How the simple spreadsheet works (Upload R#45 from SWIEP)

Who wants to use this analysis?

If you own a Bergey Excel-s connected to a GridTek10 inverter you may want to use this spreadsheet. There are two good reasons to use it. (1) If you need more energy generation at your home/farm. (2) If you can sell wind-generated energy to your power company at a premium price. This is rare, but I know of some areas in Washington State where energy generation cooperatives pay premium prices ($0.25 to $0.50 per kWh). In my case I have a net-zero energy home and currently produce about as much energy as I currently use per year, but by 2011 or 2012 my energy needs will increase by 5,000 to 10,000 kWh per year AND I want to provide this with sustainable energy sources (sun & wind). This is because I will buy a plug-in electric/gas car. By then both GM and Toyota plan to have plug-in vehicles with a range of 40 miles on a full battery charge, which is good enough for local commuting. On longer trips a gasoline engine will take over to get you longer distances.

Bergey Excel-s cost-benefit analysis	
8,800	kWh/yr with GridTek10
$50,000	Initial cost Turbine+Inverter
20	life of system yr
$0.284	**$/kWh**
33.62%	% boost
$11,000	Added cost to replace inverter
$0.186	**$/kWh**
2,959	kWh/yr gain
	=user input values

Energy gain from efficiency increase	
81.00%	GridTek10
92.00%	PowerSync II
13.58%	%boost
1.1358	Boost factor for inverter efficiency
Energy gain from no off-line time	
15.00%	% energy loss GridTek10
1.1765	Boost factor for no cut out time
NET Energy gain	
1.3362	Combined boost
33.62%	Net % boost

Alternative cost by PV system	
	kWh/yr with 10 kW PV
11,300.00	panels
$79,500	Initial cost PV system
20	life of system yr
$0.352	**$/kWh**

The spreadsheet is quite simple. You enter values in the yellow squares and look at the results in the blue squares. The release of this spreadsheet is really premature because I wanted to wait for hard figures to put into it, but the user with the right

numbers can do it. I have entered hard figures that apply to my situation but I had to guess others. Here are my "guesstimates":

- Price of the PowerSync II ($11,000) based on the price of comparable 12 kW inverters (e.g., that used by the Ventera 10 kW turbine or others http://www.venteraenergy.com/).
- Average efficiency of the PowerSync II (should be about 92% if it is a modern design).
- A 15% average annual loss of energy caused by GridTek10 overload faults (See R#40, R#41 and R#42 in SWIEP. The reports will be updated as more results come in).

So in my case the cost to add about 3000 kWh/year in generation capacity by buying a PowerSync II is less than adding 3000 kWh/year in PV panels. I would still need to add some PV but not as much. You can play around with the numbers yourself. If the power loss due to off-line time is less than about 4% then it is cheaper for me to put up all PV to add capacity.

Does Mike Bergey believe my loss estimates (15% from off-line time)?

I am not sure. He does not clearly say in his recent messages to me. He says I have not told him anything new. He told me that losses are likely to be around 1%. But if I am correct then I am telling him something new. Mike's low loss figure comes from BWC's WindCad Model. The WindCad model is a purely stochastic model, i.e., it predicts annual energy production purely on the statistical probability of wind speeds occurring at any one location and the resulting energy production based on the stochastic probability of a bin-wind-speed 'times' the power curve. I don't want to get into lots of details today. I will explain it fully later. But the error in Mike's power loss estimate comes from ignoring a necessary time-series analysis. The aim of my studies is to see if I can add a realistic time-series module to the Wind-Cad model so that owners of the GridTek10 can estimate power loss in more than one way.

In my location the stochastic model would predict a small energy loss (1%), but wind speeds follow a Gaussian time-series distribution in any 5-min time interval. So the GridTek10 needs only a brief stochastic event, i.e., a wind gust > 16 m/s for a second or two for the GridTek10 to go off line for the next 5-min. During this 5-min off-line-time the stochastic probabilities of Gaussian distribution would predict a time series of wind events producing power over most of the output spectrum of the inverter (2 to 12 kW, see Fig. 3 in R#40). When you take into account the time-series event you see the plausibility of a larger amount of energy loss than the purely-stochastic model (WindCad) would predict.

I have to wait until May to complete my study in order to firm up my guesstimates. But Mike Bergey might be happy regardless of the outcome of my study. If I am wrong then he will be proven correct and he is happy. But if I am correct then Mike Bergey may end up selling a few more PowerSync inverters than in his current business projections hence he will make more money which ought to make him happy too.