Synthetic filtration-package comparison

Scope: a cost-tracing exercise for two fictional alternatives. Neither is tied to a vendor or real facility. Technical equivalence is assumed only to demonstrate arithmetic [C13-C14].

1. Source assumptions

Input	A	B	Evidence
Initial included capital (CAD)	40,000	55,000	C2-C3 / S1.3-S1.4
Operating power (kW)	12	8	C2-C3 / S1.3-S1.4
Other included annual cost (CAD/year)	4,000	2,500	C2-C3 / S1.3-S1.4
Hours (h/year); years	4,000; 5	4,000; 5	C1 / S1.2
Electricity (CAD/kWh)	0.12	0.12	C1 / S1.2

2. Reproducible included-cost model

Annual energy (kWh/year) = power (kW) x hours (h/year).
Annual electricity (CAD/year) = energy x electricity price (CAD/kWh).
Included annual cost = annual electricity + other annual cost.
Included total cost = initial capital + study years x included annual cost [C4-C7].

Calculated quantity	A	B
Annual energy (kWh/year)	48,000	32,000
Annual electricity (CAD/year)	5,760	3,840
Included annual cost (CAD/year)	9,760	6,340
Five-year included total (CAD)	88,800	86,700

B has CAD 15,000 greater initial capital and CAD 3,420/year lower included annual cost at base assumptions; five-year savings exceed the capital gap by CAD 2,100 [C2-C3,C6-C8]. These are undiscounted included costs, not a complete lifecycle-cost estimate.

Sensitivity and limits

3. Where the cost ordering changes

Let H be hours/year and P be electricity price in CAD/kWh. A total minus B total = -15,000 + 5 x (4 x H x P + 1,500) CAD. Positive means B has lower included cost; negative means A has lower included cost [C1-C3,C9].

With P = 0.12, equal cost occurs at H = (15,000/5 - 1,500)/(4 x 0.12) = **3,125 h/year**.
With H = 4,000, equal cost occurs at P = (15,000/5 - 1,500)/(4 x 4,000) = **0.09375 CAD/kWh**.
At base hours and price, elapsed-year break-even = 15,000/3,420 = **4.386 years**, approximately. This interpolates uniform annual savings; annual accounting periods would first show a lower B cumulative total at year 5 [C9].

Case (one change at a time)	A total CAD	B total CAD	Lower included cost
Base, five years	88,800	86,700	B by 2,100
2,000 h/year	74,400	77,100	A by 2,700
0.08 CAD/kWh	79,200	80,300	A by 1,100
B other annual cost +500	88,800	89,200	A by 400

4. What this does not establish

No real technical eligibility, safety, treatment performance, or vendor pricing has been established. Discounting, financing, inflation, taxes, additional installation, replacements, residual value, outages and other excluded effects could change the result. Sensitivity cases are invented illustrations, not confidence intervals [C13; S1.1,S1.5].

5. Evidence and decision

Decision: no real technology selection. In this toy model, B ranks lower in included cost at base assumptions, but that ordering reverses under modest illustrative changes. Obtain the facts that could reverse the decision before drawing a real conclusion.

Evidence key: ASM = explicit assumption; CALC = calculation; UNK = unresolved. C1-C14 map to audit/claim_ledger.csv. S1 identifies synthetic-source.md and its numbered sections. All numeric inputs are ASM; there are no external sourced equipment claims.

Reproduce: use inputs.json and reproduce.py; compare with expected-results.json. Read the separate checker findings before public release. AI-assisted example; professional responsibility is not supplied by either AI agent.