



ROI & ENERGY PAYBACK ANALYSIS

Refrigeration VIG ROI & Energy Payback

Refrigeration Application

APPLICABLE STANDARDS & REFERENCES

- ASHRAE Refrigeration Handbook 2022
- ASHRAE eGRID 2023
- AHRI Standard 1200
- EIA Commercial Energy Prices 2024
- NSF/ANSI 7

KEY RESULT

Annual Cost Savings

\$0

Simple payback: N/A

10 doors | 8.40 m2 total | deltaT 40 degC

Baseline U: 2.2 W/m2.K | VIG U: 0.5 W/m2.K | COP: 2.5



RESULTS SUMMARY

Refrigeration Application

Doors: 10	Area/door: 0.84 m2	deltaT: 40 degC	Hrs/day: 24	COP: 2.5	Energy: \$0.12/kWh
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ANNUAL ENERGY SAVINGS

ANNUAL COST SAVINGS \$0 per year	COMPRESSOR ENERGY SAVED 0 kWh/yr per year
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PAYBACK & INVESTMENT

SIMPLE PAYBACK N/A Check inputs	INCREMENTAL COST \$3,800 \$380 per door x 10 doors
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NET PRESENT VALUE

NPV AT 10 YR \$0 net of incremental cost	NPV AT 15 YR \$0 net of incremental cost	NPV AT 15 YR \$0 net of incremental cost
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CARBON IMPACT

ANNUAL CO2 REDUCTION 0 kg CO2 per year	LIFETIME CO2 (15 YR) 0 kg CO2 total avoided emissions
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DISCLAIMER

Steady-state conduction model per ASHRAE Refrigeration 2022 §14. Covers conduction only - actual savings may be higher due to reduced defrost cycles and elimination of anti-sweat heater wires. Use as a comparative planning tool - not a certified energy audit.



METHODOLOGY & ASSUMPTIONS

ENERGY MODEL

Heat gain through glazing (ASHRAE Refrigeration 2022 §14, steady-state conduction):

$$Q_{\text{gain}} (\text{Wh/yr}) = U (\text{W/m}^2.\text{K}) \times A (\text{m}^2) \times \Delta T (\text{K}) \times \text{hours/day} \times 365$$

$$E_{\text{compressor}} (\text{kWh/yr}) = Q_{\text{gain}} / \text{COP} / 1000$$

The compressor must remove the heat gain from the refrigerated space.

COP relates electrical input to heat removed: $E_{\text{elec}} = Q_{\text{removed}} / \text{COP}$.

FINANCIAL MODEL

Annual cost savings = Energy saved (kWh/yr) x electricity cost (\$/kWh)

Simple payback = Incremental cost / Annual cost savings

NPV = Annual savings x $[(1 - (1+r)^{-n}) / r]$ - Incremental cost

CO2 reduction = Energy saved x 0.386 kg/kWh (EPA eGRID 2023)

ASSUMPTIONS & LIMITATIONS

Conduction model only - radiation and infiltration excluded

Actual savings may be higher due to reduced defrost cycles and elimination of anti-sweat heater wires

ΔT and operating hours use application-type defaults unless overridden

Uniform electricity cost - demand charges and time-of-use pricing excluded

Use as a comparative planning tool - not a certified energy audit

REFERENCES

ASHRAE Refrigeration Handbook 2022, Chapter 14 - Display cases and refrigerated storage

AHRI Standard 1200 - Performance of commercial refrigerated display and storage cabinets

NSF/ANSI 7 - Commercial refrigerators and freezers

EPA eGRID 2023 - US national average CO2 intensity: 0.386 kg/kWh

EIA (2024) - US commercial average electricity price: \$0.12/kWh