

# Solar Power *Sizing* *Calculator*

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Estimate backup power needs for essential devices. Calculate system size, battery capacity, and realistic costs for Malaysian homes. Power your family during grid failures with practical, affordable solar solutions.

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## **Solar Power Sizing Calculator for Malaysian Homes**

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**Designed for Malaysian families**, this guide provides practical solar sizing methodology for backup power systems, accounting for tropical sun patterns, realistic device consumption, and Malaysian costs and suppliers.

**This guide covers:** Device power consumption, daily energy calculations, system sizing formulas, battery capacity requirements, solar panel sizing, real Malaysian costs, and implementation examples for typical homes.

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# Why Solar?

Malaysia's climate makes solar backup power practical and affordable

Malaysia receives 4–5 hours of usable solar irradiance daily year-round. Even during monsoon season with cloud cover, we get 3–4 hours. This consistent daily sun makes solar power realistic for Malaysian families—unlike cold climates where winter performance is poor.

## What can solar power do for you?

**Small solar systems (500W–2kW) don't replace grid power.** They provide backup for essentials during blackouts:

- Phone and device charging (your communication lifeline)
- Lighting (LED lights reduce power needs dramatically)
- Internet/WiFi router (critical during emergencies)
- Electric fans (essential in tropical climate)
- Refrigeration (keep food from spoiling)
- Water pumping (if your home uses electric pump)

A properly sized system keeps your family functioning during 12–24 hour blackouts (common during severe weather in Malaysia) without fuel costs or generator noise.

## Solar vs other backup power options

OPTION	INITIAL COST	RUNNING COST	LIFESPAN	BEST FOR
Generator (fuel)	RM 1,500–3,000	RM 30–50/day fuel	5–10 years	Short-term backup
Small solar system	RM 3,000–8,000	RM 0 (after setup)	20–25 years	Extended backup
Hybrid (solar + battery)	RM 8,000–20,000	RM 0 (after setup)	20+ years	Full family independence

Solar systems have no running costs. Once installed, they generate power for 20–25 years. This makes them economical for extended emergencies.

#### PRACTICAL STRATEGY

Many Malaysian families combine solar with a small generator. Solar handles normal use and extends operation. Generator provides backup for cloudy days or extended outages. This balanced approach is affordable and reliable.

# Understanding *Power Consumption*

Watts, kilowatts, and hours—the basics you need

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## Three essential concepts

### WATTAGE (W)

How much power a device uses at that moment. A 10W LED bulb uses 10 watts. A 1500W hair dryer uses 1500 watts (1.5 kilowatts).

### KILOWATT-HOUR (KWH)

Energy used over time. A 100W device running for 10 hours uses 1 kilowatt-hour ( $100W \times 10h = 1000Wh = 1kWh$ ). This is how utility companies bill you.

### DAILY ENERGY CONSUMPTION

Sum of all watts used by each device, multiplied by hours running.

## Simple calculation formula

**Watt-hours per day = (Device Wattage) × (Hours running)**

Example: LED light uses 10W, runs 8 hours daily  
 $= 10W \times 8h = 80 \text{ watt-hours (Wh)}$

Example: Electric fan uses 50W, runs 12 hours daily  
 $= 50W \times 12h = 600 \text{ watt-hours (Wh)}$

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**Total daily = 80 + 600 = 680 Wh per day**

## Why this matters for solar sizing

Your solar system must generate enough energy to cover daily consumption PLUS losses. If you use 500Wh daily, you need panels that generate 600–700Wh (accounting for system inefficiencies).

### KEY INSIGHT

Don't calculate based on worst-case. Calculate based on typical use during emergency. You'll reduce consumption (fewer lights, shorter fan runtime) during blackout—this isn't normal operation.



# Device Power Consumption Tables

Real wattage of common Malaysian household devices

## Lighting

DEVICE	WATTAGE	NOTES
LED bulb (9W equivalent)	9W	Preferred for solar backup
LED bulb (15W equivalent)	15W	Bright enough for most tasks
Fluorescent tube (T5, 2ft)	10W	Good alternative to LED
Incandescent bulb (60W)	60W	Avoid—wastes battery power

## Communication & devices

DEVICE	WATTAGE	NOTES
WiFi router	10–15W	Most important device to power
Phone charger (in use)	5–10W	Actual charging, not idle
Laptop charger	60–100W	High power when charging
Portable power bank charging	10W	Precharge during day

## Cooling & fans

DEVICE	WATTAGE	NOTES
Electric fan (ceiling, low)	30–50W	Essential in Malaysia
Electric fan (ceiling, high)	50–80W	More power at higher speeds
Portable fan	20–40W	Lower power option
Air conditioning (1.5 tons)	1,200W	Not practical for small solar

## Refrigeration

DEVICE	WATTAGE	NOTES
Refrigerator (small, compressor)	200–400W peak	Runs ~4–6 hrs/day = 800–2000Wh
Refrigerator (large, standard)	400–600W peak	Runs ~6–8 hrs/day = 2400–4800Wh
Freezer (separate)	400–800W peak	Requires significant battery
Small cooler box	50–100W	Lower power alternative

## Cooking & water

DEVICE	WATTAGE	NOTES
Electric water pump (for pressure)	300–500W	Intermittent, high startup power
Water heater element	2,000–4,000W	NOT practical for solar backup
Microwave	800–1,200W	High power draw—rarely solar-friendly
Rice cooker (small)	600W	Possible with medium battery

REALITY  
CHECK

Notice: Most Malaysian homes focus on LED lighting, fans, router, and refrigeration. These are the priority essentials during blackout. High-power items (AC, heater, microwave) are rarely practical with small solar systems.

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— CHAPTER FOUR

# Calculate Your *Daily Energy Needs*

Step-by-step calculation for your specific family

## Three example scenarios

### SCENARIO 1: MINIMAL BACKUP (LIGHTING + PHONE CHARGING)

- 2 × LED lights (10W each) running 8 hours =  $20W \times 8h = 160Wh$
- WiFi router (12W) running 12 hours = 144Wh

- Phone charging (once daily, 10Wh)
- **Total: 314Wh per day**

#### SCENARIO 2: MODERATE BACKUP (LIGHTING + FANS + ROUTER + REFRIGERATOR)

- 4 × LED lights (10W each) running 6 hours =  $40W \times 6h = 240Wh$
- Electric fan (50W) running 10 hours = 500Wh
- WiFi router (12W) running 12 hours = 144Wh
- Refrigerator (350W peak, ~5 hrs/day compressor) = 1,750Wh
- Phone + laptop charging = 30Wh
- **Total: 2,664Wh per day**

#### SCENARIO 3: EXTENDED BACKUP (FULL HOUSE ESSENTIALS)

- 6 × LED lights (10W each) running 8 hours = 480Wh
- 2 × electric fans (50W each) running 12 hours = 1,200Wh
- WiFi router (12W) running 16 hours = 192Wh
- Refrigerator (350W, 6 hrs compressor) = 2,100Wh
- Water pump (400W, 2 cycles/day, 30 min each) = 400Wh
- Phone + laptop + power bank charging = 50Wh
- **Total: 4,422Wh per day**

## Create your own calculation

### 1 List essential devices

During a blackout, what must stay powered? Lights, router, fan, refrigerator, phone chargers?

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### 2 Find wattage for each

Check device label, use table above, or look up model online

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### 3 Estimate hours of use

During emergency, how many hours per day will this run?

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### 4 Multiply and add

Wattage × hours for each device, then sum all results

#### PRO TIP

Add 20% to your calculated total to account for system inefficiencies (inverter losses, wiring losses, battery charging losses). A system sized for 2,500Wh needs to generate 3,000Wh to actually deliver 2,500Wh.

# Solar Panel Sizing

How much panel capacity you actually need

## The Malaysian advantage: 4 hours daily sun

Malaysia averages 4–5 hours of peak sun equivalent daily (even during monsoon, typically 3–4 hours). This is the irradiance level where a panel produces its rated wattage.

## Panel sizing formula

**Panel capacity (watts) = Daily energy need (Wh) ÷ 4 hours × 1.2 (system efficiency)**

For 2,500Wh daily need:

= 2,500 ÷ 4 × 1.2

= 625 × 1.2

= 750W panels needed

**750W panels = approximately 2 × 400W or 3 × 250W panels**

## Real panel sizing examples

DAILY NEED (WH)	PANEL SIZE	CONFIGURATION
500Wh	150W	1 × 150W panel
1,000Wh	300W	1 × 300W panel
2,000Wh	600W	2 × 300W panels
2,500Wh	750W	2 × 400W panels
4,000Wh	1,200W	3 × 400W panels
5,000Wh	1,500W	4 × 400W panels

## Panel types available in Malaysia

- **Polycrystalline (older, still common):** 250–300W typical, RM 1,500–2,000 per panel

- **Monocrystalline (more efficient):** 350–400W typical, RM 2,000–3,000 per panel
- **Half-cut monocrystalline (best):** 400–450W, RM 2,500–3,500 per panel
- **Portable/flexible panels:** 100–200W, RM 1,500–3,000, useful for RVs or temporary setup

## Panel placement considerations

- **Roof space:** South-facing roof is ideal in Malaysia (though any orientation works reasonably well)
- **Shading:** Avoid shadows from trees, buildings, or structures. Even partial shading reduces output significantly
- **Angle:** 5–10° tilt (roughly matching latitude) is optimal for Malaysia. Flat roof mounting works adequately
- **Maintenance:** Dust and bird droppings reduce output. Clean panels every 2–3 months during dry season

**Don't overthink panel selection.** Most panels are 350–400W monocrystalline today. Buy from reputable brands (Canadian Solar, JinkoSolar, Trina). All modern panels last 25+ years. The exact wattage matters less than system sizing overall.

# Battery Storage Requirements

How much battery capacity you need for backup

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## Why battery size matters

Solar panels only produce power during daylight. For evening and night usage, battery stores daytime excess. Undersized batteries mean you run out of power by evening.

## Battery sizing formula

**Battery capacity (kWh) = Daily energy need (Wh) × Days of autonomy ÷ 0.8 (usable capacity)**

Example: 2,500Wh daily, want 2 days backup  
=  $2,500 \times 2 \div 0.8$   
=  $5,000 \div 0.8$   
= 6.25 kWh battery capacity needed

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**6.25 kWh = approximately 5 × 1.28 kWh batteries (or 13 × 512Wh units)**

## Battery types for Malaysian homes

### LITHIUM (LIFEPO4) - RECOMMENDED

- **Lifespan:** 10–15 years, 5,000+ charge cycles
- **Cost:** RM 3,000–5,000 per kWh
- **Usable capacity:** 90–95% (vs 50–70% for lead-acid)
- **Maintenance:** None required
- **Size:** Compact and lightweight

### LEAD-ACID (AGM) - BUDGET OPTION

- **Lifespan:** 3–5 years, 500–1,000 cycles
- **Cost:** RM 800–1,500 per kWh
- **Usable capacity:** 50–70% (must not fully discharge)
- **Maintenance:** Periodic checks required
- **Size:** Heavy, requires ventilation

## Example battery configurations

SYSTEM SIZE	LITHIUM OPTION	LEAD-ACID OPTION	COST (LITHIUM)
2 kWh	2 × 1kWh modules	4 × 12V 200Ah batteries	RM 6,000–10,000
5 kWh	5 × 1kWh modules	8 × 12V 200Ah batteries	RM 15,000–25,000
10 kWh	10 × 1kWh modules	16 × 12V 200Ah batteries	RM 30,000–50,000

### LEAD-ACID REALITY

Lead-acid batteries are cheap upfront but require replacement every 3–5 years. Over 15 years, you'll buy 3–5 sets of batteries. Lithium costs more initially but lasts 15 years with no maintenance. Cost per year is actually similar—lithium wins on convenience.

# Complete System *Examples*

Real configurations for different Malaysian family needs

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## System 1: Minimal backup (apartment, small usage)

USE CASE: LIGHTING, ROUTER, PHONE CHARGING

- **Daily energy:** 500Wh
- **Solar panels:** 1 × 300W monocrystalline (RM 2,500)
- **Battery:** 2 kWh lithium (RM 6,000–8,000)
- **Inverter:** 2kW (RM 2,000–3,000)
- **Installation & wiring:** RM 2,000–3,000
- **Total investment:** RM 12,500–16,500

**Provides:** 4 days of independent operation (normal usage pattern). 2–3 days full blackout operation.

## System 2: Moderate backup (family home, balanced)

USE CASE: LIGHTS, FANS, ROUTER, REFRIGERATOR, PHONES

- **Daily energy:** 2,500Wh
- **Solar panels:** 2 × 400W monocrystalline (RM 5,000–6,000)
- **Battery:** 5 kWh lithium (RM 15,000–20,000)
- **Inverter:** 3–4kW (RM 3,000–4,500)
- **Installation & wiring:** RM 3,000–4,000
- **Total investment:** RM 26,000–34,500

**Provides:** 2 days of extended blackout operation. Refrigerator stays powered. Full family comfort.

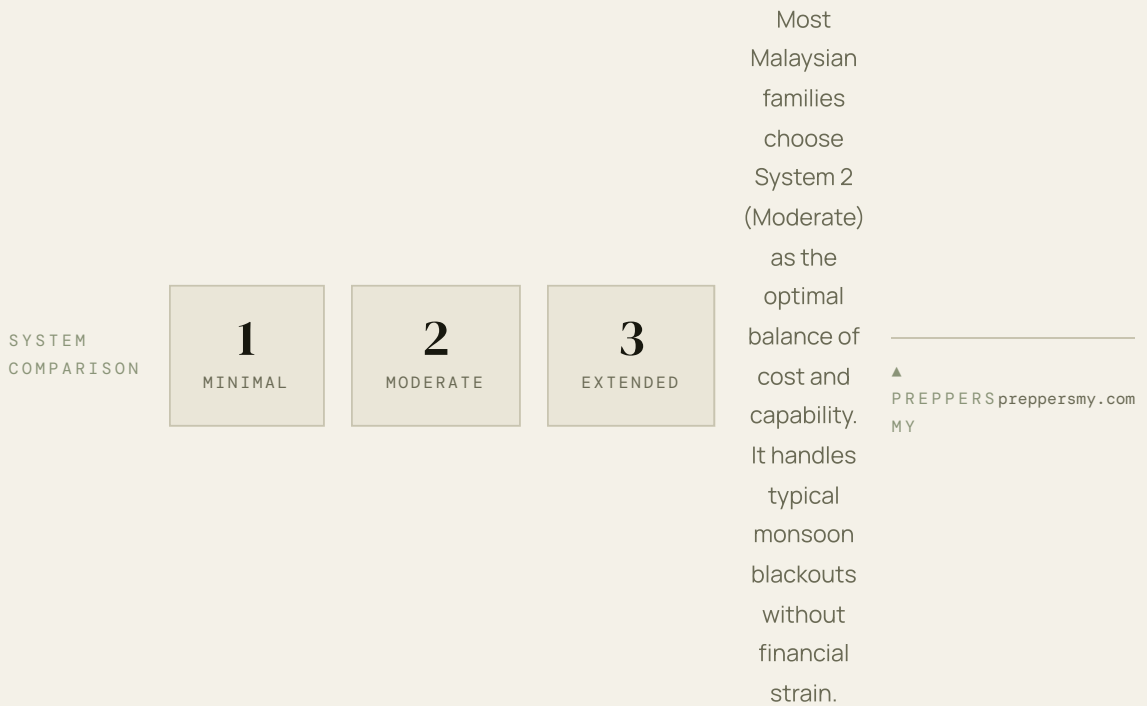
## System 3: Extended backup (large family, comprehensive)

USE CASE: EVERYTHING ABOVE PLUS WATER PUMP, MORE LIGHTS/FANS

- **Daily energy:** 4,500Wh
- **Solar panels:** 3 × 400W monocrystalline (RM 7,500–9,000)
- **Battery:** 8 kWh lithium (RM 24,000–32,000)
- **Inverter:** 5–6kW (RM 4,500–6,000)

- **Installation & wiring:** RM 4,000–5,000
- **Total investment: RM 40,000–52,000**

**Provides:** 2–3 days extended operation. Near-normal household operation during blackouts. Water independence.



— CHAPTER EIGHT

# Malaysian Costs & Suppliers

Real pricing and where to buy in Malaysia

## Component pricing in Malaysia (2026)

### SOLAR PANELS

- 250W polycrystalline: RM 1,500–2,000
- 300W monocrystalline: RM 2,000–2,500
- 400W monocrystalline: RM 2,500–3,200
- 450W high-efficiency: RM 3,000–3,800

### BATTERIES (LITHIUM)

- 1.28 kWh (1 unit): RM 3,500–4,500
- 2.56 kWh (2 units): RM 7,000–9,000
- 5.12 kWh (4 units): RM 14,000–18,000
- 10 kWh (8 units): RM 28,000–36,000

#### INVERTERS

- 2kW hybrid inverter: RM 2,500–3,500
- 3kW hybrid inverter: RM 3,500–4,500
- 5kW hybrid inverter: RM 5,000–6,500

#### INSTALLATION & BALANCE OF SYSTEM

- Wiring, breakers, switches: RM 1,000–2,000
- Racking and mounting: RM 1,000–2,000
- Installation labor: RM 2,000–4,000

## Where to buy in Malaysia

#### ONLINE PLATFORMS

- **Lazada & Shopee:** Panels, small batteries, components. Good for budget shopping.
- **Alibaba/Global sources:** Direct from manufacturers. Larger orders (10+ panels).

#### LOCAL INSTALLERS

- **Kuala Lumpur area:** Plus X Energy, Sunseap, Soluna (reputable, professional installation)
- **Regional options:** Search "solar installer [your city]" for local options
- **Advantage:** Warranty, professional installation, ongoing support

#### BUDGET CONSIDERATION: DIY VS PROFESSIONAL

- **DIY:** Save RM 2,000–4,000 installation cost, but requires electrical knowledge and safety caution
- **Professional:** Pay RM 2,000–4,000 extra for warranty, safety assurance, and support
- **Recommendation:** Professional installation worth the cost for most families (safety, warranty coverage)

#### SHOPPING STRATEGY

Buy panels from Lazada/Shopee (often RM 300–500 cheaper), but hire professional installer for assembly (RM 2,000–3,000). This balances cost savings with professional installation quality.

# Implementation Steps & Calculator

From decision to installation—your action plan

## Your implementation timeline

- 1 This week: Calculate your needs**

Use this guide to determine daily energy consumption. List all essential devices. Estimate hours of operation. Sum total Wh needed daily.
- 2 Week 2: Choose system size**

Based on daily need, decide between System 1 (minimal), System 2 (moderate), or System 3 (extended). Pick your budget level.
- 3 Week 3: Get quotes**

Contact 2–3 installers or search Lazada for components. Get prices for solar panels, batteries, inverter, installation. Compare total costs.
- 4 Week 4: Make decision**

Choose installer or DIY route. Place component orders. Lock in price and timeline.
- 5 Month 2: Installation**

Professional installation takes 1–3 days. Afterward, system is operational. Test all functions before accepting completion.

## Your energy calculation worksheet

### Step 1: List devices

Device: \_\_\_\_\_  
Wattage: \_\_\_\_\_ W  
Hours/day: \_\_\_\_\_ h  
Daily: \_\_\_\_\_ Wh

(Repeat for each device)

**TOTAL DAILY: \_\_\_\_\_ Wh**

### Step 2: Calculate system size

Daily Wh: \_\_\_\_\_ ÷ 4 (sun hours) × 1.2 (efficiency) = \_\_\_\_\_ W panels needed

Example: 2,500Wh ÷ 4 × 1.2 = 750W panels

### Step 3: Battery size

Daily Wh: \_\_\_\_\_ × 2 days (autonomy) ÷ 0.8 = \_\_\_\_\_ Wh battery needed

Example: 2,500 × 2 ÷ 0.8 = 6,250Wh (6.25 kWh)

## Pre-installation checklist

- Calculate daily energy consumption (use worksheet above)
- Identify ideal panel location (south-facing roof, minimal shading)
- Assess roof condition (lifespan, ability to support panels)
- Check for tall trees or buildings causing shade
- Determine electrical panel location for battery installation
- Get 2–3 professional quotes for comparison
- Check installer credentials (licenses, insurance, warranty)
- Review inverter specifications for your device mix
- Plan cable routing from roof panels to battery location
- Budget for installation labor and balance-of-system

## Post-installation checklist

- Test system operation (loads, charging, switching)
- Verify inverter display shows correct parameters
- Check that solar generation appears in inverter
- Confirm battery charging from panels during day
- Test load switchover during mock blackout
- Review manual and warranty documentation
- Understand how to reset/restart system if needed
- Plan quarterly maintenance (panel cleaning, monitoring)
- Teach family members basic operation
- Register warranty and set reminder for support contact info

**Start calculation this week.** Solar installation takes 4–8 weeks from decision to operation. The sooner you calculate needs, the sooner you can have backup power operational before next

monsoon season.

YOUR  
SOLAR  
SYSTEM  
AWAITS

Solar power transforms your family from helpless during blackouts to independent.

Malaysia's abundant sun is your advantage. Use it.

Calculate your needs this week.

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