

ILLUSTRATIVE CASE · COMPOSITE SITE · NOT A CLIENT PROJECT

CASE STUDY · COLD CHAIN

Taking a frozen store out of the peak.

2 × A2000 · 2 × PULSE P1000 2 MW · 4.2 MWh · 400 V · SOLARIS EMS

A third-party cold store in Cape Town's Airport Industria draws 12.7 GWh a year from the City on the Large User tariff. Two APEX A2000, one on each cold board behind a PULSE cabinet, take 69 % of its peak energy off the bill, hold the month's demand under 2 115 kVA and keep both cold boards running through supply interruptions. The operator owns the plant, and it pays back in less than five years.

4.2 R m

GROSS SAVING, YEAR ONE
FY2027/28 prices

<5 years

SIMPLE PAYBACK
on an indicative turnkey cost

69 %

LESS PEAK ENERGY
1 498 MWh moved a year

-532 kVA

BILLED DEMAND
every month, on average

28 %

PROJECT IRR, 15 YEARS
NPV R20 m at 12 %

CONTENTS

MODELLLED ON CITY OF CAPE TOWN LARGE USER TOU 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 chilled and frozen 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 store that never switches off.

SITE PROFILE

COMPOSITE

Operation	Third-party cold store
Location	Airport Industria, Cape Town
Capacity	32 000 pallets, chilled + frozen
Supply	11 kV, City of Cape Town
Tariff	Large User TOU, medium voltage
Transformers	2 × 1 600 kVA, 11/0.4 kV
Notified demand	3 000 kVA
Recorded peak	2 703 kVA, Feb
Power factor	0.92 lagging
Roof solar	1 200 kWp, no export
Standby	2 × 1 000 kVA gensets
Annual bill	R34.5 m ex VAT

ANNUAL BILL, BEFORE

R M EX VAT

Energy, peak		R9.90 m
Energy, standard		R11.24 m
Energy, off-peak		R10.18 m
Demand charge		R2.47 m
Network capacity		R0.69 m
Service charge		R0.03 m

Peak energy costs almost as much as all off-peak energy, in a seventh of the hours. The demand charge is set by one half-hour each month.

ENERGY BY END USE

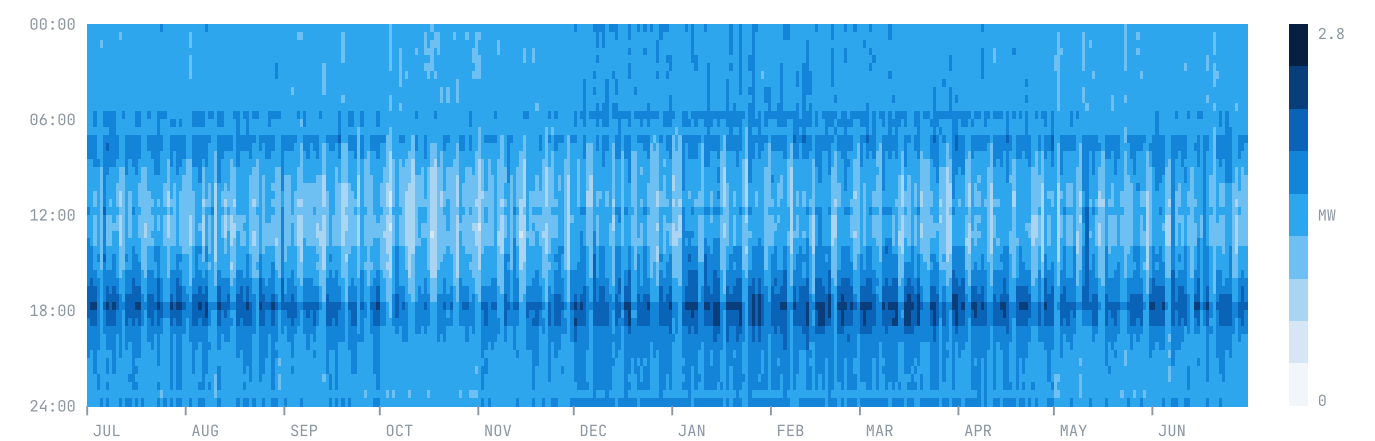
MWH A YEAR

Frozen chambers		6 590 MWh
Chilled & fruit		4 227 MWh
Docks & forklifts		1 509 MWh
Blast freezing		978 MWh
Offices & services		864 MWh
Defrost		358 MWh

The frozen chambers set a floor that never moves. Docks, offices and services together are less than a fifth of the energy.

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

GRID DRAW WITHOUT STORAGE • MW



Each column is a day from July 2026 to June 2027, each row a half-hour. The dark band in the early evening is the compressors at their hardest as the roof array fades and the day's fruit is pulled down. The lighter midday hours are the roof at work; weekends show as lighter stripes.

THE BRIEF

Cut the peak-window and demand charges and stop compressor trips when the supply drops, without touching throughput or set points.

THE CONSTRAINT

Capital is approved on payback: the board's hurdle is five years. Room for two containers in the service yard; the roof is already full.

THE RISK

The supply drops about 16 times a year. Each drop trips every compressor, and the pull-down when power returns can set a new demand peak.

02 • THE LOAD

Summer sets the demand. Winter sets the price.

The hottest afternoons and the fruit season push the demand to its peak in Feb. The dearest kilowatt-hours come from June to August, when a peak one costs 4.2 times an off-peak one.

FIG 02-1 • AVERAGE SUMMER WEEKDAY

JANUARY TO MARCH • KW

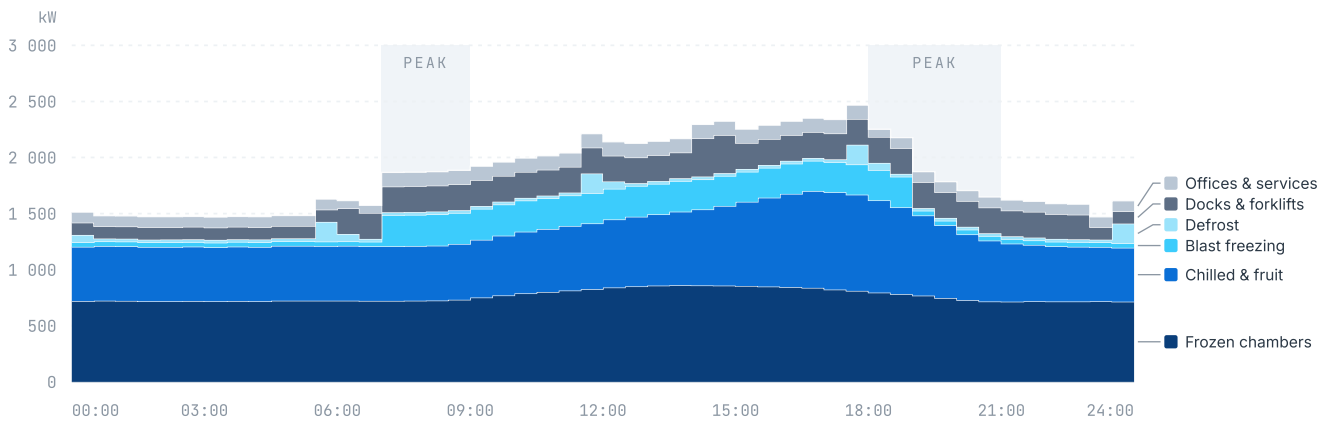


FIG 02-2 • WINTER WEEKDAY

JUN - AUG • KW

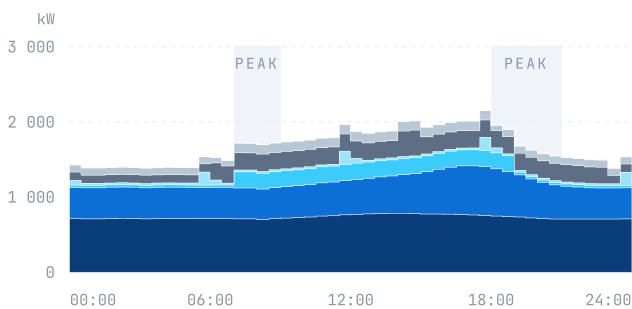


FIG 02-3 • SUMMER SATURDAY

NO PEAK • KW

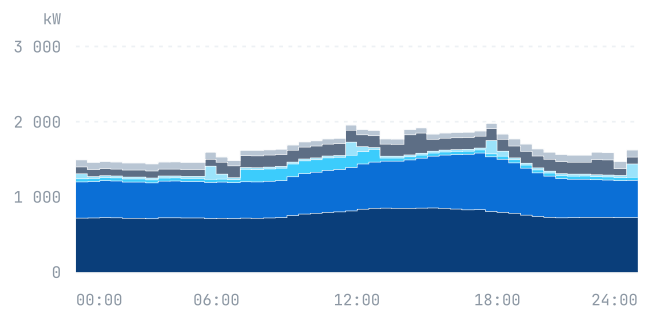
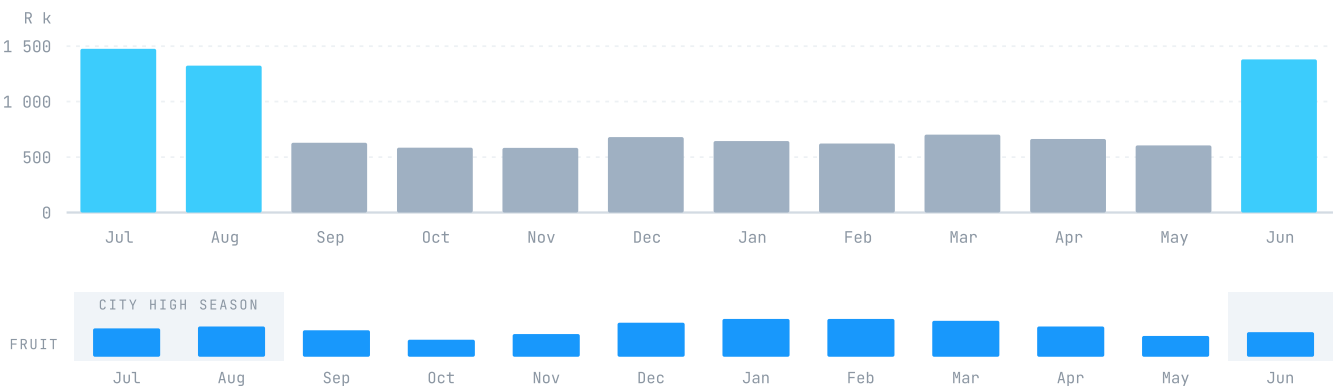


FIG 02-4 • WHAT THE PEAK PERIODS COST, AGAINST THE FRUIT SEASON

R K, WITHOUT STORAGE



Finding 01

The compressors never stop

Frozen and chilled rooms are 71 % of the peak-window load. They cannot be switched off, only supplied differently.

Finding 02

Winter costs 2.1 times more

The same kilowatt-hour costs R7.56 in a July peak and R3.52 in a February one, so three months carry most of the energy value.

Finding 03

The demand peak is in summer

Heat and fruit intake set the highest half-hours in the cheap season. The battery has a different job in each half of the year.

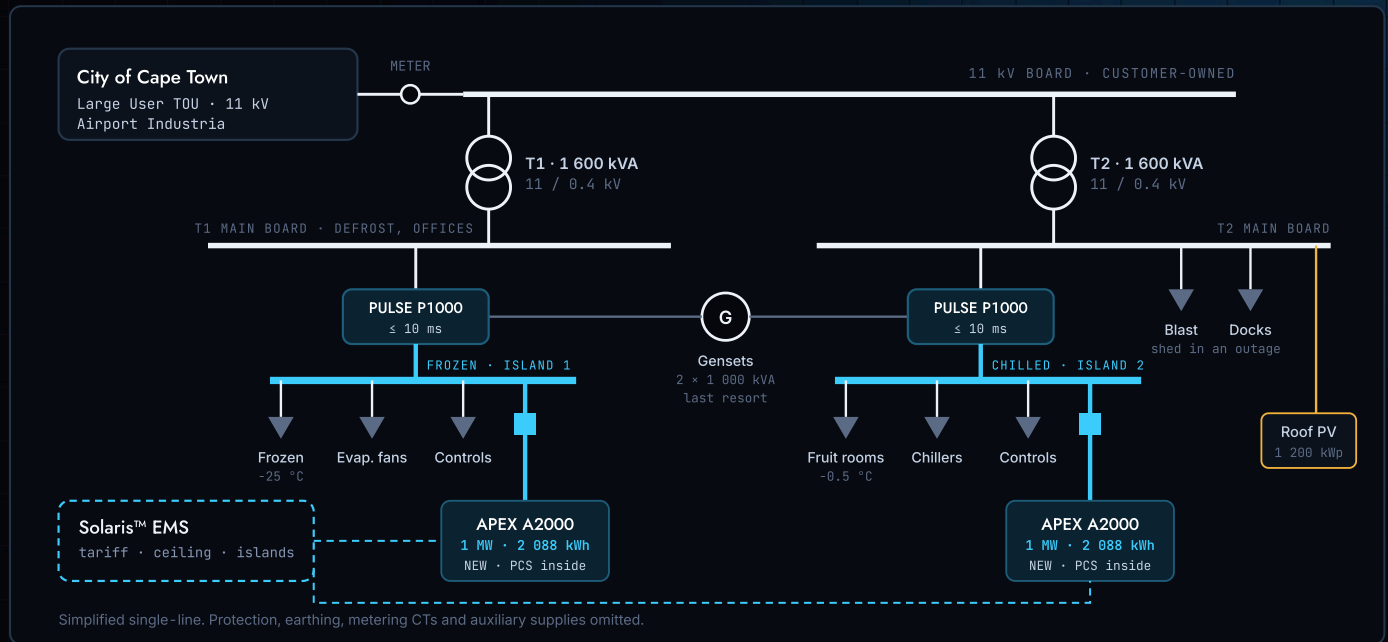
03 • THE PLANT

Two containers, two islands.

Each cold board gets its own A2000 behind a PULSE cabinet: the frozen chambers on T1, the chilled and fruit rooms on T2. The gensets move onto the PULSE second ports; the roof array stays as it is.

FIG 03-1 • SINGLE-LINE, AS CONNECTED

SIMPLIFIED



PLANT AT A GLANCE

PER THE RANGE DATASHEETS

Battery	2 × APEX A2000, 4 176 kWh LFP
Usable	3 758 kWh at 90 % depth
Power	2 × 1 000 kW, PCS inside, 400 V
Transfer	2 × PULSE P1000, ≤ 10 ms
Reserve	450 kWh held for the cold boards
Ceiling	Monthly, 1 680 – 2 030 kW
Control	Solaris™ EMS, reads roof PV and gensets
Footprint	≈ 26 × 12 m of the service yard

FIG 03-2 • THE YARD

INDICATIVE



Indicative plan, not to scale. Plant yard ≈ 26 × 12 m, 3 m clearance around each A2000. LV cable runs to the cold boards ≈ 40 m.

WHY TWO A2000

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

OPTION	RATING	NMD AFTER	CYCLES / YR	GROSS SAVING	PAYBACK	NPV
1 × A2000 + PULSE	1 MW / 2.1 MWh	2 400 kVA	483	R2.3 m	4.1 yrs	R10 m
2 × A2000 + PULSE ♦	2 MW / 4.2 MWh	2 200 kVA	534	R4.5 m	3.8 yrs	R20 m
3 × A2000 + PULSE	3 MW / 6.3 MWh	2 100 kVA	391	R5.0 m	4.9 yrs	R16 m

One A2000 covers one cold board and half of each peak window. The second doubles the saving for about the same payback and covers both islands. A third adds R0.5 m a year but cycles less and pays back more slowly. ♦ Selected.

04 · HOW IT RUNS

Two cycles a weekday, one ceiling a month.

Solaris empties the batteries through the morning peak, refills them in standard time under the month's ceiling, empties them again from 18:00 and tops them up off-peak, never below the cold boards' reserve.

FIG 04-1 · WEDNESDAY 15 JULY 2026 · WINTER

MODELLED · KW

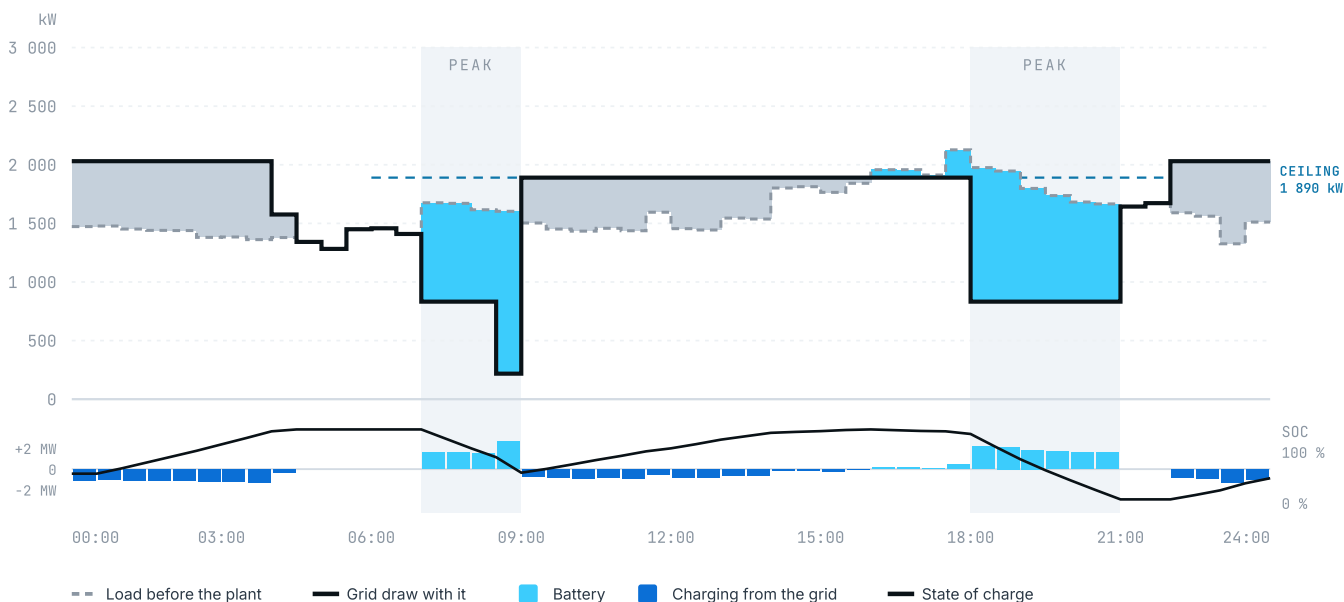
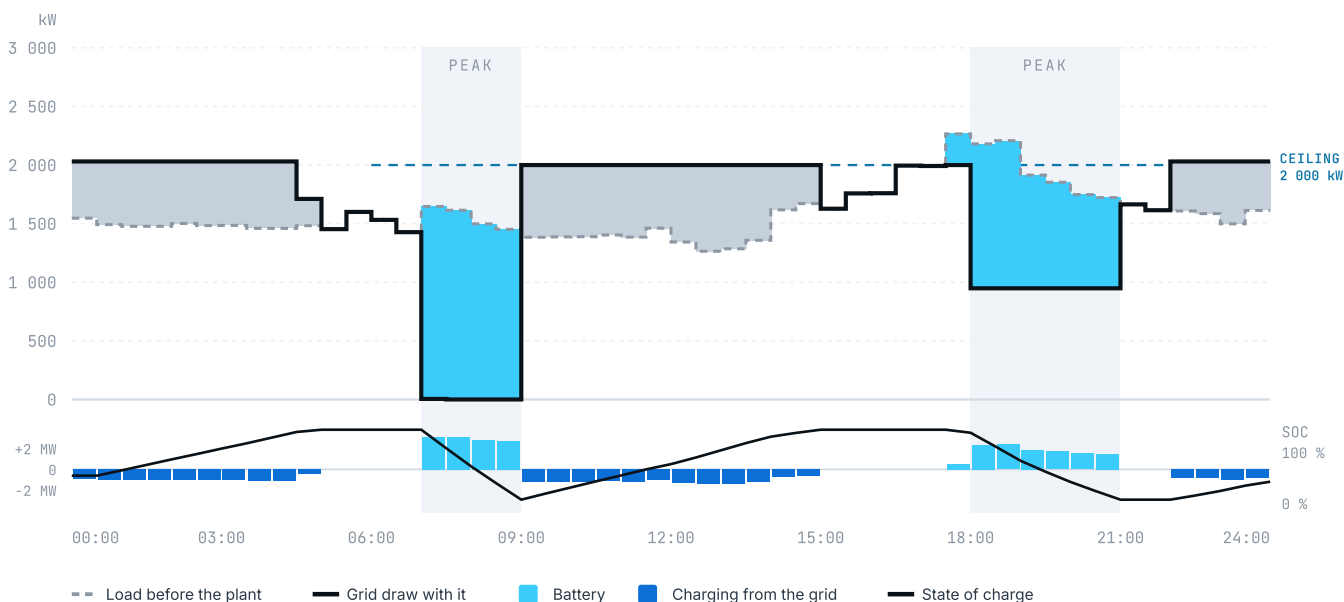


FIG 04-2 · WEDNESDAY 17 FEBRUARY 2027 · SUMMER, FRUIT SEASON

MODELLED · KW



Dashed: the store's draw net of the roof array, before the plant. Black: grid draw with it. Cyan: energy the batteries supply, so the store does not buy it. Grey: energy bought above the old draw to recharge, at off-peak or standard prices, under the month's ceiling. The lower strip is battery power (± 2 MW) and the state of charge.

534

EQUIVALENT FULL CYCLES A YEAR

2 006 MWh

DELIVERED FROM THE BATTERIES

12 / 12

MONTHS HELD UNDER THE CEILING

1 498 MWh

MOVED OUT OF THE PEAK WINDOWS

05 • THE BILL

R4.5 m a year,
from four lines.

05

Most of the saving is energy moved out of the peak windows, worth most in winter. A demand ceiling every month, a better power factor and a lower notified demand add the rest.

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

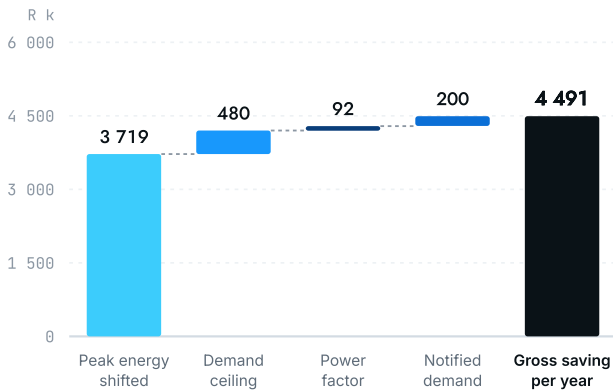
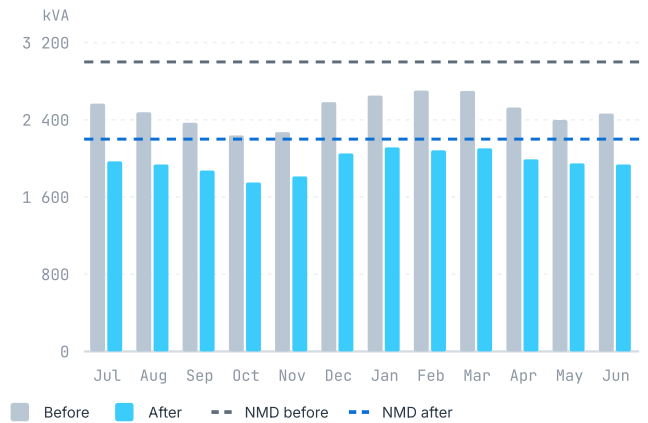


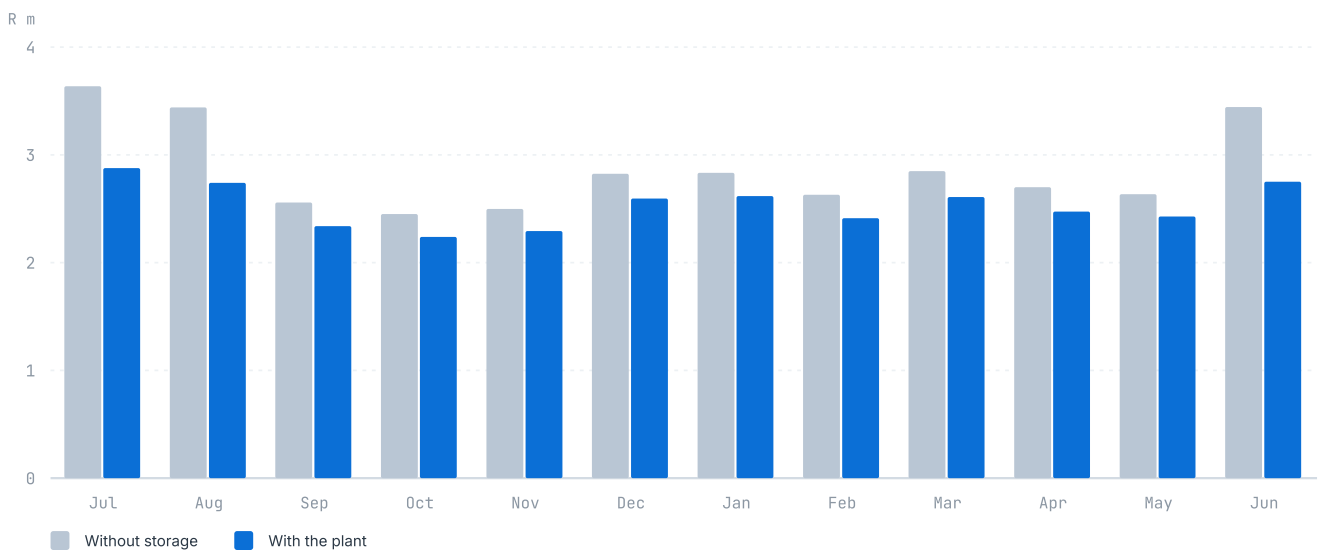
FIG 05-2 • MONTHLY BILLED DEMAND KVA



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	R3.72 m
Demand ceiling	The month's highest half-hour held down: 2 496 → 1 964 kVA on average	R0.48 m
Power factor	PCS holds 0.96 at the meter, so the same kW bills fewer kVA	R0.09 m
Notified demand	NMD renewed at 2 200 kVA: the network capacity charge	R0.20 m
Total		R4.49 m

FIG 05-3 • MONTHLY BILL, BEFORE AND AFTER

R M EX VAT, FY2026/27 RATES



Bills are rebuilt line by line from the City of Cape Town Large User time-of-use tariff, medium voltage (CCT-LPU-TOU-MV, 2026/27): active energy by period and season, the demand charge on the month's highest half-hour in peak or standard time, the network capacity charge on the notified maximum demand and the monthly service charge. The notified-demand saving starts in year two, once the reduction is accepted. Avoided diesel and protected stock are not counted.

06 • FIFTEEN YEARS

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

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

<5 _{yrs}

SIMPLE PAYBACK

28 %

PROJECT IRR

20 _{Rm}

NPV AT 12 %

5.4 _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

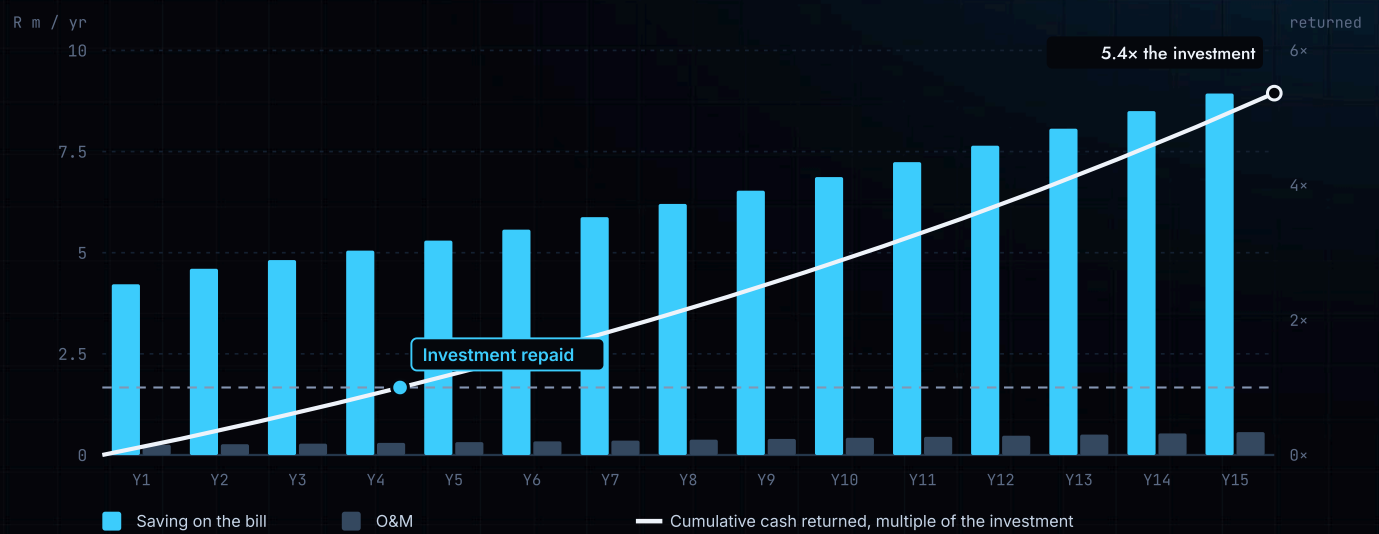
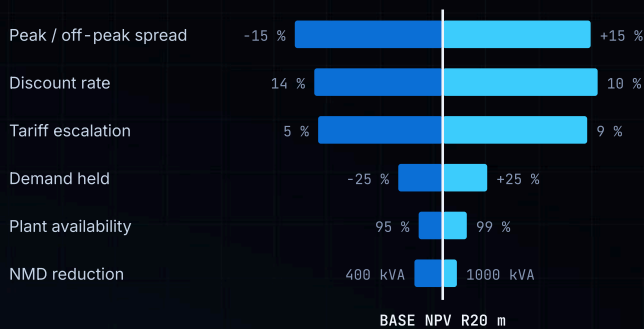


FIG 06-2 • WHAT MOVES THE NPV

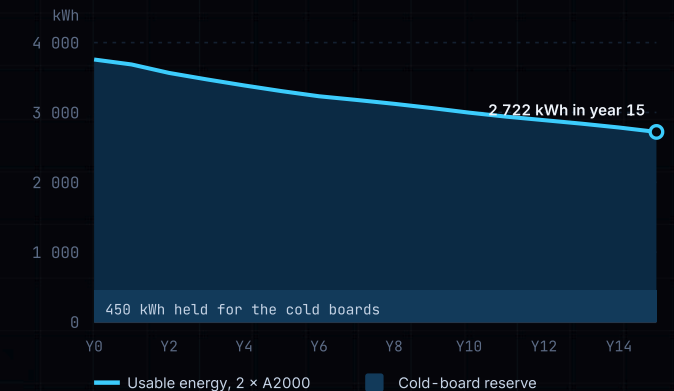
R M AT 12 %



Even the worst single case leaves an NPV of R15 m.

FIG 06-3 • USABLE ENERGY

MEASURED CURVE • KWH



On the cell maker's measured curve at 1.46 cycles a day. The peak - shifting saving is cut in step with it; the demand saving needs power, and holds.

INDICATIVE OWNERSHIP TERMS

FINAL TERMS IN THE SITE PROPOSAL

Structure	Turnkey supply, install and commissioning
Ownership	The operator, 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 plant room
Alternative	Service agreement: fixed monthly fee

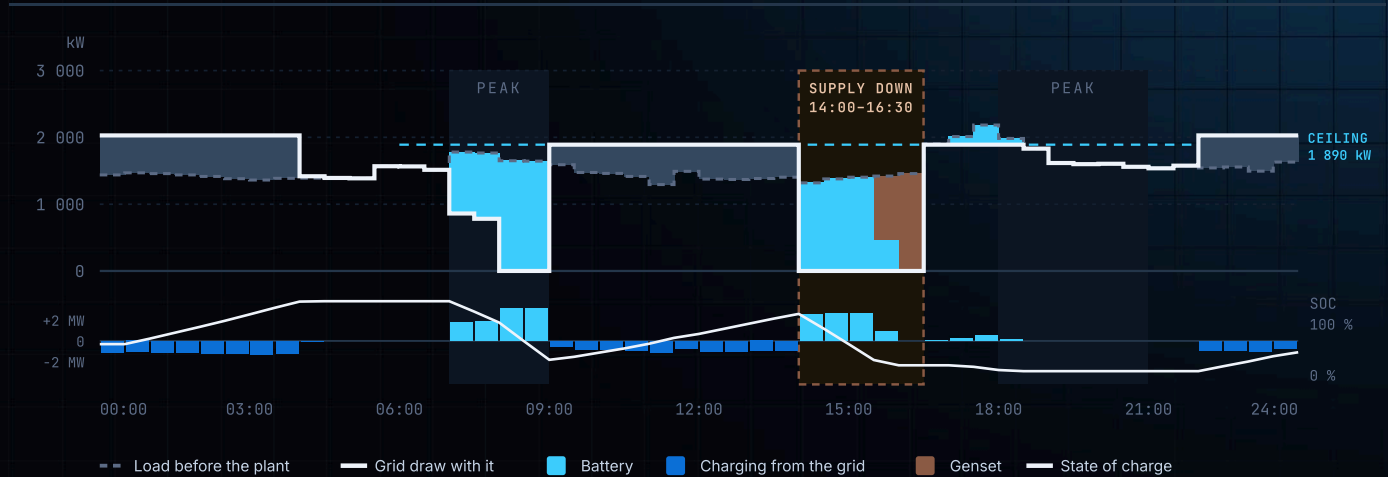
07 · RESILIENCE & DELIVERY

When the supply drops, the chambers hold.

Both PULSE cabinets open in half a cycle and the A2000s take the cold boards. The gensets start only if the batteries run low, and join with no second break.

FIG 07-1 · THURSDAY 16 JULY: A CABLE FAULT TAKES THE 11 KV SUPPLY FROM 14:00 TO 16:30

MODELLED · KW



Blast freezing and the docks stop, defrost is held and the roof inverters trip. Both cold boards run on as islands on stored energy, with 1 206 kWh from the gensets at the end; inside the window the dashed line is those boards alone. The cost: most of that evening's peak shift.

16

SUPPLY INTERRUPTIONS A YEAR, MODELLED

32 → 12_h

GENSET HOURS A YEAR

7.2_{k litres}

DIESEL AVOIDED A YEAR

16 → 0

COMPRESSOR TRIPS A YEAR

FIG 07-2 · FROM LOAD STUDY TO COMMERCIAL OPERATION

INDICATIVE, WEEKS



RISKS WE CARRY, AND HOW

City approval	Lodged at order; no export, to NRS 097-2-1
Tariff changes	Solaris re-optimises to the new clock
Cell ageing	Measured curve; reserve and ceiling hold in year 15
Fire	Gas detection and clean-agent suppression in each A2000

Your store, 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 paycheck.

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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 the City of Cape Town 2026/27 tariff book (Large User TOU, medium voltage), PVGIS (SARAH3) yield for Cape Town and APEX A2000 and PULSE P1000 ratings. The outage pattern, escalation beyond 2027/28, the installed cost and all site data are assumptions.