




Earthships



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Contents

1. What is an earthship?
2. How does an earthship work?
 - ▶ Construction & Materials
 - ▶ Energy, Heating & Cooling
 - ▶ Food
 - ▶ Water
 - ▶ Waste Management
3. Do earthships really work?
 - ▶ Pros and cons of earthship living
 - ▶ Why do it?
4. Future of Earthships





What is an earthship?

What is an earthship?

- **Self-sufficient**, low cost passive solar home
- **Net Zero** in theory

- Architect Michael Reynolds
 - Earthship Biotecture



Earthships in Taos,
New Mexico

Designed to Meet Human Needs

- Shelter
- Food
- Energy
- Clean Water
- Garbage Management
- Sewage Treatment



How does it work?

Six Design Principles:

1. Building with Natural and Repurposed Materials
2. Thermal/Solar Heating and Cooling
3. Solar and Wind Electricity
4. Water Harvesting
5. Contained Sewage Treatment
6. Food Production



1. Building with Natural and Repurposed Materials



Scrap tires

Mud/earth

Plastic liners

Concrete

Rebar

(Local) timber +
plywood

Scrap cans

Plastic cisterns +
tubing

Power organizing
module + batteries

Piping

Rubber liners (for
water storage)

Rock/gravel

Straw and sand

Scrap glass bottles

Peat moss filter

Waterproof building
paper

Insulation (rigid)

Windows

Water organizing
module

Insulation made from
recycled clothing

Metal roofing

Solar panels

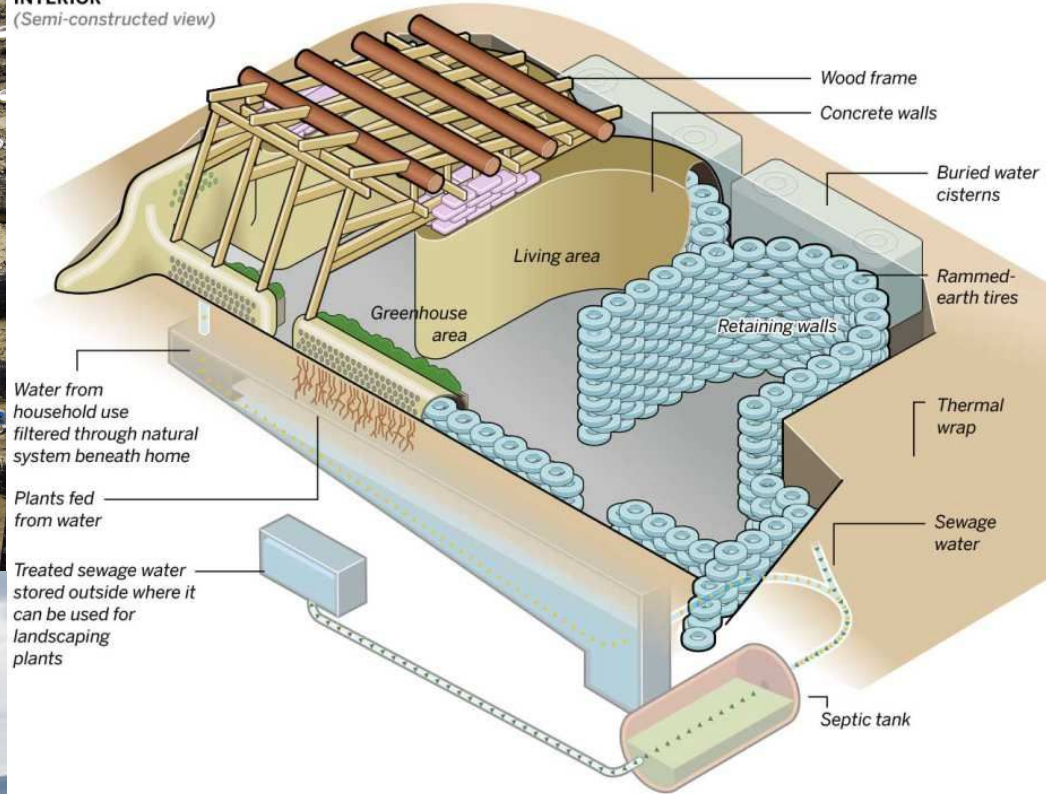
Laminated wood
floors

BETTER LIVING THROUGH GARBAGE

Earthships are self-sustaining homes constructed from as much locally-sourced, reclaimed material as possible.

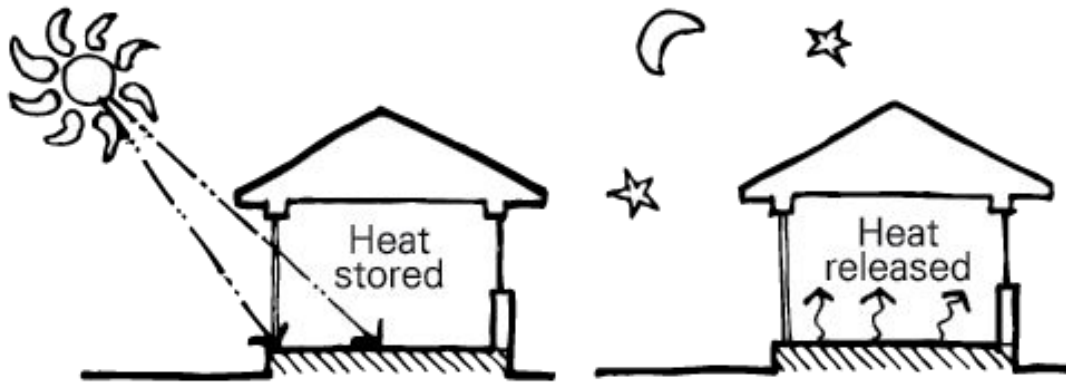
INTERIOR

(Semi-constructed view)

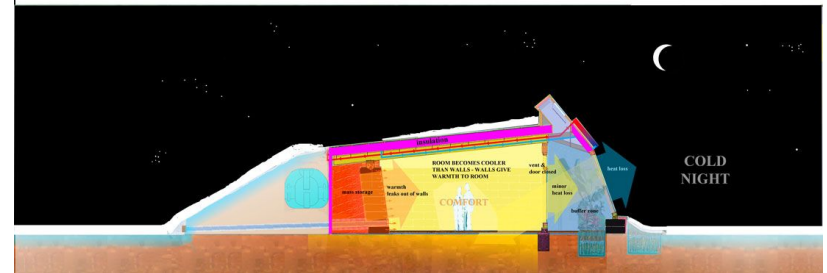
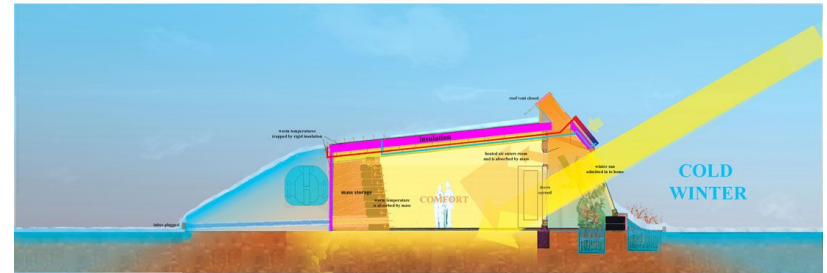
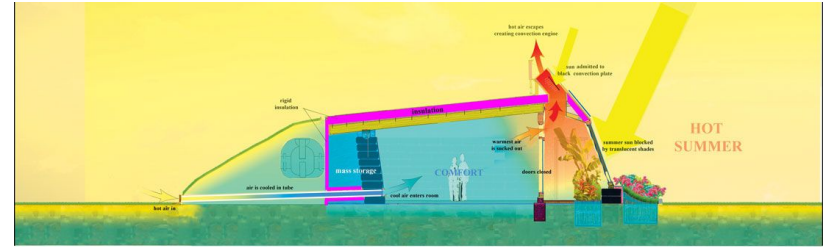
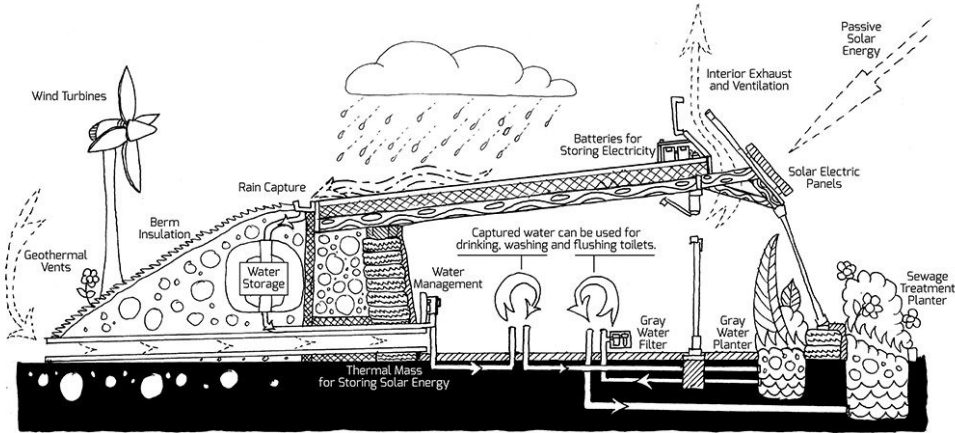


2. Thermal/Solar Heating and Cooling

Thermal mass: “the material inside a building that can help reduce the temperature fluctuations throughout the course of the day; thus reducing the heating and cooling demand of the building itself.”



“Passive cooling uses free, renewable sources of energy such as the sun and wind to provide cooling, ventilation and lighting needs for a household.”



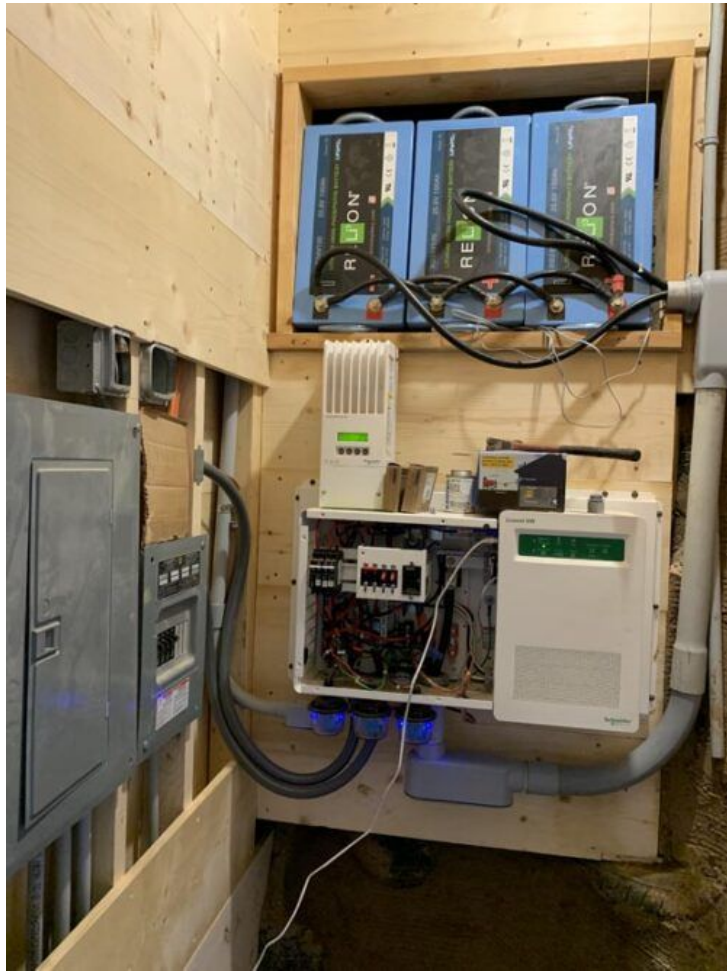
3. Solar and Wind Electricity

Earthships can operate
off-grid or partially on-grid.



Solar Power

- ▶ Pre-wired, pre-configured setup
- ▶ Modular
- ▶ Pair with battery bank
- ▶ Solar hot water heaters



Alternative Power Options

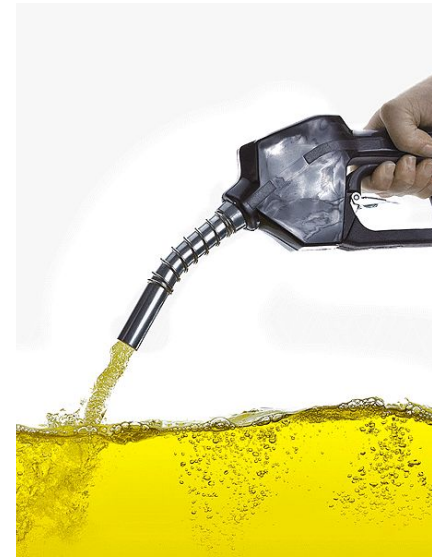
Wind



Micro Hydro



Biodiesel



4. Water Harvesting



Water from rain and snowmelt is collected using a well designed **catchment system**

- Specially designed roofs (metal roofing, cement plaster coated with acrylic coating, EPDM rubber, Brai with acrylic coating)
- Silt filters
- **Cisterns**

An inch of rain collected from a square foot is $\frac{2}{3}$ gallons of water

Every drop of water that lands on an Earthship roof is used **4** times



In from cisterns

To house

To pressure tank

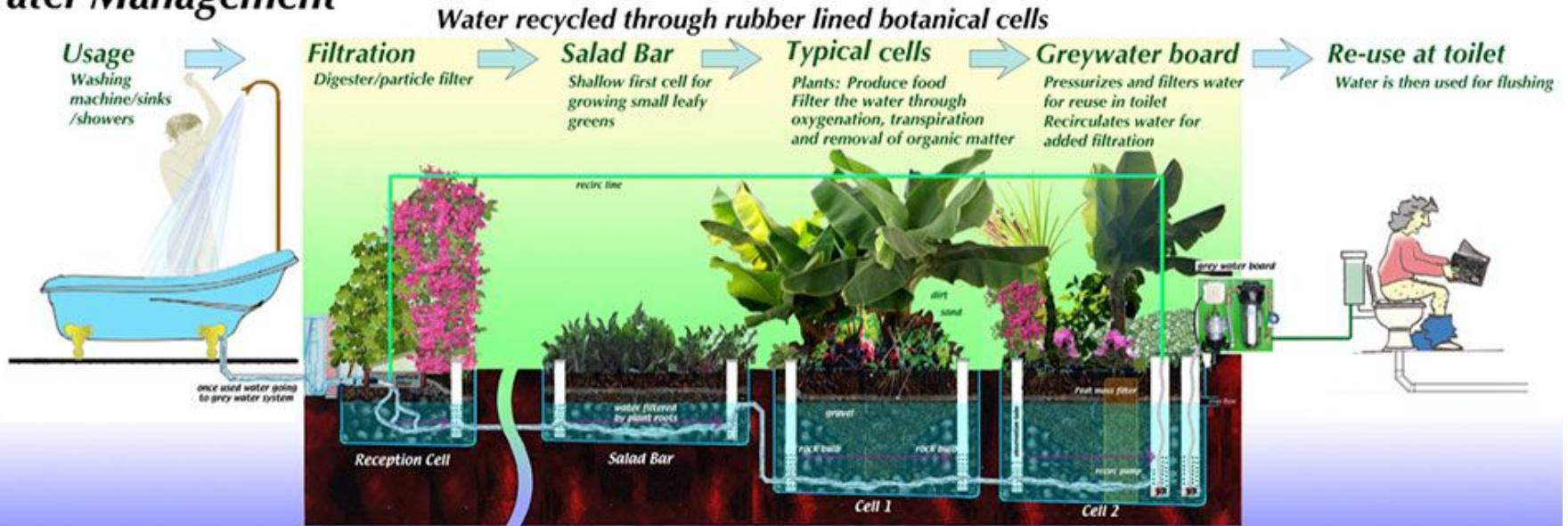
To drinking water spigots

- The water stored in cisterns then feeds into a pump and filter system before going to a water heater and pressure tank
- Some water is made **potable**

Water Organizing Modules



Water Management



- **Grey water** (untreated wastewater) is collected and sent to use for subsurface irrigation through the Earthship greenhouse to grow food
- The **botanical cells** filter water through gravel and plant roots, removing nitrogen and phosphate
- Water can be recycled several times through these indoor plants



5. Food Production

- Every Earthship has a greenhouse
- Plants that typically thrive are herbs, peppers, tomatoes, kale, beets, cucumbers, etc
- Hydroponic planters (add vertical growing space and doesn't utilize soil)
- Recently Earthships have been incorporating aqua botanical cells to increase food production with fish



6. Contained Sewage Treatment

- After grey water is used in botanical cells, it is collected and pumped into the toilet tank (grey water organizing module)
- 40% of water in homes is used for toilet flushing
- **Black water**- water that has come into contact with fecal matter
- Black water is sent into septic tanks and drains out to water outdoor plants
 - Black water shouldn't be used for food producing gardens







Is this really possible?

Success Stories

- Michael Reynolds' Greater World Community
 - 70 homes housing more than 100 people
 - Off the grid



“Learning to live within the limit of our battery banks, water tanks and the natural forces that nature supplies”



Are earthships really net
zero?

Net Zero?

- Diesel required for excavation (very little)
- The buildings **CAN** utilize solar and/or geothermal heat, cooling and hot water, and provide rain and greywater harvesting but very often **DON'T**



In theory, anyone can build
an earthship.





**Accessibility depends on
cost and climate**



Cost

- Reynolds claims earthships cost about the same as conventional homes to build but offer **future savings**
- Cost of replacement components
- “Simple construction methods” so amateurs and owners/friends can be involved in the building (which also lowers price)
- Reused materials help affordability

Location and Climate

- Only proven successes in Taos New Mexico
 - Possible because even in variable climates these homes have a remarkably stable indoor temperature range
- Research being done in Australia



More Limits on Location


- Earthships are considered "experimental architecture" and **building codes** are not designed for experiments. Many locations do not allow them.
- Financing for experiments is rarely available





Who would build an Earthship?

Why would someone want to live in
one?



Motivations

Moral reasons

- Reduce carbon footprint

Cost

- Spend less on utilities



Self-Sufficiency and Autonomy

- Too dependent on the systems around us



Motivations

- Now more than ever people are looking for a way to go green-- what better way than by **living** green
- Many people blame systems around them; off the grid living is a way to **cut ties from these systems** entirely



Would you
consider living in
an earthship?



Thank You!



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