

07 · AGRICULTURE · CITRUS PACK-HOUSE · LIMPOPO

ILLUSTRATIVE CASE · COMPOSITE SITE · NOT A CLIENT PROJECT

CASE STUDY · AGRICULTURE

Taking a citrus pack-house out of the peak.

A2000 · HELIOS H500 · PULSE P1000 1 MW · 2 MWH · 600 KWP · 400 V · SOLARIS EMS

A citrus pack-house and cold store in the Letsitele valley draws 5.0 GWh a year from Eskom on Ruraflex. One APEX A2000 on the cold-store board, with a new 600 kWp array on its DC bus, takes three quarters of its peak energy off the bill, holds its demand under 1 186 kVA and carries the cold rooms through feeder trips. The grower owns the plant, and it pays back in less than five years.

3.5 R m

GROSS SAVING, YEAR ONE
FY2027/28 prices

<5 years

SIMPLE PAYBACK
on an indicative turnkey cost

75 %

LESS PEAK ENERGY
514 MWh moved a year

-450 kVA

NOTIFIED DEMAND
1 700 → 1 250 from year two

30 %

PROJECT IRR, 15 YEARS
NPV R19 m at 12 %

CONTENTS

MODELLLED ON ESKOM RURAFLEX 2026/27

01	02	03	04	05	06	07
The site	The load	The plant	How it runs	The bill	Fifteen years	Resilience & delivery

This case study describes a composite site, assembled from typical South African citrus pack-house and cold-store loads. It is not a client, a project or a result. Tariff rates, time-of-use periods, the solar yield and product ratings are real; the site, its load and its outcomes are modelled. A site proposal replaces every figure with one from your own data.

01 • THE SITE

A pack-house at the end of a rural line.

01

The packing lines run April to September; the cold rooms run every hour of the year. The bill is R12.5 m, and 36 % of the energy cost is bought in 14 % of the hours.

■ SITE PROFILE

COMPOSITE

Operation	Citrus pack-house + cold store
Region	Letsitele valley, Limpopo
Supply	22 kV rural overhead line
Tariff	Ruraflex Ru12N, zone 1
Transformers	2 × 1 250 kVA, 22/0.4 kV
Notified demand	1 700 kVA
Recorded peak	1 584 kVA, June
Power factor	0.90 lagging
Roof solar	600 kWp, zero export
Standby	500 kVA genset, cold store
Grid energy	5.0 GWh a year
Annual bill	R12.5 m ex VAT

■ ANNUAL BILL, BEFORE

R M EX VAT

Energy, peak	R3.52 m
Energy, standard	R3.24 m
Energy, off-peak	R3.11 m
Legacy & ancillary	R1.26 m
Capacity charges	R1.23 m
Service & admin	R0.09 m
Reactive energy	R0.07 m

Peak energy costs more than all off-peak energy, in a seventh of the hours. It is the line the battery attacks first.

■ ENERGY BY END USE

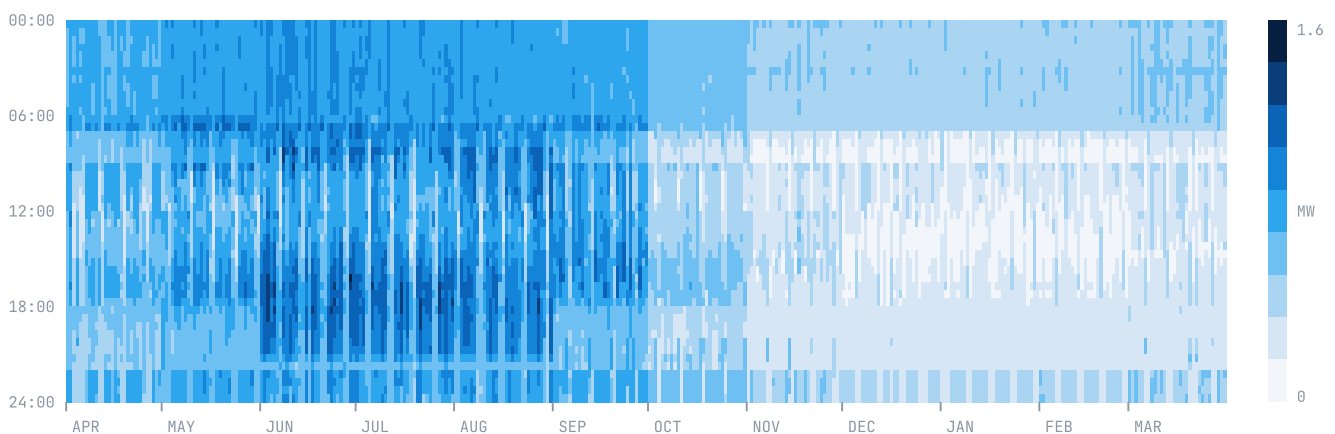
MWH A YEAR

Cold rooms	2 723 MWh
Irrigation	1 098 MWh
Packing lines	665 MWh
Workshop & services	661 MWh
Pre-cooling	526 MWh
Degreening	205 MWh

The cold rooms set a floor that never moves. Irrigation is already pumped off-peak, so it stays on the grid.

■ FIG 01-1 • EVERY HALF-HOUR OF THE YEAR

GRID DRAW WITHOUT STORAGE • MW



Each column is a day from April 2026 to March 2027, each row a half-hour. The dark block is the packing season, densest from June to August when the lines run a second shift. The pale midday band is the roof array at work; the night band is the irrigation pumps.

THE BRIEF

Cut the cost of the peak windows and hold the cold rooms through feeder trips, without touching packing throughput.

THE CONSTRAINT

Capital is approved on payback: the board's hurdle is five years. One spare way on the cold-store board and fallow land beside it.

THE RISK

The feeder trips about 26 times a year. Each trip stops every compressor, and a cold-treatment run depends on holding fruit temperature.

02 • THE LOAD

The harvest lands in the dearest months.

Valencias and navels are packed from April to September. The heart of it, June to August, is Eskom's high season, when a peak kilowatt-hour costs six times an off-peak one.

FIG 02-1 • AVERAGE HIGH-SEASON WEEKDAY

JUNE TO AUGUST • KW

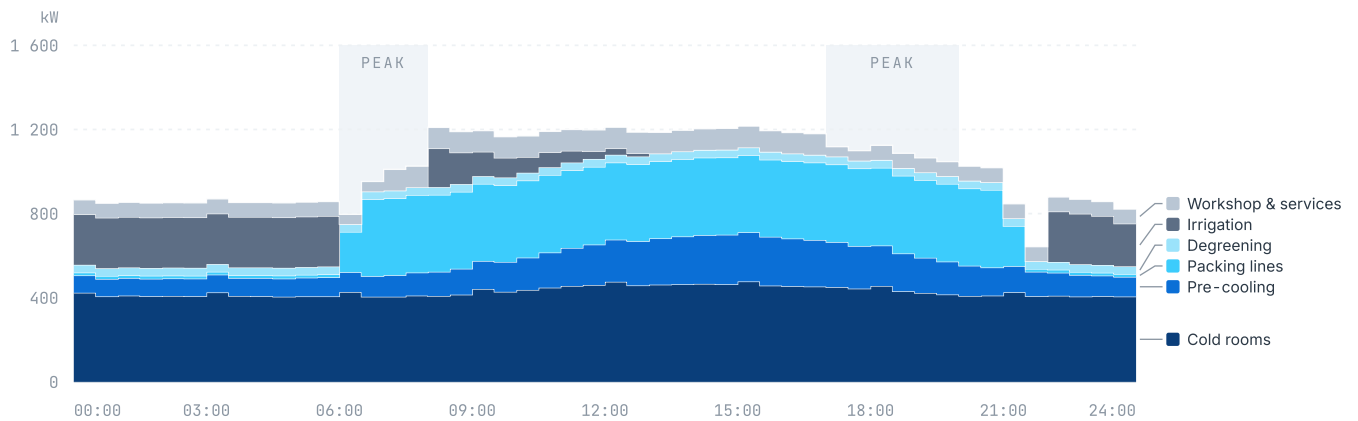


FIG 02-2 • OFF-SEASON WEEKDAY

NOV - FEB • KW

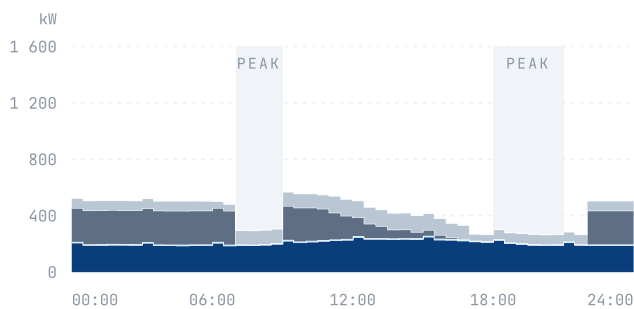


FIG 02-3 • IN-SEASON SATURDAY

NO PEAK • KW

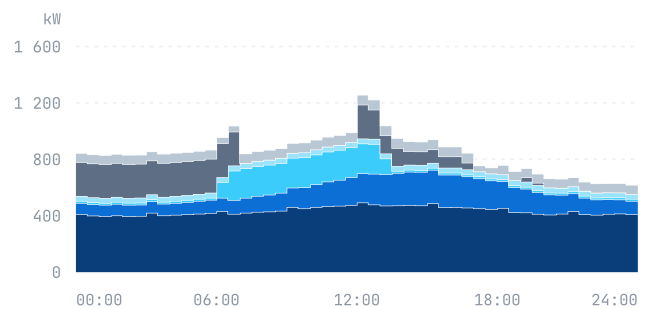
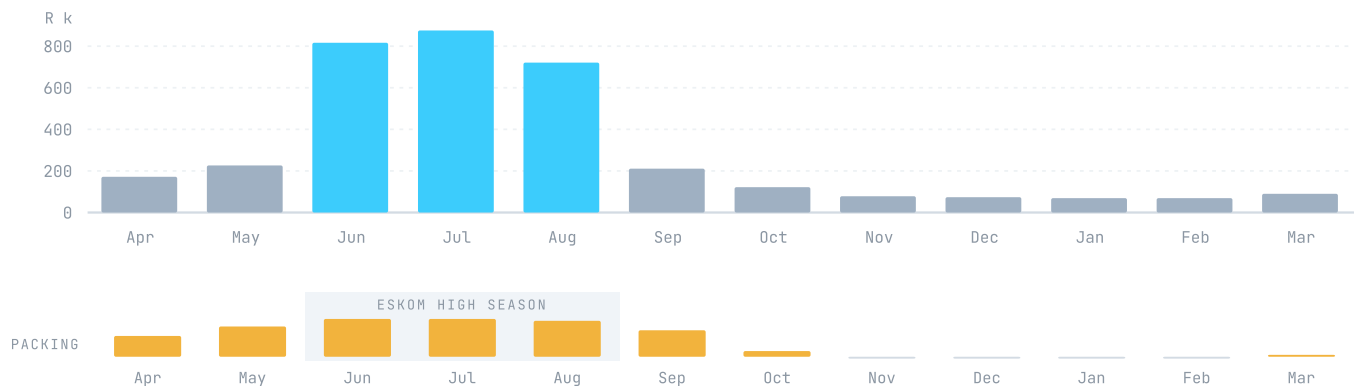


FIG 02-4 • WHAT THE PEAK PERIODS COST, AGAINST THE PACKING SEASON

R K, WITHOUT STORAGE



Finding 01

The cold rooms never stop

Cold rooms and pre-cooling are over half the peak-window load. They cannot be switched off, only supplied differently.

Finding 02

Winter costs 2.4 times more

The same kilowatt-hour costs R7.40 in a July peak and R3.07 in a November one, so three months carry most of the value.

Finding 03

The sun is strongest in winter

The valley's dry winter gives the array its best months exactly when the packing lines and the tariff peak together.

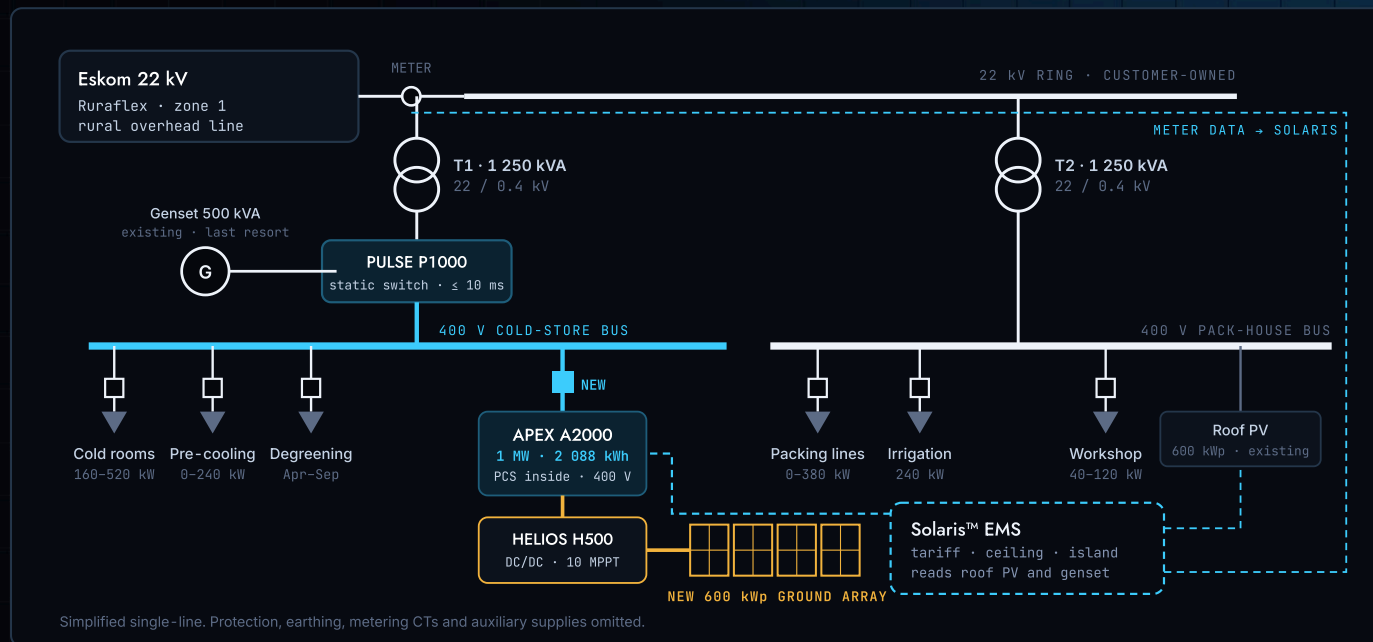
03 • THE PLANT

One container, one island.

The A2000 lands on the cold-store board behind a PULSE cabinet. A new array feeds its DC bus through HELIOS. The roof array and the packing lines on T2 stay as they are.

FIG 03-1 • SINGLE-LINE, AS CONNECTED

SIMPLIFIED



PLANT AT A GLANCE

PER THE RANGE DATASHEETS

Battery	1 × APEX A2000, 2 088 kWh LFP
Usable	1 879 kWh at 90 % depth
Power	1 000 kW, PCS inside, 400 V
Solar	HELIOS H500, 600 kWp ground array
Transfer	PULSE P1000, ≤ 10 ms
Reserve	400 kWh held for the cold store
Control	Solaris™ EMS, reads roof PV and genset
Footprint	≈ 150 m ² yard + ≈ 0.9 ha array

FIG 03-2 • THE YARD

INDICATIVE



Indicative plan, not to scale. 3 m clearance around the A2000. LV cable to the T1 board ≈ 60 m.

WHY ONE A2000 AND AN ARRAY

FULL YEAR AT FY2027/28 PRICES • INDICATIVE TURNKEY COST • NPV AT 12 %

OPTION	RATING	NMD AFTER	CYCLES / YR	GROSS SAVING	PAYBACK	NPV
1 × A2000, no solar	1 MW / 2.1 MWh	1 250 kVA	366	R2.1 m	4.5 yrs	R8 m
1 × A2000 + HELIOS ♦	1 MW / 2.1 MWh	1 250 kVA	372	R3.9 m	3.7 yrs	R19 m
2 × A2000 + HELIOS	2 MW / 4.2 MWh	1 250 kVA	261	R4.9 m	4.2 yrs	R22 m
3 × A2000 + HELIOS	3 MW / 6.3 MWh	1 250 kVA	185	R5.0 m	5.3 yrs	R15 m

Without solar the battery pays slowly: Ruraflex's off-season spread is thin. The array nearly doubles the saving. A second A2000 adds R1.0 m a year but cycles less, since one already covers both peaks; it is the phase-two step. ♦ Selected.

04 · HOW IT RUNS

Sun by day, stored for the peaks.

Solaris empties the battery through both peak windows, refills it at midday from the array and tops it up off-peak, never above a 1 150 kW ceiling and never below the cold store's reserve.

FIG 04-1 · WEDNESDAY 15 JULY 2026 · HIGH SEASON, PACKING

MODELLED · KW

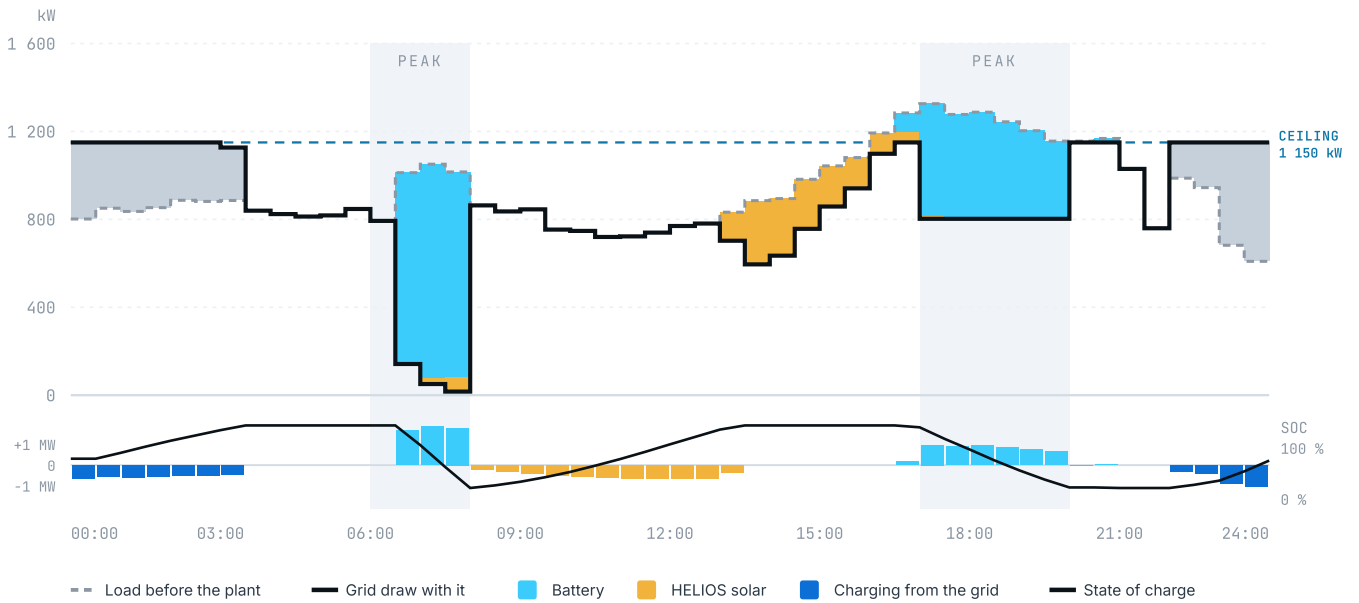
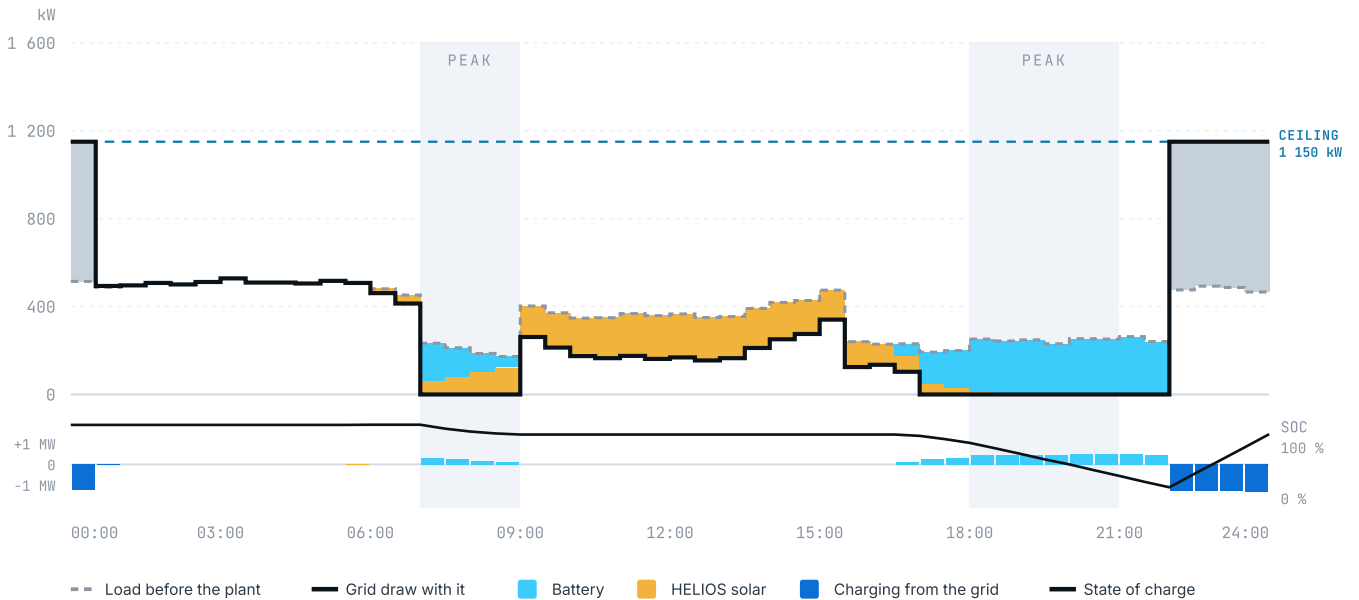


FIG 04-2 · WEDNESDAY 18 NOVEMBER 2026 · OFF-SEASON

MODELLED · KW



Gold: solar from the new array, delivered to site or stored. Cyan: energy the battery supplies, so the pack-house does not buy it. Grey: energy bought above the old draw to recharge, at off-peak or standard prices. The lower strip is battery power (± 1 MW) and the state of charge; gold below the line is the sun charging it.

372

EQUIVALENT FULL CYCLES A YEAR

699 MWh

DELIVERED FROM THE BATTERY

902 MWh

NEW SOLAR, THROUGH HELIOS

99.9 %

OF ALL SOLAR USED ON SITE

05 • THE BILL

R3.9 m a year, from four lines.

05

The array and the battery earn about the same share: solar replaces energy outright, storage moves the rest out of the peak. A lower notified demand and a better power factor add the remainder.

FIG 05-1 • WHERE THE SAVING COMES FROM R k • FY27/28

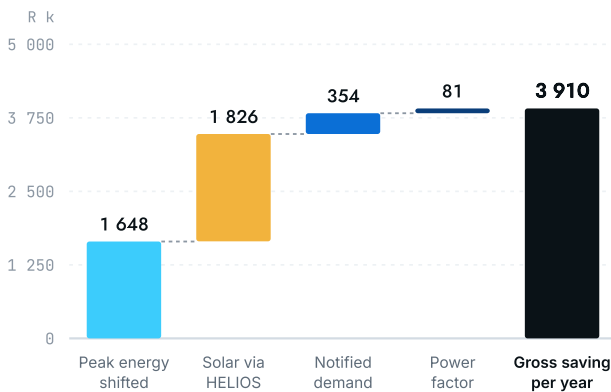
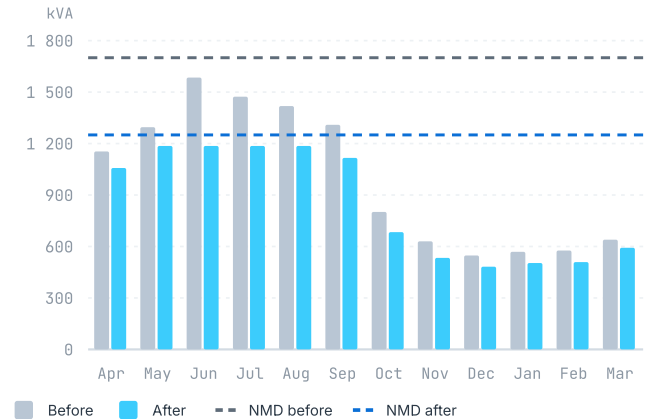


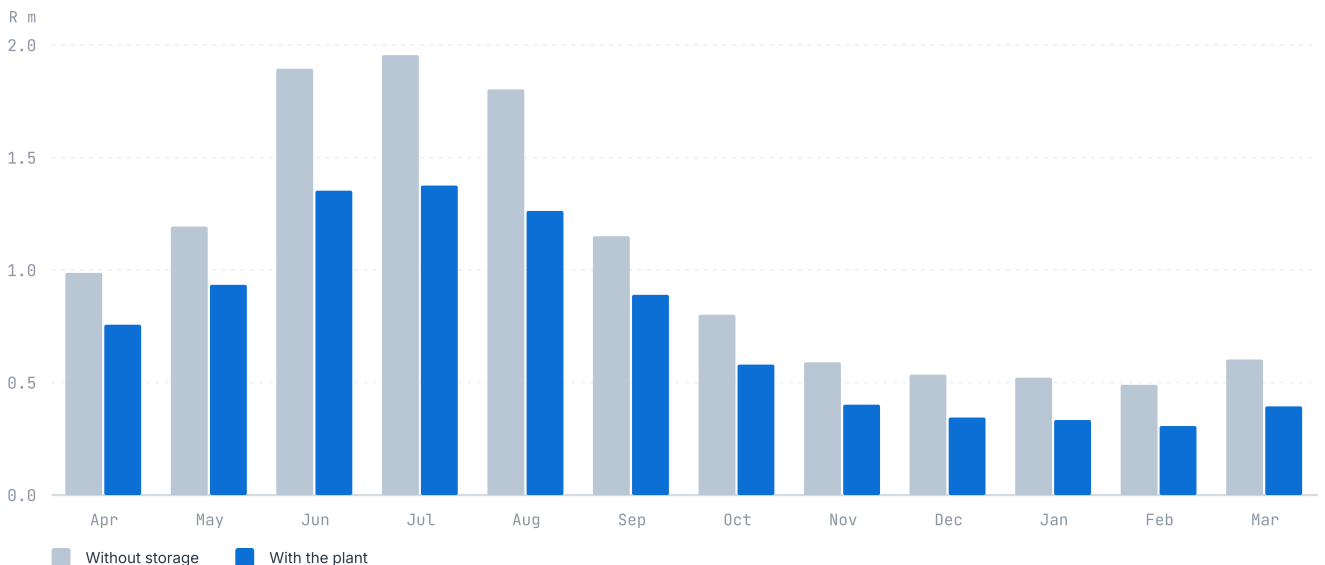
FIG 05-2 • MONTHLY PEAK DEMAND KVA



VALUE STREAM	HOW IT IS EARNED	PER YEAR
Peak energy shifted	Peak kWh bought at off-peak and standard prices instead, net of 12 % losses	R1.65 m
Solar through HELIOS	902 MWh a year from the new array, used on site or stored for the peaks	R1.83 m
Notified demand	NMD renewed at 1 250 kVA: generation and network capacity charges	R0.35 m
Power factor	PCS holds 0.97 at the meter; the high-season reactive charge falls away	R0.08 m
Total		R3.91 m

FIG 05-3 • MONTHLY BILL, BEFORE AND AFTER

R M EX VAT, FY2026/27 RATES



Bills are rebuilt line by line from the Ruraflex schedule (Ru12N, ≥ 500 V and ≤ 22 kV, transmission zone 1): active energy by period and season, legacy and ancillary charges, generation and network capacity charges on the annual utilised capacity, reactive energy in the high season and daily service and administration charges. The notified-demand saving starts in year two, once the reduction is accepted at renewal. Avoided diesel and protected fruit are not counted.

06 • FIFTEEN YEARS

Less than five years to pay back. Then it saves.

The grower buys the plant turnkey and we run it. The saving rises with the tariff and eases as the cells and modules age; O&M is the only cost after day one.

<5 _{yrs}

SIMPLE PAYBACK

30 %

PROJECT IRR

19 _{Rm}

NPV AT 12 %

5.9 _x

THE INVESTMENT, RETURNED

FIG 06-1 • SAVING, RUNNING COSTS AND CASH RETURNED

NOMINAL R M • TARIFF +8.83 % IN YEAR ONE, THEN 7 % A YEAR

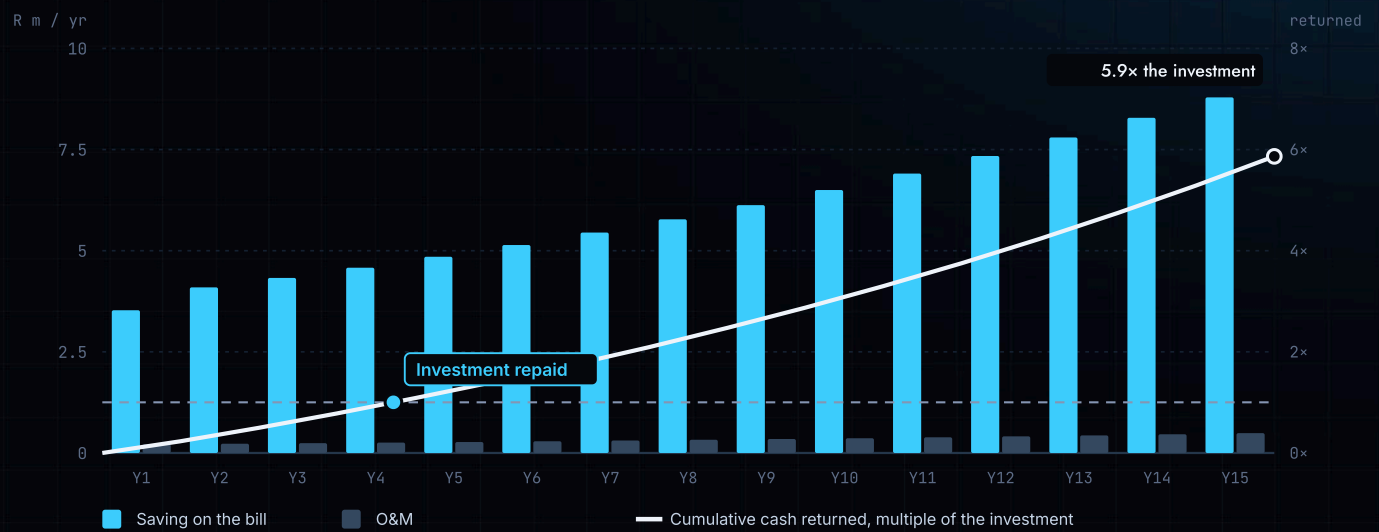
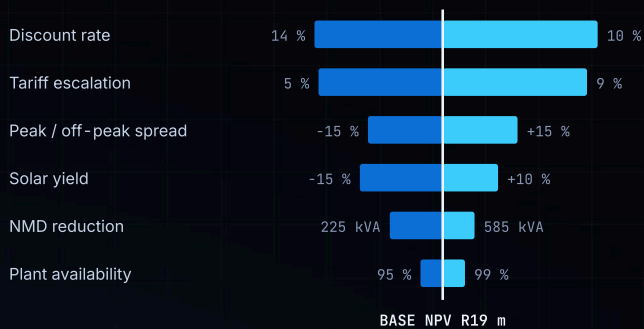


FIG 06-2 • WHAT MOVES THE NPV

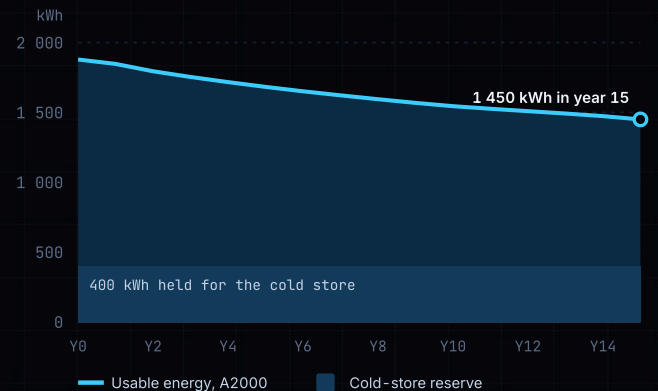
R M AT 12 %



Even the worst single case leaves an NPV of R16 m.

FIG 06-3 • USABLE ENERGY

MEASURED CURVE • KWH



On the cell maker's measured curve at 1.02 cycles a day. The peak-shifting saving is cut in step with it; solar loses 0.5 % a year.

INDICATIVE OWNERSHIP TERMS

FINAL TERMS IN THE SITE PROPOSAL

Structure	Turnkey supply, install and commissioning
Ownership	The grower, from commissioning
O&M	15-year service agreement, AMPROTEQ
Availability	≥ 97 %, measured monthly

Capacity	Tested yearly against the measured curve
Augmentation	None needed in the term
Monitoring	Solaris, 24 / 7, alarms to the farm office
Alternative	Service agreement: fixed monthly fee

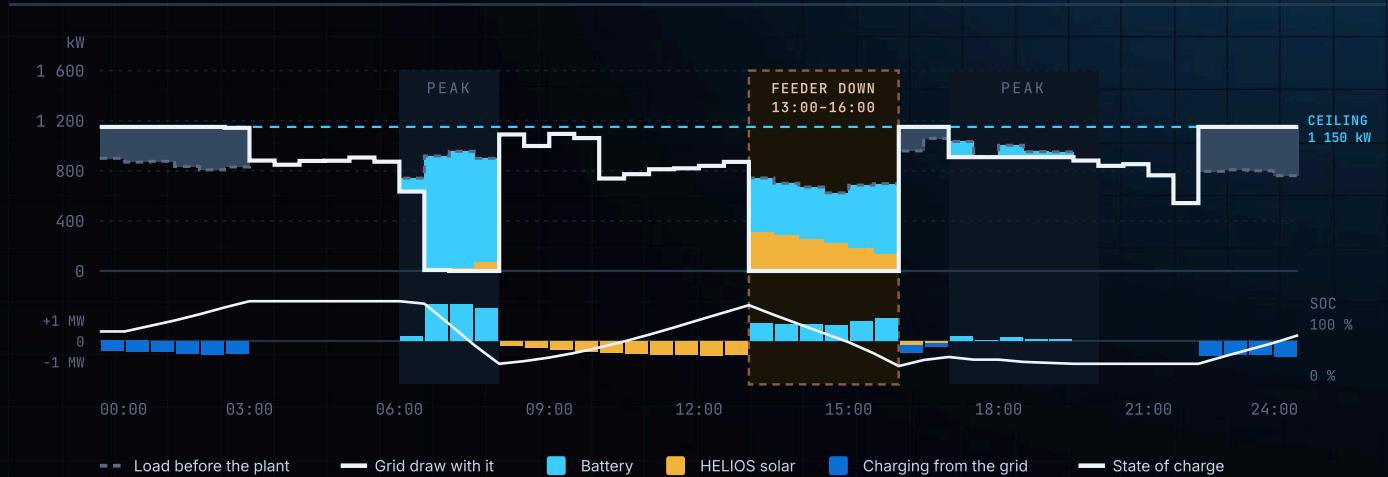
07 · RESILIENCE & DELIVERY

When the feeder trips, the cold store holds.

PULSE opens in half a cycle and the A2000 takes the cold-store bus. HELIOS keeps charging from the array; the genset starts only if the battery runs low.

FIG 07-1 · THURSDAY 16 JULY: A VELD FIRE TAKES THE FEEDER FROM 13:00 TO 16:00

MODELLED · KW



The packing lines stop and the roof inverters trip. The cold rooms, pre-cooling and degreening run on as an island, on stored energy and the sun with no genset; inside the window the dashed line is that board alone. The cost: most of that evening's peak shift.

26

FEEDER TRIPS A YEAR, MODELLED

64 → 14_h

GENSET HOURS A YEAR

4.7_{k litres}

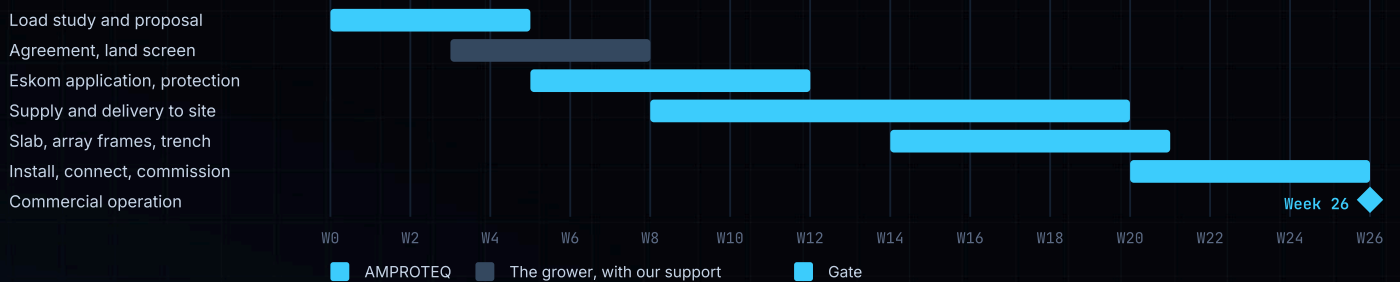
DIESEL AVOIDED A YEAR

26 → 0

COMPRESSOR TRIPS A YEAR

FIG 07-2 · FROM LOAD STUDY TO COMMERCIAL OPERATION

INDICATIVE, WEEKS



RISKS WE CARRY, AND HOW

Array approval	Lodged at order; no export, to NRS 097-2-1
Tariff changes	Solaris re-optimises to the new clock
Cell ageing	Measured curve; both peaks still covered in year 15
Fire	Clean-agent suppression; firebreak at the array

Your farm, your numbers.

Send twelve months of half-hour data, your tariff, your NMD and your genset hours. Within five working days we return the sizing, the dispatch, the bill before and after, and the payback.

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AMPROTEQ (Pty) Ltd · Agone House, 53 Adriana Crescent, Gateway Industrial Park, Centurion 0157. Illustrative case on a composite site; not a client project or an offer. Modelled with Eskom's Schedule of Standard Prices 2026/27 (Ruraflex, ≥ 500 V and ≤ 22 kV, zone 1), PVGIS (SARAH3) yield for Tzaneen and APEX A2000, HELIOS H500 and PULSE P1000 ratings. The outage pattern, escalation beyond 2027/28, the installed cost and all site data are assumptions.