

CASE SOLUTION • RWJJ CH 7-8

Gulf Coast Solar: solution

A worked solution to the commercial rooftop case, with the reasoning behind each step. The division is worth about \$726,000 to GCS, and it beats the residential upgrade on every measure.

All amounts are in dollars. Present values are computed with unrounded discount factors and shown to the nearest dollar, so a column can differ from its total by \$1.

Part A: Which cash flows count?

The test for every item is the same: does the company's cash flow change because it takes the project? If yes, include it. If the cash moves whether or not the project goes ahead, leave it out.

#	ITEM	VERDICT	WHY
1	Feasibility study, \$95,000	Exclude	Sunk cost: it has been paid, and accepting or rejecting the project cannot get it back.
2	Forgone warehouse rent, \$80,000 a year	Include	Opportunity cost: using the warehouse means giving up rent GCS would otherwise collect.
3	Loan interest at 6.5%	Exclude	Financing cost: the 11% WACC already charges the project for its funding, so counting interest again would double-count it.
4	Erosion, \$120,000 a year	Include	Cannibalization: profit the residential business loses only because the division exists is a real cost of the division.
5	Net working capital, \$300,000	Include	Cash tied up in inventory and receivables is an outflow at launch and an inflow when it is recovered at the end.
6	Equipment sale, \$350,000	Include	A cash inflow at the end of the project, but after the tax on any gain over book value.
7	Fixed costs, \$250,000 a year	Include	Incremental: these costs exist only if the division is launched.

Part B: Pro forma income statement

Depreciation. Apply each year's MACRS rate to the full \$2,400,000 cost:

YEAR	1	2	3	4	5
MACRS rate	20.00%	32.00%	19.20%	11.52%	11.52%
Depreciation	480,000	768,000	460,800	276,480	276,480

Income statement. Revenue is installations times \$30,000. Variable costs are 40% of the *division's* revenue. Erosion is a separate line: it is already stated net of residential costs, so no variable cost applies to it.

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Commercial revenue	1,800,000	2,700,000	3,300,000	2,550,000	1,500,000
Erosion	-120,000	-120,000	-120,000	-120,000	-120,000
Variable costs, 40%	-720,000	-1,080,000	-1,320,000	-1,020,000	-600,000
Fixed costs	-250,000	-250,000	-250,000	-250,000	-250,000
Depreciation	-480,000	-768,000	-460,800	-276,480	-276,480
EBIT	230,000	482,000	1,149,200	883,520	253,520
Taxes, 25%	-57,500	-120,500	-287,300	-220,880	-63,380
Net income	172,500	361,500	861,900	662,640	190,140

The warehouse rent is not on this statement because it is already an after-tax figure; it enters the cash flows directly in Part E. Loan interest is not on it either (Part A).

Part C: Operating cash flow

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
EBIT	230,000	482,000	1,149,200	883,520	253,520
Taxes	-57,500	-120,500	-287,300	-220,880	-63,380
Add back depreciation	480,000	768,000	460,800	276,480	276,480
OCF	652,500	1,129,500	1,322,700	939,120	466,620

Depreciation is added back because it is not a cash payment; its only cash effect is the tax it saves, which is already in the tax line.

Part D: After-tax salvage

STEP	CALCULATION	AMOUNT
Depreciation taken, Years 1 to 5	$20\% + 32\% + 19.2\% + 11.52\% + 11.52\% = 94.24\%$	
Book value at end of Year 5	$2,400,000 \times (1 - 0.9424)$	138,240
Sale price		350,000
Taxable gain	$350,000 - 138,240$	211,760
Tax on the gain, 25%	$211,760 \times 0.25$	52,940
After-tax salvage	$350,000 - 52,940$	297,060

The book value is the unused Year 6 rate: $5.76\% \times 2,400,000 = 138,240$. Selling above book value means GCS deducted more depreciation than the equipment really lost; the tax on the gain claws it back.

Part E: Total project cash flows

	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	-2,400,000					
Working capital	-300,000					300,000
OCF		652,500	1,129,500	1,322,700	939,120	466,620
Warehouse rent forgone		-80,000	-80,000	-80,000	-80,000	-80,000
After-tax salvage						297,060
Total	-2,700,000	572,500	1,049,500	1,242,700	859,120	983,680

Part F: NPV, IRR and profitability index

YEAR	CASH FLOW	FACTOR AT 11%	PRESENT VALUE	CUMULATIVE CASH FLOW	CUMULATIVE PV
0	-2,700,000	1.0000	-2,700,000	-2,700,000	-2,700,000
1	572,500	0.9009	515,766	-2,127,500	-2,184,234
2	1,049,500	0.8116	851,798	-1,078,000	-1,332,436
3	1,242,700	0.7312	908,652	164,700	-423,785
4	859,120	0.6587	565,929	1,023,820	142,144
5	983,680	0.5935	583,766	2,007,500	725,910

$$\text{NPV} = \underbrace{3,425,910}_{\text{PV of Years 1 to 5}} - 2,700,000 = 725,910$$

$$\text{PI} = \frac{3,425,910}{2,700,000} = 1.269 \quad \text{IRR} = 20.54\%$$

MEASURE	RESULT	TEST	VERDICT
NPV	725,910	above zero?	Accept
IRR	20.54%	above the 11% WACC?	Accept
PI	1.269	above 1?	Accept

Accept. After paying every cost, including the 11% return its investors require, the division adds about \$726,000 of value to GCS. Each dollar invested at launch returns \$1.27 in present value.

Part G: Payback

1. **Payback** is $2 + 1,078,000/1,242,700 = 2.87$ years: in the Part F table, the cumulative cash flow turns positive in Year 3.
2. **Discounted payback.** The cumulative PV turns positive in Year 4: $3 + 423,785/565,929 = 3.75$ years.
3. **Against a 3-year cutoff,** the project passes on simple payback (2.87 years) and fails on discounted payback (3.75 years). The discounted rule therefore conflicts with NPV, which says accept. The simple

rule agrees with NPV here, but by luck rather than by design.

Why a payback cutoff misleads:

- **It ignores everything after the cutoff.** Years 4 and 5 bring in \$1.84 million, including the working capital and the salvage, and a 3-year rule gives them no weight.
- **Simple payback ignores the time value of money.** A dollar in Year 3 counts the same as a dollar today. Discounted payback fixes this, but still ignores the later years.
- **The cutoff is arbitrary.** Nothing in finance says 3 years rather than 4. NPV uses the cost of capital, which comes from what investors could earn elsewhere.

Part H: The alternative

1. **The residential upgrade.** Its cash flows are a level five-year annuity, so

$$PVIFA_{11\%,5} = \frac{1 - 1.11^{-5}}{0.11} = 3.6959$$

$$NPV = -2,400,000 + 700,000 \times 3.6959 = 187,128 \quad IRR = 14.05\%$$

2. **Do the rules agree?**

	COMMERCIAL DIVISION	RESIDENTIAL UPGRADE
Investment at Year 0	2,700,000	2,400,000
NPV at 11%	725,910	187,128
IRR	20.54%	14.05%
PI	1.269	1.078

They agree: the commercial division wins on NPV, IRR and PI, so GCS should launch it. The two NPV profiles cross only at about 50%, far above both IRRs, so no sensible cost of capital flips the ranking. Had the rules conflicted, GCS should follow NPV: it measures the dollars of value a project adds, which is what shareholders own. IRR is a rate and cannot tell you how much value sits behind it.

3. **When NPV and IRR can disagree** on mutually exclusive projects:

- **Scale.** A small project can have a higher IRR and a lower NPV. Earning 50% on \$1,000 adds less value than earning 20% on \$1,000,000.
- **Timing.** If one project's cash comes early and the other's comes late, their NPV profiles cross. Below the crossover rate the late-paying project has the higher NPV; above it, the early-paying one does. IRR ranks them the same way at every rate, so it can pick the wrong one.
- **Unconventional cash flows.** A project whose cash flows change sign more than once (an outflow at the end, for example a clean-up cost) can have several IRRs, or none, and then IRR cannot rank it at all.