

A PRACTICAL GUIDE FOR HOME GARDENERS

Heating Your Home Greenhouse

Small, medium and large greenhouses



INSULATION / HEATING SYSTEMS / PLANS / COSTS



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A warmer greenhouse, with fewer surprises

A greenhouse can feel like spring at lunchtime and lose its warmth before you've finished dinner. The useful question is how much heat your plants need through the coldest hours, and how much you're willing to pay to keep it there. Start with the crop, mend the leaks and heat the smallest useful space.

This guide covers residential greenhouses in temperate and cold climates. It uses three illustrative sizes, with dimensions in feet and metres, temperatures in Celsius and Fahrenheit and separate US dollar and UK pound budgets. The dimensions are planning examples. Measure the clear inside of your own greenhouse before buying benches or heaters.

Find your section	Pages
Plant targets, site checks and heater sizing	3-6
Insulation, electric heat, fuel heat and heat pumps	7-12
Heated benches, water storage, solar and compost	13-20
Compare systems, purchase budgets and running costs	21-25
Small, medium and large greenhouse plans	26-31
Partitions, controls, humidity and safe installation	32-35
Winter checks, emergency planning and worksheets	36-38
Sources and price references	39-40

The DIY projects are insulation, thermal storage, partitions and the assembly of bought heating equipment. The plans are layout and heating concepts, not structural approvals or electrical, gas, flue or pressure-system installation drawings.

Prices were checked on 18 October 2026. Budget ranges are editorial planning allowances, not supplier quotations. Photographs are generated illustrations. Dimensioned drawings and numerical examples were prepared for this guide. Writing follows the supplied MY WRITING GUARDRAILS and WRITING STYLE documents.

Choose what winter warmth is for

Keeping dormant plants alive costs far less than pushing tomatoes through a dark winter. Write down the minimum safe temperature for each plant, then group similar plants together. A tray of seedlings may need warm compost while established pots nearby need only protection from freezing. Those are different heating jobs.

Purpose	Planning target	What to expect
Hardy winter crops	Often unheated	Use crop-specific hardiness, fleece and ventilation. Growth slows in poor light.
Frost protection	4-5°C / 39-41°F air	A starting point for suitable overwintering plants. Check cold corners and individual species.
Cool growing / tender storage	7-10°C / 45-50°F air	More fuel use. Some plants need warmer conditions or brighter light.
Warm growing	15-18°C / 59-64°F air	Higher heat demand. Winter light may still limit growth.
Propagation	Often 18-24°C / 64-75°F compost	An example range only. Use the seed packet or crop guide and a root-zone probe.

A thermostat reading of 5°C doesn't prove that every leaf is above freezing. Glass-facing leaves, pots on the floor and plants beside a leaky door can be colder. Put a second minimum-temperature sensor where the vulnerable plants sit. The controller setting may need a margin above their true minimum. [1, 5]

For most home gardeners, the first system worth pricing is a well-sealed greenhouse, modest frost protection and a small heated propagator for the plants that need more warmth.

A warm greenhouse won't replace daylight. If the crop needs extra lighting, calculate its electricity separately. Some lighting heat enters the greenhouse, but don't count it as dependable overnight backup unless the operating schedule and heat contribution are known.

Survey the greenhouse before you buy

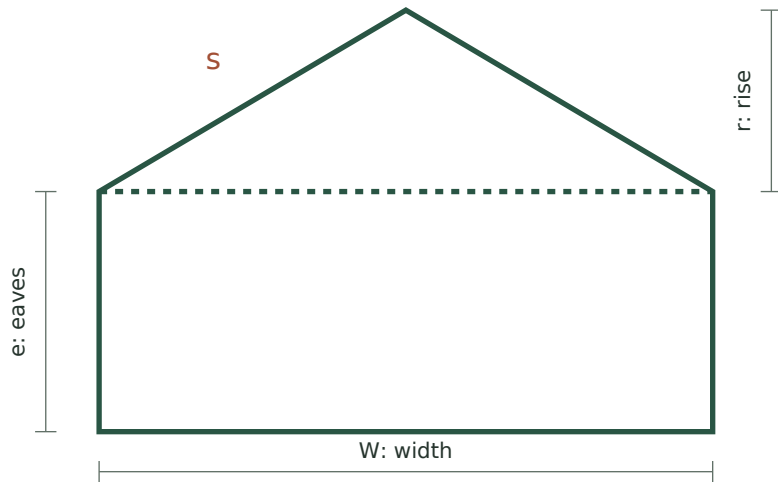
- 01.** Measure internal width, length, eaves and ridge height. Record the glazing type, panel thickness and maker's U-value if available. Photograph damaged seals and open joints.
- 02.** Choose a local winter design temperature using reliable weather data and the level of crop-loss risk you can accept. A normal winter night is not the same as the cold night the heater must handle.
- 03.** Check winter sun at morning, midday and afternoon. Note shade from buildings, evergreens and fences. A shaded site has less free daytime heat to put into water or soil.
- 04.** Find draughts on a windy day with a strip of tissue. Check door edges, vent seals and the base. Don't use a flame. Separate unwanted leaks from deliberate ventilation openings.
- 05.** Ask an electrician about the available supply, route, earthing, fault protection and spare circuit capacity. Add the heater, mats, lights, pumps and fans at their possible simultaneous load.
- 06.** Mark access routes, hose use, drainage, standing-water risks and roof condensation. Keep power connections out of these wet zones. Map heater clearances before placing the benches.
- 07.** Check the greenhouse frame's permitted hanging loads before adding a fan, screen or indoor heat-pump head. Roof bars made to hold glazing may not support extra equipment.

Create a simple record: desired minimum ____°C / °F, winter design outside ____°C / °F, usable floor ____m² / ft², available electrical capacity ____kW, budget for one cold month ____.

For an attached greenhouse, include the effect on the house, moisture separation and any building-control requirements. Heat borrowed through an open door still appears on a household energy bill. A purpose-designed connection deserves a separate heat-loss calculation.

Size the heater from heat loss

END ELEVATION



L = length
s = roof slope

Use metres throughout this calculation. For a pitched rectangular greenhouse, let W be width, L length, e eaves height and r the vertical rise above the eaves. Roof slope $s = \sqrt{[(W \div 2)^2 + r^2]}$. The exposed shell area $A = 2e(L + W) + Wr + 2Ls$. Volume $V = WL(e + r \div 2)$. Ground perimeter $P = 2(L + W)$.

Heat-loss rate $H = (U \times A) + (0.33 \times n \times V) + (f \times P)$, in watts per °C.
Required output = $H \times \text{temperature difference} \times 1.15 \div 1,000$, in kW.

U describes heat passing through the glazing in W/m²K. n is air changes per hour. f is a ground-edge allowance in W/mK. Here, the 1.15 factor adds a 15% sizing reserve. The method follows standard shell, air-leakage and perimeter heat-loss terms. Use separate U × area terms where walls and roof differ. [2]

The examples use U = 3.5 for a representative insulated shell, n = 1 and f = 0.7 for an insulated perimeter. These are modelling inputs, not a promise for bubble lining. Bare single glazing is compared at U = 6.0. Get actual assembly values. A windy, leaky or unusually cold site needs a site calculation, including ventilation and other losses.

For sensitivity checks, try n = 2 for a leakier house and f = 1.4 for an uninsulated ground edge. Very poor glazing seals can lose still more air. These screening values are not substitutes for a site survey. Heating for deliberate ventilation must be added separately. [2]

Three sizes, three cold-night tests

Example	Shell / volume	H at U = 3.5
Small: 1.83 × 2.44 m 6 × 8 ft e 1.65 m, r 0.50 m	20.09 m ² / 8.48 m ³	79.11 W/°C
Medium: 2.44 × 3.66 m 8 × 12 ft e 1.80 m, r 0.70 m	33.96 m ² / 19.20 m ³	133.75 W/°C
Large: 3.66 × 6.10 m 12 × 20 ft e 2.00 m, r 0.90 m	67.21 m ² / 54.70 m ³	266.96 W/°C

Inside 5°C / 41°F	Outside -5°C / 23°F	Outside -10°C / 14°F	Outside -20°C / -4°F
Small	0.91 kW	1.36 kW	2.27 kW
Medium	1.54 kW	2.31 kW	3.85 kW
Large	3.07 kW	4.61 kW	7.68 kW

For the medium example at -10°C outside: $133.75 \times 15 \times 1.15 \div 1,000 = 2.31$ kW. A 2 kW heater falls below that planning load. A nominal 2.5 or 3 kW unit is a starting point for selection, provided its supply, clearances and real output suit the site.

Change only U to 6.0 and the same medium greenhouse needs about 3.77 kW. The large example rises to 7.50 kW. Insulation can change which electrical supply is practical, as well as the bill. The comparison holds air leakage and perimeter insulation constant to isolate the glazing difference.

Choose output at the design condition. A heat pump advertised as 5 kW may deliver a different output in hard frost. A fuel heater may state input rather than usable output. 1 kW of heat equals about 3,412 Btu/h.

Keep the heat you pay for

Measure	Where it helps	Trade-off
Repair seals and door fit	Stops unwanted cold-air entry	Preserve required vents and drains.
Horticultural bubble lining	Adds an inner air layer to suitable glazing	Cuts light and can collect condensation. Reuse sound material.
Twin- or multiwall panels	A replacement shell with stated thermal performance	Higher initial cost. Check light transmission, frame fit and fire rating.
Night energy screen	Reduces the exposed warm volume at night	Needs reliable opening, edge fit and clearances.
Insulated base / opaque wall	Protects areas that contribute little useful light	Can shade low crops. Protect foam from fire, water and pests.
Inner crop cover / partition	Keeps a smaller crop space warmer	Daily opening and humidity checks remain necessary.

Start with repairs. Adding another skin over gaps leaves a poor structure underneath. Clean glazing first, fit compatible replacement seals and check that a closed door meets its frame. Use glazing-safe materials and the manufacturer's fixings. Don't block drainage channels or seal a vent needed by a combustion appliance.

Opaque insulation makes most sense below bench level or on a wall with little useful winter sun. In the northern hemisphere this is often the north side. Reverse the solar assumptions in the southern hemisphere. Protected, moisture-resistant insulation can reduce loss through these areas. [3]

Light is part of the trade. The RHS warns that extra transparent insulation reduces light, which matters for winter salads and other light-hungry crops. Insulate the tender-plant section first if the rest of the greenhouse holds hardy plants. [1]

Fit a removable winter liner



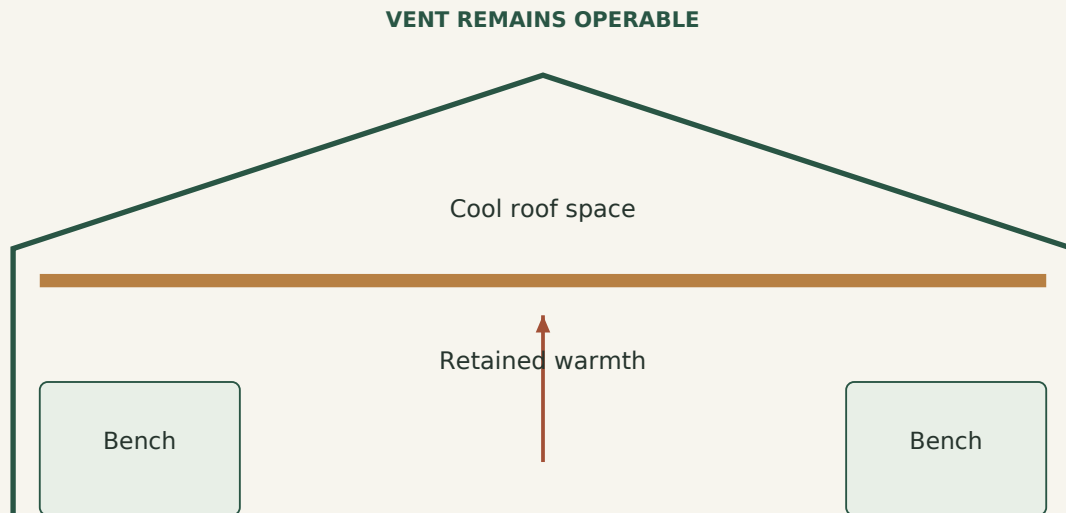
Illustration: fit the liner to the frame while leaving the roof vent available.

Gather UV-stabilised horticultural bubble material, frame-compatible clips, a tape measure, scissors, a marker and repair tape approved for the liner. Allow roughly 10-15% extra material for overlaps and awkward bays. This is a purchase allowance, not a guaranteed thermal improvement.

- 01.** Clean and dry the glazing and frame. Repair broken panels before working inside. Use safe access equipment and never lean on glass.
- 02.** Measure each bay and label the pieces. Follow the liner supplier's instructions for overlap, orientation and air gap. Clip to the frame without drilling the glazing.
- 03.** Make separate panels for opening vents and doors. Close loose seams, but leave drains, hinges and required air openings clear.
- 04.** Trim sagging pieces. Keep all plastic outside heater clearance zones. Check for drips after the first cold night, then adjust fit and ventilation.

Remove the liner when extra warmth is no longer needed or light becomes the limiting factor. Wash it with a material-safe cleaner, dry it before storage and replace brittle or torn pieces.

Close a screen after sunset



Gold: removable night screen on its own approved supports

A purpose-made greenhouse energy screen can reduce night heat loss without leaving the crops shaded all day. The usable saving comes from the complete installation: material, sealed edges, openings and the hours it stays closed. Treat supplier saving percentages as conditional. A loose household curtain isn't an equivalent tested system. [4]

- 01.** Choose greenhouse screen fabric with declared fire performance, moisture behaviour and installation guidance. Get the frame maker's approval for its supports and moving load.
- 02.** Set the screen above the tallest winter plants, clear of heaters and lights. Keep doors, vents and maintenance access usable. Fit the supplier's edge details.
- 03.** Arrange a manual pull or approved drive that can be reached without climbing. The screen must retract clear of glazing needed for daylight.
- 04.** Close after useful solar gain ends. Reopen in the morning, watching for a fall in crop temperature as cold roof air mixes down. Test the routine before hard frost.

Don't drape fleece, blankets or bubble material over a heater. A crop cover needs its own supports and enough separation from every hot surface and discharge stream.

A roof screen reduces working headroom. Allow room for the gathered fabric and any hanging crops before ordering. Small greenhouses often gain more practical value from a compact propagator or a rear partition.

Electric heat: the straightforward option

A greenhouse-rated electric fan heater is often the simplest active system where a suitable supply already exists. It gives quick air heating and useful circulation. Buy for the calculated heat loss, environmental rating and controls. A claim such as 'heats 12 m²' leaves out the outdoor temperature and insulation.

Equipment	Best use	Limit to understand
Fan heater	Whole-air frost protection in small or medium houses	Air path and clearances take space. Fan failure can affect distribution.
Tubular heater	Gentle background heat in a small enclosure	Low output may be far below the greenhouse heat loss. Guard hot surfaces.
Oil-filled / convector unit	Only where specifically approved for the damp location	Bulky, slower air mixing and no special saving per unit of resistance heat.
Infrared heater	A designed local radiant zone	Uneven leaf heating and shadowing. Placement needs care.
Heat mat / soil cable	Seed trays, root zones or a small warm enclosure	Doesn't prove that leaves or the rest of the greenhouse are frost-free.

Resistance heaters turn roughly one unit of electrical energy into one unit of heat at the greenhouse. A ceramic element, oil reservoir or 'eco' switch doesn't change that basic relationship. Savings come from lower heat loss, a lower average temperature, a smaller heated area or better control. Fan-only operation moves air but doesn't remove heat from a closed greenhouse.

- 01.** Select equipment explicitly suitable for the greenhouse environment and intended operating schedule. Overnight frost protection needs equipment whose instructions permit that use.
- 02.** Install on its specified base or support, preserve all clearances and arrange a protected supply. Set the sensor at crop height away from the discharge.
- 03.** Run a supervised test, check cold corners and confirm that the controller stops and restarts the heat correctly. Log temperatures before leaving valuable plants dependent on it.

Example listings: US Palma is 1,500 W at 120 V. The UK version is 2,000 W at 230 V. Similar names don't mean interchangeable electrical ratings. [19, 20]

Gas, paraffin and other fuel heaters

Fuel heat can supply several kilowatts without putting that whole load on an electrical circuit. For a residential greenhouse, a properly installed flued or sealed-combustion system is the stronger choice where gas is practical. It still needs a suitable installation, fuel storage or supply and regular servicing. Many units need electricity for their fan and controls.

System	Useful role	Costs and drawbacks
Flued natural gas	Larger houses with a viable mains connection	Connection and flue can dominate the budget. Check useful output and service access.
Flued propane / LPG	Sites without mains gas	Cylinder or tank storage, deliveries and cold-weather vaporisation must be sized.
Unflued gas greenhouse heater	Specialist application only where permitted	Adds combustion moisture indoors. Needs specified ventilation and combustion safety controls.
Paraffin / kerosene	Limited supervised use where the appliance is permitted	Refilling, fumes, soot and uneven control can make it a poor everyday choice.

An unflued heater releases its combustion products into the growing space. That includes water vapour, and faulty combustion can expose people to carbon monoxide and plants to harmful gases. Ventilation removes some of the heat you've bought. An oxygen-depletion device is not a substitute for a carbon-monoxide alarm or correct installation. [7, 8]

- 01.** Ask a qualified installer to assess fuel supply, combustion air, flue route, appliance certification and local rules. Obtain a written usable-output figure at your conditions.
- 02.** Provide the prescribed non-combustible base, clearances and outdoor fuel storage. Protect the greenhouse shell at any approved flue penetration.
- 03.** Have the installer commission combustion, controls and ventilation. Record the service date and fuel reorder level. Use alarms rated for the temperature and humidity where they operate.

Never use a barbecue, charcoal burner, camping stove or improvised candle-and-pot heater inside the greenhouse. Keep generator exhaust outside and away from every building opening.

Heat pumps for regular winter heating

A heat pump moves heat from outside into the greenhouse. If its actual coefficient of performance, or COP, is 2.5, each 1 kWh of electricity supplies 2.5 kWh of heat. That can make a large difference when heating runs for months. Installation costs can be hard to recover in a tiny greenhouse used for a few frosty nights.

Cold-weather capacity, efficiency and defrost behaviour vary by model. Obtain performance at the outdoor design temperature, not only the mild-weather rating. Standard room units can also have a minimum heating setpoint around normal indoor comfort temperatures. A unit that cannot hold your chosen 5°C or 8°C target may waste energy or be unsuitable. [9]

Questions for the installer

- Does the manufacturer approve this model for a humid, dusty greenhouse, including its electrical components and warranty?
- What heat output and COP are available at the winter design temperature and the proposed indoor setpoint? How is defrost allowed for?
- Can it restart safely after a power failure and operate with the required low-temperature control? Avoid unofficial thermostat modifications.
- Where will the outdoor unit shed defrost water without icing the path? Will snow, leaves or nearby walls block its air clearances?
- How will the indoor air reach the far end without blasting plants? What are the noise, service and refrigerant requirements?

For the large worked greenhouse at 5°C inside and -10°C outside, ask for at least 4.61 kW of usable output at that condition, subject to a final site survey. A nominal 5 kW label alone is insufficient.

A high-mounted indoor unit preserves floor area, but needs an approved support and space below its discharge. Keep a separate frost-protection plan for equipment failure. For low annual heat demand, a modest resistance heater may remain the cheaper purchase even though it uses more electricity per unit of heat.

Warm the roots you need to grow



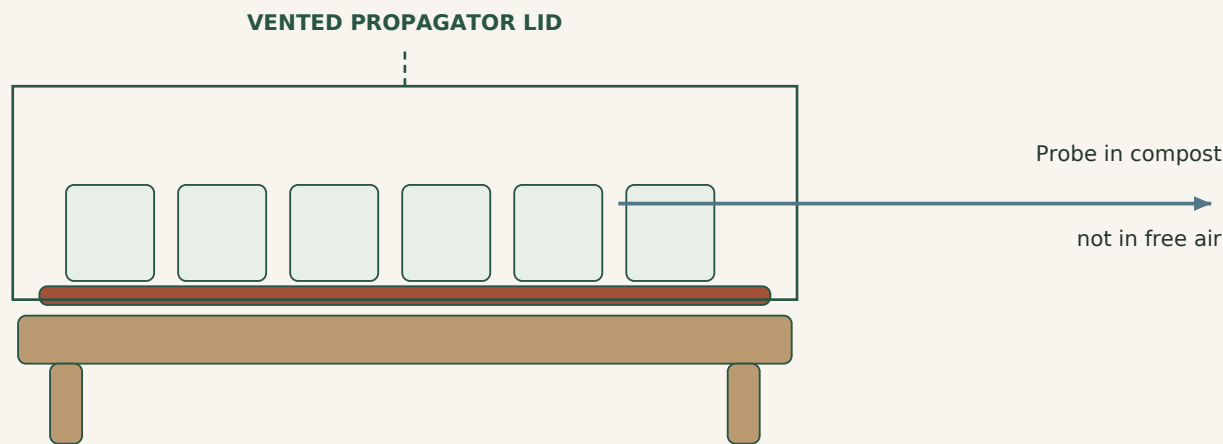
Illustration: a flat horticultural heat mat, seed trays and a separate compost probe.

Root-zone heating is useful when seeds or cuttings need warmer compost than the greenhouse air. A mat under a few trays can use a small fraction of the power of a whole-house heater. Pair it with a vented propagator where the product instructions allow. Check both compost and air temperature, since warm roots don't protect an exposed shoot from frost. [10, 11]

Method	Where it fits	Installation point
Horticultural mat	Existing flat bench	Lay flat. Never fold, overlap, puncture or cover contrary to its instructions.
Soil-heating cable	Purpose-built sand bed or raised bed	Use the maker's depth, spacing, medium and loading instructions. Never cross the cable.
Warm-water bench	Large or long-season greenhouse	Needs designed tubing, flow, temperature control, leak and freeze protection.

Choose the compost setpoint from the crop instructions. After germination, many seedlings need less bottom heat and more light. Reduce heat where appropriate and watch for stretched growth, dry tray edges or persistently wet compost. A probe pulled out of its tray can drive the mat harder than intended.

Assemble a heated propagation bench



Heat mat lies flat on its specified support surface
Schematic section. Follow the mat and tray instructions.

Example worktop: 1.20 × 0.60 m (about 4 × 2 ft), with a working height of 0.80-0.90 m. Start with a stable, braced bench rated for the wet trays and equipment. This project adds a bought horticultural heating system. It doesn't involve making a heating element or wiring a controller.

Buy or gather	Specification
Bench and top	Flat, moisture-tolerant and compatible with the mat. Load rating must exceed the measured wet load.
Heating kit	A greenhouse-rated mat sized to lie flat inside the top, with its compatible thermostat.
Trays and lid	Use a compatible watering tray if required. Leave adjustable ventilation.
Temperature checks	Root probe in a representative tray plus a separate thermometer for the surrounding air.

- 01.** Level and secure the bench. Place the mat exactly as its instructions require. Add no foil, foam or extra insulating layer unless the maker permits it.
- 02.** Arrange trays without overloading the top. Put the probe at root depth in a representative cell, secure its lead and keep the controller and connections dry.
- 03.** Water away from live connections. Set the crop temperature and check the centre and edges after the system settles. Record the readings and adjust tray placement if needed.

The heated surface occupies 0.72 m² / 7.75 ft² of bench area. Allow access to the controls and retain the full aisle. A 100 W mat at 50% duty uses 1.2 kWh a day: \$0.24 at \$0.20/kWh or £0.30 at £0.25/kWh. This is an example, not a measured duty cycle.

Water stores warmth, but only so much

Water can absorb daytime heat and release some of it as the air cools. The limit is energy stored above the temperature you need. A black barrel in a cloudy greenhouse can't produce new heat. If a heater warms the water overnight, that energy came from your fuel or electricity.

Stored heat in water, kWh = litres × 0.001163 × useful temperature drop in °C.
Example: 540 litres cooling from 15°C to 7°C stores about 5.0 kWh.

That 5.0 kWh equals five hours at a 1 kW load in an ideal transfer calculation. Real delivery is slower and uneven. As the water cools towards the greenhouse air temperature, heat transfer fades. Don't subtract the full stored amount from the design heater capacity. Test the system through dull weather before trusting it with tender plants.

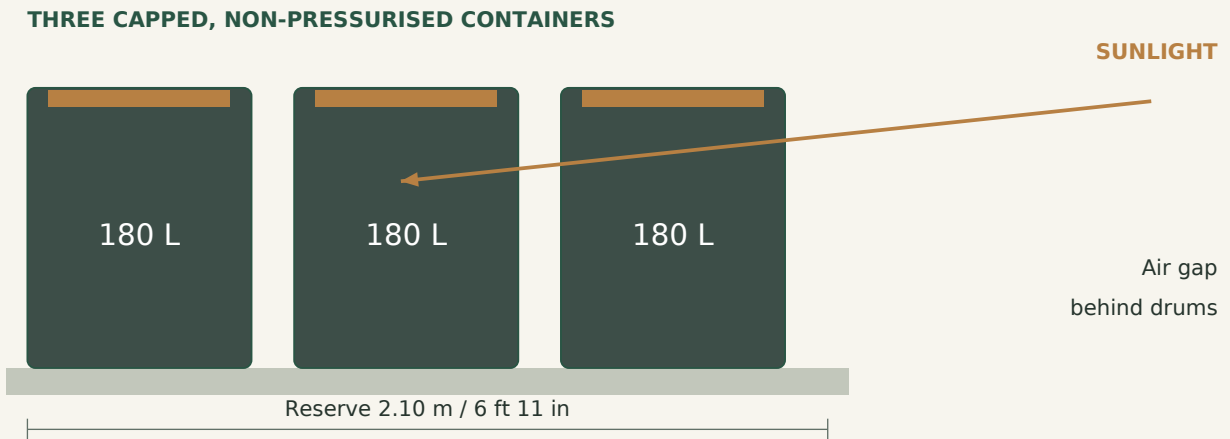
Water volume	Heat over an 8°C drop	Water mass alone
100 L / 26 US gal	0.93 kWh	100 kg / 220 lb
200 L / 53 US gal	1.86 kWh	200 kg / 441 lb
540 L / 143 US gal	5.02 kWh	540 kg / 1,190 lb
1,000 L / 264 US gal	9.30 kWh	1,000 kg / 2,205 lb

Where water earns its space

Place containers where winter sun can reach them without shading the crop. A north-side row is often useful in the northern hemisphere if the south glazing stays clear. Under-bench containers save growing surface, but may receive little sun. Measure their afternoon and dawn temperatures to see whether they are contributing. [12]

Masonry and soil also store heat. Compare useful energy, exposed surface and installation weight before adding mass. A stack of paving slabs inside a small greenhouse can consume valuable space while offering less storage per kilogram than water. Thermal mass works best alongside lower heat loss and sensible temperature targets.

Build a ground-supported water bank



This example uses three purpose-made, opaque 200 L water containers filled to 180 L each, subject to their maker's instructions. Reserve about 2.10 × 0.70 m (6 ft 11 in × 2 ft 4 in) for containers up to 0.60 m diameter, gaps and access. Buy the containers first, then confirm the dimensions.

- 01.** Choose clean containers with known previous contents, secure lids and a safe, non-pressurised vent arrangement. Never reuse chemical drums or turn them into pressure vessels.
- 02.** Prepare level, well-compacted ground with a load-spreading paved base. Filled weight exceeds 540 kg plus the containers. Get a structural check for decking, suspended floors or questionable slabs.
- 03.** Stand the empty containers in their final positions, clear of electrical equipment, exits and heater clearances. Use manufacturer-approved restraint if tipping is possible. Don't stack them.
- 04.** Fill to the permitted level, leave the specified expansion space and close the lids. A secure vent or screened opening must not create a child-access or mosquito problem.
- 05.** Record water and greenhouse temperatures at sunset and dawn for a week. Check leaks and settlement. If freezing is possible, follow the container maker's winter instructions or drain them.

The example bank reserves 1.47 m² / 15.8 ft². That's about 16% of the medium greenhouse floor or 7% of the large one, before extra access. It won't fit the small layout without giving up most of a bench.

Use plain water for this passive project. Don't add automotive antifreeze or improvised immersion heaters. A container that could freeze needs a designed winter plan.

Solar electricity: plan for the dark hours

Solar panels make electricity during daylight. Greenhouse heating often peaks after sunset. Grid-connected PV can offset some purchased energy, but an ordinary grid-tied system is not automatically a power-cut supply. Batteries, a suitable inverter and approved islanding equipment are needed for that role. [13]

A small panel cannot carry a large night load

A 1 kW heater running for 12 hours needs 12 kWh. If usable battery discharge is 80% and inverter efficiency is 90%, nominal battery storage would need at least $12 \div (0.80 \times 0.90) = 16.7$ kWh for that one night. Cold-weather battery limits, reserve and ageing can raise the requirement. The inverter must also support the actual load.

Under an illustrative winter yield of 1.5 peak-sun-hours per day and an 80% system factor, a 400 W panel produces 0.48 kWh a day. Generating 12 kWh would require about 10 kW of panels before storage losses. Local winter weather may be better or much worse. Use a location-specific model and examine several sunless days, not just a monthly average.

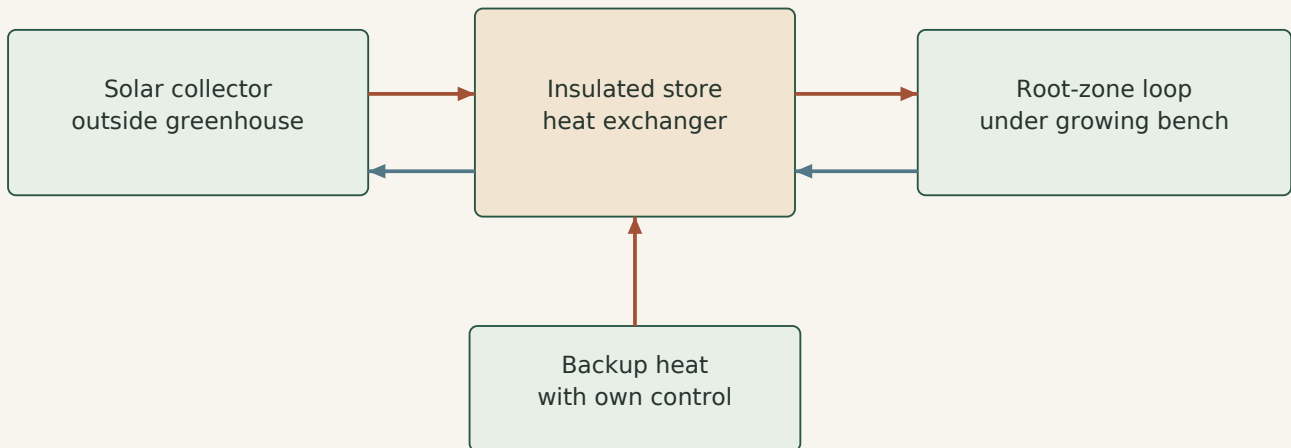
Approach	Practical role
Small PV kit	Sensors or a small daytime fan, subject to the electrical design.
House-roof PV + grid supply	Offsets some household and greenhouse electricity. Keeps panels off crop glazing.
PV + heat pump	Reduces purchased energy where generation and heat demand overlap.
Off-grid PV + batteries	Needs a full winter energy design, realistic reserve and backup plan.

Avoid shading the greenhouse roof with PV unless the growing design allows it. Panels on a house, shed or separate ground frame often preserve more useful crop light.

Storage and installation can cost far more than a modest mains heater. For occasional frost protection, compare the cost of a proper electricity supply or moving tender plants indoors before committing to an off-grid heating system.

Solar thermal and warm-water heat

SOLAR THERMAL: FUNCTIONAL SCHEMATIC



Pumps, expansion, relief and freeze protection are installer-designed.

A solar thermal collector heats a fluid, then transfers heat to a water store or growing zone. This can suit a greenhouse with a regular root-heating load and room for a properly insulated store. A warm sunny afternoon can charge the system, but a cold cloudy week still needs another heat source. [14]

The store may operate well above crop temperature. A heat exchanger and controlled mixed-temperature circuit can protect the root zone. Collector stagnation, boiling, freezing, pressure and expansion all need to be designed for. Don't connect a homemade sealed solar coil to an ordinary barrel.

A realistic installation sequence

- 01.** Log the required root-zone heat and compare it with local winter solar availability. Include pump electricity and heat lost from pipes and storage.
- 02.** Ask a solar or heating professional to size the collector, store, heat exchanger, expansion vessel, pressure relief and frost protection. Specify fluids suitable for the application.
- 03.** Put the collector where it receives sun without shading crops. Give the store a verified load-bearing base and reserve service space.
- 04.** Commission controls so the pump runs only when useful heat can move to the store or crop. Test backup operation and the system's response to a power cut.

An existing house boiler can also feed a greenhouse water circuit through a designed connection. Include underground pipe losses, freeze protection and any effect on the house system. Long pipe runs can make an apparently cheap heat source expensive. Underfloor heating responds slowly, while bench loops target a smaller growing area. [6]

Compost heat and traditional hotbeds

HOTBED CONCEPT: NOT A WHOLE-HOUSE HEATER



An active compost mass releases heat as microbes break down material. A hotbed puts a growing area above that warmth. Output changes with ingredients, moisture, oxygen and age, so it is better treated as a seasonal experiment or a local supplement. A cool, partly filled compost bin is unlikely to heat a whole greenhouse. [11, 15]

Build a trial bed before depending on it

- 01.** Reserve a ground-level footprint around 1.20 × 1.20 m with working access. Use a sound, open-bottom frame and leave drainage and airflow. Keep it outside heater clearances and away from wiring and exits.
- 02.** Fill roughly 0.50-0.60 m deep with a mixed batch of suitable fresh green material and chopped browns. Moisten to a wrung-out-sponge feel. This volume is a trial, not a rated heat source.
- 03.** Keep propagation trays separate from raw compost or manure and its drainage. Use a stable tray support and monitor the actual compost in the seed trays, not just the hot pile centre.
- 04.** Wait until tray temperatures settle in the crop's safe range. Vent the frame on sunny days. Measure morning and evening, and provide another way to protect plants when the pile cools.

Fresh manure can bring pathogens, ammonia and odours. Don't put it beside ready-to-eat leaves or let runoff reach produce. Follow local food-growing guidance. A planted hotbed isn't proof that manure has completed a validated composting process. Gloves, handwashing and separate tools reduce handling contamination. [16]

Allow at least 1.44 m² / 15.5 ft² for the trial bed itself. Turning and replacing material need more room. Give the project no guaranteed kilowatts in your heater-sizing calculation.

Ground storage, biomass and the green claims

Ground-air heat storage

Some deep-winter greenhouse designs move warm air through a buried rock or soil store during sunny periods, then recover heat later. This is a planned building system. Soil conditions, drainage, duct resistance, fan power and heat transfer matter. A few pipes buried under an existing greenhouse don't guarantee useful winter heat. Minnesota's work provides researched designs and crop guidance for cold-climate solar greenhouses. [17]

Consider ground storage during a new build or major rebuild. Excavation beneath an existing frame can disturb foundations and buried services. Obtain a design for drainage, cleaning access, condensation and controls. Ground-air storage is different from a ground-source heat pump, which uses a refrigeration system and requires a separate installation assessment.

Wood and pellets

A purpose-designed biomass appliance may suit a large greenhouse where fuel is available and the owner can manage it. Include a compliant chimney, fuel store, fire-resistant construction and the space lost to clearances. Hand-fired stoves demand attention through the night. Pellet units generally need electricity for feeding and controls.

Wood is not automatically a clean option. Smoke contains fine particles and other pollutants, and fuel sourcing, transport and stove performance affect the environmental balance. Check local smoke rules and neighbours' exposure. Never burn treated wood, painted timber or rubbish. [18]

Lower-impact priority	Reason
Grow crops suited to a cooler winter	Reduces the heat requirement at its source.
Repair, insulate and heat a smaller zone	Cuts demand regardless of the fuel.
Use a suitable heat pump for regular demand	Can reduce electrical input per unit of delivered heat.
Add measured solar storage or renewable supply	Useful where the site and operating pattern support it.

Compare carbon using local electricity emissions per kWh divided by the actual COP, or fuel emissions divided by system efficiency. Include equipment life and replacement where possible. A small measured improvement is more useful than an untested 'free heat' claim. Solar and compost systems still need maintenance. Include pump or fan electricity, replacement parts and the value of your time.

Compare what each method can deliver

Method	Can be primary heat?	Effect on usable space
Electric fan heater	Yes, if sized and approved	Casing is small. Clearance and discharge zone can be much larger.
Tubular / local radiant heat	Only for a calculated small load	Long wall strip or overhead zone. Keep plants off hot surfaces.
Heat mats / soil cables	For the local root zone	Little extra floor loss. Heated bench surface remains useful for plants.
Flued gas / LPG	Yes, with a designed installation	Unit, flue, fuel storage and servicing space.
Heat pump	Yes, with verified cold output	Indoor wall space plus outdoor unit and airflow clearances.
Water or masonry storage	Supplement only in this guide	Heavy floor load. Drums may replace bench or bed space.
PV + battery	Yes only with a full off-grid design	Panels, battery enclosure and service access, usually outside.
Solar thermal	Usually backed up	Collector, store, pipe routes and crop distribution system.
Compost hotbed	Local, variable heat	Large bed and working access for material replacement.
Ground-air store	Site-designed solar system	Little later floor loss, but major excavation and duct access.
Wood / pellet system	Yes, if designed for the load	Large clearance and fuel-handling footprint.

A larger heater doesn't necessarily use more energy when a good thermostat maintains the same temperature. The greenhouse loses heat at its own rate. Oversizing can still cause short cycling, uneven temperatures and unnecessary supply costs. Choose enough capacity for the design condition without treating maximum wattage as a running-cost forecast.

Compare the whole occupied envelope: appliance + required clearance + service access + fuel or storage. A wall-mounted unit can preserve floor area, while a cheap stove may displace much of a small greenhouse.

Purchase and installation budgets

These broad planning allowances are estimates prepared for this guide in October 2026. US and UK ranges describe separate budgets, not currency conversions. Recheck local quotes, tax and delivery. Greenhouse purchase is excluded. Electrical supply upgrades, trenching and major structural work are extra unless specified.

Solution / scope	US budget	UK budget
Lining, clips and minor seals for a small/medium house	\$80-300	£50-220
Manual night-screen materials and simple supports	\$150-600	£100-450
Fan heater + thermostat, equipment only	\$150-400	£100-300
Tubular heater + control, equipment only	\$60-200	£40-150
Mat + control + basic propagator, equipment only	\$60-250	£40-220
Three-container water bank + basic ground base	\$150-600	£100-450
Trial compost hotbed, materials only	\$75-300	£50-220
Flued gas/LPG installation, existing nearby supply	\$1,500-5,000+	£1,200-4,000+
Small air-to-air heat pump, typical simple installation	\$3,000-8,000+	£2,000-6,000+
Solar thermal collector, store and distribution installed	\$4,000-12,000+	£3,000-10,000+
PV + substantial battery for night heat, installed	\$15,000-40,000+	£10,000-30,000+
Wood / pellet unit + flue, simple installation	\$2,000-8,000+	£1,500-6,000+

Price anchors checked 18 October 2026: Bio Green US Palma with digital thermostat, \$229.99 before sales tax (1,500 W). UK Palma digital package, £199.99 including VAT (2,000 W). UK Jumbo propagation kit, £199.99 including VAT. These are manufacturer listings, not endorsements or installation quotes. [19-21]

Ground-source heat pumps, buried thermal stores and major hydronic work need site quotes. Groundworks can outweigh equipment cost. Add a contingency and a separate allowance for repairs, servicing, alarm equipment and replacement consumables.

Turn watts into a running-cost estimate

Electric resistance cost = rated kW × hours × fraction of time heating × electricity price per kWh.

Heat-pump cost = useful heat needed in kWh ÷ actual COP × electricity price.

Use the tariff on your own bill. For transparent comparisons this guide uses \$0.20/kWh and £0.25/kWh as illustrative rates. They are not national averages or current tariff quotations. The examples exclude standing charges, demand charges, taxes not already in the tariff and separate lighting.

Example	Daily use	US / UK daily cost
2 kW heater, 12 hours, 25% duty	6 kWh	\$1.20 / £1.50
2 kW heater, 12 hours, 50% duty	12 kWh	\$2.40 / £3.00
2 kW heater, 12 hours, 100% duty	24 kWh	\$4.80 / £6.00
Heat pump supplies 12 kWh, COP 2.5	4.8 kWh electricity	\$0.96 / £1.20
30 W circulation fan, 24 hours	0.72 kWh	\$0.14 / £0.18

Fuel costs need usable heat

For fuel, divide its unit price by the heat content per unit and by the fraction delivered as useful heat. Keep the efficiency and fuel heat-content basis consistent. As an illustration, propane at \$3.00 per US gallon, about 26.8 kWh per gallon [26] and 85% usable efficiency costs \$0.132 per useful kWh. Delivering 12 kWh costs about \$1.58, before fan power and service.

An LPG example at £1.00 per litre and about 7.0 kWh per litre gives £0.168 per useful kWh at the same 85% assumption, or about £2.02 for 12 kWh. These are assumed fuel prices, not quotes. Use your supplier's figures. A cheap cylinder price can hide delivery charges and small-cylinder premiums.

For a metered gas supply, use the billed kWh price divided by the system's seasonal efficiency. Unflued combustion requires added ventilation, so a nominal near-100% appliance figure doesn't represent the whole greenhouse's useful heat retention.

What one cold month might cost

These are steady-condition comparisons using the insulated H values on page 6, with heating needed for 12 hours each day over 30 days. Daytime heating is assumed to be zero. Solar storage and crop lighting are excluded. Real weather changes hourly. A cold, dull day can add substantial heating beyond these night-only figures.

Size	Average temperature lift*	Useful heat per month	Resistance heat US / UK
Small	5°C / 9°F	142 kWh	\$28 / £36
Small	10°C / 18°F	285 kWh	\$57 / £71
Small	20°C / 36°F	570 kWh	\$114 / £142
Medium	5°C / 9°F	241 kWh	\$48 / £60
Medium	10°C / 18°F	482 kWh	\$96 / £120
Medium	20°C / 36°F	963 kWh	\$193 / £241
Large	5°C / 9°F	481 kWh	\$96 / £120
Large	10°C / 18°F	961 kWh	\$192 / £240
Large	20°C / 36°F	1,922 kWh	\$384 / £481

*Temperature lift is the indoor target minus the average outdoor temperature during heating hours. At an indoor target of 5°C, lifts of 5, 10 and 20°C correspond to outside averages of 0, -5 and -15°C. A temperature difference in °F is 1.8 times the difference in °C.

The large 10°C-lift case needs 961 kWh of useful heat. At an actual average COP of 2.5, a heat pump would use about 384 kWh, costing \$77 or £96 at the sample tariffs. At COP 2.0, that rises to \$96 or £120. Add standby, defrost-related losses and auxiliary power if they are not included in the measured COP.

The 15% sizing reserve is not added to the energy bill. It provides spare output for design uncertainty. For seasonal estimates, multiply H by local heating degree-hours at your actual setpoint, divide by 1,000 and adjust for solar gain, ventilation and measured performance.

Combine methods that do different jobs

Package	Combination	Why it earns consideration
Small frost shelter	Seal + removable lining + controlled fan heater	Low installation complexity where safe mains power exists. Add a propagator only if needed.
Medium mixed growing	Cool whole house + warmer rear partition or heated bench	Tender plants receive more heat without warming every pot to the same level.
Large regular winter use	Improved shell + suitable heat pump + screen + backup	Lower electricity per unit of heat can repay higher purchase cost with enough annual demand.
Sunny low-energy crop house	Cold-tolerant crops + solar-friendly layout + water or ground storage	Reduces bought heat, with backup for cloudy cold spells.
Site without electricity	Cold-hardy crops + covers, or professionally designed fuel heat	Avoid assuming a small solar kit can replace reliable night heat.

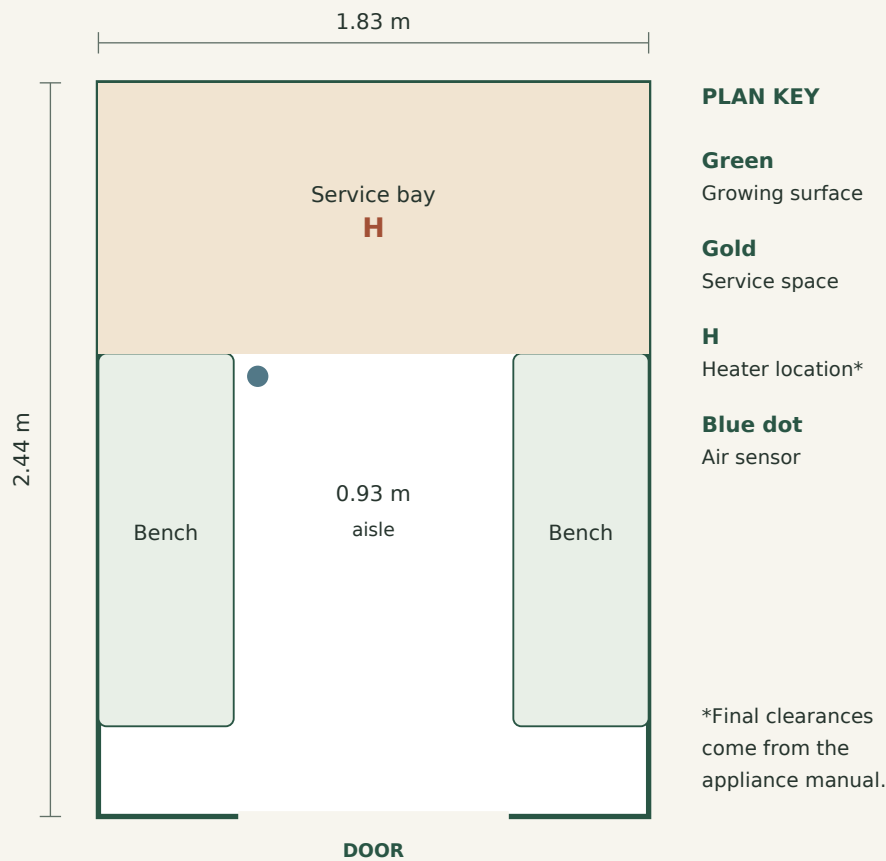
Test savings without adding percentages together

In the medium model, changing U from 6.0 to 3.5 reduces H from 218.66 to 133.75 W/°C, about 39%. That's a comparison of two assumed shell values, not a bubble-wrap saving claim. Lowering the target from 10°C to 5°C when it is -5°C outside reduces the temperature lift from 15 to 10°C, a further one-third reduction under those fixed conditions.

Apply improvements to the remaining load. Two 30% reductions would leave 49% of the original, not 40%. A heater, mat and water bank also share heat within the same enclosure, so summing separate estimates can count some energy twice. A meter and temperature log show what the complete installation actually uses.

Illustrative payback: if a heat pump costs \$3,000 more than resistance heating and saves \$360 a year after extra maintenance, simple payback is about 8.3 years. At £2,000 extra and £300 annual saving, it is about 6.7 years. Use quoted costs and your own annual heat demand.

Small greenhouse: protect the aisle



Floor allocation	Area
Two benches: each 0.45 × 1.24 m	1.12 m ² / 12.0 ft ²
Main aisle: 0.93 × 1.24 m	1.15 m ² / 12.4 ft ²
Front access strip: 1.83 × 0.30 m	0.55 m ² / 5.9 ft ²
Rear service reservation: 1.83 × 0.90 m	1.65 m ² / 17.7 ft ²

This conservative starting layout protects a 0.93 m / 36.6 in aisle and reserves the rear for heating equipment. The bay is a planning reservation, not a certified safety envelope. Finalise the heater first. If its manual requires more room, shorten the benches or select a suitable mounted system.

Internal usable dimensions total 4.47 m² / 48.1 ft². Kit sizes are often external and the frame may reduce this. Check door width and opening direction. The plan doesn't certify wheelchair access or turning space.

Put the small-house plan to work

For a modest collection needing frost protection, this is a sensible place to start. The worked heat requirement is 0.91 kW at 5°C inside and -5°C outside, or 1.36 kW at -10°C. Those figures rely on the insulation and leakage assumptions on page 5. A bare or draughty 6 × 8 ft house can need much more.

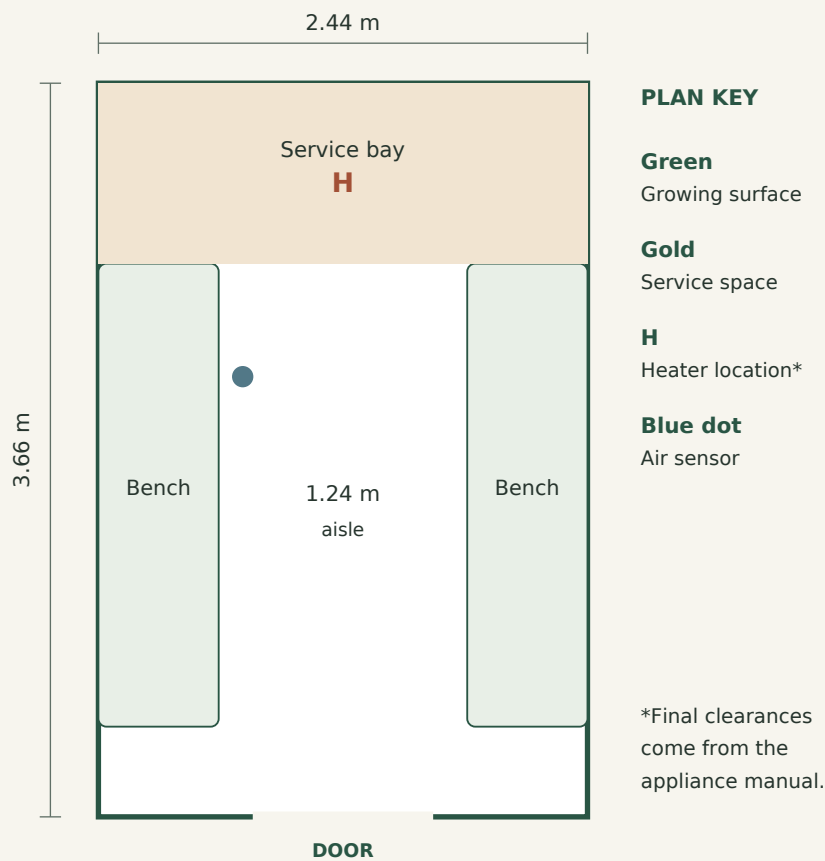
Shopping and setup sequence

- 01.** Repair the shell and measure the actual internal width. Mark a 0.93 m centre aisle with removable tape. Mark the rear service bay before moving plants back in.
- 02.** Choose a greenhouse-approved heater with enough design-condition output. A 1.5 kW US unit or 2 kW UK unit may suit the stated -10°C case, but check the installation and supply before purchase.
- 03.** Provide two narrow benches, no deeper than the measured clear space allows. Keep pots and tray edges out of the air path. Place the most vulnerable plants near the control zone, away from glazing.
- 04.** Fit a removable liner where it suits the crop's light needs. Add a canopy-height controller sensor and a separate minimum-temperature sensor near the coldest plants.
- 05.** Test on several cold nights. Check at dawn before solar warmth masks a cold corner. Raise the control target if measured plant-zone temperatures fall too low.

Starter allowance, excluding supply works	US / UK
Lining and basic seal repairs	\$80-180 / £50-130
Heater with control	\$150-300 / £100-230
Independent temperature alarm	\$40-100 / £30-80
Indicative subtotal	\$270-580 / £180-440

If a suitable heater cannot fit with its clearances, heat a compact propagator for the tender plants and move the rest to a safe winter location. Don't trade away the exit route to squeeze in equipment.

Medium greenhouse: leave room to work



Floor allocation	Area
Two benches: each 0.60 × 2.31 m	2.77 m ² / 29.8 ft ²
Main aisle: 1.24 × 2.31 m	2.86 m ² / 30.8 ft ²
Front access strip: 2.44 × 0.45 m	1.10 m ² / 11.8 ft ²
Rear service reservation: 2.44 × 0.90 m	2.20 m ² / 23.6 ft ²

The central aisle is 1.24 m / 48.8 in wide. Bench depth stays at a manageable 0.60 m / 23.6 in for one-sided access. The rear bay can hold an approved heating installation or a passive water bank, but don't assume both fit together once clearances and service access are included.

Total internal floor: 8.93 m² / 96.1 ft². Put a propagation mat on part of one bench if only seedlings need higher temperatures. For a separate warm rear section, use the partition plan on page 32.

Choose a medium-house heating package

This size can hold a useful mix of overwintering pots and spring propagation. It also crosses a common electrical limit. The worked load at 5°C inside and -10°C outside is 2.31 kW. A 2 kW heater isn't enough for that modelled condition, even if the product description names a similar floor area.

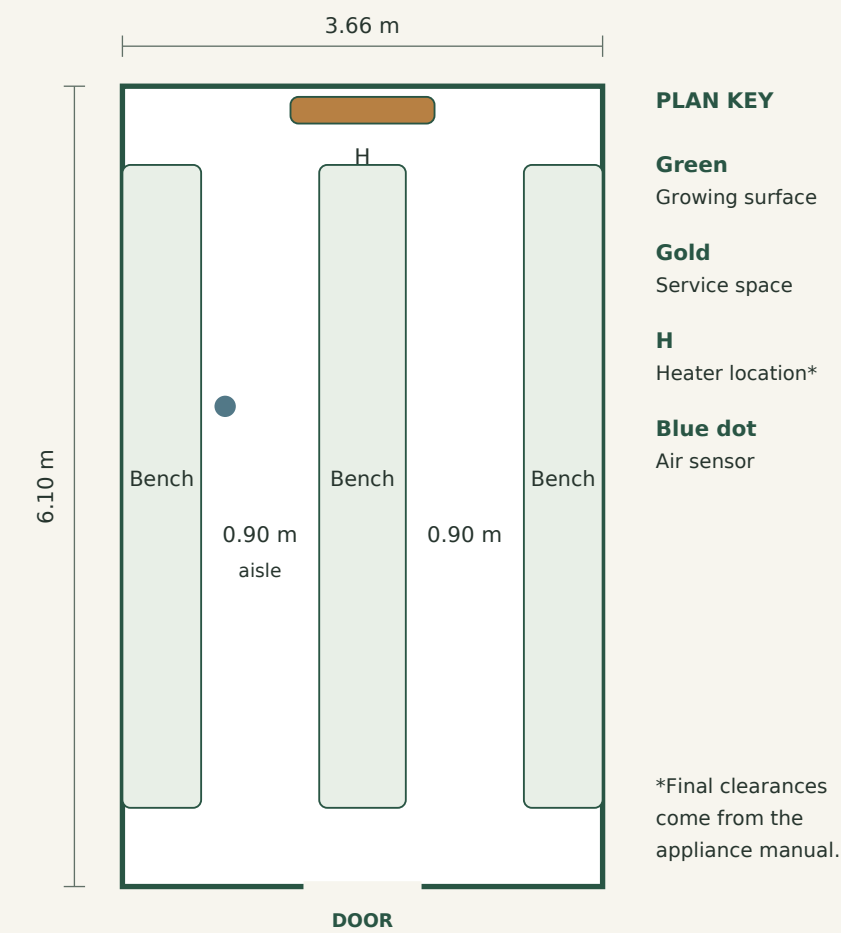
- 01.** Confirm the shell's performance and the cold-night target. Get the electrical supply checked before choosing one larger heater or several smaller units. Two sockets can share one circuit.
- 02.** Install benches and mark the service bay. If a low-temperature heat pump is being considered, have its mounting, air path and outdoor position approved before building around it.
- 03.** Use a canopy-height thermostat to hold the main space at the plant group's minimum. Put a mat and its separate compost probe on one bench for higher root temperatures.
- 04.** If a partition is chosen, move the air-control sensor into the heated section and give it its own ventilation. Recalculate the warm zone rather than dividing the whole-house load by floor area.
- 05.** Record one week of temperatures and energy use. Check the far corners after a cloudy day, when stored solar warmth is least helpful.

Illustrative package	US / UK allowance
Liner, seals and simple partition materials	\$150-450 / £100-330
Suitable electric heat and controls	\$250-600 / £180-450
Local mat / propagator and alarm	\$100-300 / £70-240
Indicative subtotal, no supply work	\$500-1,350 / £350-1,020

At a 10°C average lift for 12 hours per night, the whole-house model uses about 482 kWh per 30-day month. The sample electricity cost is \$96 or £120. A partition or mat can lower demand if it lets you lower the temperature elsewhere, but savings must be measured for the finished setup.

A water bank is an optional experiment here. Preserve the heater's space first, then decide whether the stored daytime warmth is worth the bench or floor area it displaces.

Large greenhouse: separate the heat zones



Floor allocation	Area
Two side benches: 0.60 × 4.90 m each	5.88 m ² / 63.3 ft ²
Centre bench: 0.66 × 4.90 m	3.23 m ² / 34.8 ft ²
Two aisles: 0.90 × 4.90 m each	8.82 m ² / 94.9 ft ²
Front and rear strips: 0.60 m deep	4.39 m ² / 47.3 ft ²

Total floor is 22.33 m² / 240.3 ft², with 9.11 m² / 98.1 ft² of growing surface. The heater symbol shows a candidate high-mounted position. Its support, overhead clearance, discharge and service access must be approved. Outdoor equipment space is additional.

The 0.60 m end strips are narrow cross-access areas. Enlarge them and shorten benches if turning, mobility or handling needs demand it. Keep both 0.90 m side aisles clear.

Give the large house dependable backup

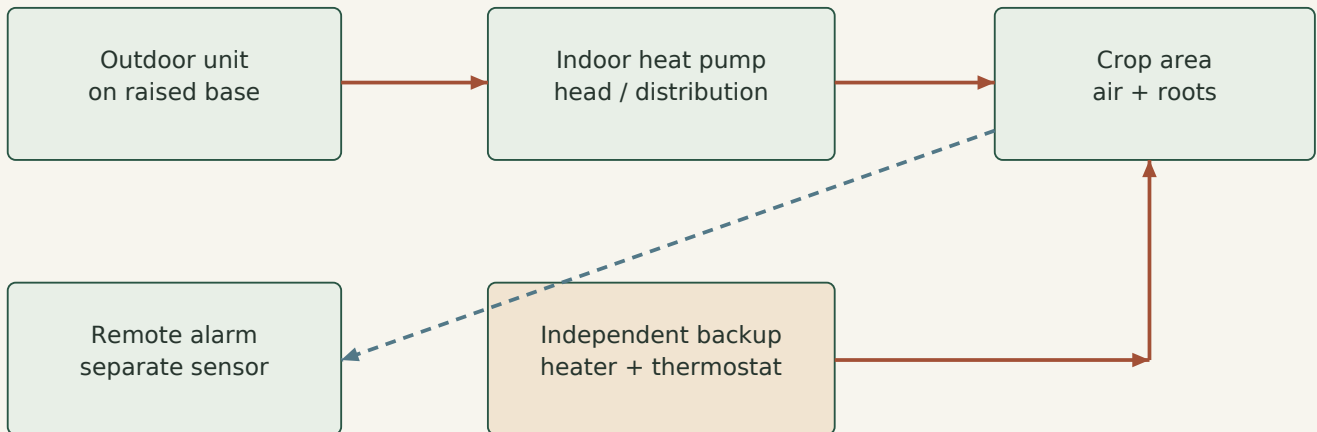


Diagram shows functions only. It is not a wiring or refrigerant drawing.

The worked large-house load is 4.61 kW at 5°C inside and -10°C outside. At -20°C it reaches 7.68 kW. This is enough demand to justify comparing heat-pump and professionally installed fuel options. Electrical resistance remains possible where the supply supports it, but check the seasonal cost before buying.

- 01.** Have the final load calculated using the actual panels, perimeter, leakage and local weather. Ask for useful output at the design condition and a separate annual-energy estimate.
- 02.** Divide plants by temperature need. Keep root-heating circuits local to propagation benches. Use a greenhouse-rated circulation system to limit cold pockets without drying leaves.
- 03.** Choose a backup objective: protect the whole greenhouse at the minimum safe temperature, or protect a smaller refuge zone. Calculate that separate load and provide a suitable independent control.
- 04.** Arrange outdoor-unit drainage, fuel storage or the flue with the installer. Keep maintenance access and the doorway clear. Verify power-failure restart and alarm delivery before winter.

Two heaters on one failing supply are not power-cut protection. A second heater can cover a failed appliance. A power outage needs an approved alternative supply, a suitable fuel system or a plan to move plants.

A heat-pump project may start around \$3,000-8,000 or £2,000-6,000 for a simple installation, before greenhouse-specific support, supply work and backup. Compare written quotes that include low-temperature control, cold-weather output and maintenance access.

Partition a smaller warm zone



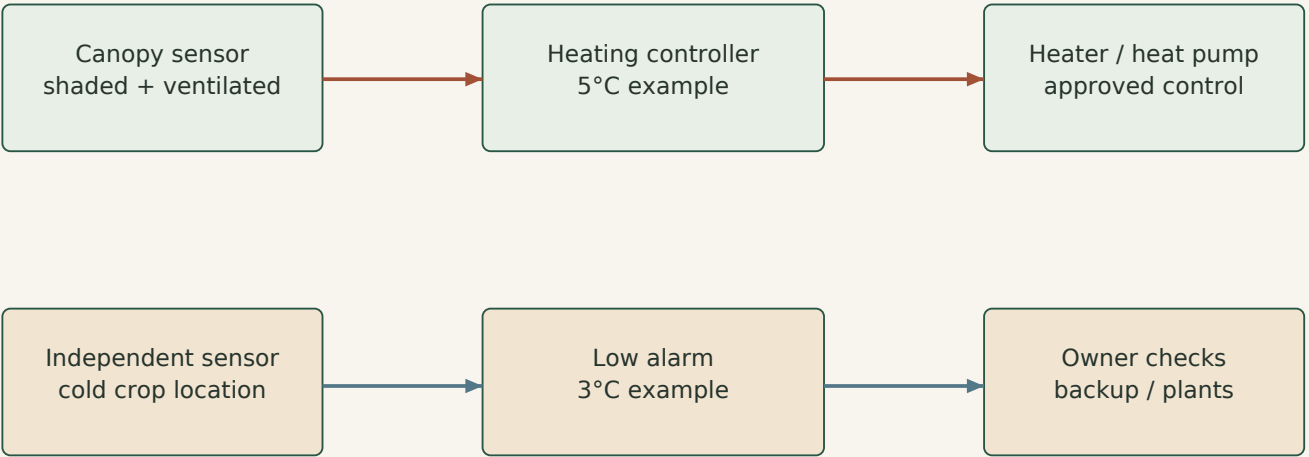
This example splits the 8 × 12 ft greenhouse into two 8 × 6 ft sections. The rear warm zone has 4.47 m² / 48.1 ft² of floor. Its partition adds another heat-loss surface, so its heater load won't be exactly half the full-house figure. Include the partition's area, material and temperature difference in the calculation.

- 01.** Group the tender plants in the rear. Check their light, aisle and heater-clearance needs. Confirm that the rear zone can still ventilate without opening the whole front door.
- 02.** Measure the full cross-section, including the roof triangle. Assemble a light frame using compatible brackets or an independently supported system. Don't drill glazing or overload the greenhouse frame.
- 03.** Fit horticultural liner or suitable clear panels to the frame. Provide a closable access opening wide enough for trays and pots. Keep the floor edge tidy so it cannot trip someone.
- 04.** Place the heater and control sensor inside the warm zone. Route approved power connections away from watering. Check the cold side with another thermometer.
- 05.** Test the closed partition at night and open or vent it as needed in daylight. Check condensation and leaves touching the liner. Remove the partition when the winter grouping ends.

Materials: measured frame members and compatible fixings, clear greenhouse lining or panels, repair tape, a closable access detail and separate temperature checks. Allow 10-15% material waste. Use the glazing maker's instructions for expansion gaps and panel fixing.

Keep plastic outside every heater's stated clearance. A loose curtain that can blow into a fan heater is unsuitable, even if it saves heat.

Control the crop temperature



Separate root-zone probe controls the heat mat. Keep the circuits distinct.

Put the main air sensor at the height of the vulnerable plants, shaded from direct sun and exposed to representative moving air. Keep it away from glazing, doors and heater discharge. Compare it with a separate thermometer before winter. Sensors can read correctly while still measuring the wrong place. [5]

Setting or device	Example purpose
Main air target: 5°C / 41°F	Suitable frost-protection example only. Adjust for the crop and sensor error.
Low alarm: 3°C / 37°F	Warns before the chosen crop zone gets too cold. Allow time to respond.
Backup start: about 4°C / 39°F	An example staged setting. Verify the actual switching behaviour and sufficient separation.
Root-zone thermostat	Uses its own compost probe and crop-specific temperature.
High-temperature ventilation	Opens above the crop's suitable daytime limit, with enough separation from heating.

Controllers differ. Some switch on below a target and stop above it. Others treat the target as one edge of the differential. Read the instructions and observe a full cycle. Avoid frequent heat-pump cycling, and use only its approved controls. A smart plug must be explicitly rated and approved for the load and operating conditions.

Use an independent alarm sensor and test message delivery with the door closed. A Wi-Fi alarm can disappear when the power or home router fails. For valuable plants, consider a battery-backed or cellular alert and a person who can respond. No alarm replaces enough heating capacity.

Warmth needs air movement and dry leaves

A greenhouse sealed for winter can hold too much moisture. Condensation on cold glazing, wet paths and crowded foliage create a damp crop environment. Heating raises the air's moisture-holding capacity, but it doesn't remove the water. Ventilation or a suitable dehumidification system must carry that moisture away.

- 01.** Water in the morning where the crop allows, directing water into the pot rather than over leaves. Empty unwanted standing water and repair leaks. Give wet foliage time to dry before night.
- 02.** Space plants so air can move between them. Remove dead leaves and spent flowers. A warm mat under wet trays can increase moisture release into a small enclosure.
- 03.** Use gentle circulation to limit stagnant pockets. Point the flow along or above the crop, avoiding a hot jet at leaves. A circulation fan moves internal air but doesn't exchange it with outside air.
- 04.** Vent during suitable daylight periods and monitor the crop temperature. In a heated house, a brief controlled exchange followed by reheating may be needed. Avoid icy draughts directly onto tender plants.
- 05.** Check roof drips, door seals and the underside of screens after cold nights. Leave necessary drainage paths open and keep condensation away from power connections.

Cool, humid conditions and wet leaves favour grey mould. Removing diseased material, improving spacing and shortening wet periods help reduce the problem. Manage the cause before raising the temperature to compensate. [23]

Insulation must not disable summer or winter ventilation. A sunny winter morning can overheat a closed propagator even while the ground outside is frozen. Automatic vent openers still need regular inspection. [25]

A dehumidifier adds heat and uses electricity, but low-temperature performance varies. Choose a machine approved for the environment and its drainage arrangement. Include its power in the budget. For most small houses, good watering habits and measured ventilation are the first steps.

Safe services and clear working space

Electrical supply

Use greenhouse-suitable equipment and an electrician-designed supply with appropriate RCD or GFCI protection, earthing and protection against water and physical damage. A splash-resistance rating doesn't make a plug safe in standing water. Keep connections raised and dry, and don't run leads through door seals. [22]

A 1,500 W heater at 120 V draws about 12.5 A. A 2,000 W unit at 230 V draws about 8.7 A. Those calculations don't establish circuit compliance. The electrician must consider continuous loads, cable length, voltage drop, other equipment and local rules. Avoid extension leads, reels and power strips for electric space heaters. [8]

Fuel, fire and people

Use the appliance's full clearance envelope, including above it and in the outlet stream. Keep fleece, bubble liner, timber staging and stored pots or packaging outside it. General portable-heater advice calls for at least 3 ft / 0.9 m from combustible materials. Greenhouse equipment must follow its own approved installation requirements. [8]

Gas and flue work belong with the appropriately qualified installer. Provide the specified combustion air, shutoff access and alarms. Keep cylinders in their approved storage position and location. Never refuel a hot or operating appliance. Obtain an appliance suitable for the planned operating schedule, including unattended frost protection where needed.

Local checks before installation

- Ask the local authority or permitting office about greenhouse alterations, electrical work, fuel storage, flues and any applicable smoke rules.
- Check insurance conditions, boundary restrictions and heat-pump noise or siting requirements. Rules differ by location and system.
- Confirm structural capacity before adding hanging equipment, water containers, heavy screens or roof-mounted hardware.
- Keep exits, manual shutoffs and working aisles accessible. Protect children and pets from hot surfaces and unstable equipment.

The DIY instructions stop at manufacturer-approved assembly and garden work. They do not replace a site electrical, combustion, refrigerant or structural design.

Keep the system working through winter

When	Check
Each day in cold weather	Read minimum/maximum temperatures, check the forecast, look for wilt, drips and blocked airflow.
Each week	Review energy use, inspect sensor position, confirm alarm delivery and check fuel or backup readiness.
Before the heating season	Clean equipment as instructed, inspect seals and liner, test controls and book required professional service.
After a storm or power cut	Check damage, vent position, trips, restart status and water or pipe freezing before restoring normal operation.

Symptom	First checks
Heater runs constantly, too cold	Capacity, open vent, failed seal, wet insulation, blocked airflow and actual output.
Warm at heater, cold at far bench	Air path, crowded pots, sensor too close to outlet and inadequate circulation.
Unexpectedly high bill	Setpoint, stuck relay, open vents, lighting, fan-only hours and changed tariff.
Seed trays too hot	Displaced probe, mat overlap, unapproved insulation underneath or closed lid in sun.
Repeated electrical trips	Stop using the affected circuit. Have faults, moisture and loading checked. Do not keep resetting it.
Fuel smell, soot or CO alarm	Leave the area, keep others out and contact the appropriate emergency or qualified service response. Do not restart.

Isolate and cool equipment before cleaning, following its instructions. Have fuel-burning equipment inspected and serviced on the required schedule. Blocked vents, damaged heat exchangers and poor combustion can affect both people and plants. [8, 24]

Compare bills with weather. A cold month costs more even when everything works. A plug-in meter can help only if it is approved for the appliance load and environment. A properly installed circuit meter is often better for permanent or larger systems.

Make a plan for the night heat fails

The useful backup is the one you can put into action at midnight. Write down which plants move first, where they can go and who can help if you're away. A small collection can often be moved to a cool, bright, frost-free room. A large planted greenhouse needs another heating route or a protected refuge zone.

Before a forecast freeze

- Test the heater, controls and low-temperature alarm. Check the forecast against the system's design temperature.
- Top up approved fuel storage or battery reserves within their instructions. Inspect outdoor heat-pump airflow and drainage.
- Group movable tender plants for quick handling and prepare crop covers on independent supports, clear of every heater.
- Keep a torch, contact details and a route to safe plant storage ready. Confirm that the helper has access and knows the shutoffs.

If the heat stops

- 01.** Read a separate thermometer and identify the cause without opening live equipment. If there is smoke, fuel smell, arcing or a CO alarm, leave and seek the appropriate help.
- 02.** Move vulnerable plants or start the pre-approved backup. Close unnecessary openings, but retain required ventilation. Covers slow cooling and don't create warmth.
- 03.** Use only an approved generator arrangement outdoors, well away from all buildings and openings. Never place it in the greenhouse, shed or garage. Never backfeed a socket. [8]
- 04.** After power returns, confirm the heater and controller restarted correctly. Check frozen pipes, leaks and plant temperatures before leaving the system alone.

A 1 kWh battery at 90% usable AC delivery powers a 1 kW resistance heater for only about 0.9 hour at full output. Battery power rating, cold limits and reserve also matter. Size backup in both kW and kWh.

Passive heat storage buys time only while it is warmer than the crop space. Avoid assuming yesterday's sunny afternoon will protect the greenhouse through several freezing nights.

Your greenhouse heating worksheet

Planning record	Your entry
Inside width × length	_____
Eaves height / ridge height	_____
Glazing / lining / U-value source	_____
Target temperature / crop minimum	_____
Outside design temperature	_____
Calculated heat requirement	_____
Heater usable output at design condition	_____
Supply capacity / installer contact	_____
Clearance envelope / lost growing space	_____
Electricity or fuel unit price	_____
Low alarm / backup action	_____

A seven-night commissioning record

Night	Outside min	Crop min	Energy / fuel	Notes
1				
2				
3				
4				
5				
6				
7				

Make the first change you can verify: fix a leak, fit a better sensor or move the tender plants into a smaller warm space. Then measure again. A greenhouse that suits your winter crops and your budget is more useful than one kept warmer than it needs to be.

Sources and further reading

Numbers in the guide refer to the sources below. Links were checked on 18 October 2026. Calculations, example layouts and budget allowances are original planning examples. General guidance does not override product instructions or local requirements.

- [1] Royal Horticultural Society.** How to heat a greenhouse efficiently
Crop targets, winter lining and light trade-offs.
- [2] University of Georgia Cooperative Extension.** Greenhouses: Heating, Ventilation, and Cooling, B792
Shell, air-leakage and perimeter calculation method. Model inputs are stated on page 5.
- [3] UMass Amherst, John W. Bartok Jr..** Insulating Sidewalls and Endwalls has a Short Payback
Insulation on areas contributing little useful sunlight. Historic prices were not reused.
- [4] UMass Amherst.** Energy and Shade Screen Systems for Greenhouses
Greenhouse screen principles and installation trade-offs.
- [5] UMass Amherst.** Selecting and Maintaining Thermostats
Sensor position, control differential and maintenance.
- [6] UMass Amherst.** Greenhouse Heat Distribution
Air and warm-water distribution, local heating zones.
- [7] UMass Amherst.** Heating System Efficiency for Greenhouses: Important Factors to Consider
Combustion, flues and plant exposure to pollutants.
- [8] US Consumer Product Safety Commission.** Keep Warm and Safe This Winter, 2026
Portable-heater, fuel and generator safety.
- [9] US Department of Energy, Building Science Education.** Air-to-Air Heat Pumps factsheet
System types and cold-weather performance considerations.
- [10] Penn State Extension.** Two Designs for Low Cost Hot Beds for Small Scale Production
Local bottom heat and covered propagation spaces.
- [11] Utah State University Extension.** Extending the Garden Season
Hotbeds and heating-cable principles.
- [12] ATTRA / National Center for Appropriate Technology.** Season Extension Techniques for Market Gardeners
Solar heat storage and the limits of water-based storage.
- [13] US Department of Energy.** Solar Photovoltaic System Design Basics
PV equipment and electrical storage.

Sources and price references

[14] ATTRA / National Center for Appropriate Technology. Organic Greenhouse Vegetable Production
Solar thermal storage and root-zone system examples.

[15] Utah State University Extension. Compost Practices
Composting conditions and emissions context.

[16] Utah State University Extension. Pathogens
Manure handling and pathogen concerns.

[17] University of Minnesota Extension. Deep winter greenhouses
Researched solar greenhouse designs and underground thermal storage.

[18] US Environmental Protection Agency. Wood Smoke and Your Health
Wood-smoke pollutants. The archived Burn Wise programme ran through 2025.

[19] Bio Green US. Palma with digital thermostat, 1,500 W
\$229.99 before sales tax on the checked listing. Verify US voltage and specification.

[20] Bio Green UK. Palma with digital thermostat, 2,000 W
£199.99 including VAT on the checked listing. Verify the current UK package.

[21] Bio Green UK. Jumbo propagation station with mat and thermostat
£199.99 including VAT on the checked listing. Tray availability should be confirmed.

[22] Electrical Safety First. Electrical Safety Advice for the Garden
RCD protection, water exposure and cable protection.

[23] University of Maryland Extension. Gray Mold or Botrytis Blight on Indoor Plants
Humidity, leaf wetness and air movement.

[24] UMass Amherst. Heating System Maintenance
Professional combustion checks and seasonal maintenance.

[25] Royal Horticultural Society. Greenhouse: Ventilation and Shading Tips
Ventilation and overheating prevention.

[26] US Energy Information Administration. Energy units and calculators explained
Fuel-unit conversion background. Use supplier heat-content figures for final costing.

Edition: October 2026. Gardening Latest. Prices can change. Photographs illustrate the ideas and are not measured installation records. Use the drawings and the equipment manuals when planning the actual work.