SKILL GUIDE · ENERGY & HEAT

Sizing a Fuel-Powered Generator

The Fire-Starting & Generator Safety guide covers not killing yourself or a lineworker with one; it doesn't cover choosing the right size. This guide is that sizing math: running watts vs. starting watts, real fuel consumption by type, and the honest tradeoff between a generator and the solar and battery alternative.

Start from the same load tiers

The four load tiers in the solar sizing guide, whole house, house essentials, non-house essentials, and bare essentials, apply here too; a generator gets sized against the same real numbers, not a different framework. What's different about a generator is the sizing math itself and the fuel behind it.

Running watts vs. starting watts

Add up the running watts of everything you'd realistically run at the same time, then add just your single largest starting (surge) watts on top, not every device's surge added together.

WARNING

Starting watts is where undersizing actually happens

A fridge or well pump's motor can spike 2-6x its running wattage for a second or two at startup. A generator sized only against running watts will stall or trip the moment that motor kicks on, even though it looked adequate on paper. Check the appliance's starting watts, not just its running watts, before sizing against it.

Target running the generator at roughly 50-80% of its rated capacity with 20-25% headroom above your calculated load, not near its maximum. As a rough real-world anchor: most households cover their house-essentials tier with a 5,000-7,500 watt portable unit; a true whole-house standby unit (central AC included) typically runs 12,000-22,000 watts.

A generator's rated wattage assumes sea level, and much of Utah isn't

Most portable generators lose roughly 3% of their rated output for every 1,000 feet of elevation above sea level, thinner air means less oxygen for combustion. At 6,500 feet, common in Utah's mountain valleys and higher canyons, that's close to a 20% real-world derating from the number printed on the box. Build that margin into your sizing if you live or plan to run a generator at elevation, rather than discovering the shortfall during an actual outage.

Calculate your own numbers

Plug in your own numbers to size against your actual load. This doesn't replace understanding the method, it just does the arithmetic; the formula is shown with your numbers filled in. If you can't find a real number for an appliance, the typical-wattage table below the calculator is a reasonable stand-in.

Total running watts (everything at once)

e.g. 1800

Add up the running watts of everything you'd have on at the same time. Check each appliance's nameplate/label; if it lists amps instead of watts, multiply amps × 120V (or 240V for a large appliance like a well pump or electric range).

Largest single device's starting watts

e.g. 2200

Check the manual for "starting watts," "surge watts," or LRA (locked rotor amps × volts). If it's not listed, estimate 2-3x that device's own running watts, a real, commonly-cited range for motor-driven appliances.

Target load percentage

65

Calculate

Want an exact reading instead of an estimate?

A plug-in power meter (a "Kill A Watt" or equivalent, roughly $20-30) gives you a real running-watts number for anything that plugs into a standard outlet, and leaving it connected 24 hours reads real accumulated energy use too. Most cap out around 1875W, check that against the appliance first. For a hardwired 240V load, a well pump, electric dryer, or central AC, a clamp meter at the breaker (or an electrician, if you're not comfortable near an open panel) or a whole-home monitor like Emporia Vue or Sense gives the same real number per circuit. One caveat either way: these tools read average current, not a motor's true instantaneous starting surge, so for starting watts specifically, the manufacturer's spec sheet ("LRA," locked rotor amps, times voltage) is still the more authoritative number.

Typical figures for common appliances, use the real nameplate value when you can find one; these are reasonable stand-ins when you can't.

Appliance	Running watts	Starting watts
Refrigerator	~700W	~2,200W
Well pump	~1,000W	~2,000-3,000W
Sump pump	~800W	~1,300-2,400W (2-3x running)
Furnace blower	~800W	~1,600-2,400W (2-3x running)
Window AC, 5,000 BTU	~500W	~1,500W
Window AC, 10,000 BTU	~900W	~2,700W

Fuel type: a real tradeoff, not a clear winner

Fuel	Consumption (typical mid-size unit)	Shelf life	Tradeoff
Gasoline	~0.25-0.8 gal/hr depending on load and generator size	Starts degrading in as little as 30 days untreated; stabilizer extends this to roughly 12-18 months	Cheapest and most available fuel, but needs active rotation and stabilizer to stay usable in storage
Propane	~2-3 gal/hr at full load; burns about 20-25% more by volume than gasoline for the same output	Effectively indefinite if the tank and valves aren't damaged	The best fuel for long-term storage without maintenance, at the cost of needing more volume and a propane-rated unit
Diesel	~0.6-3.0 gal/hr depending on load and size	Degrades slower than gasoline but still benefits from a biocide/stabilizer in long-term storage	Most fuel-efficient and durable option, but generally the highest upfront equipment cost

A dual-fuel unit (gasoline and propane) trades a small amount of efficiency for real flexibility, useful if you're not sure which fuel you'll actually be able to resupply.

Inverter vs. conventional: a real difference for medical electronics

An inverter generator produces meaningfully cleaner power, generally under 3% total harmonic distortion (THD), compared to 5-10% or higher from a conventional generator. That's not a marketing spec; a CPAP, an oxygen concentrator, or anything else with a circuit board and a precision power supply is more vulnerable to that dirtier power than a simple resistive heater or incandescent bulb is. If the Access & Functional Needs chapter's medical equipment applies to your household, an inverter generator is the safer default, not just the quieter and more fuel-efficient one.

Getting power from the generator to what you're running

Without a transfer switch or interlock kit (see Fire-Starting & Generator Safety for why backfeeding a wall outlet is never the answer), you're running extension cords from the generator to individual appliances, and cord gauge matters more than it looks like it should. A standard 12-gauge cord is fine for a 20A circuit at distances under 50 feet, but push past 50 feet, or run anything close to 30A, and you need to step up to 10-gauge; a cord that's too thin for its load and length drops voltage and heats up, both real fire and equipment-damage risks, not just an efficiency loss. As a working rule: 10-gauge for generator use in general, and mandatory at 30A regardless of length.

Portable vs. standby

A portable generator needs a person to deploy, fuel, and run it every time, and needs a transfer switch or interlock kit (see the Fire-Starting & Generator Safety guide) to power your house's circuits legally and safely. A standby generator auto-starts on its own transfer switch within seconds of an outage and needs no manual intervention, at a real cost: several times the price of a comparable portable, plus professional installation. Neither is the objectively right answer; it's a genuine budget-versus-convenience tradeoff.

Generator or solar and battery: an honest comparison

A generator gets you back to near-full power immediately and doesn't care about cloud cover or the time of year the way solar does. Its real limit is fuel: a finite, resupply-dependent resource in exactly the kind of prolonged disruption this manual plans around, and the same disruption that makes fuel harder to buy is often the reason you need the generator in the first place. Solar's limit is different: capacity and weather, not a supply chain, once it's installed, it keeps working for free as long as the sun does. Many households reasonably want both: a generator for fast, high-wattage recovery in the first days, and solar plus battery for the indefinite stretch after fuel runs out or becomes hard to resupply.

Sources

- Running vs. starting watts and generator sizing method: BigRentz; Batteries Plus
- Fuel consumption by type: GRETECH; Generator Source
- Gasoline vs. propane shelf life: Ferrellgas; TruePrepper
- Inverter generator power quality and THD: Anker SOLIX; Erayak Power
- Typical appliance running/starting watts: SizeMyHome; HVAC Base
- Plug-in power meter accuracy and use: Wikipedia, Kill A Watt; P3 International
- Clamp meters and whole-home circuit-level monitoring: Energy Vanguard
- Generator altitude derating (roughly 3% per 1,000 ft): Genesal Energy; Generator Bible
- Extension cord gauge selection for generator use: Vantecable