Appendix D: Personal Insights and Experience

So how did this idea occur to me? Well, the answer to that is related to why I was in The Gambia in the summer of 2007. I was helping to build a new high school in the town of Sanyang and my primary contribution to the project was the procurement of resources and the training of community stakeholders on the use of a solar power system to provide the school with electricity. I'm sure everything in this thesis makes a ton more sense now…

Making an incredibly long story short, the solar charge controller we used for the solar system was donated to us by Morningstar Solar. It happened to contain a serial RS-232 port that enabled a cellular modem to interface with it and wirelessly transmit data about the solar power system to a remote server. And, unsurprisingly, Morningstar encourages their customers to interface with their controllers in this way. I instantly thought, "Wow, what a useful way to keep up on the performance of the school's power system!" Not only could you do long-term system analysis and telemetry, you could provide local overseers with an easy means to monitor the solar array from anywhere at any time.

So I looked into the details and found out that the cellular modem required to monitor the solar controller was a whopping $700. Yikes. And, the fancy web service provided by the third-party monitoring company would cost about $50 a month. This made the entire idea a non-starter, but I never stopped thinking about how useful it would be if you could actually monitor the solar array remotely. Furthermore, it seemed like such a simple task. Serial communication is not exactly high technology. Cellular telephony is not space-aged, either. Why is it so expensive?

Existing solar monitoring systems are expensive because solar energy is expensive. The demand for solar energy is high, but there are precious few companies actually mass-producing solar panels. And, because solar monitoring is a fairly specialized task, the hardware used by companies that offer telemetry services is often proprietary and highly customized. So, with the combination of solar energy being already expensive and the fact that solar monitoring technologies are currently limited in their application, the price is bound to be high.

Expenses aside, another problem with existing monitoring systems is the fact that most cellular modems require an external power supply. This is an immediate problem for off-grid systems because it creates a phantom load on the battery bank. Additionally, some solar controllers use Ethernet cables to transfer their data. This requires wired Internet—another deal-breaker for most off-grid solar applications. Such are the

reasons that I intend for this project to be both load-neutral and to use wireless communication. But on that point, another issue arises: Where are the cellular networks in places without electricity?

Fortunately, this problem is already solved, for the most part. In many parts of Sub-Saharan Africa, for instance, recent developments in cellular infrastructure have resulted in places with no reliable electrical grid actually being within the range of cell towers. (The paradoxical consequence of this is the fact that you could technically talk on a cell phone but never be able to charge it.) That said, a rural school or hospital running on solar energy is actually pretty likely to have a cellular signal. So, remote monitoring via cellular communication can most definitely work in perhaps otherwise electrically isolated communities.

My experiences in the Gambia reinforced a lot of the criticisms I had researched regarding the experience of solar technology in development efforts in Sub-Saharan Africa. One example in particular sticks out in my mind. In Sanyang, a Belgian NGO had erected a rather large solar array to power a water pump for a local health clinic. I was informed that this pump was no longer working. Upon inspection, it appeared that a fuse had blown after the pump voltage surged as a result of running dry in the well. While I cannot confirm this diagnosis, the critical point is that nobody in the community was given any direction whatsoever as to what to do in such a situation by the NGO that built this system. Not even a manual was left behind! The solar array was sitting idle in the sun, and the health clinic was using hand-pumped water carried to the site in buckets.

(The picture above is from that health clinic, and the empty water tank attached to the ill-fated water pump is in the background.)

Situations like this are all too common in the aftermath of short-sighted development projects, and must be avoided if such efforts are to be taken seriously. A sustainable project is more than the hip photo-op aesthetics of a solar array in a small African town. True sustainability must consider the economic impact of the introduction of technological infrastructure, and have sustainable financing schemes built in to account for both the cost of maintenance and the training of community stakeholders. Anything less is a waste of time and money.