RAINWATER HARVESTING IN OFF GRID APPLICATIONS

Presented by Charlee Myers
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CONGRATULATIONS TO ARCSA FOR THE 15TH ANNUAL CONFERENCE AND FOR THE ORGANIZATION’S 25TH ANNIVERSARY!
HOW DID WE GET HERE?
WHERE DID YOU GET YOUR START IN RAINWATER HARVESTING?
WHAT CONSTITUTES BEING “OFF GRID”?  

What does off grid mean? Stand alone rainwater systems relying on gravity are off the water grid. However, for our purposes today, homes and businesses that rely on solar or wind power along with rainwater and are totally off grid will be the focus.
HOME AND BUSINESS
TRES PIEDRAS IN
RURAL TAOS COUNTY, NM
TAOS COUNTY, NM
FROM TAOS PUEBLO TO WHEELER PEAK, HIGHEST POINT IN NM AT 13,161 FEET ELEVATION
RIO GRANDE EXITS TAOS COUNTY AT 6,000 FT ELEVATION
2204 SQUARE MILES, @50% FEDERAL, 8% TRIBAL
MANY HISTORIC BUILDINGS AND A CAST OF CHARACTERS TOO.
CORONADO 1540S, DON JUAN DE ONATE 1597, 1615, KIT CARSON, D.H. LAWRENCE, GEORGIA O’KEEFE, DENNIS HOPPER, DENNIS WEAVER (MCLOUD), MICHAEL MARTIN MURPHY, ROBERT MIRABAL
ALL WERE ATTRACTED BY THE MOUNTAINS AND THE MESAS…
RIO GRANDE GORGE BRIDGE
ONE OF THE VERY FEW LARGE RIFTS ON
EARTH’S SURFACE
PRIMARY RIVER IN THE SOUTHWEST
WATER ISSUES
FIRST EXPOSURE TO SOLAR AND RAINWATER HARVESTING
WHAT KINDS OF FACTORS CONTRIBUTE TO BEING OFF GRID?

- Remote locations not close to any infrastructure
- Personal choices – being both efficient and sustainable
- Environmental consciousness
- Survivalist tendencies/ “doomsday preppers”/ Y2K
- Second homes/ vacation homes
- Subdivision/ HOA requirements
ALTERNATIVE BUILDING MATERIALS
PUMICE-CRETE
STRAW BALE
RASTRA BLOCK
INSULATED CONCRETE FORMS (ICF)
ADOBE CONSTRUCTION
NOW
AND THEN – OVER 1000 YEAR OLD
TAOS PUEBLO UNESCO WORLD
HERITAGE SITE
GREATER WORLD EARTHSHP COMMUNITY JUST WEST OF THE RIO GRANDE GORGE BRIDGE
REMOTE AREAS DO NOT HAVE ACCESS TO WATER

OUTSIDE OF LA JARA, COLORADO
CIELITO LINDO SUBDIVISION
ONE OF AT LEAST A DOZEN TAOS COUNTY
SUBDIVISIONS WITH NO UTILITIES
What are the components to create electricity using a Solar PV System?

1. Solar Panels – These panels consist of photovoltaic (PV) cells that transform energy from the sun into a direct current (DC) electricity
2. Inverter – This converts the DC electricity into a usable alternating current (AC) electricity
3. Battery storage – necessary if not a grid tied system
4. Electric Panel – The AC electricity runs into an electric panel, also known as a breaker box or fuse box, in order to directly power things that use electricity, such as lighting, water pumps, and appliances
If we think of electricity as water flowing through a pipe it can help us understand amps, volts and watts. Amps would be the volume of water flowing through the pipe. The water pressure would be the voltage. Watts would be the power (volts x amps) the water could provide (think back to the old days when water was used to power mills). So with this analogy in mind the definitions below for amp, volt and watt should be easier to understand:

- **Amp** – an ampere is the unit for measuring electricity. The accepted standard unit used for measuring how fast an electric current flows is an example of an ampere.

- **Volt** – the basic unit of electromotive force in the SI and MKS systems, equal to the electromotive force, or difference in potential, that causes a current of one ampere to flow through a conductor having a resistance of one ohm.

- **Watt** – the basic unit of electric, mechanical, or thermal power, equal to one joule per second or 10 ergs per second (of a horsepower): for electric power it is equal to one volt-ampere.

High amp use can draw down the battery storage system to critical levels. Standard pumps use a very high amperage at start-up and are not suitable for most solar powered systems.
GREEN POWER FOR YOUR HOME

SOLAR PANEL

INVERTER

CHARGE CONTROLLER

AC APPLIANCES

BATTERY

WIND TURBINE

© CanStockPhoto.com - csp45899369
OFF GRID CABIN NEAR EL VADO LAKE IN NORTHERN NEW MEXICO. NEW OWNER WANTED A DEPENDABLE SOURCE OF CLEAN WATER.
JUST LIKE THE SHURFLO PUMP, THIS AQUATEC .5 HP PUMP RUNS OFF OF DIRECT 12 VOLT CURRENT. THIS HELPS MINIMIZE DRAWDOWN OF THE BATTERY SYSTEM BUT THESE INLINE PUMPS ARE LIMITED TO NO MORE THAN @30 FEET OF DISTANCE FROM RAINWATER STORAGE TANKS.
COMING FULL CIRCLE – TAUGHT ABOUT SOLAR FROM ENGINEER WINDY DANKOFF IN 1987, NOW HIS COMPANY PRODUCES BOTH SOLAR INLINE BOOSTER PUMPS AND SOLAR DEEP WELL PUMPS.

The Dankoff Flowlight Booster Pump provides city water pressure anywhere. It has been a standard in home renewable energy systems since 1986. It is economical for domestic water supply, drip irrigation, and water purification.

A booster pump is far more cost effective than an elevated tank, providing pressure equivalent to over 100 feet (30 m) of elevation.

It uses one third to one half the energy of a conventional AC pump, and eliminates high starting surges.

It is more powerful, quieter, and much more durable than plastic RV/Marine pumps. Wearing parts are replaceable, and typically last 5 to 10 years. Overall life expectancy is 15 to 20 years.

Our complete instruction manual and easy installation kit make this pump simple for anyone to install and service, with no previous experience.

Choice of Voltage
- 12, 24 or 48 V DC, others (inquire)
- 115 V AC (low surge PM motor minimizes inverter and wire size)
Soft-Start

Both the SQ and SQE motors have a soft start because of the integrated electronics. Soft start reduces the starting current and gives the pump a smooth and steady acceleration.

The soft-start will reduce your chance of water hammer, minimizes the risk of wear and prevent overloading of your circuit during start-up.
SOMETIMES YOU HAVE TO BE CREATIVE WITH DOWNSPOUTS…
During the 1970s architect Michael Reynolds began developing the ideas and designs that became what he later named Earthships. Now based at the greater World Earthship Community near the Rio Grande Gorge Bridge area of Taos County, NM, Reynolds has developed dozens of these unique homes in our local area and hundreds around the country and the world.
USE AND REUSE OF MATERIALS

- Utilizing a variety of recycled materials such as old tires filled with compacted earth for the walls, aluminum cans imbedded in pumice-crete for insulated interior walls, and old bottles as lighting features, the Earthship model is based on recycling as well as being a
EARTHSHIPS HAVE BEEN BUILT ALL OVER THE WORLD

As well as in many states from Montana to Georgia, Vermont, and West Virginia

- Argentina
- France
- Easter Island
- Uruguay
- Panama
- Malawi
- Sierra Leon
- Haiti
- Puerto Rico
- The Philippines
- China
- Japan
- Indonesia
- Germany
- The Netherlands
- England
- Canada
- Mexico
- Spain
- Jamaica
WATER COMES FROM THE SKY

If there are energy shortages, individuals will have water problems.
If there is ecological damage, individuals will have water problems.
If there are economic crises, individuals will have water problems.
If there are computer glitches, individuals will have water problems.
If there is political turmoil, individuals will have water problems.

RAINWATER HARVESTING IS A CENTRAL COMPONENT OF THE SELF-SUFFICIENT EARTHSHIP

Quote from one of Mike Reynolds’s series of books on both the construction of and philosophy behind his architectural style.
ZERO DISCHARGE DRAINAGE SCHEMATIC
Path of water in biological shelters:

1. Water from rain and snow melt is caught on specifically designed roof structures.

2. Roof configurations direct water through silt catching devices and into cisterns.

3. Cisterns are positioned to gravity feed a pump and filter panel, including a drinking filter that filters out bacteria.

4. Water is pushed by the pump into a conventional pressure tank and through the filters and household water pressure with soft, filtered rain water is the result.

5. This fresh rain water is used by the home owner for any household use except flushing toilets.

6. Waste water (“grey water”) is directed into a grease and particle filter and then through a 30” deep interior rubber lined planter.
7. Oxygenation, filtration, transpiration, and bacteria encounter takes place in the planter.

8. At the low end of the planter water is directed through a peatmoss/charcoal filter and then recollected in a small well.

9. This twice used water is pumped from the well to flush a conventional toilet.

10. The toilet water is delivered to a solar enhanced septic tank (called an incubator).

11. Water goes from the solar septic tank into rubber lined, exterior landscaping planters set up very similar to the interior planter.

12. The system is valved so that all waste water can have the option of flowing into the septic tank. The septic overflow is valved so that all waste water can go into a conventional drainfield rather than the rubber lined exterior planters.

The result is a conventional sewage system that can become a quadruple use grey water recovery system with the turning of two valves.
January 25, 2001

Michael Reynolds
Solar Survival Biotechnology
P.O. Box 1041
Taos, NM 87571

RE: Wastewater Treatment Systems for Earthships

Dear Mr. Reynolds,

The staff of the Community Services Bureau, Liquid Waste Program has reviewed your design submittal for a liquid waste treatment system to be used in your Earthship construction.

The system consists of a properly sized conventional septic tank/drainfield system with a graywater evapotranspiration (ET) cell prior to the blackwater source and a blackwater ET cell after the septic tank. An overflow is provided for the graywater ET cell and is plumbed back to the system prior to the septic tank. An overflow is also provided for the blackwater ET cell and is plumbed back to the system prior to the drainfield.

The treated graywater will be used to flush the toilets only. Total evapotranspiration of the blackwater is anticipated.

Because the design incorporates a conventional system sized and constructed in accordance with the Liquid Waste Disposal Regulations, this system can be permitted without the need for a variance. The graywater and blackwater cells are considered additional treatment steps beyond what is required.

If you have any questions or if the program staff can be of any more assistance, please feel free to contact me at (505) 476-8531.

Sincerely,

Steve Walker, Manager
Environmental Services Program

Cc: Cecilia Williams, Chief, CSB
Taos Field Office
BIOTECTURE LOW COST SEPTIC SYSTEM DESIGN CONSTRUCTED IN HAITI
ALL THE THINGS THAT PEOPLE NEED FOR LIFE
Acknowledgements to Michael Reynolds and his staff at Earthship Biotecture www.Earthship.com and at the non-profit 501 (c) 3 Biotecture Planet Earth www.earthshipglobal.com for providing text and pictures
THANK YOU FOR YOUR PARTICIPATION AND FOR YOUR INVOLVEMENT IN RAINWATER CATCHMENT!
OTHER TIMES CREATIVITY COMES IN THE FORM OF DECORATING TANKS LIKE THESE ON THE HOPI NATION IN NORTHERN ARIZONA

PHOTOS COURTESY OF HOPI TUKSWA PERMACULTURE