EVERYDAY TECHNOLOGY / FREE QUICK GUIDE

Measure Before You Buy

A practical introduction to sizing a portable power system

Portable power systems are often marketed by battery capacity or inverter wattage. Neither number, by itself, tells you whether the system will operate your equipment for the time you need.

Start with the requirement: What must run, how much electricity does it actually use, and for how long?

This guide applies to **Personal Use** and **Business Use**. The process is the same whether you are protecting a refrigerator during an outage or keeping a small vendor's lights and payment terminal operating.

The five questions

• What equipment must remain powered?

• How many watts does each device draw while operating?

• How much energy does it consume over a representative period?

• What is the required runtime, including interruptions or changing conditions?

• What reserve is needed, and can the system handle startup loads?

A portable power station is a possible answer. It is not the starting point.

Illustrations in this guide explain the method; they are not measurements of your equipment. The customer is responsible for confirming requirements and selecting any product.

1 Build an equipment inventory

List only the equipment that must operate during the planned period. Separate essential loads from optional loads.

For each device, record:

• Device and quantity

• Rated or measured running watts (W)

• Expected hours of operation

• Whether it operates continuously or cycles on and off

• Whether it may run at the same time as other equipment

• Known startup or surge requirements

Personal Use example

A refrigerator may cycle on and off, while a network router normally runs continuously. The refrigerator's label wattage alone may not represent its average energy consumption.

Business Use example

A small food vendor may need lighting and a transaction terminal throughout the selling period, plus a refrigerator that cycles. Cooking equipment is not assumed to be part of this example.

Two different numbers matter

Watts (W) describe the rate at which equipment uses power. They help determine the inverter output required while devices run together.

Watt-hours (Wh) describe energy used over time. They help determine battery capacity and runtime.

Example: a steady 50 W device operating for 6 hours uses approximately **300 Wh** (50 × 6). This calculation is useful for steady loads; cycling loads should be measured over representative conditions.

2 Measure instead of guessing

For plug-in equipment, a suitable energy monitor can show actual consumption over time. Measurement is particularly useful for refrigerators, freezers, and other devices whose power use changes.

Equipment used in developing this approach

The **Kasa KP125M** energy-monitoring smart plug was used in the project's measurement work. It can report power consumption and historical energy use through its supported software. It is an example of a measurement tool, **not a required purchase or endorsement**.

Other choices include the **Kill A Watt** plug-in electricity monitor and comparable meters that record accumulated kWh. The critical requirement is that the instrument measure energy over time, not merely show a momentary watt reading.

How to take a useful measurement

• Confirm that the meter is suitable for the outlet and appliance load; follow its electrical ratings and instructions.

• Record the starting accumulated energy reading and the start time.

• Operate the equipment under conditions representative of actual use.

• Record the ending reading and elapsed time.

• Subtract starting energy from ending energy; convert kWh to Wh by multiplying by 1,000.

Example: Start = 1.20 kWh; end = 1.95 kWh. Energy used = 0.75 kWh = **750 Wh** during the test.

A brief test may miss compressor cycles, door openings, temperature changes, or business activity. A complete operating-period test is preferable before using measured consumption for planning.

Important limitation

A standard plug-in energy meter may not capture the very brief startup surge of a motor or compressor. Check manufacturer startup specifications or use suitable instrumentation when surge capacity matters. Do not use plug-in meters on hardwired circuits.

3 Convert measurements into a requirement

A battery has an energy rating, usually in Wh or kWh. The useful energy delivered to connected equipment can be lower because of conversion losses, operating conditions, and reserve settings.

Step A: establish energy needed

Add the measured or reasonably estimated Wh for every required device over the intended operating period. Avoid mixing a one-hour reading with a full-day requirement without adjusting for time and actual duty cycle.

Step B: account for losses and reserve

For an initial screening estimate, divide the load energy by an assumed usable fraction. For example, if you assume 80% of nominal capacity will be available to the loads, a **1,200 Wh** requirement suggests **1,500 Wh** nominal battery capacity (1,200 ÷ 0.80). The 80% is an illustration, not a universal product specification.

Step C: check inverter output

Add the running watts of equipment that may operate simultaneously. The inverter’s continuous output must accommodate that combination. Check motor and compressor startup requirements separately.

Step D: test the real operating conditions

Consider ambient temperature, repeated compressor starts, battery aging, and whether the unit must be recharged during an outage. A runtime estimate is not a guarantee.

A useful decision check

• Is the required operating period clearly defined?

• Are the measurements representative of that period?

• Does the proposed inverter support simultaneous running loads and startup demands?

• Is the reserve sufficient for uncertainty and changing conditions?

4 Decide what to do next

Once you know the required energy, running wattage, surge needs, and runtime, you can compare products on a consistent basis. You may choose a portable power station, a different backup arrangement, or decide that no purchase is necessary.

Your decision, your equipment

This project does not rank manufacturers or direct you to a particular brand. Use your requirements to question product claims, compare published specifications, and request clarification from vendors before spending money.

Want a more structured analysis?

The optional **Measure Before You Buy - Planning Worksheets (Worksheet 3)** provide an equipment inventory, measurement log, measurement analysis, and a safeguard that calls for renewed approval when previously approved measurements change. Versions are provided for Apple Numbers and Microsoft Excel, along with a printable PDF.

The worksheets support your analysis; they do not select a product or guarantee performance. Purchasing them is optional.

Before you buy

• Keep a copy of your measurements and assumptions.

• Check each manufacturer’s actual usable capacity, inverter limits, and charging specifications.

• Confirm warranty, support, return terms, and safe installation requirements.

• Choose the solution that meets your requirements, or postpone the purchase until the evidence is sufficient.

Better Decisions Begin With Better Analysis

Reference information: TP-Link KP125M product and energy-monitoring documentation; P3 International Kill A Watt P4400 documentation. Product names are examples only. No affiliation or endorsement is implied.

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