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COURSE 6 OF 10
FIRST EDITION 2026

HEAT PUMP TRAINING PROGRAM

Course 6 — Economics, Energy and Sustainability

One of ten vendor-neutral courses, with worked examples, P&IDs, a quiz and a glossary, written for Indian conditions.

Values marked "typical", "approximate" or "illustrative" are not test data; check them against manufacturers' manuals and current standards before use.

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LEVEL 2 · APPLICATION AND DESIGN

Course 6 — Economics, Energy and Sustainability

Powered by Sunniva. This Level 2 course is for building owners, energy consultants and finance teams who must judge whether a heat pump makes financial and environmental sense. After it you will be able to: (1) compare the cost of heat from any fuel on a fair, per-useful-kWh basis; (2) calculate simple payback, ROI and lifecycle cost; (3) estimate CO_2 savings and the value of solar PV and time-of-day tariffs; and (4) put these numbers into a clear business case for management.

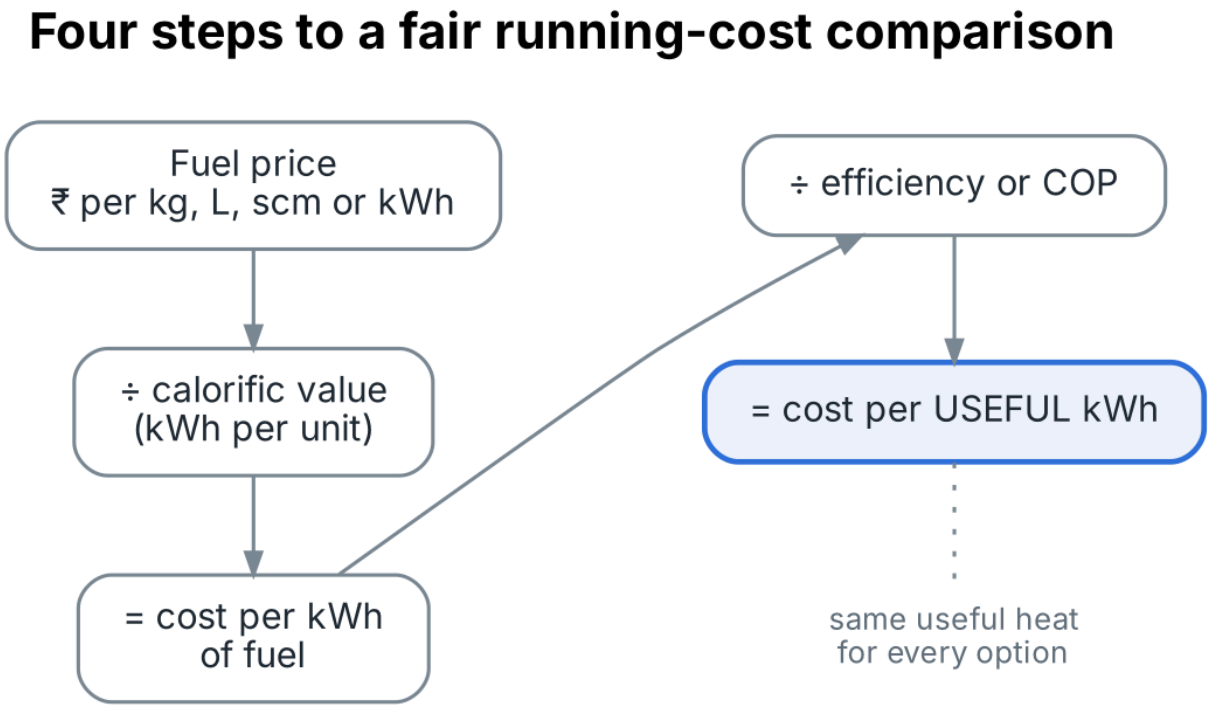
6.1 How to compare running costs fairly

Key idea: compare fuels by the cost of one unit of useful heat delivered, not by the price on the bill.

A litre of diesel and a unit of electricity are not the same thing. Each contains a different amount of energy. Each appliance also wastes a different share of it.

Think of buying rice. A 5 kg bag at ₹300 and a 2 kg bag at ₹140 cannot be compared by bag price. You divide by weight first. Heat works the same way, but you also subtract what spills on the floor.

Useful heat is the energy that actually reaches the water, air or process. It is measured in kWh (kilowatt-hour, 3.6 MJ). Calorific value is the energy contained in one unit of fuel. Efficiency is the share of that energy that becomes useful heat. For a heat pump we use COP (coefficient of performance): useful heat out divided by electricity in.



Four steps to a fair running-cost comparison

Rule	Why it matters
Use the same useful heat demand for every option	Otherwise you compare different jobs
Use net calorific value (NCV) consistently	Gross values flatter combustion efficiency
Use seasonal efficiency, not peak test efficiency	Boilers cycle; heat pump COP changes with weather
Include standby and distribution losses	Long pipes and hot tanks lose heat all day
Include maintenance, not only fuel	Burners, chimneys and filters cost money
Use the real tariff, including fixed and demand charges	The average ₹/kWh can differ from the energy rate

Net calorific value (NCV) excludes the heat locked in water vapour in the flue gas. Gross calorific value (GCV) includes it. Mixing the two can shift results by about 10%.

Worked example — what does one useful kWh cost from an electric geyser?

$$\text{Cost per useful kWh} = \frac{\text{Fuel price per unit}}{\text{Energy per unit} \times \text{Efficiency}}$$

1. Electricity price (example): ₹9/kWh. Energy per unit: 1 kWh.
2. Typical electric resistance efficiency including tank losses: 0.95.
3. Cost per useful kWh = 9 ÷ (1 × 0.95) = ₹9.47.

Remember

- Divide price by energy content, then by efficiency.
- Keep one useful heat demand for all options.
- Use seasonal, real-world efficiency figures.
- Add maintenance and fixed charges before deciding.

Common mistake: comparing ₹/kWh of electricity with ₹/kg of LPG directly, without converting both to useful kWh.

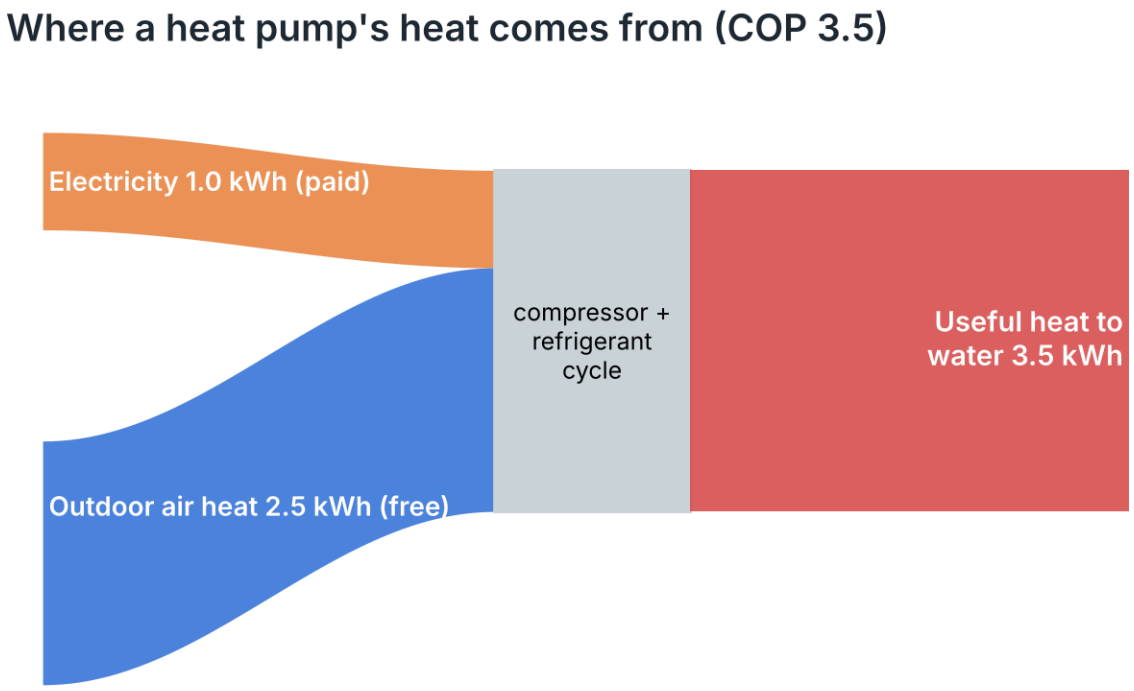
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6.2 Cost per useful kWh: electricity, LPG, PNG, diesel, biomass

Key idea: a heat pump turns 1 kWh of electricity into about 3–4 kWh of useful heat, so its cost per useful kWh is a fraction of the tariff.

A heat pump does not create heat by burning. It moves heat already present in the outside air into water, like a fridge, but using the heat it rejects instead of the cold it makes. The electricity drives the compressor; the ambient air supplies the rest.

Combustion appliances can never deliver more heat than the fuel contains. Their efficiency is always below 100%. A heat pump's COP is above 1 because the free ambient heat is not on the bill.



Where a heat pump's heat comes from

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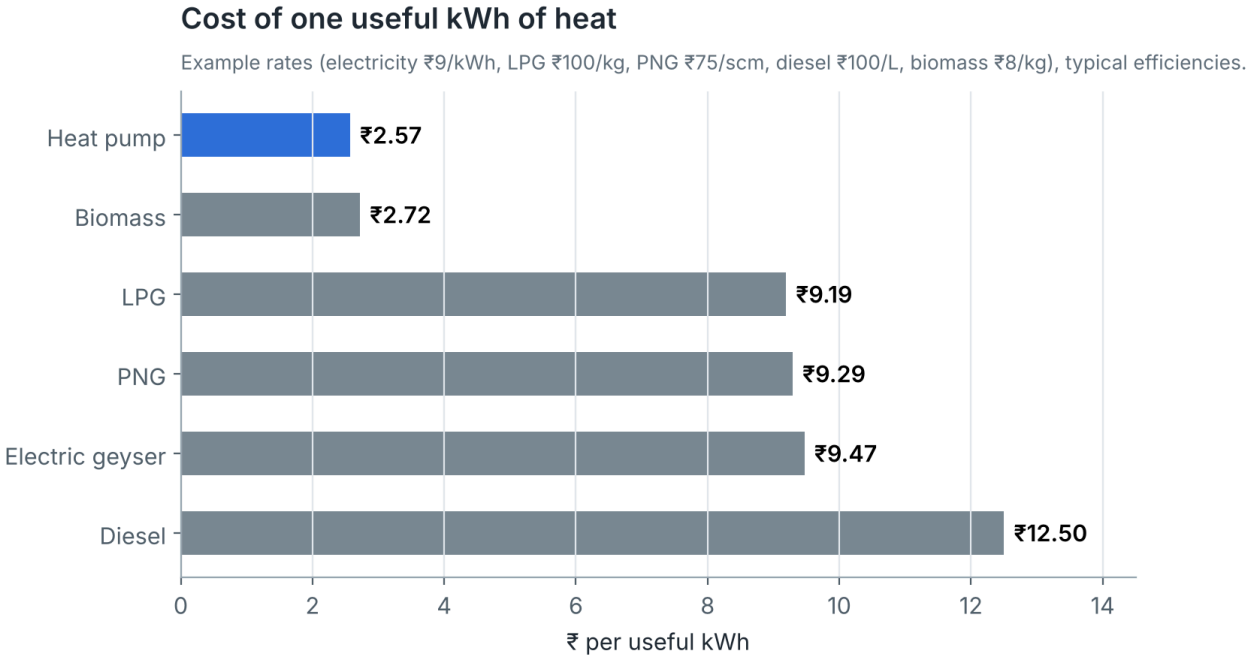
Typical reference values used in this course

Energy source	Example price	Typical NCV	Energy per unit (kWh)	Typical efficiency / COP
Electricity (resistance geyser)	₹9/kWh	—	1.0 per kWh	0.95
Electricity (air-source heat pump, hot water 55–60 °C)	₹9/kWh	—	1.0 per kWh	COP 3.5 (typical range 3–4.5)
LPG	₹100/kg	~46 MJ/kg	~12.8 per kg	0.85
PNG (piped natural gas)	₹75/scm	~34 MJ/scm	~9.5 per scm	0.85
Diesel (HSD)	₹100/L	~36 MJ/L	~10.0 per L	0.80
Biomass briquettes	₹8/kg (example)	~15 MJ/kg	~4.2 per kg	0.70

scm means standard cubic metre, the gas volume at reference conditions. HSD means high-speed diesel. Biomass values vary widely with moisture content.

Cost per useful kWh (example rates, typical efficiencies)

Source	Cost per kWh of fuel	÷ efficiency	Cost per useful kWh
Heat pump (COP 3.5)	₹9.00	3.5	₹2.57
Biomass briquettes	₹1.90	0.70	₹2.72
LPG	₹7.81	0.85	₹9.19
PNG	₹7.89	0.85	₹9.29
Electric resistance geyser	₹9.00	0.95	₹9.47
Diesel	₹10.00	0.80	₹12.50



Cost of one useful kWh of heat

Biomass looks cheap on fuel alone. It needs storage space, manual feeding, ash removal and emission control. Its supply and moisture also vary by season, which affects real efficiency.

Worked example — LPG in a Chennai hostel kitchen water heater

$$\text{Cost per useful kWh}_{\text{LPG}} = \frac{100}{12.8 \times 0.85}$$

1. Energy in 1 kg LPG ≈ 46 MJ ÷ 3.6 = 12.8 kWh.
2. Cost per kWh of fuel = ₹100 ÷ 12.8 = ₹7.81.
3. Divide by efficiency 0.85: ₹7.81 ÷ 0.85 = ₹9.19 per useful kWh.
4. Heat pump: ₹9 ÷ 3.5 = ₹2.57. The heat pump heat costs about 28% of LPG heat.

Remember

- Heat pump cost per useful kWh = tariff ÷ COP.
- At typical COP, heat pump heat costs roughly a quarter to a third of LPG, PNG or diesel heat.
- Biomass can be cheap but carries hidden handling costs.
- Recalculate whenever fuel prices change.

Field tip: ask for the last 12 months of fuel bills. Real consumption beats any estimate.

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6.3 Payback, ROI and lifecycle cost

Key idea: a heat pump costs more to buy but less to run, so judge it over its whole life, not on purchase price.

Simple payback is the number of years the yearly saving takes to repay the extra investment. ROI (return on investment) is the yearly saving as a percentage of investment. Lifecycle cost adds up purchase, energy, maintenance and replacement over the equipment's life.

It is like choosing between a cheap two-wheeler that drinks petrol and a costlier efficient one. After a few years the efficient one has paid for its extra price.

Lifecycle cost often uses NPV (net present value). NPV discounts future savings because ₹1 next year is worth less than ₹1 today. The discount rate is usually the company's cost of capital.

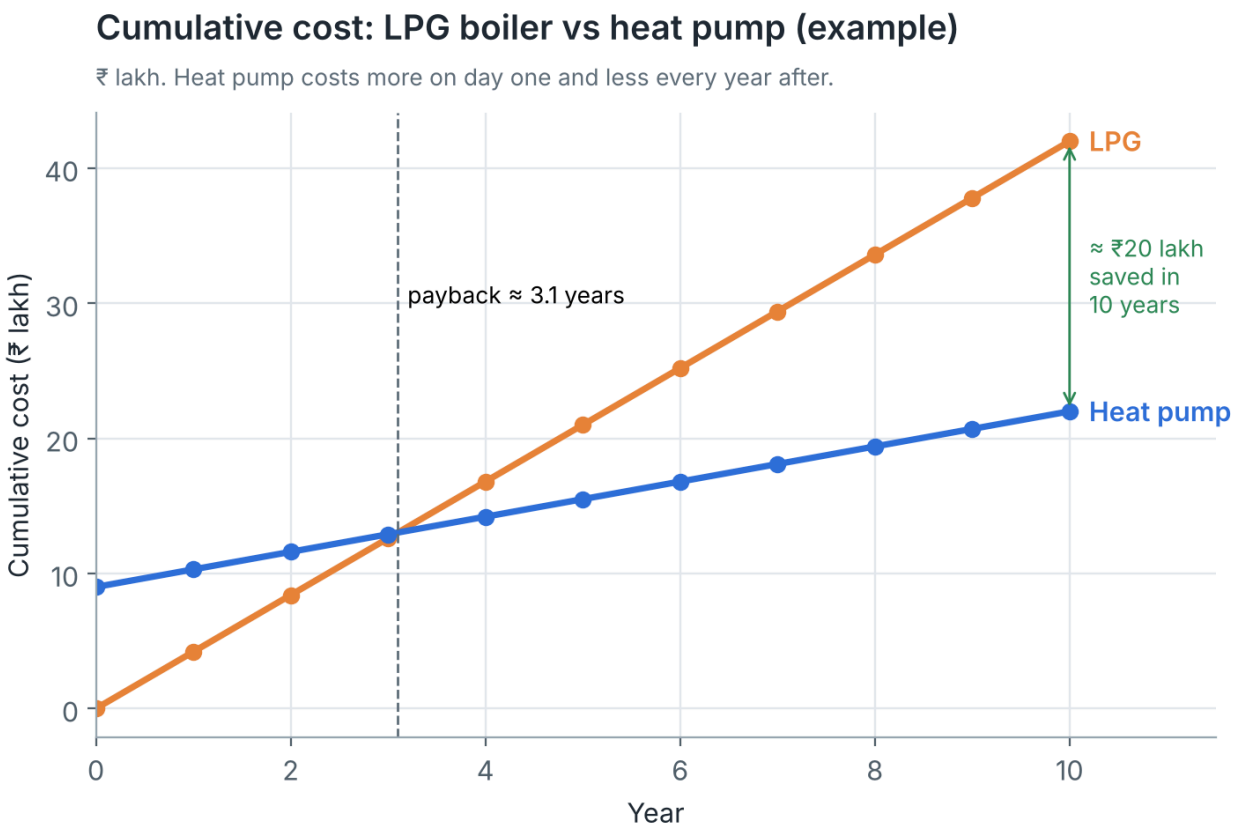
Worked example — hotel in Bengaluru replacing LPG for hot water

Demand: 3,000 litres per day heated from 25 °C to 60 °C, every day.

$$Q = m \cdot c_p \cdot \Delta T \qquad \text{Simple payback} = \frac{\text{Extra capital cost}}{\text{Net annual saving}}$$

1. Daily heat: Q = 3,000 kg × 4.186 kJ/kg·K × 35 K = 439,530 kJ ÷ 3,600 = 122 kWh/day.
2. Yearly heat: 122 × 365 ≈ 44,560 kWh.
3. LPG: 44,560 ÷ (12.8 × 0.85) ≈ 4,096 kg × ₹100 = ₹4.10 lakh. Add maintenance ₹10,000 (example). Total ≈ ₹4.20 lakh/yr.
4. Heat pump at COP 3.5: 44,560 ÷ 3.5 ≈ 12,730 kWh × ₹9 = ₹1.15 lakh. Add maintenance ₹15,000 (example). Total ≈ ₹1.30 lakh/yr.
5. Net annual saving ≈ ₹4.20 − ₹1.30 = ₹2.90 lakh.
6. Installed heat pump system (example): ₹9.0 lakh. Simple payback = 9.0 ÷ 2.90 ≈ 3.1 years.
7. Simple ROI = 2.90 ÷ 9.0 ≈ 32% per year.
8. NPV over 10 years at 10% discount rate: annuity factor = (1 − 1.1^{-10}) ÷ 0.1 = 6.145. NPV = 2.90 × 6.145 − 9.0 ≈ ₹8.8 lakh.

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Cumulative cost: LPG boiler vs heat pump

Measure	What it tells you	Weakness
Simple payback	How fast the money comes back	Ignores savings after payback and time value of money
Simple ROI	Yearly return on capital	Same as above
NPV	Value created today, in ₹	Needs a discount rate assumption
IRR (internal rate of return)	The discount rate at which NPV = 0	Harder to explain; can mislead on small projects
Lifecycle cost	Total cost of ownership	Needs life and replacement assumptions

Remember

- Payback = extra capital ÷ net annual saving.
- Include maintenance on both sides.
- NPV shows value; payback shows speed.
- Test the result with higher and lower fuel prices (sensitivity).

Common mistake: using the heat pump's full price when the old boiler must be replaced anyway. Use only the extra (incremental) cost in that case.

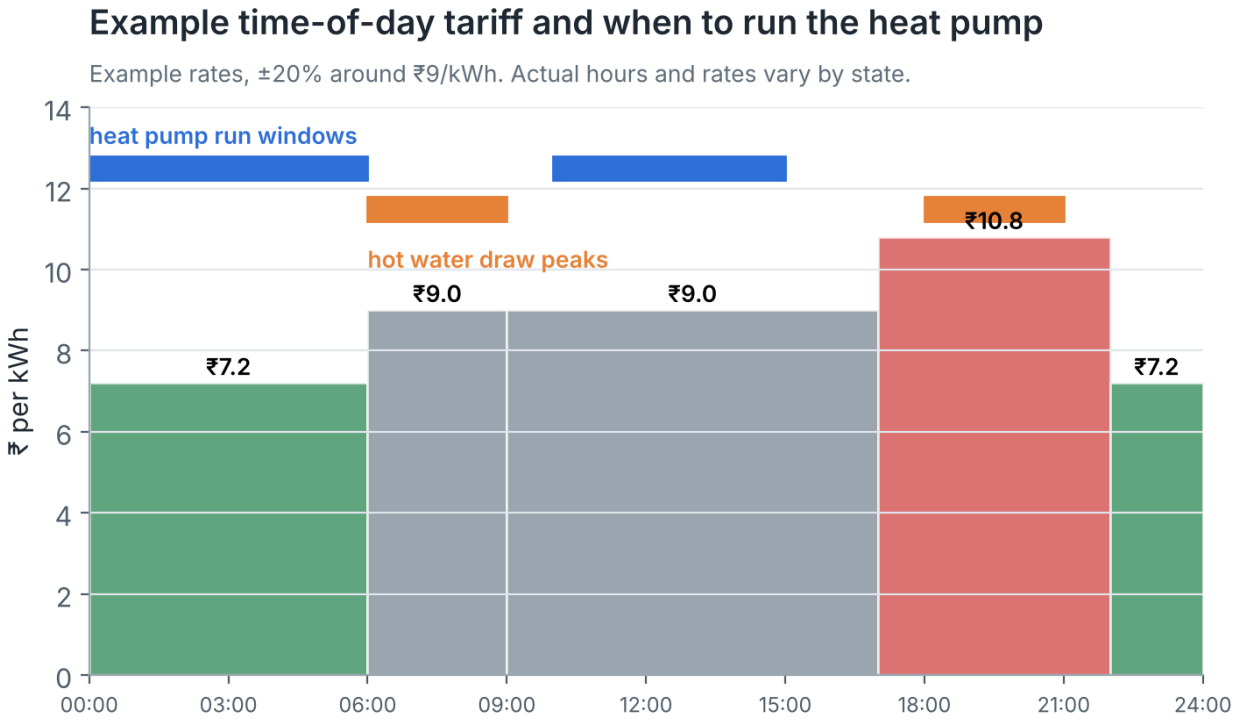
6.4 Electricity tariffs and time-of-day operation

Key idea: with a hot water tank, a heat pump can run when electricity is cheapest, cutting running cost further.

Many Indian commercial and industrial tariffs have time-of-day (ToD) rates. ToD means the energy rate changes by hour. Peak hours cost more; off-peak or solar hours may cost less. The exact hours and percentages differ by state and change often.

A hot water tank works like a battery for heat. You fill it when power is cheap and draw from it when needed. The heat pump heats the tank in cheap hours; the building uses the hot water later.

Bills also contain fixed or demand charges. Demand charge is billed on maximum kVA (kilovolt-ampere) drawn, per month. Starting several large machines together can raise it.



Example time-of-day tariff and run windows

Choice	Effect on cost	Effect on COP
Run in daytime (warm air)	Normal or solar-hour rate	Higher COP
Run at night off-peak	Lower rate	Lower COP in winter, as air is colder
Avoid evening peak	Avoids peak surcharge	Neutral
Stagger compressor starts	Lower demand charge	Neutral

In hot climates such as Chennai, night COP falls only slightly. In Delhi or Dehradun winters, night air can be 5–10 °C colder than afternoon air. That can cancel part of the off-peak saving.

Worked example — shifting the Bengaluru hotel load

$$\text{Daily saving} = E_{\text{daily}} \times (\text{Peak rate} - \text{Off-peak rate})$$

1. Daily heat pump electricity: 12,730 ÷ 365 ≈ 35 kWh.
2. Example rates: peak ₹10.8 (+20%), off-peak ₹7.2 (−20%).
3. All at peak: 35 × 10.8 = ₹378. All off-peak: 35 × 7.2 = ₹252.
4. Daily saving = ₹126. Yearly ≈ ₹46,000, before any COP change.

Remember

- Storage tanks let heat pumps follow cheap tariff hours.
- Check the current state tariff order for ToD hours.
- Balance cheaper night rates against lower night COP.
- Watch demand charges, not only energy charges.

Field tip: size the tank to cover the peak-hour draw so the heat pump can stay off during peak.

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6.5 Calculating CO_2 savings

Key idea: CO_2 per useful kWh = emission factor of the energy source ÷ efficiency or COP.

An emission factor is the CO_2 released per unit of energy used. For grid electricity it is the CO_2 from power stations per kWh delivered. India's grid factor is approximately 0.7 kg CO_2/kWh because much power comes from coal. It is falling as solar and wind grow.

Because a heat pump divides the grid factor by its COP, it emits less CO_2 per useful kWh than LPG or diesel; against PNG it breaks even at about COP 3, so it wins when its seasonal COP is above about 3 or as the grid gets cleaner.

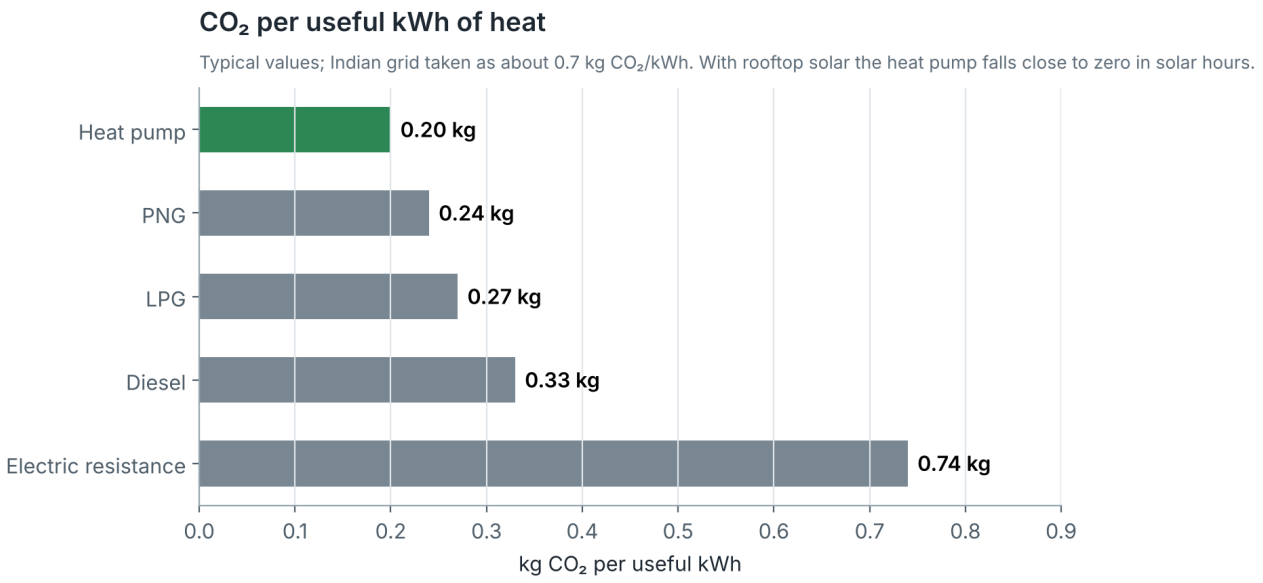
Typical emission factors (approximate)

Source	Per unit	Per kWh of fuel (NCV)
Grid electricity (India, approximate)	0.7 kg/kWh	0.70 kg
LPG	~2.98 kg/kg	~0.23 kg
PNG / natural gas	~1.9 kg/scm	~0.20 kg
Diesel	~2.68 kg/L	~0.27 kg
Biomass (sustainably sourced)	Treated as near-zero net CO_2	~0 (biogenic)

CO_2 per useful kWh (typical)

Source	Factor ÷ efficiency	kg CO_2 per useful kWh
Heat pump, COP 3.5	0.70 ÷ 3.5	0.20
PNG boiler	0.20 ÷ 0.85	0.24
LPG boiler	0.23 ÷ 0.85	0.27
Diesel boiler	0.27 ÷ 0.80	0.33
Electric resistance	0.70 ÷ 0.95	0.74

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CO₂ per useful kWh of heat

Worked example — hotel in Goa replacing a diesel boiler

Demand: 2,000 L/day from 25 °C to 60 °C.

$$\text{CO}_2 = \text{Energy used} \times \text{Emission factor}$$

1. Daily heat = 2,000 × 4.186 × 35 ÷ 3,600 = 81.4 kWh. Yearly ≈ 29,720 kWh.
2. Diesel: 29,720 ÷ (10.0 × 0.80) ≈ 3,715 L. CO_2 = 3,715 × 2.68 ≈ 9.96 t/yr.
3. Heat pump: 29,720 ÷ 3.5 ≈ 8,490 kWh. CO_2 = 8,490 × 0.7 ≈ 5.94 t/yr.
4. Saving ≈ 4.0 t CO_2 per year, about 40%.
5. Cost bonus: diesel ₹3.72 lakh vs heat pump ₹0.76 lakh per year (example rates).

Remember

- Use an approximate grid factor of 0.7 kg/kWh and state it.
- Divide the factor by COP or efficiency.
- Heat pumps beat electric geysers by about 3–4 times on CO_2.
- Savings grow as the grid gets cleaner.

Common mistake: comparing a heat pump with an electric geyser using fuel factors. Both use the grid; the COP alone drives the saving.

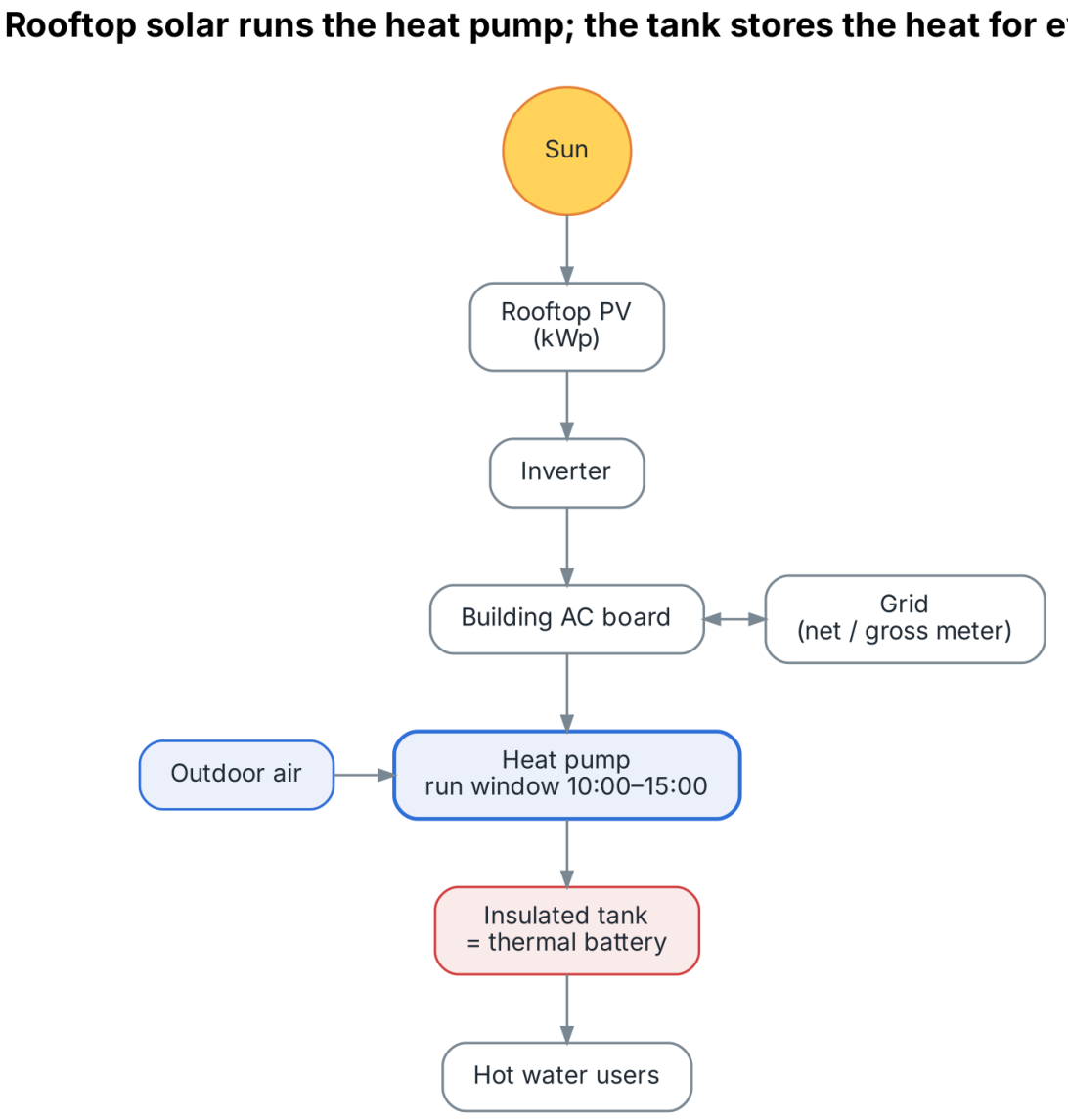
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6.6 Pairing heat pumps with rooftop solar PV

Key idea: solar PV plus a heat pump plus a hot water tank stores sunshine as hot water, which is cheaper than storing it in batteries.

Rooftop solar PV (photovoltaic) panels turn sunlight into electricity. Their rating is in kWp (kilowatt-peak), the output under standard test light. In most of India, 1 kWp typically produces about 4–5 kWh per day, averaged over the year.

PV makes power at midday. Hot water is often needed in the morning and evening. A well-insulated tank bridges the gap. Heat from a heat pump in the tank is a "thermal battery" that costs far less per kWh stored than a lithium battery.



Rooftop solar with a heat pump and tank

Metering type	How it works (general)	Best heat pump strategy
Net metering	Exported units offset imported units	Daytime running still preferred; check state caps
Gross metering	All PV is sold at a fixed tariff	Heat pump simply buys from grid
Self-consumption only	No export credit	Run heat pump in solar hours to avoid wasting PV

Rules on net and gross metering vary by state and DISCOM (distribution company). Check the current regulation before you size the system.

Worked example — sizing PV for the Bengaluru hotel heat pump

$$\text{PV size (kWp)} = \frac{\text{Daily heat pump electricity (kWh)}}{\text{Specific yield (kWh/kWp/day)}}$$

1. Daily heat pump use ≈ 35 kWh.
2. Typical yield in Bengaluru ≈ 4.5 kWh/kWp/day.
3. PV size = 35 ÷ 4.5 ≈ 7.8 → choose 8 kWp.
4. Roof area at a typical 8–10 m²/kWp: about 65–80 m² of shade-free roof.
5. Yearly PV energy ≈ 8 × 4.5 × 365 ≈ 13,140 kWh. At ₹9/kWh that is ≈ ₹1.18 lakh/yr avoided.
6. Example PV cost ₹50,000/kWp → ₹4.0 lakh. Simple payback ≈ 3.4 years.

Remember

- 1 kWp gives typically 4–5 kWh/day in India.
- Run the heat pump in solar hours and store heat in the tank.
- Thermal storage is cheaper than battery storage.
- Check state metering rules before sizing.

Field tip: keep PV panels clean. Dust in dry cities can cut output noticeably within a few weeks.

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6.7 Green building ratings and incentives (IGBC, GRIHA, LEED)

Key idea: green building ratings reward efficient hot water, low-carbon energy, good refrigerants and measured performance, and heat pumps support all four.

A green building rating is a voluntary scorecard. Points are given for energy, water, materials, indoor quality and site. Higher scores earn higher levels of certification.

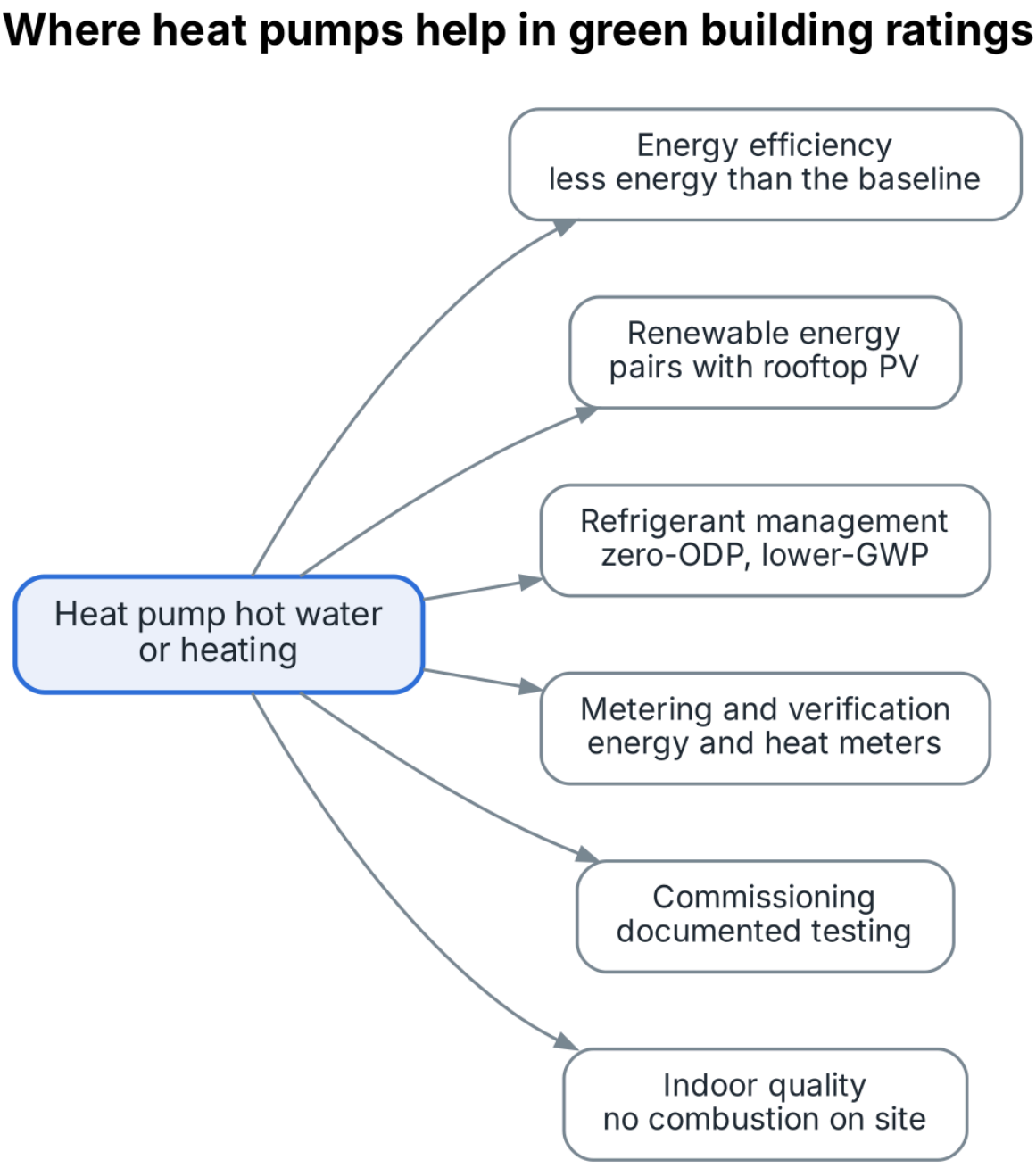
Three systems are common in India:

Rating system	Run by	Typical use in India
IGBC	Indian Green Building Council, part of CII (Confederation of Indian Industry)	Homes, offices, factories, townships and more
GRIHA	GRIHA Council, set up with TERI and supported by MNRE	Widely used for government and public buildings
LEED	US Green Building Council (USGBC), certified through GBCI	Multinational offices and export-oriented facilities

GRIHA stands for Green Rating for Integrated Habitat Assessment. TERI is The Energy and Resources Institute. MNRE is the Ministry of New and Renewable Energy. LEED stands for Leadership in Energy and Environmental Design.

India also has the Energy Conservation Building Code (ECBC) from the Bureau of Energy Efficiency (BEE). Rating systems often use it as a reference for minimum energy performance.

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Where heat pumps help in green building ratings

How heat pumps typically help (general themes, not credit numbers)

- **Energy performance:** lower energy than a baseline electric or fuel-fired water heater.
- **Renewable integration:** easy to run from on-site solar PV.
- **Refrigerants:** ratings favour zero ODP (ozone depletion potential) and lower GWP (global warming potential) refrigerants.
- **Measurement:** sub-metering of electricity and heat output supports performance credits.
- **Commissioning:** documented testing and handover records.
- **No on-site combustion:** no flue gases or fuel storage on the premises.

Incentives. Some states and urban local bodies have offered benefits for rated buildings. Examples include extra floor area ratio or property tax rebates. These schemes change often, so always check the

current local rules. Tax treatment of energy-saving equipment should be confirmed with a tax adviser.

Remember

- IGBC, GRIHA and LEED are voluntary rating systems.
- Heat pumps help with energy, renewables, refrigerants and metering.
- Provide data: COP, refrigerant type, GWP and meter readings.
- Check current local incentives; they vary by city and state.

Field tip: give the project's green building consultant a one-page data sheet early. Late data often means lost points.

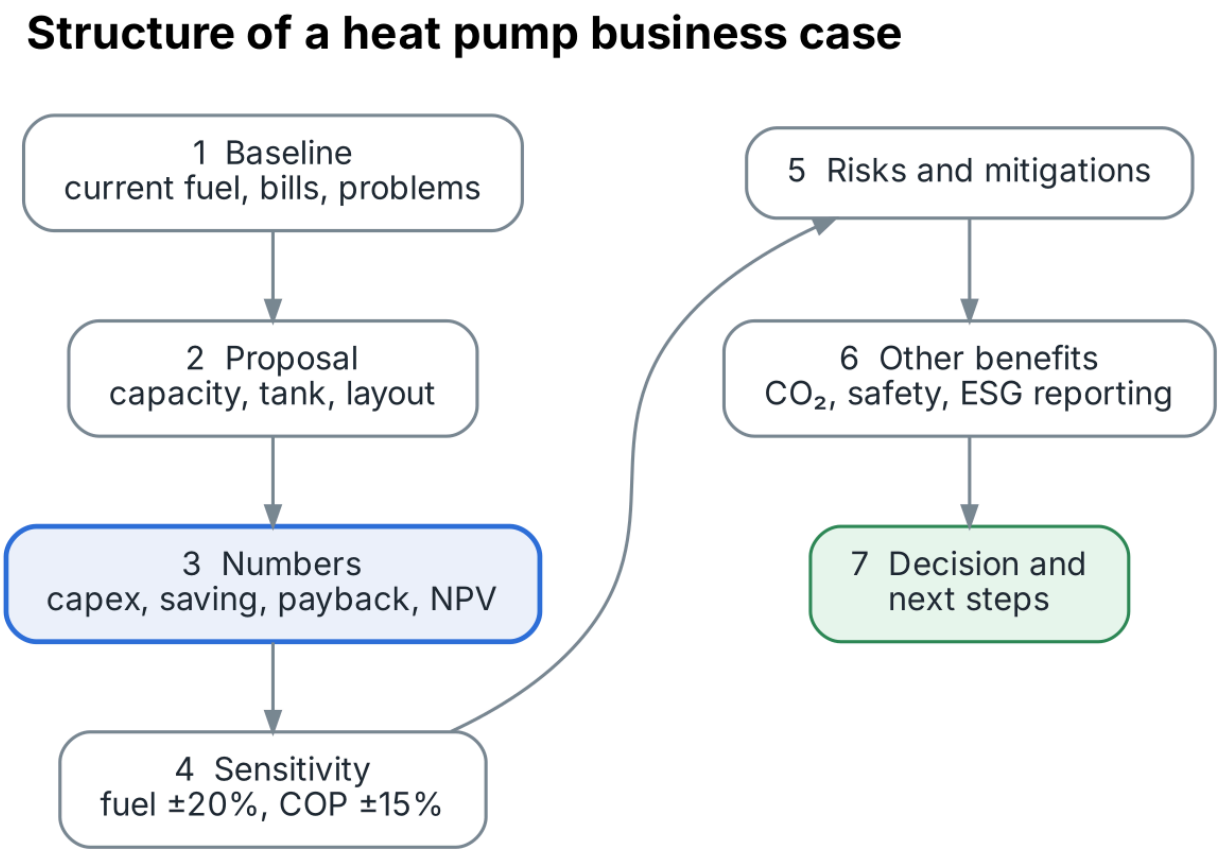
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6.8 Building the business case for management

Key idea: a good business case shows the money, the risks and the non-money benefits on one page, with honest assumptions.

Management wants clear answers. How much? How fast does it pay back? What could go wrong? What else do we gain?

Present one recommended option plus the "do nothing" baseline. Show every assumption so a finance team can check it.



Structure of a heat pump business case

Section	What to include
Baseline	12 months of fuel bills, hot water demand, current problems
Proposal	Capacity, tank size, location, backup plan
Financials	Capex, annual saving, payback, ROI, NPV
Sensitivity	Results at ±20% fuel price and ±15% COP
Risks	Power cuts, water quality, space, maintenance skills
Benefits	CO_2 saved, no fuel storage, safer kitchens, ESG (environmental, social, governance) reporting
Ask	Budget, approval date, project timeline

Worked example — sensitivity table for the Bengaluru hotel

$$\text{Payback} = \frac{9.0}{S_{\text{LPG}} - S_{\text{HP}}}$$

Base: LPG cost ₹4.20 lakh/yr, heat pump cost ₹1.30 lakh/yr, capex ₹9.0 lakh.

Case	LPG cost/yr	Heat pump cost/yr	Saving/yr	Payback
Base	₹4.20 L	₹1.30 L	₹2.90 L	3.1 yr
LPG price −20%	₹3.38 L	₹1.30 L	₹2.08 L	4.3 yr
LPG price +20%	₹5.02 L	₹1.30 L	₹3.72 L	2.4 yr
COP 3.0 instead of 3.5	₹4.20 L	₹1.49 L	₹2.71 L	3.3 yr

LPG ±20% applies to the fuel part (₹4.10 L) only; maintenance stays ₹0.10 L. At COP 3.0, electricity = 44,560 ÷ 3.0 × ₹9 ≈ ₹1.34 L, plus ₹0.15 L maintenance.

Remember

- Always compare against "do nothing".
- Show every assumption and its source.
- Include a sensitivity table; it builds trust.
- Add non-money benefits such as CO_2 and safety.
- Finish with a clear request and timeline.

Common mistake: presenting only the best case. One surprise later can sink trust in every future project.

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Quiz 6

1. What is the fair basis for comparing heating fuels?
    - A. Price per unit on the bill B. Cost per useful kWh delivered C. Calorific value only D. Appliance purchase price
2. At ₹9/kWh and COP 3.5, what is the heat pump's cost per useful kWh?
    - A. ₹9.00 B. ₹31.50 C. ₹2.57 D. ₹5.50
3. 1 kg of LPG contains about how much energy (NCV)?
    - A. 1.0 kWh B. 4.2 kWh C. 12.8 kWh D. 46 kWh
4. Simple payback equals:
    - A. Annual saving ÷ capex B. Extra capex ÷ net annual saving C. Capex × discount rate D. Fuel cost ÷ COP
5. Why does NPV discount future savings?
    - A. Equipment wears out B. Money today is worth more than money later C. Tariffs always fall D. Tax rules require it
6. Under a ToD tariff, the main role of a hot water tank is to:
    - A. Raise COP B. Let the heat pump run in cheaper hours C. Reduce water hardness D. Remove the need for a pump
7. Using an approximate grid factor of 0.7 kg CO_2/kWh and COP 3.5, CO_2 per useful kWh is about:
    - A. 0.20 kg B. 0.70 kg C. 2.45 kg D. 0.05 kg
8. In India, 1 kWp of rooftop PV typically produces per day:
    - A. 0.5–1 kWh B. 4–5 kWh C. 10–12 kWh D. 24 kWh
9. Which of these is NOT an Indian-origin green building rating?
    - A. IGBC B. GRIHA C. LEED D. None of these
10. What should a business case always be compared against?
    - A. The cheapest heat pump B. The "do nothing" baseline C. A competitor's quote D. Last year's budget

Answer key

1. B — Different fuels hold different energy and appliances waste different amounts.
2. C — ₹9 ÷ 3.5 = ₹2.57.
3. C — About 46 MJ/kg ÷ 3.6 ≈ 12.8 kWh.
4. B — Years for the net saving to repay the extra investment.
5. B — The time value of money; the discount rate reflects the cost of capital.
6. B — Stored hot water lets the heat pump avoid peak hours.
7. A — 0.7 ÷ 3.5 = 0.20 kg.
8. B — Typical average yield across most of India.
9. C — LEED is run by the US Green Building Council.
10. B — Savings only mean something relative to what happens if nothing changes.

Glossary

Term	Meaning
Useful heat	Heat that actually reaches the water, air or process
kWh	Kilowatt-hour; 3.6 MJ of energy
Calorific value	Energy contained in one unit of fuel
NCV / GCV	Net / gross calorific value; NCV excludes heat in flue water vapour
Efficiency	Useful heat out ÷ fuel energy in, for combustion or resistance heaters
COP	Coefficient of performance; useful heat out ÷ electricity in
Seasonal efficiency	Average efficiency over a year of real operation
scm	Standard cubic metre of gas at reference conditions
Simple payback	Extra capital ÷ net annual saving, in years
ROI	Return on investment; annual saving as % of capital
NPV	Net present value; discounted future savings minus capital
IRR	Internal rate of return; discount rate at which NPV = 0
Lifecycle cost	Total cost of owning equipment over its life
Sensitivity analysis	Re-running results with changed assumptions
ToD tariff	Time-of-day tariff; energy rate varies by hour
Demand charge	Charge based on maximum kVA drawn in a billing period
Emission factor	CO_2 released per unit of energy used
kWp	Kilowatt-peak; PV rating under standard test conditions
Net / gross metering	PV export rules: offset imports, or sell all generation
Thermal storage	Storing energy as hot water for later use
IGBC / GRIHA / LEED	Green building rating systems used in India
ECBC	Energy Conservation Building Code issued by BEE
ODP / GWP	Ozone depletion potential / global warming potential of a refrigerant
ESG	Environmental, social and governance reporting

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> *It started as an instinct. In 2012 I wanted to do something in energy conservation. That was the whole of it. There was no plan to build machines, and no plan to build them in India. Both came later.*

Kashyap founded Sunniva Encon in 2012 to work on energy conservation. The company now designs and builds heat pumps at its own factory in Asangaon, Maharashtra, with its office in Mumbai, and supplies hot water, space heating and process heat systems across India, including remote, high-altitude sites.

Over these years he has seen heat pumps chosen, sized, installed and serviced in every kind of Indian condition, and seen how often good machines are let down by poor selection, rushed installation or missing maintenance. Most of those problems come from knowledge that is not widely taught.

This program is his answer: an open, vendor-neutral course that shares that knowledge with students, technicians, installers, consultants and facility teams. It teaches the technology, not a brand. The lessons carry no product names or sales claims; Sunniva's part is only to make the material available.

- Founder Director, Sunniva Encon LLP, since 2012
- More than 5,000 heat pump installations across India
- Own heat pump factory in Asangaon, Maharashtra, built for 2,000 machines a year
- Nationwide service network reaching sites as remote as Leh
- Published research paper on ScienceDirect (Elsevier, 2015): sciencedirect.com/science/article/pii/S1877050915007735

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THANK YOU.

Thank you for learning with us. Questions, corrections and suggestions for the next edition are welcome.

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