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Flaws in our alternative energy thinking/recommendations

Additional submitted attachment is included below.

Docket No. 15-IEPR-11
Workshop on the State of the Science on Scenarios to Deeply Reduce Greenhouse Gas Emissions from California's Energy System 7/24/15 and 7/27/15

Comments submitted by
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This submission is in addition to my verbal comments at the 7/24 workshop session. For the record, my Ph.D. is in Atmospheric Physics.

In my opinion there are some fundamental flaws in the belief that California can achieve a "real" 50% renewable portfolio. We can achieve one in "name" but the practical aspects are different, especially without significant storage options, which might be available only much later in the future.

Solar and wind are intermittent power sources. They produce an effective capacity of 20% to 40% of their nameplate capacity. And there are times when there is no sun and no wind. To compensate for this issue, utilities build continuously-running, gas-fired power plants. Conceivably, these must provide up to 100% of the required power when alternative sources are not available. More practically, they probably have to plan on providing 2/3rds of that.

This means that your renewables portfolio is burning fossil fuels almost all the time and at some times it is close to being the only source of power. The renewable portfolio as currently defined contributes large amounts of CO2 to the atmosphere, which was opposite of its intent.

Additionally, with a gas infrastructure we are emitting large quantities of methane through leakage and incomplete combustion. Methane is a worse greenhouse gas than CO2 by a factor of about 20 on a per molecule basis. This means that we are still contributing heavily to global warming.

One simple workaround would be to add an excess of alternative energy nameplate capacity. But that would increase your energy costs by 2.5 to 5 times. Perhaps, this would make more sense if you have a real energy storage option. (Even though the new Tesla battery technology looks promising, the Commission should not kid itself that this is right around the corner as a viable utility-scale solution. Even when it is, the adoption and installation rates will be much longer than desired, as is typical for all new technology introductions.) It is simple to say that during peak times you can control the

output of the alternative energy sources so as to not flood the grid. This is conceivable for wind. You can feather the blades. But you may have much greater maintain costs if this is being done everyday. For solar, you can shut off the inverter at the solar plant. Then your panels, being non-reflective, become black body radiators, i.e. heaters. You would then be contributing to local warming directly.

This is just one set of issues as we address climate change. Here are others.

Scope – While the mission of the Commission is to find solutions for California's needs, we need to bear in mind that climate change is a global problem. Californians can also suffer from the CO2 problems in the rest of the country and the world. It is convenient to think that if we fix California, we are all set. We are not. So we should also be thinking in creating exportable technology to address climate change. Therefore, I believe there should be an economic development effort as part of your considerations, i.e., environmentally-sound export technology and products.

Time Frame and Intensity – Virtually all models have fallen short of reality in predicting the effects of climate change, such as polar cap and glacial melting. There is a very understandable reason for this. Scientists are naturally conservative. They believe they do more harm by overestimating than by underestimating. But with climate change, I believe we will be better served by some overestimating. By underestimating, we take the risk of not taking the right steps while they can still be effective. In this game, if we are late, we are really screwed.

Suggested efforts talk about having things under control by 2050 or even 2100. According to Elizabeth Kolbert's *The Sixth Extinction*, the Great Barrier Reef is already 50% dead as well 80% of the coral in the Caribbean. The prime culprit is carbon dioxide. Ocean acidification is progressing much faster than anyone predicted. It impedes the ability of species at the base of the marine food chain to produce shells and skeletons. We are altering the chemistry of the oceans, the source of nearly 20% of the world's food supply and 50% of it oxygen. I believe all remediation dates must be moved in to at least 2030.

Quantity – Most efforts aim to replace combustion electrical energy production. Though desirable, it doesn't go far enough. We need to think in terms of massive amounts of additional energy to counter the effects of climate change. A few examples: a.) we must convert to an electric-vehicle world; b.) we need a broad program of desalination; c.) we need carbon-neutral industrial feedstocks, plus fuels for unique applications, such as aircraft, agriculture, mining, etc.; and d) we need clean power for massive materials-processing for ocean remediation to correct acidification.

Just taking desalination as an example, the Carlsbad Desalination plant will produce 50M gallons of fresh water a day, providing 7% of San Diego's need and using 40 MW. To service all the cities in California, you would need 40 such plants. Your energy needs would be a big chunk of the production of a Diablo Canyon Power Plant. These numbers pale in comparison to the energy needed to address ocean acidification.

Approach – Alternative energy sources cannot provide the quantities of energy required. See *A Cubic Mile of Oil* by SRI's Crane, Kinderman and Malhotra page 79 and chapter 9 for details. Most alternative energy sources are too expensive, demand too many resources and threaten too much of the environment, per kWHr actually delivered. I asked the author if this implied that we will have a primarily fossil fueled in 2050. He replied that it does.

Only nuclear has the energy density to address these needs. Nuclear also has a better safety record and lower environmental and health impact than alternative energy sources. Using Diablo Canyon as an example, it is also cheaper.

Recommendations

1.) Revise the goal of our environmental efforts to "Zero CO2 emissions".
2.) Revise California's Renewable Portfolio Standard to include nuclear power. This will make it much easier to meet aggressive CO2 emission goals. By using more nuclear, it will be much easier for utilities to flatten out the "Duck Curve"
3.) Actively support the relicensing of Diablo Canyon Power Station.
4.) Press for legislation changes to allow Diablo Canyon to install the latest turbine technology, which will increase efficiency, decrease nuclear waste, decrease cooling requirements, and provide power for an additional 70,000 homes. (One issue here is that Diablo Canyon is restrict by state law from exceeding its current operating limit.)
5.) Recommend additional nuclear plants in the state and fixing the San Onofre Power Plant (if it is not too late) just as Ohio did with its Davis-Bessie Plant.
6.) Recommend the investigation of a Molten Salt Reactor industry in California. Molten Salt Reactors are walk-away safe and can burn down existing nuclear waste. This is a tremendous opportunity for California. It is potentially an industry as large as the aircraft industry. It can provide exportable products and a large number of high-paying high-tech and manufacturing jobs. (These sorts of activities are already taking place in China. They have over a 1000 people working on a government supported project using technology developed at Oak Ridge National Laboratories. In June, the China National Nuclear Power

Corporation sought US$2B in an IPO on the Shanghai exchange. They raised US$273B. If we do not enter this market, I guarantee we will be buying their products here, all built with Chinese technicians, not Californian.)

Below are the notes that I used to make my verbal statement at the 7/24 workshop hearing. My verbal comments differed based on input from the session.

Renewables **July 24, 2015**

a. Since renewable energy sources are dependent on climate and sunlight conditions, they produce variable amounts of energy below their maximum capacity ratings.

b. Since renewable energy sources produce variable power, they must be backed up by dedicated continuous-running gas-fired power plants to make up the difference.

c. Since the effective power capacity delivered by renewable sources runs from 20% to 40% of the maximum power capacity, to make up the difference you either have to have 2.5 to 5 times the number of power sources as the original or gas-fired power plants to handle the shortfall of 60% to 80%, and perhaps higher when the alternative source is not available

d. Because the power generated by renewables is variable, their backup gas-fired power plants usually run at less than peak efficiency, generating sub-optimal amounts of CO2.

e. Because renewable energy sources require backup gas-fired power plants that generate CO2, they cannot be considered truly carbon-free.

f. Because utility companies can be swamped by multiple renewable energy power generators during peak performance periods, they pay those power producers to provide less or zero power during those periods.

g. Because renewable energy sources are dependent on climate and sunlight conditions, they are relatively energy-sparse compared to nuclear or fossil fuels.

h. Because renewable energy sources are energy-sparse, they require much larger areas than nuclear or fossil fuel plants to generate the same amount of energy.

i. Because renewable energy sources require much larger collection areas, they require significant investment in transmission capabilities and roads.

j. Today, we do not have many and good mechanisms for storing excess electrical power that could be used on demand during periods of low power production.

k. Because renewable power production is relatively energy-sparse and geographical broad, initial investment is comparatively high and requires taxpayer support.

l. Because renewable power production is energy-sparse it is relatively expensive to the consumer.

m. Because renewable power production is relatively energy-sparse and expensive, it cannot keep up with fossil fuel expansion to meet user demand.

n. Because renewable energy sources are relatively energy-sparse, geographically broad and expensive, they are difficult to ramp up fast enough to prevent degradation or collapse of climate factors upon which humans rely and enjoy.

o. Because renewable energy sources are relatively energy-sparse, geographically broad and expensive, they cannot be deployed fast enough to respond to abrupt natural and manmade disasters.

p. Renewables at present and projected development rates cannot meet the massive amounts of energy required to reverse ocean acidification and address other climate change induced issues.

q. Only nuclear overcomes all these difficulties.

Respectfully Submitted

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