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Follow-up comments on EPIC Stakeholders Meeting
submitted to AdvancedTechnology@sce.com
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Dear EPIC Administrators:

During the discussion at the SCE workshop in Westminster on August 17, a question was raised by Andy Schwartz about what assumptions utilities would make about the resource mix in 2050, and in particular the amount of renewables development, when defining or gauging the merit of EPIC research projects. It is conceivable, for example, that different technologies might prove useful or necessary in one scenario but not another. Doug Kim's response, as I understood it, was that it's difficult to look that far into the future, and that we will have to take this one Investment Plan at a time, since things will evolve and change from one three-year period to the next. This made a great deal of sense, but it also prompted two thoughts.

First, about the importance of a long time horizon for EPIC investments: When evaluating the ratepayer benefits of utility R&D, the natural tendency would be to focus on shorter-term payoffs, e.g. within the time period of a general rate case. As with any evolving complex system, however, it is not a foregone conclusion that a series of choices to maximize any given variable in the near term will result in a trajectory that maximizes the same variable in the longer term. While we cannot be omniscient about the future, it is nevertheless important to consider plausible or likely developments over longer time periods. It seems that the EPIC program is an excellent opportunity (and, arguably, has an ethical responsibility) to frame ratepayer benefits within a longer time horizon – especially given that State policy goals, despite the many uncertainties, have in fact been articulated for 2050. Thus, when selecting or evaluating EPIC projects by way of the question, "what benefits to California ratepayers does this afford," it would seem appropriate to think of these benefits on the time scale of decades rather than years. It follows that projects should not be disqualified or de-prioritized solely on the basis of low *near-term* returns for ratepayers.

One crucial long-term ratepayer benefit (which would not be observable on a shorter time scale, and thus not deliberately attainable through a series of short-term optimization choices) is to preserve future options rather than foreclosing them. This leads to my second point, about assumptions made regarding the future resource base. Though we may frame future returns on EPIC investments by stipulating a world in which carbon emission goals over the coming decades are somehow met, we cannot yet know what roles will be played by specific technologies and resources in service of these goals. Thus, not knowing what the electric grid will look like, we cannot evaluate grid benefits of technologies or operating strategies in any quantitative or comparative sense (e.g., to rank proposed projects).

What we can do, however, is to follow two principles:

1. The no-regrets principle, in which we favor technologies and projects that promise to yield *some* benefit regardless which one of a set of fundamentally plausible futures turns out to unfold, and
2. The principle of preserving rather than foreclosing potentially desirable future options.

To apply these principles in the EPIC context, I suggest that we ask which new technologies or operating strategies are so essential for preserving desirable future options, and moreover are likely to be so slow to develop and implement at scale, that without them, and without beginning to develop them *now*, these future options become almost certainly unattainable.

In my view, it is important to focus especially on options deemed highly desirable yet uncertain to be attainable, such as an extremely high-renewables, high-efficiency and highly-flexible-demand portfolio in a grid that provides reliable, high-quality power at reasonable cost. The priority for EPIC, then, would be to support and develop those technologies without which such a scenario looks impossible. This perspective is consistent with an emphasis on *enabling* technologies (for example, tools to support forecasting or visibility on the grid), prioritized over *contributing* technologies (for example, specific generation or storage technologies) without which the desired scenario might turn out more expensive, but not altogether infeasible.

This approach could be characterized as developing each three-year investment plan with a three-decade perspective. It might be worth considering a scenario planning exercise [e.g., see Brown, Cibulka and von Meier in *Public Utilities Fortnightly*, April 2011] using independent variables to develop different plausible futures as contexts for testing the no-regrets and option-preserving principles above.

With best regards,

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