

Exercise walk-through

1.5

Scientific Issues

GAC Science

Method — Key knowledge: a measured benefit informs a choice without deciding every value or risk

Scientific **evidence** 证据 can inform a decision about technology by estimating effects under stated conditions. A **risk** 风险 concerns the chance and seriousness of harm; “possible” and “frequent” are different claims. **Uncertainty** 不确定度 describes limits on a value or estimate, not a licence to invent a confidence range. Costs, accessibility, reliability and acceptable trade-offs also matter. A power comparison alone does not decide whether a real installation is suitable.

Method — Source A: text or task brief

Fictional classroom task: the school compares an existing 60 W lamp with a proposed 10 W lamp for a space needing suitable lighting. For this numerical estimate only, assume each lamp uses its stated constant power for 5 hours daily across 20 days. Use energy $E = P \times t$, with power in kW and time in hours for kWh. These are supplied classroom assumptions, not measured yearly usage.

No measurements of brightness, flicker, lifetime or installation suitability are provided. The new lamp's purchase cost and any tariff are absent. The school has not approved a replacement. Actual electrical installation must be handled through the school's authorised personnel, not by students.

Method — Source B: response or review record

A poster says: “The new lamp uses no energy and saves exactly 100 RMB every month. Lower power proves it is equally bright and has no risks. Every room should be changed tomorrow without permission. Because some uncertainty remains, science has nothing useful to contribute.” The facilities team proposes checking lighting requirements, purchase and installation costs, compatibility and an approved comparison before deciding.

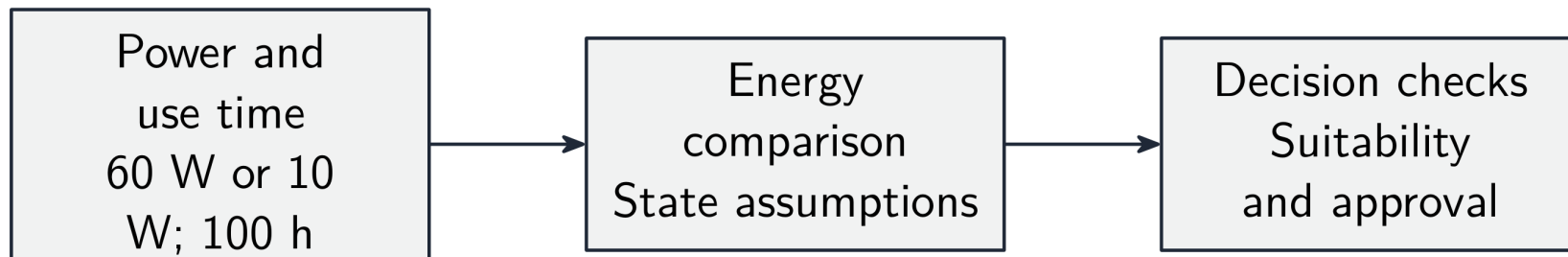
Method — Worked example: calculate an assumption-based energy estimate

Known: power 60 W and usage $5 \times 20 = 100$ hours. Why convert power to kW? The requested energy unit is kWh.

$$E = Pt$$

$$E_{old} = (60/1000) \text{ kW} \times 100 \text{ h} = 6.0 \text{ kWh}$$

This is a calculation under stated assumptions, not a direct measurement of future use. It cannot give a monetary saving without a tariff.



Exercises 2.1-2.3

2.1 State the energy equation and convert 10 W to kW. [2]

2.2 Calculate the assumed total operating time. [2]

2.3 Calculate the new lamp's energy use and the reduction from the old lamp. [3]

Exercises 2.1-2.3

2.1 State the energy equation and convert 10 W to kW. [2]

2.1

: $E = P \times t$: 10 W = 0.010 kW.

2.2 Calculate the assumed total operating time. [2]

2.2

: total time equals daily hours times days.: $t = 5 \times 20 = 100$ h.

2.3 Calculate the new lamp's energy use and the reduction from the old lamp. [3]

2.3

: $E = Pt$: $E_{\text{new}} = 0.010 \times 100 = 1.0$ kWh.: reduction = $E_{\text{old}} - E_{\text{new}} = 6.0 - 1.0 = 5.0$ kWh under the supplied assumptions.

Exercises 2.4-3.1

2.4 Identify THREE missing checks needed before claiming equal suitability or a financial saving. [3]

3.1 Evaluate the poster with six distinct corrections or limits. [6]

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2.4 Identify THREE missing checks needed before claiming equal suitability or a financial saving. [3]

2.4

each: required brightness/lighting performance; installation compatibility or authorised safety review; tariff; purchase/installation cost; lifetime or reliability. Credit distinct relevant checks, with at least one suitability check and one financial input.

3.1 Evaluate the poster with six distinct corrections or limits. [6]

3.1

each: new lamp still uses estimated 1.0 kWh; no tariff supports the claimed RMB saving; power alone does not prove equal brightness; no-risk claim is unsupported; replacement needs school approval and authorised personnel; remaining uncertainty does not erase the bounded evidence of lower estimated energy use.

Exercise 3.2

3.2 Write an 80–110-word recommendation distinguishing the estimate from a final decision. [8]

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3.2

Local analytic rubric, 8 ×: state supplied time; give old energy; give new energy; give bounded reduction; reject monetary amount without tariff; require lighting/suitability checks; require cost checks; preserve approval and authorised installation; coherent truthful 80–110 word response. Example: “Using the classroom assumptions, both lamps operate for one hundred hours. The existing lamp uses an estimated 6.0 kilowatt-hours and the proposed lamp 1.0 kilowatt-hour, a reduction of 5.0 kilowatt-hours. This supports a bounded energy comparison, not a claim of zero use or a guaranteed monetary saving. A tariff and purchase and installation costs are needed for the financial assessment. The school should also check required brightness, compatibility and reliability before deciding whether the replacement is suitable. Any installation requires approval and authorised personnel. Uncertainty limits the conclusion but does not erase the useful estimate.”