Clause 3 - Utilities and Energy Plan

1. The community will not be connected to the electric utility grid.

2. The property includes multiple potential sources of renewable energy including a river with significant hydroelectric potential, solar, biomass and wind. We are currently in the process of assessing each of these resources – both the amount of energy available from each, and the cost to develop it.

3. The current estimate, as of January 2013, is that the combined capacity of micro-hydro and solar PV alone will be able to supply 100% of the demand, at an average per household consumption of 6-7 KWH/day or 200 KWH/month. This is based on an assumed average of 2 KW of solar PV panels per household, plus 50 KW from the river. Hydro will dominate in the rainy season, solar in the dry season.

   6-7 kWh/day is generally considered adequate to supply the basic needs of a well-designed, small, efficient home in the tropics. (To understand what this actually means, an online calculator is available at http://biorealis.com/SGEV. Users can plug in their own estimates of expected or desired daily use, and see how many panels would be required to supply the demand. The tool can also be used to estimate the percentage of the total demand supplied by each resource.

4. Various interconnection schemes are being evaluated, each with its pros & cons. The simplest and most straightforward off-grid system – but also the most costly and least efficient – would be for everyone to have their own stand-alone system with solar panels and batteries, and then be hooked up to the centralized system for supplementary battery charging. Estimated cost for this type of system is about $4 per watt, or about $8,000 for a nominal 2 KW system. (Estimate assumes quality components, professional installation and quantity purchase discounts. Market prices continue to change rapidly.)

5. A much better interconnection method would be an AC-coupled mini-grid, (as described in video at http://biorealis.com/OMV/deeptech/?p=1001). In this scheme, fewer panels and batteries would need to be purchased, and they would be installed in fewer, larger arrays, rather than on each house. This system can provide the same amount of power at lower cost because it has fewer parts, the panel arrays can be more optimally placed, and it allows more efficient use of the energy available. It can also be easily added onto as demand increases.

   The primary gain in efficiency derives from being able to move electricity around the grid from where it is produced to where it is needed, as both supply and demand fluctuate. In the first scheme above, this isn't possible. For example, on a house that the sun is shining on but where no one is home (maybe even for weeks or months?), any excess energy (after the batteries are fully charged)

cannot be fed back into the grid. It will just be wasted.

6. Usage charges will be applied to cover operating and maintenance costs. As the system will be owned and operated by, and solely for the benefit of the community, usage charges will be set by actual cost of production. With solar and micro-hydro alone, these costs will be nominal, consisting primarily of labor cost to cover maintenance and repairs. If or when a diesel generator is added to the mix, there will also be fuel costs. Fuel crops have been planted on the property to offset these costs. (See http://biorealis.com/OMV/deeptech/?p=381 for details.)

7. It would be prohibitively expensive to build a system that could supply as much electricity as anyone ever wanted to use, so the supply to each home will be limited – both the instantaneous power draw (kW) and the total daily energy usage (kWh). A sophisticated metering system will be needed to regulate that usage. Appropriate products are being researched and evaluated (e.g. http://www.ekmmetering.com/).

8. Members will be required to provide their own power (e.g. onsite solar panels, wind turbine, small, low-decibel generator, etc.) to meet the demand for any usage above and beyond the capacity of the centralized system.

9. Efficiency is primary! Low wattage lighting (LED or CFL) and fans, low energy use refrigerators and gas stoves are mandatory. "Tico" washing machines are encouraged, with clothes lines for drying clothes. Air conditioners will not be allowed to be connected to the mini-grid (nor are they considered necessary for a well-designed house at this altitude.) House plans are available that incorporate natural ventilation by way of cupola, roof monitor, or clerestory, interacting with well-placed operable windows and doors.

Clause 4 - Water Supply and Wastewater Collection

1. A potable water line will be plumbed to each home site.

2. Members are also encouraged to install onsite rainwater catchment systems – rain gutters, storage tank and filtration system. The goal is to not only supplement the centralized water system, but to provide redundancy and a measure of local self-reliance in keeping with the mission statement.

3. A centralized sewer system will not be provided. Each house will have either a standard Costa Rican 'biodigestor' (septic tank) or a composting toilet (recommended). It is also recommended that graywater be treated onsite to a quality suitable for reuse for secondary uses (e.g. irrigation). To learn more about the benefits of urine separation and dry composting toilets, see http://biorealis.com/OMV/deeptech/?p=1209. They conserve both water and valuable nutrients, in keeping with the mission statement

4. Food Waste – All organic food waste will be composted or digested as part of the integrated food production system.

5. All Members must participate in the Recycling and Reclamation Program. Residents should have a composting bin for food waste and any other compostable materials, along with recycling bins for crushed metal cans, glass and plastic bottles and/or containers. Members must take recyclable materials to the designated recycled waste collection site located at the main reception/parking area.