Three Ways to Improve the Reliability of a 100% Renewables System.

In the previous two articles I used the batteries in EVs as the source of backup power when wind and solar power is not available, such as during a calm night. Windless nights will occur frequently. If we have too many windless nights and cloudy days in a row, our 150 homes will be in trouble because the EV batteries will become run down and the lights will go out. And because the batteries are discharged, there will be no transportation either.

You might naively think that a simple connection to the larger grid will solve the problem. It won't. I will discuss why below. Keep in mind Hawaii, which cannot connect to a larger grid.

#1 – The first possibility for improving the reliability of our 150 home microgrid would be to install more batteries. This will be an expensive addition because batteries are expensive. Doubling the size of the batteries in the EVs would cost another $60,000. To keep them charged up will require increasing the size of solar and wind sources, possibly doubling them, which would cost each home owner another $20,000 for the second wind generator and $25,000 for doubling the size of the centralized solar farm (which is adjacent to the 150 home subdivision). We have spent an additional $100,000 to keep the lights on during extended calm and cloudy days. Our 150 home subdivision residents decide not to invest in additional solar and wind because the power supply is still not completely reliable, even with the additional battery, wind, and solar power additions. The additional storage idea is a bad idea.

#2 – The 150 homes may decide to connect to a larger system to provide backup power during the extended cloudy and calm days. However, the larger system is made up of thousands of microgrids just like ours, all hoping to draw on the larger grid for backup power, and hopefully not all at the same time. In this 100% renewables system, we have some microgrids that have extra power that can be used to supply energy to other microgrids that are short on energy. Each microgrid will need to install more wind and solar capacity than they need for their own system in order to have reserve power to assist their neighboring microgrid systems.

However, there is a severe shortcoming with this design of thousands of microgrids interconnected with each other. Because weather patterns cover large areas, we are likely to have times when large regions become deficient in power at the same time on cloudy calm days. This means that large transmission lines will be needed to cover the US, much like the interstate highway system so that reserve power from one large area can be supplied to the other distant deficient area. These lines do not currently exist. They will be expensive and take many years to construct. There will be opposition to this plan due to its environmental impact and cost, so this plan may never be fully realized. Note that this interconnected system is not available to residents in Hawaii. The building of all these lines connecting the eastern US to the western US to the Texas system (which are all currently isolated) is also a bad idea for improving reliability.

#3 – If the 150 homes microgrid wants a nearly 100% reliable source of backup power and does not want to connect to the larger grid, they could install a conventional generator that would only be run at times the renewables power is insufficient. There are four fuel types that could be used to power the standby generators: a) fuel oil, b) natural gas, c) coal, and d) nuclear. Three emit CO2, except CO2 CCS (carbon capture and sequestration) might be used to capture the CO2. On Hawaii the backup fuel would probably be fuel oil rather than natural gas. The 150 homes might choose either a) or b) to keep initial costs low; however, these are not renewable sources.