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Comment Received From: Fred Morse
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Comments on 2 Sept 2020 SB 100 workshop

Please see attached pdf document

Additional submitted attachment is included below.

I am Dr. Fred Morse. I am the President of Morse Associates, Inc, a renewable energy consulting company formed in 1989. I am the former Senior Advisor, US Operations for Abengoa Solar, Inc. where he led the company's business development activities in the US. Dr. Morse played a key role in the development and financing of the Solana and Mojave Concentrating Solar Power (CSP) plants, each 280 MW with a combined investment of about \$4 Billion. I first became involved in renewable energy issues in the late 1960s when he served as Executive Director of the White House Assessment of Solar Energy as a National Energy Resource. In my work at the US Department of Energy, I played a significant role in defining and managing major solar energy R&D programs, including Solar Heating and Cooling, PV and CSP. I was the Chairman of the Utility-Scale Solar Power Division of the US Solar Energy Industries Association (SEIA) for well over a decade. I am a graduate of Rensselaer Polytechnic Institute, received an M.S. in Nuclear Engineering from MIT and a PhD in Mechanical Engineering from Stanford University.

My comments related to the 2 Sept CEC SB 100 workshop are:

1. The various solar thermal technologies need to be properly defined – it is solar heating and cooling or is it concentrating solar-thermal power? Both are relevant for California.
2. Needs were identified for carbon free firm capacity and carbon free baseload capacity. There was no mention of Concentrating Solar-thermal Power (CSP) with thermal energy storage (TES) although a CSP+TES plant can meet both. It provides synchronous generation, fast ramping and most ancillary services. There are CSP+TES plants that often operate 24/7 and prudent planning must consider these plants for California.
3. There was a stated need for flexibility and diversity – yet CSP+TES, which can address both needs, was never mentioned.
4. There was a clear need expressed for long duration energy storage. CSP plants with molten salt thermal energy storage has demonstrated this capability, with low cost. This technology is in commercial use in Arizona since 2013, in over two dozen CSP 50 MW plants in Spain for over a decade, and in several other countries. Some CSP plants have up to 17 hours of full load energy storage.
5. When I questioned E3 why CSP was not seriously considered, the answer was because PV is much cheaper. This is an apples-to-oranges comparison. While PV does have a LCOE much lower than that for CSP, they have different uses. For example, CSP+TES can operate carbon free all night at a much lower cost than batteries charged by PV.
6. A more comprehensive consideration of technology options is needed to ensure that California does not miss important options for generation and storage. And this will

require using current cost and performance data. Long term planning for California grid needs should include considerations of:

- a. The need for long duration (8 to 12 hours) storage in the near term. Planning and procurement for this level of energy storage needs to be made now to assure its adequacy, and
 - b. The long term operating and battery replacement costs of PV + batteries over a 20-40 year plant life.
7. Not enough attention was paid to siting. If California will need over 30 GW of new solar generation, it is necessary now to plan for its siting and transmission access. Included in such a plan should be ways to lower the development costs as is done in other countries.
 8. Little attention was paid to procurement which needs to change from “least cost” to “best fit” to acquire the capabilities to meet the evolving grid needs as it moves to 100% carbon-free generation.
 9. CSP+TES projects offer much higher local content than PV with batteries projects, in addition to offering more local high skilled jobs for O&M.
 10. I suggest that the CEC should hold a workshop where the authors of the newest capacity expansion models can meet and compare results. That would provide greater credibility to the results from the RESOLVE model and perhaps suggest ways to modify it to better address California’s evolving carbon-reduction targets and related needs.