down to Gigawatt Touchdown**

Of course, as the goal is electrification, the energy will be served up in watt-hours. All the meters in everyone's homes racking up the kilowatt hours (kWh) which aggregate to megawatt hours (MWh) at the city level, gigawatt hours (GWh) at county level, and finally Terawatt hours (TWh) at the state level. Estimates for how many TWh a fully decarbonized California will need throughout the year vary. Mark Jacobson of Stanford University calculates 1,119 TWh. The actual endgame number will vary. It could be more, or less. We are just using it here to establish a ballpark figure.

1,119 TWh is a lot of energy, but the implications are hard to fathom. Also, the metric is not as helpful as it could be. You don't measure a football field in nanometers. You measure it in yards. The trouble is the metric. 1119 TWh is 127 GWyr.

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<sup>2</sup> <https://www.eia.gov/state/print.php?sid=CA>

If Mark Jacobson is right, CA is a 127GWyr field. It could be less, it could be more. I'm sure your state planners have a number – which, interestingly, is not well publicized. If you want citizen clarity and buy in and to expedite that NIMBY process, **get that number out there**. Anchor the endgame. And show the citizens how far down the total field you are.

Let's say it's a 100 GWyr field, and you have 15 GWyr down with the nuclear, hydro and solar. Now you need 85GWyr to go. How can you achieve that?

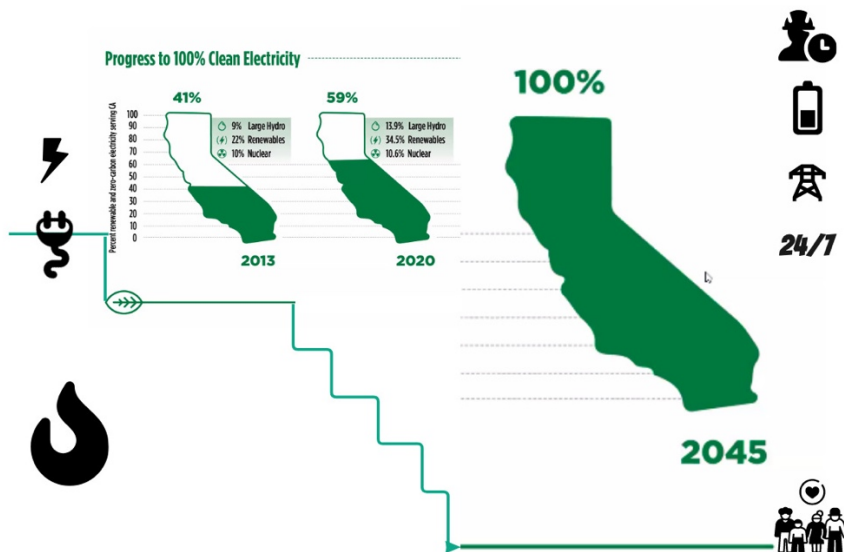
It's OK to be back of the envelope.

1GWyr is about the power output of one nuclear reactor. Diablo Canyon power plant has two reactors, and an output of about 2GWyr – so that checks out.

1 GWyr is about the power output of 30 square miles of land covered in utility scale solar panels (IEEE stats, assumes well configured panels. Otherwise you would need 50 – 70 square miles per GWyr).

1 GWyr is about the delivered power output - depending on turbine size - .

I could go on, but must get this letter in before the deadline today. One more infographic,



...this one modified from the CAISO presentation. You have to make it clear to the citizens that the electricity we're talking about is present use – but since the goal is electrification and endgame decarbonization, well there are steps to take, and a lot to plan, and we're just getting started. Show us your next [First Gigawatt Down](#). All the way to a California Zero Carbon Touchdown.

Best regards,

Rezwan Razani