

Checking the model, two ways

Fast is useless if it is wrong. A reviewer needs two kinds of evidence: that the model agrees with itself, line by line, and that it agrees with a model someone else wrote. This post shows both for Riverbend.

01 AGAINST ITSELF: THE WORKBOOK

The engine calculates in Python. The workbook then rebuilds the model in live Excel formulas, with inputs only on its Assumptions tab and engine-only values (the solved sculpting, for instance) marked as such. Excel recalculates it independently, and three layers of checks compare the two:

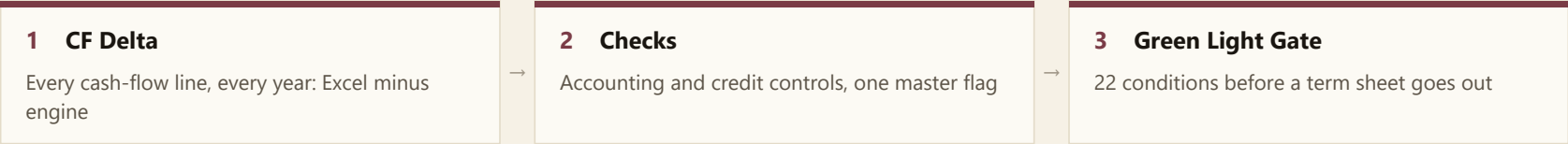


TABLE 9.1 The workbook's Checks tab, as Excel calculates it

#	CHECK	TYPE	VALUE	PASS
1	Balance sheet balances in every year (A - L - E)	Error	0	TRUE
2	Cash balance never negative	Error	0	TRUE
3	Cash Flow tab (Excel formulas) = engine cash flows	Error	0	TRUE
4	Senior debt repaid by final maturity (year 15)	Error	0	TRUE
5	Engine model-integrity checks	Error	14/14 pass	TRUE
6	Engine credit findings	Warning	13/13 pass	TRUE
7	Base-case minimum DSCR at or above the lock-up covenant	Warning	1.570x	TRUE
MASTER CHECK: all error checks pass				TRUE

Master check: =AND(E7,E8,E9,E10,E11). Shaded cells are engine-computed values written into the workbook; the rest are live Excel formulas.

The zero-difference test is the strongest of the three. Every cell is a live subtraction, and the tab has to read zero everywhere:

TABLE 9.2 CF Delta: the Cash Flow tab (Excel) minus the engine, R, years 0 to 6

CASH-FLOW LINE	Y0	Y1	Y2	Y3	Y4	Y5	Y6
Revenue	0	0	0	0	0	0	0
Operating Costs	0	0	0	0	0	0	0
EBITDA	0	0	0	0	0	0	0
Tax — Ungear­ed	0	0	0	0	0	0	0
Unlevered FCF	0	0	0	0	0	0	0
Capital Expenditure	0	0	0	0	0	0	0
Unlevered Cash Flow	0	0	0	0	0	0	0
Pre-tax Unlevered CF	0	0	0	0	0	0	0
Interest	0	0	0	0	0	0	0
Principal	0	0	0	0	0	0	0
Total Debt Service	0	0	0	0	0	0	0
Senior Debt Service	0	0	0	0	0	0	0
Tax — Geared	0	0	0	0	0	0	0
12B Refund	0	0	0	0	0	0	0
Working Capital Movement	0	0	0	0	0	0	0
CFADS	0	0	0	0	0	0	0
Levered FCF	0	0	0	0	0	0	0
DSRA Movement	0	(0)	0	0	(0)	0	0
DSRA Balance	0	0	0	0	0	0	0
MRA Movement	0	0	0	0	0	0	0
MRA Balance	0	0	0	0	0	0	0
Equity Investment	(0)	0	0	0	0	0	0
Debt Drawdown	0	0	0	0	0	0	0
Financing Costs in Construction	(0)	0	0	0	0	0	0
DSRA Initial Funding	(0)	0	0	0	0	0	0
Construction VAT Bridged by Sponsors	(0)	0	0	0	0	0	0

Each cell is a formula such as ='Cash Flow'!B16-'Python CFs'!B16; the tab covers every year of the project. Shown to the rand, so (0) is a small negative difference that rounds to zero; the largest anywhere in the tab is R0.36.

TABLE 9.3 Green Light Gate, by zone

ZONE	CONDITIONS	GREEN
Zone 1 Model Integrity and Accounting	4	4
Zone 2 Debt Sizing and Repayment Mechanics	4	4
Zone 3 Cash Waterfall Priority	3	3
Zone 4 Corporate Tax and SA Jurisdiction	3	3
Zone 5 South African Specifics	3	3
Zone 6 Returns, Sensitivities and Credit Approval	5	5
Overall	22 / 22 conditions GREEN	

Each condition is a formula on the gate tab.

02 AGAINST A MODEL I DIDN'T WRITE

NREL's System Advisor Model is the U.S. National Renewable Energy Laboratory's open project finance model. The same inputs go into both, through SAM's own code, and every cash-flow line is compared year by year. On an annuity loan at 70% gearing with 27% income tax, they agree to the rand:

TABLE 9.4 SAM case B, line by line

LINE ITEM	SAM	ENGINE	LARGEST GAP, ANY YEAR
Energy (MWh)	2,098,569	2,098,569	< 1 MWh
Revenue	R3,097.7m	R3,097.7m	< R1
Operating costs	R396.8m	R396.8m	< R1
EBITDA	R2,700.9m	R2,700.9m	< R1
Senior interest	R456.1m	R456.1m	< R1
Senior principal	R420.0m	R420.0m	< R1
Debt service	R876.1m	R876.1m	< R1
Income tax	R444.1m	R444.1m	< R1
Equity cash flow	R1,380.7m	R1,380.7m	< R1
Senior debt at close	R420.0m	R420.0m	< R1
Equity invested (year 0)	R180.0m	R180.0m	< R1
Equity IRR (after tax)	21.45%	21.45%	0.002 bps
Minimum DSCR, after tax (debt years)	1.440x	1.440x	1.9e-13

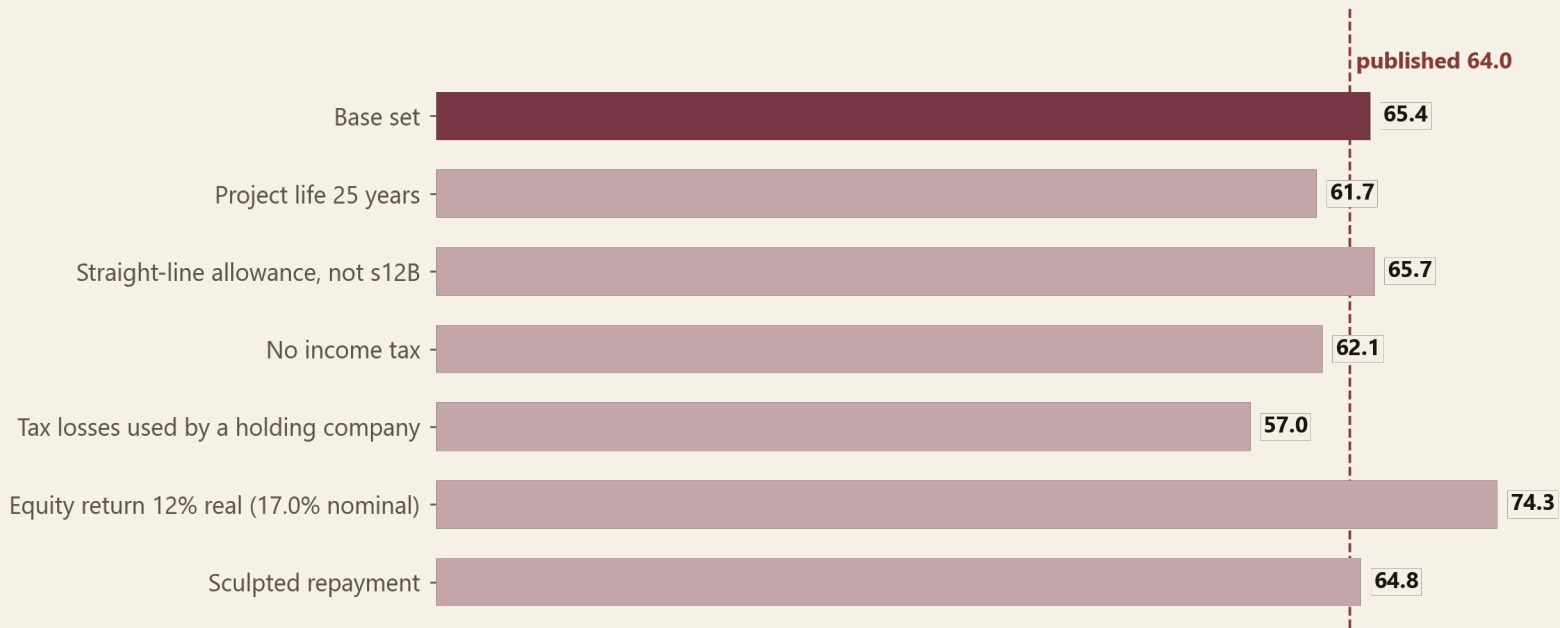
Rebuilt by scripts/build_validation_report.py on every run.

One case differs, by design. Year-1 interest alone exceeds CFADS / 1.30. SAM then sizes the debt with a negative year-1 principal payment (the balance grows); the engine does not allow negative amortisation, so year 1 is interest-only and the debt is slightly smaller. Senior lenders do not normally permit negative amortisation unless capitalised interest is agreed, so the engine's result is the one a term sheet would support.

03 AGAINST A PUBLISHED SOUTH AFRICAN CASE

Meridian Economics published a 2020 levelised cost for South African solar PV. The note does not state every assumption, so the engine is run on the stated ones and then across the choices the note leaves open:

EXHIBIT 9.5 Tariff for the stated equity return, c/kWh (2020 rand)



Source: Meridian Economics, Briefing Note 2020/01, "Meridian's Levelised Cost Tool: exploring the various cost components of renewable energy projects in South Africa", June 2020, Table 1 (best estimate values).

04 CONCLUSION

On the stated assumptions the engine lands at 65.4 c/kWh against 64.0 published, and the published figure sits inside the range the open choices span. Together with the workbook's own checks, that is evidence a reviewer can re-run rather than take on trust. Next: the full document set from one run.

One run to the full document set

Ten outputs, each read back against the model.

Riverbend Solar is an illustrative case study: a fictional deal with no real counterparty. Every figure comes from one run of the engine; every exhibit is generated, none is typed.