

Question 1

A manufacturing company plans to install a leak-detection programme and a variable-speed compressor. The investment cost is 160 k€ and the planned useful life is 6 years. The table below reports the annual operating costs and expected annual electricity cost savings (k€):

	0	1	2	3	4	5	6
Oper. costs		10	10	10	12	12	12
Elect. savings		45	55	60	62	67	67

Calculate the simple payback using the average net annual cash flows and using the actual net cash flows. Calculate the discounted payback using a real discount rate of 9%.

Comment on the difference between the three values.

(Answer: PB1=3.3 years; PB2=4 years; DPB=5 years)

Question 2

A firm compares two heat-recovery solutions (SH1 and SH2) for a drying oven. Both reduce natural-gas consumption. The real MARR is 11%, and the useful life is 7 years. Salvage values refer to the last year of the useful life. The firm contracted with the supplier of SH1 to an equipment reconditioning after 4 years of operation. SH2 does not need reconditioning during the planned life span. Data are summarised in the table:

(k€)	SH1	SH2
Investment cost	180	260
Salvage value	25	45
Reconditioning cost	35	0

Expected annual net operating cash flows are:

(k€)	1	2	3	4	5	6	7
SH1	45	45	45	50	50	52	52
SH2	55	55	60	60	62	62	62

Compute the Net Present Value of both alternatives.

Compute the Profitability Index of both alternatives.

Decide which alternative should be recommended and explain why.

(Answer: NPV(SH1)=34.41k€; NPV(SH2)=39.06k€; PI(SH1)=1.17; PI(SH2)=1.15)

Question 3

A manufacturing facility evaluates two mutually exclusive rooftop photovoltaic configurations, each with a 12-year operating life and real MARR = 10%.

PV1 (PV only): investment 360k€ at $t = 0$; net annual saving (self-consumed energy) of 74k€; an inverter replacement of 60 k€ at the end of year 8; salvage value 45 k€ at year 12.

PVB2 (PV + battery storage): investment 560 k€ at $t = 0$; net annual saving of 110 k€; a battery/power-electronics replacement of 95 k€ at the end of year 7; salvage value 60 k€ at year 12.

Calculate the discounted payback period and the equivalent annual annuity of each configuration.

Discuss the results and, in case, highlighting why the two indices may identify a different option as the most convenient.

(Answer: $DPB(PV1)=7$ years; $DPB(PVB2)=9$ years; $EA(PV1)=19.16k€$; $EA(PVB2)=23.46k€$)