A FRAMEWORK FOR NZ'S ENERGY FUTURE

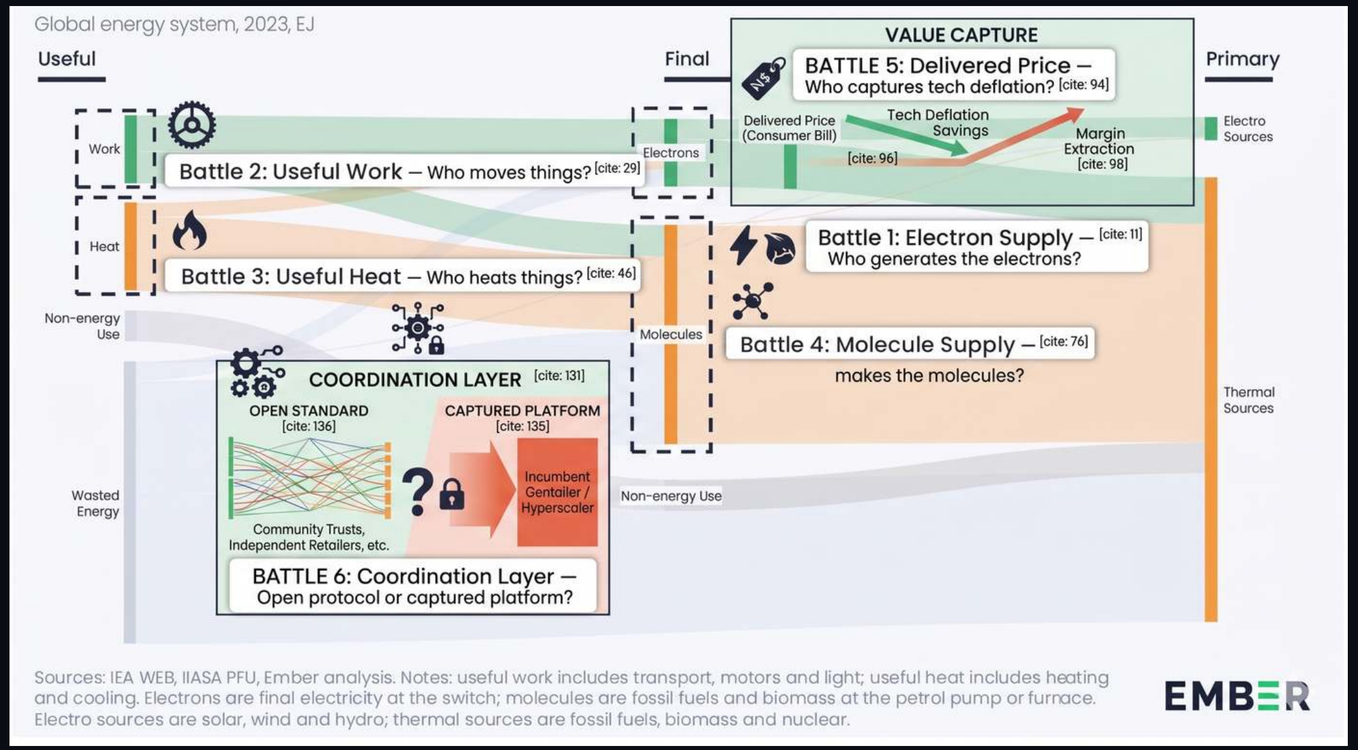
The Six Battles of the energy transition

Four battles decide what gets delivered — electrons, motion, heat, molecules. Two more decide who keeps the value — the delivered price, and the coordination layer above the meter.

THE FRAMING

The energy transition isn't one battle. It's six, running in parallel.

Battles 1–4 are about **what** gets delivered — electrons, motion, heat, molecules. Battles 5–6 are about **who keeps the value** — the price and the coordination layer.



A NEW LENS

Start from the consumer , not the supplier.

THE OLD VIEW

Barrels, tonnes, joules of primary supply

Counts energy at the wellhead. Makes fossil fuels look dominant.

THE REQUIRED VIEW

Useful work + useful heat delivered to the consumer

Counts what people actually use. Fossil fuels look smaller. The transition looks further along.

AT A GLANCE

Six battles. Four delivery, two value.

BATTLE 01

Electron Supply

Who generates the electrons? Clean sources vs. thermal plants.

~5%
solar & wind share today

BATTLE 02

Useful Work

Who moves things? Electrons vs. molecules for motion.

10.5M
fossil machines to replace

BATTLE 03

Useful Heat

Who heats things? Heat pumps & electric vs. gas and coal.

43%
of useful energy demand

BATTLE 04

Molecule Supply

Who makes the molecules that remain? Green vs. fossil.

40 TWh
of "Superpower" available

BATTLE 05

Delivered Price

Who captures the tech deflation behind the meter?

7:1
gentailer dividends vs. renewable capex

BATTLE 06

Coordination Layer

Open protocol or captured platform above the meter?

24–36
months until the default sets

BATTLE · 01

Electron Supply.

01

The supply-side battle: clean sources — solar, wind, hydro — versus fossil-fuel thermal plants for generating electricity.

BATTLE 01 · PHYSICS

Clean electrons beat thermal by 3× on physics alone.

Primary-energy-to-electricity conversion efficiency.

THERMAL POWER STATIONS

29 %

Burn over three units of fuel to deliver one unit of electricity.

SOLAR & WIND

92 %

Capture the resource, convert directly. Minimal thermodynamic losses.

BATTLE 01 · NZ TODAY

NZ is 85.5% renewable — but solar is just 3%.

ANNUAL GENERATION

~40 TWh

Generated in NZ today, 85.5% of which is renewable.

SOLAR SHARE

3%

Despite being the cheapest long-run marginal cost energy available.

The market structure rewards **scarcity** — gas peaking to protect lake levels disproportionately drives gentailer profits — not abundance.

That's a policy failure, not a resource constraint.

SOURCE · EMBER, SEANZ

BATTLE 01 · END STATE

70 TWh, firmed daily, for $308 per person per year.

RETHINKX · NZ PROSPERITY SCENARIO



COST · 20 YEARS

$308 per person, per year.

Broadly comparable to what NZ already spends on energy infrastructure. This is affordable. What's missing is the will to get there.

BATTLE 01 · LEVERS

Four levers to accelerate supply.

01 / **Homeowner finance.** 10-year finance for rooftop solar and battery installations.

02 / **Government procurement.** Leverage all-of-government demand into Power Purchase Agreements for new firmed solar generation only.

03 / **Behind the meter.** Fast-track on-site generation for appropriate public sector users and sites.

04 / **Flexibility & demand response.** Incentivise solutions that decouple grid investment from peak capacity growth.

BATTLE · 02

Useful Work.

02

The motion battle: electrons versus molecules to power transport, machinery, and industry. The technology case is clearest here, and the economics most compelling.

BATTLE 02 · PHYSICS

Electric motors are 3× more efficient than combustion.

Built into the physics, not the technology.

INTERNAL COMBUSTION ENGINES

~25 %

Most of the fuel's energy is lost as heat.

ELECTRIC MOTORS

90 %+

Convert electricity to motion with minimal loss.

BATTLE 02 · STATE OF PLAY

Stationary work is done. Mobile work is the contest.

ALREADY ELECTRIC

Washing machines

Computers & data centres

Industrial motors

THE CONTEST NOW

Passenger & fleet **transport**

Heavy haulage & **trucks**

Farm & Forestry Equipment

GLOBAL SIGNAL · EMBER 2026

80%

of the **growth** in global useful-work demand (2019–2023) was met by electricity. Molecules supplied the other 20%.

WHAT IT MEANS

The balance has already tipped. New motion demand is going electric by default.

Oil demand in transport **may peak this year** — IEA.

China appears to have **passed its peak** already — Ember.

BATTLE 02 · END STATE

The prize: replace 10.5 million fossil machines.

10.5

million machines

SOURCE · REWIRING AOTEAROA

The full fleet of fossil-powered vehicles, motors, and equipment across NZ households, farms, and businesses — quantified in Rewiring Aotearoa's Machine Count report.

A machine-by-machine replacement cycle. Economics strengthen every year as clean prices fall and fossil machines reach end of life. The incremental cost is basically NIL because the machines were going to be replaced anyway.

BATTLE 02 · LEVERS

Five levers to accelerate motion.

01 / **Level the playing field.** Apply Road User Charges (RUCs) to all vehicles.

02 / **Stop ICE imports.** Sharply reduce second-hand fossil car imports.

03 / **Charging network.** Invest in national fast-charging; remove the first-customer tax on network upgrades.

04 / **Electric trucks.** Incentivise heavy transport and haulage to transition.

05 / **V2G standards.** Fast-track vehicle-to-grid standards and preparedness.

BATTLE · 03

Useful Heat.

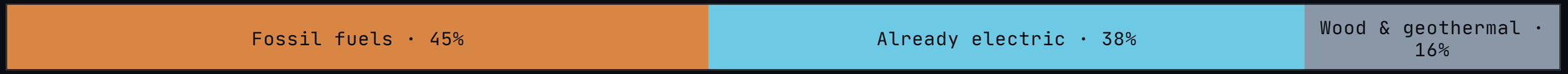
03

The hardest battle. Heat is 43% of NZ's useful energy demand — nearly equal to motion — and it's where fossil fuels are most entrenched.

BATTLE 03 · SCALE

Heat is 43% of useful energy — and the hardest to shift.

NZ TOTAL HEAT DEMAND · 59 TWH / YR (212 PJ)



26.7 TWH FOSSIL (GAS & COAL) 22.7 TWH ELECTRIC 9.7 TWH WOOD & GEOTHERMAL

Most fossil heat burns **natural gas** and **coal** . The question is what's electrifiable, and at what temperature.

SOURCE · MBIE EEUD 2023

BATTLE 03 · TEMPERATURE

Temperature decides the solution.

RANGE	TOTAL (TWH)	FOSSIL (TWH)	ELECTRIC (TWH)	ELECTRIFIABLE?
Low < 100 °C space heat · hot water · low-temp process	25.3	12.9	10.3	Yes — now
Medium 100–300 °C dairy · food · light industry	14.8	5.4	1.8	Yes — near term
High > 300 °C cement · steel · petrochemicals	13.4	8.4	5.1	Hard — Battle 04
Cooling & refrigeration	5.5	—	5.5	Already done
TOTAL	**59.1**	**26.7**	**22.7**	**18.3 prize**

BATTLE 03 · THE PRIZE

Low and medium temp is the 18.3 TWh prize.

ELECTRIFIABLE PRIZE

18.3

TWh of fossil heat

TEMPERATURE SPLIT

LOW	< 100 °C · viable today	12.9 TWh	70%
MED	100–300 °C · near term	5.4 TWh	30%

HEAT PUMP EFFICIENCY · COP 3–5

300–500%

vs. gas boilers at 75–95%

RESIDENTIAL · 15 YEAR VIEW

Already **3× cheaper bills** and **10× lower emissions** than gas.

BATTLE 03 · INDUSTRIAL FOCUS

Dairy is the single biggest target.

FOSSIL HEAT USED BY DAIRY PROCESSING

7.6

TWh / year

By far the largest industrial heat user in NZ.

80–160 °C — pasteurisation, evaporation, spray drying.

Squarely in the zone commercial heat pumps reach **today**.

Alliance Group Nelson plant (2019) cut diesel use **44%** in year one.

Industrial heat-pump operating costs: **45–75%** of gas or coal boilers.

EECA-cofunded projects save an average **$300K / yr** in ETS liability alone.

SOURCE · EECA · ALLIANCE GROUP

BATTLE 03 · THE BLOCKER

The block isn't the tech. It's the capex signal.

SEE TRANSITION AS

70–80%

"Theoretically possible but financially unattractive" — EECA SME research.

GAS CONTRACTS

2×

Doubling on renewal. Supply has fallen 45% in six years.

THE DECISION

DEFERRED

Fixable — with clear gas-contraction timelines and transition financing.

The signal is clear. The CapEx decision is being deferred. That's a fixable problem.

BATTLE 03 · LEVERS

Two levers to accelerate heat.

01 / **Government-cost financing.** Finance the transition for dairy and low-temperature industry at the government's cost of capital.

02 / **NZ-made high-temp R&D.** Publicly funded R&D into domestic high-temperature solutions.

BATTLE · 04

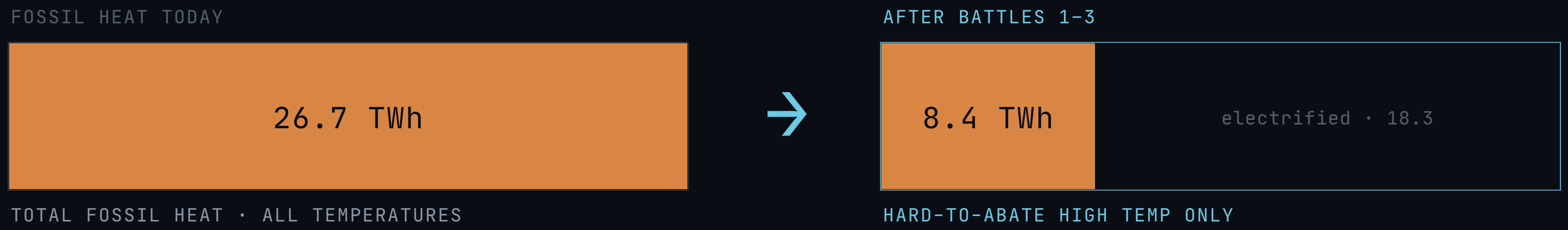
Molecule Supply.

The final battle: who supplies the molecules that remain once we've electrified everything we can — petrochemical feedstocks, high-temp processes, hard-to-abate sectors.

04

BATTLE 04 · THE LEVERAGE

Winning battles 1–3 makes battle 4 smaller.

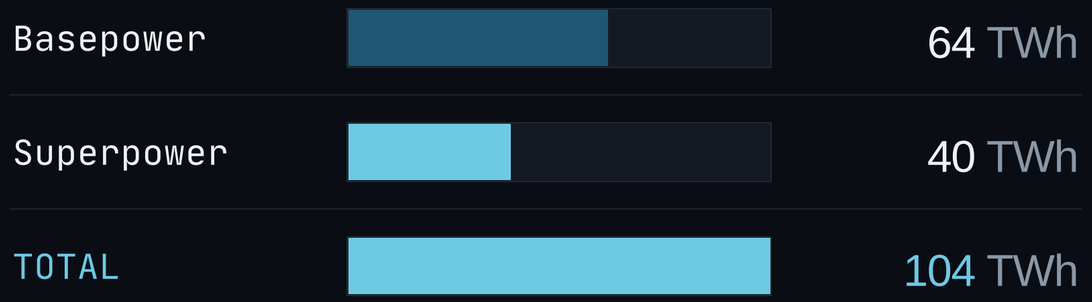


Total molecule demand shrinks dramatically. Battle 4 becomes a **much more manageable target** .

BATTLE 04 · SUPERPOWER

Superpower — 40 TWh of near-zero-cost surplus.

RETHINKX · NZ 2045 PROSPERITY SCENARIO



Superpower is the structural byproduct of building enough generation to cover the worst-case winter day.

Its marginal cost approaches **zero**.

At that price, green hydrogen and ammonia become economically viable.

BATTLE 04 · END STATE

From $20B importer to clean molecule exporter.

TODAY

$20B spent

Per year imported in fossil fuels.

NZ buys molecules from abroad at volatile prices.

→

2045 PROSPERITY SCENARIO

Net exporter

NZ exports green hydrogen & ammonia.

Superpower makes domestic production cheaper than imports.

BATTLE 04 · LEVERS

Two levers to unlock abundance.

01 / **Retire the scarcity model.** Surgically penalise actors that entrench or benefit from scarcity pricing in electricity.

02 / **Reward flexible demand.** EV charging, batteries, modular and non-time-sensitive data centre workloads. These users don't just avoid curtailment — they create the conditions for Superpower.

BATTLE · 05

Delivered Price.

The pricing battle. Every input to electricity is a technology that deflates — panels, batteries, turbines, inverters, chips. Who captures that deflation between the factory and the meter?

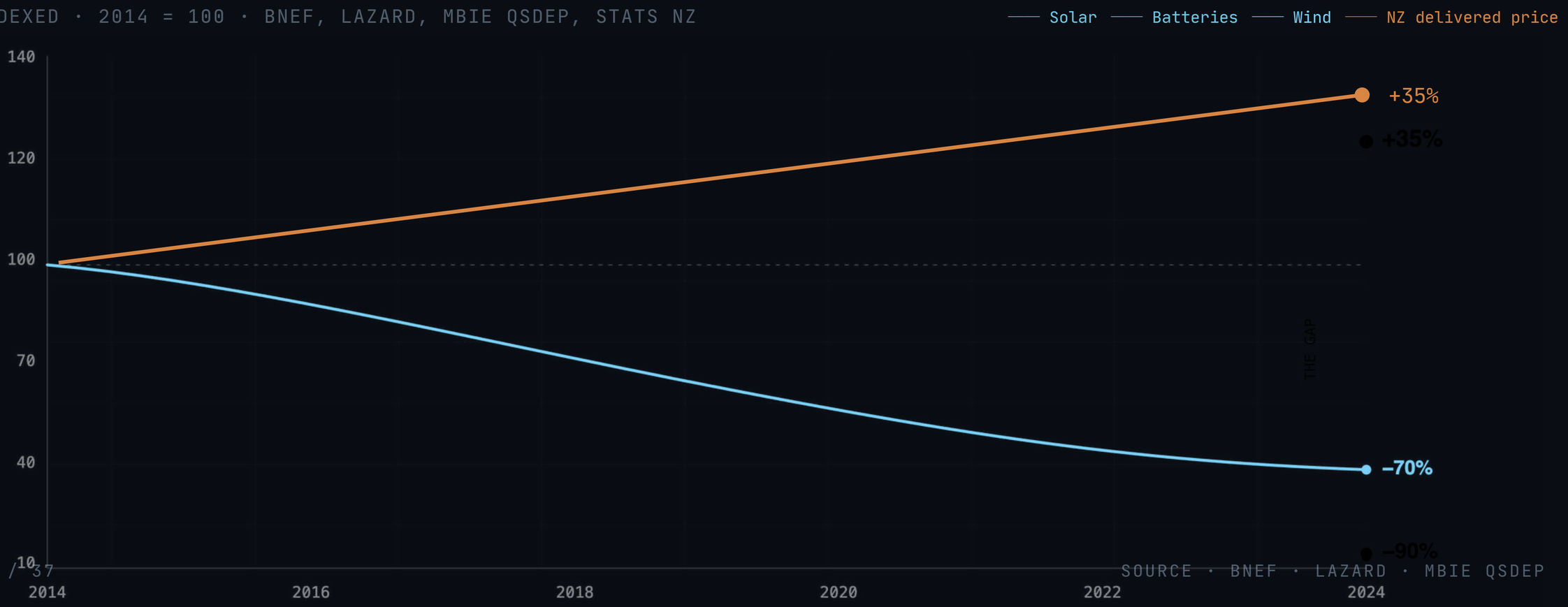
05

BATTLE 05 · THE GAP

Upstream costs fell 70–90% . NZ bills went up 35%.

The gap between the curves is margin being captured — or cost waste — somewhere in the delivery chain.

INDEXED · 2014 = 100 · BNEF, LAZARD, MBIE QSDEP, STATS NZ



SOURCE · BNEF · LAZARD · MBIE QSDEP

BATTLE 05 · THREE EXTRACTORS

Three mechanisms do most of the extracting.

MECHANISM 01

Volumetric RAB recovery

Network capital costs socialised across a shrinking kWh base. Per-capita consumption has fallen for a decade while allowances rise.

+37%
DPP4 EDB allowance vs. DPP3 (real)

MECHANISM 02

Merit-order windfall

Every generator paid the clearing price set by the last thermal unit. Solar, wind and hydro collect the gas-set price at near-zero marginal cost.

$1.66B
/yr hydro windfall · 2021–2024

MECHANISM 03

Thin forward hedge market

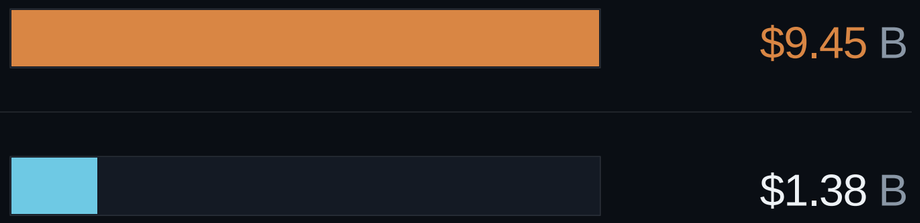
Independent retailers buy hedges from gentailers who also compete with them. Spot swung $32 → $519 /MWh in 20 months.

16×
spot range inside two years

BATTLE 05 · SINCE PRIVATISATION

7 : 1 — extraction to reinvestment.

MAJOR GENTAILERS · ELEVEN YEARS POST PARTIAL PRIVATISATION



Inframarginal rent is kept as margin, not passed through or reinvested.

The more efficient households get, the more the maths loads the bill onto their remaining kWh. A death spiral by design.

BATTLE 05 · LEVERS

Six levers to close the gap.

01 / **Asset-utilisation pricing.** Shift distribution to time-of-use, away from an escalating fixed daily charge.

02 / **Protect behind-the-meter.** Ensure network charges reward flexibility, not penalise it.

03 / **Wholesale reform.** Stop inframarginal rent capture; cap-and-floor the thermal windfall.

04 / **Public thermal backstop.** Run residual thermal sub-economically as a public resilience asset — no profit on scarcity.

05 / **Liquid hedge market.** Let independent retailers manage price risk without paying competitors a premium.

06 / **Transparent bill.** EA publishes every delivered kWh by component — generation, hedge, admin, HV, LV, system.

BATTLE · 06

Coordination Layer.

06

The structural battle above the meter. Between household hardware and the wholesale market sits a coordination layer. Whoever owns it captures the value the hardware below produces.

BATTLE 06 · TWO FUTURES

Platform or protocol?

The layer between household hardware and the wholesale market — metering, aggregation, bidding, settlement.

PLATFORM · CAPTURED

A hyperscaler or incumbent gentailer swallows the aggregation layer.

Citizens become tenants on hardware they already paid for. The default pattern in California and parts of Europe.

PROTOCOL · OPEN

An open coordination standard lets many operators connect.

Independent retailers, iwi aggregators, community trusts and new entrants all plug into the same published protocol.

BATTLE 06 · WINDOW

The window is 24–36 months until the default gets baked into rules set during DPP5.

24–36

months · until DPP5 rules set

In California and parts of Europe, platform incumbents have already set the default.

In NZ the layer is still contested. Regulators have started scoping rules but haven't locked the architecture.

The default for the next decade gets baked in during **DPP5**.

BATTLE 06 · LEVERS

Four levers to keep the layer open.

01 / **Publish an open coordination standard.** EA commits to a deadline inside the current regulatory period.

02 / **Mandate open APIs.** Smart meters, inverters, batteries, EV chargers — as a condition of connection.

03 / **ComCom scrutiny.** Apply before incumbent gentailers or offshore platforms acquire NZ aggregators.

04 / **Capitalise community aggregators.** Seed iwi and community-owned aggregator models while the layer is still contestable.

SYNTHESIS

Six battles, running in parallel.

01	Electron supply · ~5% solar & wind, scarcity-priced	~40 → 70 TWh	33%
02	Useful work · stationary done, mobile the contest	10.5M machines	38%
03	Useful heat · 18.3 TWh prize, low-temp viable today	38% electric	38%
04	Molecule supply · unlocked by winning 1, 2 and 3	8.4 TWh residual	12%
05	Delivered price · tech-deflation gap, gentailer rent	$1.66B / yr windfall	15%
06	Coordination layer · open protocol vs. captured platform	24–36 month window	20%

PROGRESS BARS ILLUSTRATIVE — REFLECTS RELATIVE MATURITY OF EACH BATTLE TODAY.

CLOSING

Four battles decide what gets delivered. Two decide who keeps the value.

SOURCES

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