CHAPTER 6

Energy & Heat

New here? Ready, Set, Ready is a 10-minute starting point: an honest assessment, one gap closed for real, then a map for using the rest of this site. Once something's actually happened, Surviving picks up where this chapter leaves off, organized by chronology instead of category. Curious how Tier, Stage, and Phase relate? See the Glossary.

Why This Category Comes Fourth

In Northern Utah specifically, cold weather is a real, recurring risk every year, not a rare exception. Hypothermia can kill in hours, not days, and it doesn't require a blizzard; a cold, damp, powerless house overnight is enough. This chapter and the previous one are closely linked: cold-weather injuries are a medical emergency, and the wrong heating choice (an unvented fuel source in a sealed room) is a carbon monoxide emergency. Energy for lighting and communication matters too, but heat is the piece with a survival clock attached to it.

As with the prior chapters, each tier adds capability rather than replacing what came before: Tier 1's flashlights and glow sticks stay in the kit even after Tier 3 brings a wired-up solar array online.

Stored vs. Generated

The same stored-versus-produced shift that runs through this manual's other chapters applies here too. Tier 1 is Stored: surviving on stored batteries, propane, and body heat, nothing is being generated. Tier 3 is Generated: there's no grid to return to and no more fuel deliveries, so energy shifts from something stored and consumed to something continuously generated (solar, wood, human power) and repaired. Tier 2 is the transition, and it starts generating sooner here than in the Water and Food chapters: a solar generator introduces real generation at Tier 2 already, but propane, kerosene, and firewood reserves are still finite, so Tier 2 is still partly running on a clock. Tier 4 is Generated at community scale. Knowing whether a given piece of gear is stored or generated is the difference between a plan that runs out and one that doesn't.

Tier 1: Short-to-Medium Term (Hours – 14 Days)

Goal: *Stored: using what's already stored. Conserve body heat and battery power while waiting for grid restoration. Prevent hypothermia and carbon monoxide poisoning.*

Tier 1 assumes the grid is down but help or restoration is realistically days away, not months. The two failure modes that actually kill people in this window are hypothermia and carbon monoxide poisoning; both are entirely preventable with correct habits, and both are the focus of this tier over anything else.

Skills to Build

- **Layering:** Base layer (moisture-wicking, not cotton; wet cotton actively pulls heat from skin), insulating layer (wool or synthetic fleece), and a wind/weather shell. Layering traps warm air between layers far more effectively than one thick garment. See the Staying Warm Without Power skill guide for the full technique.
- **Fuel Safety:** Understand that any fuel-burning device (camp stove, grill, generator) produces carbon monoxide, an odorless gas that kills without warning. The rule has no exceptions: never run one indoors, in a garage (even with the door open), or in a tent. See the Fire-Starting & Generator Safety skill guide for the full safety rundown.
- **Battery Conservation:** Put phones in low-power mode or airplane mode except for brief check-ins, and reserve power banks for communication devices and medical equipment, not entertainment or convenience.
- **One-Room Heating:** Pick the smallest interior room without exterior walls, close it off, hang blankets over the doorway, and concentrate heating and bodies there instead of trying to heat the whole house. See the Staying Warm Without Power skill guide for the full setup.

▸ GO DEEPER

The **Energy & Heat Addendum** builds these into real, tested competency.

For the hands-on how-to:

Generator, Heater & Utility Shutoff Safety | Staying Warm Without Power | Fire-Starting: Ignition, Fire Lays & Extinguishing | Building a Jean Pain Compost Heat Mound | Building a Rocket Mass Heater | DIY Solar Water Heater | Sizing a Solar Array & Battery System | Sizing a Fuel-Powered Generator | Pedal Power: Bicycle Generators

Stirling Engines: Turning Stored Heat Back Into Power

Tech & Equipment

- **LED Flashlights/Headlamps:** One per family member: high lumens, low battery draw. Headlamps free both hands, which matters more than it sounds like it will.
- **Power Banks:** 20,000+ mAh capacity, enough for multiple phone/radio charges without grid power.
- **Propane Camp Stove:** Outdoor cooking only: never indoors, never in a garage, never in a tent. This is the single most important rule in this chapter.
- **Carbon Monoxide Detector:** Battery-operated, placed near sleeping areas (not directly beside the stove or heater itself, to avoid nuisance alarms), required any time a fuel-burning device is used nearby. Check the alarm's expiration date; most CO sensors are only rated for 5–7 years and stop reliably sensing after that even if the unit still powers on.

Materials & Supplies

Item	Quantity / Spec	Notes
Warmth	Wool blankets, 0°F-rated sleeping bags, thermal underwear	0°F rating is a survival minimum, not a comfort rating; actual comfort is several degrees higher than the rating.
Lighting	Extra batteries (Li-ion, AA, AAA), chemical glow sticks	Glow sticks carry no fire risk; prefer them over candles when open flame isn't necessary.
Fuel	16 oz propane cylinders, ~1 can/day estimate	For outdoor cooking only.
Ignition	Waterproof matches, lighters, fire starters	Store at least two independent ignition methods in case one fails.

WARNING

Carbon Monoxide Kills Without Warning

Any fuel-burning device, a camp stove, grill, or generator, produces carbon monoxide, a colorless, odorless gas. By the time symptoms appear, poisoning is already underway. The rule has no exceptions and no safe workaround: never run one indoors, in a garage even with

the door open, in a tent, or on a porch or in a carport. Pair every fuel-burning device with a working, battery-backed CO detector, placed near sleeping areas, not directly beside the device itself.

Battery Safety: Don't Mix Ages or Chemistries

Never load a device with a mix of old and new batteries, or batteries of different chemistries (alkaline, lithium, NiMH) together. The weaker battery gets reverse-charged by the stronger ones, which can cause leakage, reduced performance, or in rare cases overheating and venting. Buy and store batteries in labeled, dated sets, and replace a full set together rather than topping off with whatever's on hand. This applies to every battery-powered device throughout this manual, not just this chapter's own equipment.

Northern Utah Note

Hypothermia along the Wasatch Front is a Tier 1 risk, not a Tier 2+ concern: a powerless house in a January cold snap can drop to dangerous indoor temperatures within a single night. Know the early signs (uncontrollable shivering that suddenly stops, confusion, slurred speech, numb extremities) and treat them as a medical emergency; see the Medical Care chapter for treatment. Elderly household members and infants lose body heat faster and need a warmer safe-room target than healthy adults; plan their space accordingly, and see the Access & Functional Needs chapter for anyone dependent on powered medical equipment.

Quick Checklist

- [ ] Batteries stored and replaced in matched sets; no mixing ages or chemistries in a device
- [ ] LED flashlight/headlamp per person, with spare batteries
- [ ] Power bank(s), 20,000+ mAh, reserved for comms/medical devices
- [ ] Battery CO detector installed near sleeping areas, alarm not expired
- [ ] Propane camp stove and fuel: outdoor-only use understood by everyone in the household
- [ ] 0°F-rated sleeping bags/wool blankets, one per person
- [ ] Two independent ignition methods stored
- [ ] Safe room identified and ready to close off (blankets over doorway, away from exterior walls)

- [ ] Practiced: everyone in the household can name the CO safety rule without prompting

Tier 2: Extended (2 Weeks – 3 Months)

Goal: *The stored-to-generated transition, still finite but beginning to generate power directly. Generate alternative power for critical devices (radios, medical) and provide safe heating/cooking for weeks without grid power.*

Tier 2 moves from surviving on stored batteries to actually generating and managing power and heat on an ongoing basis. This is where equipment choice and correct setup matter most: the wrong heater or an improperly grounded solar system is a fire or CO risk, not just an inconvenience.

Skills to Build

- **Alternative Cooking:** Get comfortable running a propane or wood stove for actual daily meal prep, not just boiling water. Fuel-efficient technique matters over a multi-month window (see the Food chapter's Tier 2 bulk-cooking guidance).
- **Solar Setup:** Learn to safely connect portable panels to batteries or a power station: correct polarity, appropriate gauge wiring, and not exceeding the charge controller's rated input.
- **Fuel Storage & Rotation:** Propane itself doesn't expire, but tanks and valves corrode over years and need periodic inspection. Kerosene degrades within roughly 1–2 years unless treated with a stabilizer. Firewood needs to season (dry) for 6–12 months before it burns efficiently and cleanly; green wood burns dirty and contributes to chimney creosote buildup.
- **Draft-Proofing:** Seal gaps around windows and doors in the safe room with weatherstripping or towels; heat retention matters as much as heat generation.

▸ GO DEEPER

The **Energy & Heat Addendum** builds these into real, tested competency.

For the hands-on how-to:

Generator, Heater & Utility Shutoff Safety | Staying Warm Without Power | Fire-Starting: Ignition, Fire Lays & Extinguishing | Building a Jean Pain Compost Heat Mound | Building a Rocket Mass Heater | DIY Solar Water Heater | Sizing a Solar Array & Battery System

Sizing a Fuel-Powered Generator | Pedal Power: Bicycle Generators | Stirling Engines: Turning Stored Heat Back Into Power

Tech & Equipment

- **Solar Generator:** A portable power station (1000Wh+) with solar input, for radios and medical devices. Size it against actual device wattage draw, not just the marketed capacity; a CPAP or oxygen concentrator alone can meaningfully change the sizing math. See the Access & Functional Needs chapter if that applies to your household, and the Sizing a Solar Array & Battery System skill guide for the real formula behind that sizing math.
- **Unvented Propane Heater with Oxygen-Depletion Sensor:** Products like the Mr. Heater Buddy are sometimes labeled “indoor-safe,” but they are unvented (there is no exhaust to the outside); the low-oxygen shut-off sensor is what makes indoor use survivable, not ventilation the unit provides itself. Always crack a window for fresh air exchange per the manufacturer’s instructions, keep a working CO detector in the same room, and never run one in a room where people are sleeping unless the specific model is rated for that use.
- **Wood Stove:** If already installed, have the chimney professionally swept and the damper function checked before the season it’s needed; creosote buildup from summer disuse is a real chimney-fire risk. See the Building a Rocket Mass Heater skill guide for a far more fuel-efficient alternative, plus the real legal path to building one. See the Stirling Engines skill guide if you want to pull a real, honest bonus of electricity out of a fire you’re already running for heat.
- **Battery Bank:** Deep-cycle AGM or lithium batteries for solar storage. Lithium batteries lose usable capacity in cold temperatures; plan for an insulated or heated storage location if they’ll sit through a Utah winter.

Materials & Supplies

Item	Quantity / Spec	Notes
Fuel reserves	20+ gal propane/kerosene, or 1+ cord firewood	A cord is a stacked pile 4 ft × 4 ft × 8 ft; use this to sanity-check any firewood delivery.
Lighting	LED lanterns (100+ hr runtime), extra bulbs	Far more efficient than incandescent lanterns over a multi-month window.
Extension cords	Heavy-duty, 12-gauge	12-gauge is rated for higher current draw, needed for running real appliances off a generator or power station.
Window insulation	Plastic shrink kits or heavy blankets	Applied at night especially: single-pane and older double-pane windows are the biggest heat-loss point in most homes.

Northern Utah Note

If a fuel-burning generator (rather than a solar generator) is part of your plan, the same CO rules from Tier 1 apply at a larger scale: outdoors only, at least 20 feet from any window, door, or vent, and never in a garage even with the door open. Heavy snow load can also bring down power lines and block generator/panel access; keep a clear, shoveled path to any outdoor equipment as part of your winter routine. See the Sizing a Fuel-Powered Generator skill guide for choosing the right size and fuel type before you need it.

Quick Checklist

- [ ] Solar generator or equivalent power source, sized against actual device wattage needs
- [ ] Heating source confirmed vented-outside OR unvented-with-working-ODS, CO detector co-located
- [ ] Wood stove chimney swept and damper checked before the season it’s needed
- [ ] 20+ gallons fuel or 1+ cord seasoned (dry) firewood on hand
- [ ] Battery bank stored where cold won’t significantly cut capacity
- [ ] Heavy-duty 12-gauge extension cords on hand
- [ ] Window insulation applied nightly in the safe room
- [ ] Practiced: ran the household’s actual heating/power setup for at least one full night before needing it

Tier 3: Permanent (Indefinite)

Goal: *Generated: generating rather than consuming. Total energy independence using renewable sources and biomass. Transition to hand tools and passive heating.*

Tier 3 assumes there's no grid to return to and no more fuel deliveries. Energy shifts from something stored and consumed to something continuously generated and managed (solar, wood, and human power) with the skills to repair the systems that make that possible.

Skills to Build

- **Woodworking:** Building and maintaining wood stoves, chimneys, and the hand tools this tier depends on.
- **Electrical Repair:** Wiring DC systems, repairing inverters, and maintaining battery banks: the off-grid solar array in this tier is only as reliable as the household's ability to fix it.
- **Passive Solar Design:** Using thermal mass and south-facing glass to capture winter heat passively. Design in summer shading (an overhang or deciduous trees) too; the same south-facing glass that's an asset in a Utah January becomes a liability in July without it. See the DIY Solar Water Heater skill guide for applying this same principle to heating water instead of a room.
- **Biomass Processing:** Making charcoal or processing wood for maximum BTU efficiency per unit stored: a meaningful multiplier on a finite woodlot. See the Building a Jean Pain Compost Heat Mound skill guide for a different approach: extracting sustained heat from wood chips through decomposition instead of combustion.

▸ GO DEEPER

The **Energy & Heat Addendum** builds these into real, tested competency.

For the hands-on how-to:

Generator, Heater & Utility Shutoff Safety | Staying Warm Without Power | Fire-Starting: Ignition, Fire Lays & Extinguishing | Building a Jean Pain Compost Heat Mound | Building a Rocket Mass Heater | DIY Solar Water Heater | Sizing a Solar Array & Battery System | Sizing a Fuel-Powered Generator | Pedal Power: Bicycle Generators

Stirling Engines: Turning Stored Heat Back Into Power

Tech & Equipment

- **High-Efficiency Wood Stove:** With a cooktop, so one fuel source covers both heating and cooking simultaneously.
- **Off-Grid Solar Array:** Larger-scale panels, charge controllers, and inverter system sized for ongoing household power, not just critical devices. See the Sizing a Solar Array & Battery System skill guide for the actual formulas, load tiers, and the Utah-specific winter sun-hours gotcha that undersizes most first attempts.
- **Hand Tools:** Saws, axes, drills, and grinders, non-electric or DC-powered, since grid tools become useless the moment the array or battery bank has a bad day.
- **Bicycle Generator:** For charging small batteries through human power when solar input is low (heavy overcast, deep winter). See the Pedal Power skill guide for real output numbers, a real commercial option, and the DIY design that actually works.

Materials & Supplies

Item	Quantity / Spec	Notes
Fuel stockpile	Cordwood reserves, coal, or charcoal capability	Plan a sustainable harvest rate, not just a stockpile; see Northern Utah note.
Spare parts	Fuses, wire, diodes, capacitors, solder	Covers general household and appliance repairs; see the Communication chapter for radio-specific spare parts and its note on EMP resilience.
Thermal mass	Water barrels, stone, or brick inside the home	Absorbs daytime heat and releases it slowly overnight: a passive multiplier on any active heating.
Clothing production materials	Wool, leather, fur	For making or repairing warm clothing if textile resupply is no longer available.

Northern Utah Note

Solar panels need to be mounted at an angle steep enough to shed snow, or cleared by hand after storms; a snow-covered array produces nothing. Cold measurably improves solar panel efficiency (panels perform better cold than hot), which partly offsets shorter winter daylight, but battery storage capacity drops in the cold, so oversize storage rather than relying on panel output alone. If sourcing firewood locally, coordinate with wildfire defensible-space guidance in the Shelter & Structural Safety chapter; woodpile placement matters for both heat supply and fire risk.

Quick Checklist

- [ ] Off-grid solar array installed and household can perform basic repairs
- [ ] Wood stove with cooktop installed, chimney maintained
- [ ] Hand tool set (non-electric/DC) assembled
- [ ] Sustainable firewood harvest rate planned against actual woodlot/supply
- [ ] Passive solar design includes summer shading, not just winter capture
- [ ] Spare electrical parts stocked
- [ ] Thermal mass installed in the primary living space
- [ ] Practiced: household has gone through at least one full off-grid week on Tier 3 systems only

Tier 4: Sustainable Community

Goal: *Generated, at community scale. Build a neighborhood-scale energy and heat system so no single household's equipment failure or fuel shortfall becomes a life-threatening emergency.*

A single household's Tier 3 solar array or wood stove is still a single point of failure: a failed inverter or an empty woodlot with no way to restock leaves that household with no heat or power until it's fixed. Tier 4 links households together so capacity, fuel, and repair skill are shared rather than isolated.

Start with the real risk, not an assumption that more sharing is always better: a neighborhood facing short, occasional outages has a different real need (loaning equipment back and forth, agreeing on load priority) than one planning for sustained infrastructure loss, where a genuinely shared system

starts to pay for itself. Ask concretely: how many households actually have real surplus generation or battery capacity to share, is there a shared or community woodlot that can regrow faster than it's cut, and does anyone have the space and willingness to run a shared repair workshop. A shared system sized past what the neighborhood can actually fuel, maintain, and staff fails the same way an unstaffed watch rotation does elsewhere in this book.

Choosing an Approach

Three real models fit different circumstances.

Approach	What it is	Fits when
Informal mutual-aid	Loaning generators, batteries, or fuel back and forth during an outage, no permanent connection or shared infrastructure	Occasional, short outages, or a neighborhood just starting to coordinate
Coordinated, separate systems	Each household keeps its own system, but agrees in advance on load priority and a shared woodlot or repair workshop	Real households willing to coordinate, but no one wants the complexity of physically tying systems together
True shared microgrid	Multiple households' systems physically interconnected under a real agreement	Genuine sustained need, and someone pursuing the real electrical and utility-interconnection requirements below

WARNING

Physically Connecting Two Households' Systems Carries a Real Backfeeding Risk

Backfeeding into a de-energized line can injure or kill a utility worker who assumes it's safely dead, and most utilities require a real interconnection agreement, and often a licensed electrician's involvement, before any generation equipment ties into the grid or into another household's system, not just a long extension cord and a verbal agreement. Check with your utility and local building department before physically connecting any two systems; a shared microgrid is a real electrical project, not a bigger version of running one generator.

Skills to Build

- **Microgrid Coordination:** Planning and agreeing on how multiple households' solar/battery systems can be connected or at least coordinated, including simple rules for whose need takes priority when total supply is limited (medical equipment first, for example).

- **Distributed Repair Skills:** Teach electrical and mechanical repair broadly rather than concentrating it in one household: a neighborhood with five people who can fix an inverter is far more resilient than one with a single expert.
- **Woodlot Management:** Coordinate a sustainable, rotating harvest across a shared or community woodlot so no single winter strips it faster than it can regrow.
- **Load Prioritization Planning:** Agree in advance on who gets shared power access first during a shortfall (medical devices, then heat, then everything else) rather than deciding it under pressure.

▸ GO DEEPER

The **Energy & Heat Addendum** builds these into real, tested competency.

For the hands-on how-to:

Generator, Heater & Utility Shutoff Safety | Staying Warm Without Power | Fire-Starting: Ignition, Fire Lays & Extinguishing | Building a Jean Pain Compost Heat Mound | Building a Rocket Mass Heater | DIY Solar Water Heater | Sizing a Solar Array & Battery System | Sizing a Fuel-Powered Generator | Pedal Power: Bicycle Generators | Stirling Engines: Turning Stored Heat Back Into Power

Tech & Equipment

- **Shared Microgrid or Battery Bank:** A solar and battery system sized to serve multiple households, with clear physical connections and access rules.
- **Community Woodlot:** A managed, shared wood-harvesting area with an agreed sustainable-yield schedule.
- **Shared Repair Workshop:** A stocked space with hand tools, spare electrical parts, and a place for community members to learn and practice repair skills together.
- **Redundant Small Systems:** Several smaller solar/battery setups distributed across households instead of one large centralized system: a design choice that means one failure doesn’t take down power for everyone.

Materials & Supplies

Item	Quantity / Spec	Notes
Community fuel depot	Shared wood/fuel reserve	Sized and restocked against the woodlot's actual sustainable yield.
Shared spare-parts inventory	Fuses, wire, inverter components	Centralized so no single household needs to stock everything alone.
Skill-share roster	Who can repair what	Simple and current; same model as the medical responder roster in the Medical Care chapter.
Redundant equipment	Multiple smaller systems vs. one large one	Deliberate design choice for resilience over efficiency.

Northern Utah Note

Utah’s rural electric cooperatives already operate on a shared-infrastructure, member-owned model, a useful real-world template for how a neighborhood energy-sharing agreement could be structured, including how costs, maintenance responsibility, and access are typically divided among members.

Quick Checklist

- [ ] Shared or coordinated microgrid/battery capacity established across more than one household
- [ ] Load-priority agreement in place before a shortfall happens
- [ ] Repair skills taught to more than one person in the neighborhood
- [ ] Community woodlot or fuel depot with a sustainable-yield plan
- [ ] Shared spare-parts inventory and repair workshop space established
- [ ] Backfeeding risk and utility interconnection agreement checked before physically connecting any two households’ systems
- [ ] Practiced: run at least one community energy/heat coordination drill or meeting

At a Glance: Energy & Heat Across All Tiers

A single-page reference for planning purposes. This does not replace the detailed guidance above; use it to see how the plan scales, not as a standalone checklist.

Tier	Mode	Duration	Heat Plan	Power Plan
Tier 1	Stored	Hours – 14 days	Layering + one-room heating	Flashlights, power banks
Tier 2	Transition	2 weeks – 3 months	Unvented/vented heater or wood stove	Solar generator, battery bank
Tier 3	Generated	Indefinite	Wood stove + passive solar design	Off-grid solar array, human power
Tier 4	Generated	Sustainable community	Shared fuel/woodlot management	Neighborhood microgrid, shared repair