

LIVING OFF-GRID

Energy-efficient,
Resource-efficient,
Enjoyable



THAD JOHNSON

OFF-GRID

The Home



The Life Style

- Comfortable
 - Warm in winter, cool in summer
 - Some maintenance
 - Consistent electricity and water
 - Aromas of Nature
 - Quiet enough to hear the sounds of bird wings flapping
- Connected
 - Cell phone
 - Satellite TV and Internet
 - Mail and package delivery

What is OFF-GRID?

Little or No “Regular” Infrastructure

- Unlimited Electricity
- Unlimited Water
- Natural Gas
- Land-line Phone
- Land-line Wi-Fi
- Cable TV
- Sewer
- Garbage Pick-up
- Road Maintenance

No Immediate Social or Emergency Support

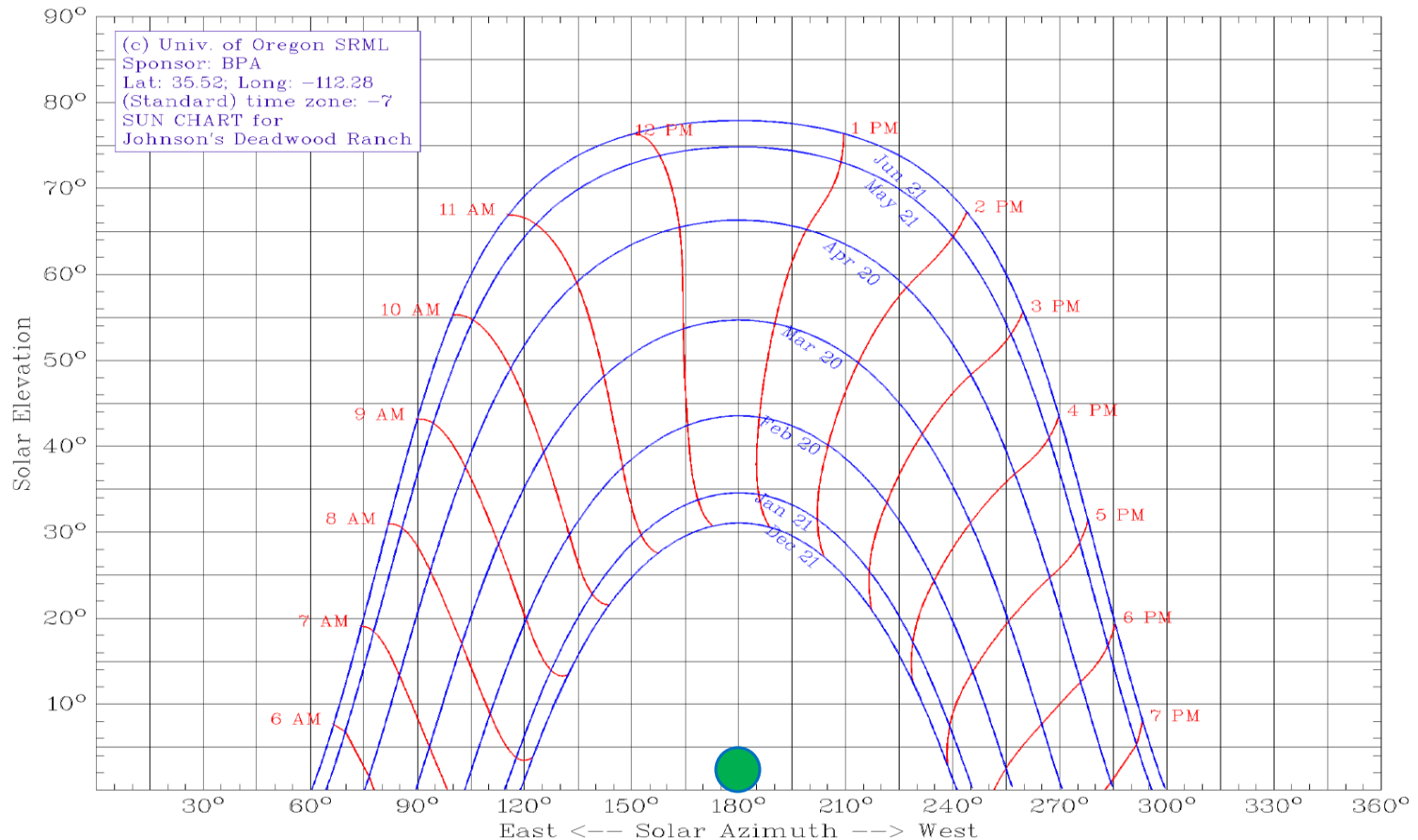
- Neighbors
- Police
- Medical
- Fire

It's not just being off the
“electrical grid”.

Live Comfortably OFF-GRID

1. Select a good off-grid site
2. Study your off-grid site
3. Be a good neighbor
4. Learn about off-grid systems & appliances
5. Learn about energy and resource-efficient design
6. Put it all together and live off-grid
7. Enjoy your self-reliance and independence!

Select a good Solar Site



Select a good OFF-GRID Site

Solar Access

- Clear southern exposure with no trees or natural formations between 20 – 80 degrees – for solar PV & passive solar heating

Cell Phone Access

- No obstructions to cell towers; check with neighbors for best carrier in the area

Wi-Fi Access

- Cell phone carrier (usually the fastest)
- Satellite is getting better; usually need southern exposure

TV Access

- Streaming not always an option
- Usually need southern exposure for satellite

Vegetation / Topography

- East and west of house site to provide early morning and late afternoon shade
- Adequate ground cover to cool site and minimize dust

Select a good OFF-GRID Site

Slight Site Slope

- Good site water drainage
- Gravity fed septic
- Gravity distribution for gray water irrigation

Septic

- Do neighbors have traditional or alternative septic systems?

Ground Water

- Water rights if water table is shallow (50-250 feet)
- Good tasting with low mineral content

Other factors

- Road access during inclement weather (evidence of slippery clay or flooded roads?)
- Wind for power generation (usually need a ridge or open space)
- Garden site for growing food

Study Your OFF-GRID Site

Solar Access

- Sun travel across the sky each season (Sun Chart)
- Natural shading by mountains, trees, fog, etc

Prevailing Weather

- Winds each season
- Temperature extremes
- Precipitation amounts each season

Site Slope / Topography

- House & driveway considerations
- Surface and water drainage
- Wetlands

Ground Water

- Rights
- Quality
- Depth

Views

- Desirable / Undesirable
- Protect your best view, keep it special

Vegetation

- What to be sure to save during construction

Animals

- Potential threats or physical damage

Be a Good Neighbor

Be a part of Nature

- Pay attention and work WITH it
- Design your home to be a part of the site - do not place your home on the highest site; views might be good but...
 - Lightning
 - Wind
 - Lack of Privacy
- Keep natural drainages natural
- Minimize site disturbance; natural vegetation takes a long time to recover

Wildlife

- Find out the habits of your wildlife and allow them to continue
- Work with animals; small fenced-in areas, provide safe corridors, no poison or insecticides, use live traps for pests
- Feed and water wildlife minimally; prey attracts predators
- Train your pets to stay close to home
- Reseed disturbed areas with natural grasses and plants
- Minimize noise and lights

Be a Good Neighbor

Vegetation

- Be sensitive to endangered or scarce plants, protect them and work around them
- Don't introduce invasive plants; remove those that exist
- Site your home so natural trees won't grow and block solar access
- Be careful with your grey water

Dark Skies

- Ensure all exterior lights are down-ported, including security lights
- Help keep Flagstaff and Coconino County "Dark Sky" communities

Neighbors

- Don't block or intrude on views
- Ensure you all have privacy
- Keep dust, light, noise, trash, etc from heading their way
- Meet them; protect your area together

Indian Artifacts

- Enjoy them where you discover them
- Call an archaeologist at the State or National Forest District

Learn About OFF-GRID Systems

Electricity

- Solar PV with battery bank
- Wind generation
- Back-up generator

Hot water

- Solar collector
- Geo-thermal
- Electric tank
- LPG tank-less

Heating

- Passive Solar
- Geo-thermal
- In-floor or below-floor radiant
- Wood or pellet stoves

Drinking Water

- Storage Tanks
 - Rainwater catchment
 - Hauled
 - Purification
- Well (if shallow water table)

Septic

- Gravity feed if possible
- Standard design (maybe)
- Alternative design (probably)
- Use compost toilets?

Consider protection from weather, people and animals.

Learn About OFF-GRID Appliances

Communication

- Phones (cell)
- TV (satellite)
- Internet (satellite)
- Mail (USPS or private box, UPS, FedEx, DHL will deliver)

Trash - Recycle

- Compost organics
- Recycle packaging or remove at source
- Haul recyclables and small volume of “trash”

Appliances, etc

- Stove/Oven: LPG
- Refrigerator: LPG or electric
- Clothes Dryer: LPG, electric or outdoor clothes line
- Low flush toilets
- Automatic on/off faucets
- Motion sensor light controls
- Exhaust fan timers
- Infra-Red water purification
- LED lights
- Energy Star whenever possible
- Etc, etc, etc

Learn About Energy-efficient Design

Use Passive Solar Strategies

- Design Strategy: Capture and store the sun's heat in the winter, capture and store cool air in the summer
- Orient the house as close to east-west as possible
- Place highest percentage of glazing on south side, lowest on east and west sides
- Install overhangs that allow full sun into south windows in winter, and no sun in summer
- Ensure enough thermal mass inside of the house to act as a thermal battery for absorbing and releasing heat

Manage your solar or it will manage you!

Use Daylighting

- Have daylight light all rooms during the day, including interior rooms when possible
- Minimize glare

Install Shading

- **Overhangs** (they protect the building walls from storms too)
- **Natural:** vegetation, hills, large rocks, etc
- **Mechanical:** interior blinds, exterior shade mechanisms

Invest in your Insulation

- Use adequate insulation in walls and ceiling/roof
- Pay attention to doors and windows
- Minimize skylights, use solar tubes instead if necessary

Learn About Energy-efficient Design

Floors

- Consider thermal mass value
- Go for low maintenance
- Insulate under floor
- Need tight air seal!

Walls / Ceiling

- Match system to requirement: SIPs, ICFs, AAC block, adobe, rammed earth, straw bale, frame, etc
- Insulation installation is important
- Need tight air seal!

Roofing

- Rainwater catchment surface, metal is preferred and recyclable

Glazing (windows)

- Values
 - **U-Value** (inverse of R-Value), lower value is higher insulation (maximum .35)
 - **SHGC** (Solar Heat Gain Coefficient), higher value allows more radiant heat
 - **VT** (Visible Transmittance), higher value allows more light
 - **AL** (Air Leakage) , lower value is less leakage
- Need tight air seal!

Source locally whenever possible.

Learn about Resource-efficient Design

Manage your resources as if they were investments – they are!

Collect Rainwater from all gutters

- Store in completely dark tanks
- Use for drinking water and/or irrigation

Re-use gray water from washer, tubs and bathroom sinks

- Irrigate vegetation and gardens

Fresh air ventilation

- Open windows and use cool night air to remove heat and odors
- Chimney effect; high windows to exhaust hot air and draw in lower cool air
- Whole house fans and/or mechanical air-exchangers

Re-use site and building materials

- Save topsoil for re-use
- Chip tree prunings and drywall for soil amendments

Grow Fruits and Vegetables

- Reduce trips to store for food
- Use compost for fertilizer

Use indigenous plants for landscaping

- Little need for pesticides or fertilizer
- Low water & maintenance

Put it all Together and Live OFF-GRID

Do-it-yourself Resources

- Local colleges and organizations
- Books and web sites
- Industry lectures and workshops
- Coconino County Sustainable Building Program

With Assistance

- Local architects
- Local builders
- Coconino County Sustainable Building Program Resource Directory

Systems

- Incorporate solar PV, rainwater catchment, radon expulsion, gray water and septic systems into your home design from the beginning

Integrate site orientation, off-grid systems, building components and lifestyle choices in your design from the beginning!

Enjoy your Self-reliance and Independence

Personal Responsibility and Confidence

- You have direct knowledge of the natural and industrial infrastructure and “costs” that are required to support your life style
- The ramifications of your life style choices are immediate
- You are as comfortable and “in communication” as you want to be
- You can fix what needs fixing when it needs fixing
- Minimize trips to town, consolidate errands

Satisfaction

- You notice the seasonal changes in temperature, rainfall, winds, vegetation, animals, birds, insects - they all affect you
- You’re not affected by increasing grid costs or outages
- You’re less affected by food costs and shortages
- You have actual “quiet” time
- You have a real connection and an appreciation of Nature

Thank-you!

SolarTerra Design LLC
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