

Electrical

Small scale electrical

As minimalist off grid off-grid systems mature, electrical power will become increasingly important. The automotive and recreational vehicle industries give us a wide variety of 12 volt appliances and gadgets to make life comfortable. This would be a very practical place to begin for household level energy.

These systems qualify for the UL designation called “Safe Low Voltages.” Beneath this level – I believe it is 48 volts – systems are exempt from the vast majority of code regulations. Work and expense otherwise consumed by regulatory compliance could now serve the refinement of household level comfort.

The bad news is that intra-community distribution systems are impractical at these voltages. The amperage levels in the power equation (watts = amps times volts) requires thicker wires, and the amount of copper required to transmit this current squares with the distance that the power is transmitted. By producing the power within the community itself, the transmission distances are kept short – hopefully short enough to eliminate the need for transformers entirely.

The good news is that producing power locally, eliminates power grids – along with their complexity, losses, environmental mayhem and centralized control. At the community or household level, power systems would be far less vulnerable to economic, political, and natural disasters.

Electrical storage

Automotive batteries would be the most available storage means for off-grid power, but limited life and environmental poisoning related to these batteries are among their drawbacks. Furthermore, the local manufacture of such batteries is far beyond reach of small community enterprises.

In cases where higher power levels of 117VAC is temporarily needed for construction or other projects, it would be nice to have a gasoline powered generator on hand. Small levels of more continuous 117AC power could be provided by DC to AC inverters. These come in a wide range of power levels.

There are also DC-DC converters available to bring 12 volts down to 5 volts to power USB plugs for charging cell phones, etc.

Charging

The simplest form of charging system would be solar panels and a simple regulators. 18 volts is a common standard among such panels, with an open circuit voltage of about 21V. These levels can be conveniently regulated and used to charge 12 volt battery systems

In the long run, local sustainability cannot afford to depend upon multi-million-dollar semiconductor foundries. Beyond that, practical solar-electric systems produce only daytime power, and adding batteries creates an expensive ecological disaster that needs to be replaced every few years. Battery expense alone makes electrical storage impractical for many applications.

If you have some form of mechanical energy available to drive an alternator you could have a system that did not depend upon sunlight. With a few tools and a little know-how, an automotive alternator may be rewound with finer wire to produce higher voltages at lower RPMs.

A broader solution

Any form of energy can be converted to heat, and heat is easy and economical to store. A system based upon the collection and storage of heat, coupled with an engine that can convert heat differences

into mechanical energy could work with almost any energy source.

Stirling engines create little noise or vibration, and can be designed to convert almost any temperatures differences into mechanical energy, and thereby power generators. The design and refinement of of these devices for household level power generation is a challenge for another story. As applied here however, there would be two major advantages: (1) They would be powered by stored heat, rather than expensive high-tech battery systems. (2) They could produce kinetic mechanical energy in real time, day or night, using only hot and cold thermal storage systems for power.