

Building the Data Transformation

Where should the Data Come From?

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THE COMMON FACTOR

Three questions that look separate. One prerequisite that is not.

FAIRNESS

Who is genuinely driving the cost of this network - and are they the ones paying for it?

Fixed costs do not disappear as solar grows. They shift, quietly and unevenly.

RELIABILITY

What is happening on my network right now, and where?

Built for one-way flow. The reversal happens at the LV edge, where visibility is thinnest.

ACCELERATING INVESTMENT

Can I say yes to this connection without risking the system?

The barrier is not capital. It is worst-case assumption.



High-quality data about what is actually happening on the network

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TWO PLACES TO MEASURE

Same objective. Different physics. Different economics.

THE DISTRIBUTION TRANSFORMER

- Total load and total export across the LV side
- Voltage at the point of supply
- Thermal headroom against the asset rating
- One device covers everyone behind it



THE HOUSEHOLD

- Consumption and export, customer by customer
- Voltage at each connection point
- Outage and restoration events from the premises
- One device per customer



Both give you visibility. Not the same visibility - and not the same cost.

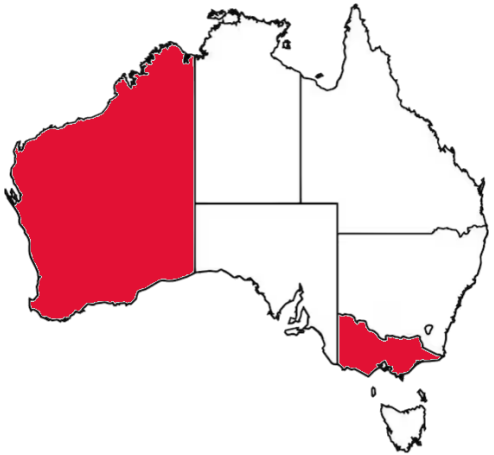
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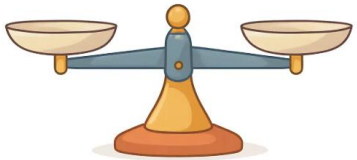
AUSTRALIA'S CROSSROAD

Power of Choice, 2013: metering opened to competition on the theory that the market would move faster

99.1%	39.2%	42.6%	46.5%	57.0%
Victoria	New South Wales	Queensland	South Australia	NEM overall

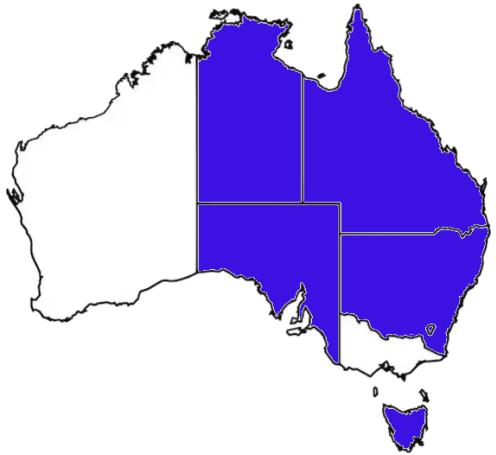
Remotely-read meters. AEMC Accelerating Smart Meter Deployment final determination, November 2024.





They did not

Australia spent a decade running two models side by side.



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WHAT HOUSEHOLD METERING GIVES YOU

The meter stops being a billing device and becomes a sensor

FAIRNESS

What each customer actually did - not what their class typically does.

Tariffs built on measured drivers of network expenditure, not averaged assumption.

RELIABILITY

Last-gasp scoping, restoration notifications, automatic pings for nested outages.

SAIFI improvement 44% to 61%; SAIDI 48% to 71% (2018 to 2024-25) - and still accelerating.

ACCELERATING INVESTMENT

Hosting capacity from measured voltage at real connection points.

Approve more connections, faster, without compromising safety or stability.







Household metering tells you the behaviour of the customers

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WHAT TRANSFORMER MONITORING GIVES YOU

A better answer than its reputation suggests

FAIRNESS

Collective fairness rather than individual fairness.

Identifies which parts of the network are carrying the burden of the transition.

RELIABILITY

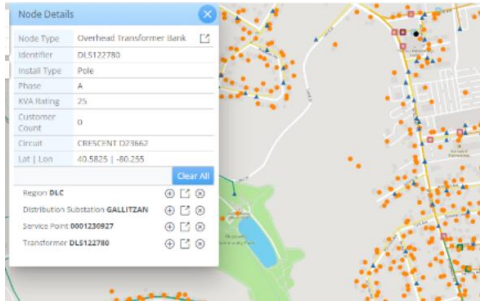
Where the physical risk actually sits: overloading, backflow, thermal ageing, voltage excursion.

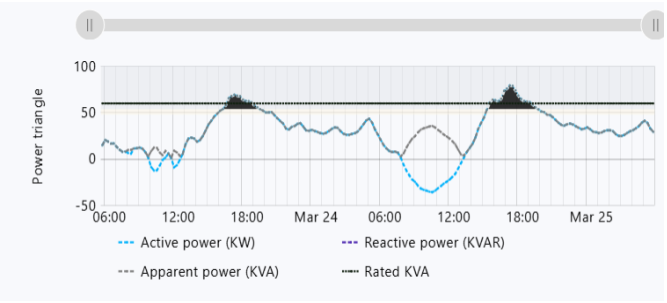
One device instead of thirty to a hundred.

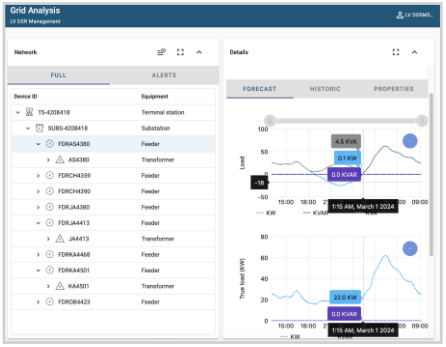
ACCELERATING INVESTMENT

The transformer is very often the binding constraint.

Thermal headroom answers the planning question: how much more solar can this street take?







Transformer monitoring tells you the condition of the network

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SIDE BY SIDE

They are answering different questions

Dimension	Household-level AMI	Transformer-level monitoring
Fairness	Sees each customer individually - who exports, who imports, who drives network cost. Cost-reflective tariffs built on measured behaviour.	Sees the aggregate. Can tell you the group is stressing the asset; cannot tell you which household caused it.
Reliability	Last-gasp and restoration notifications from every premises; nested outages found by pinging; fault located to a span.	Confirms the transformer is energised and within rating. Everything downstream remains invisible.
Accelerating investment	Hosting capacity from measured voltage at the connection point - evidence instead of worst-case assumption.	Thermal headroom at the transformer. Good enough to size storage; not enough to set a per-customer export limit.
Deployment unit	One device per customer.	One device per distribution substation - 30 to 175 customers behind each (Ausgrid).
Blind spot	None material at LV, once penetration is representative.	Everything between the transformer and the meter - where the customer experience lives.

The gap between one sensor and none is far larger than the gap between the two options

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NOW THE ECONOMICS

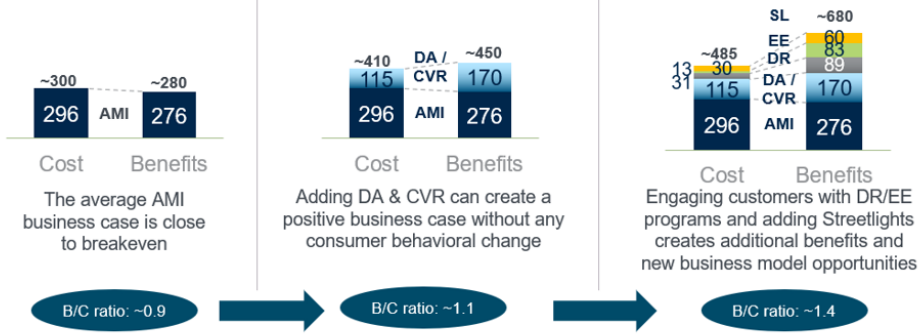
The part that actually decides these things in a board room

TRANSFORMER MONITORING

- One device serves an entire distribution substation
- 30 to 175 customers behind each one
- One to two orders of magnitude fewer devices for the same customer base
- Installed on your own asset, in your own easement - no property access required

FULL AMI

- Blended cost per customer
- AMI-only benefits make a benefit-cost ratio of about 0.9
- The early step changes - meter reading, estimated bills, first-wave theft - are captured once only



On a pure meter-to-cash comparison, transformer monitoring wins - and it is not close.

THE HIDDEN HALF OF THE AMI BUSINESS CASE

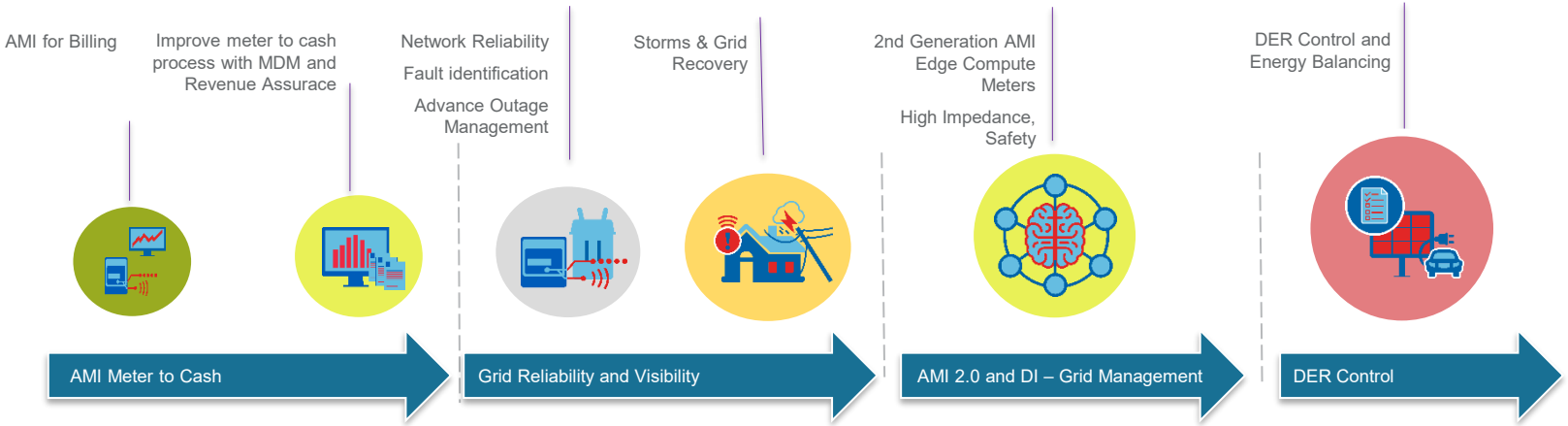
Eight years of measured evidence against one modelled forecast

0.9
AMI alone

1.4 - 1.8
Taking into account full use cases

Reliability
Accelerating Benefit from Analytics

Storm Resilience
Customer Behviour



The traditional benefits did not diminish as new ones appeared. They accelerated.

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SO WHERE DOES THAT LEAVE THE CHOICE?

I do not think the cost analysis settles it

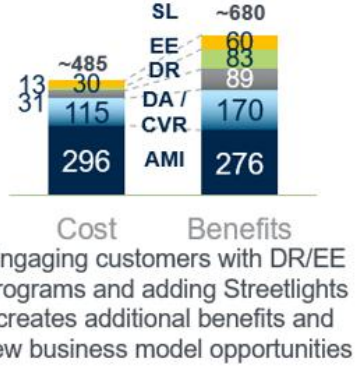
TRANSFORMER MONITORING

- Dramatically cheaper
- Answers the asset-protection question well
- If your constraint is capital and your problem is thermal, the cheaper answer may well be the right answer

FULL AMI

- Dramatically more expensive
- Only justifies itself if you intend to build on it
- The compounding is the whole argument - not the meter – it's solving other problems you may have (Prepay etc)





Engaging customers with DR/EE programs and adding Streetlights creates additional benefits and new business model opportunities



The answer depends on something we have not discussed yet.
And it is not a metering question at all.

IT COMES DOWN TO HOW YOU IMPLEMENT RENEWABLES

Australia's journey with renewable control has been anything but linear

DYNAMIC OPERATING ENVELOPES

The original ambition

A continuously calculated export limit for every customer, reflecting what the network can accommodate at that moment. Sophisticated, fair - and data-hungry.

EMERGENCY BACKSTOP

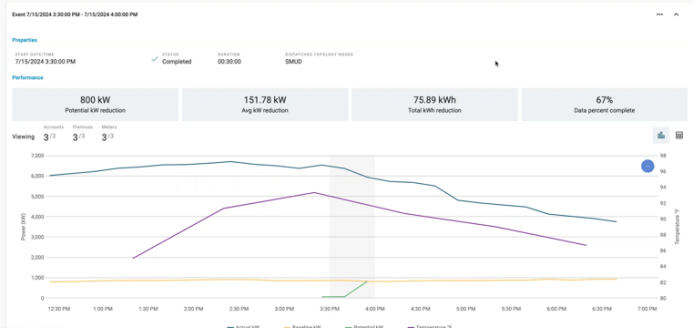
AEMO MSL framework, from 2021

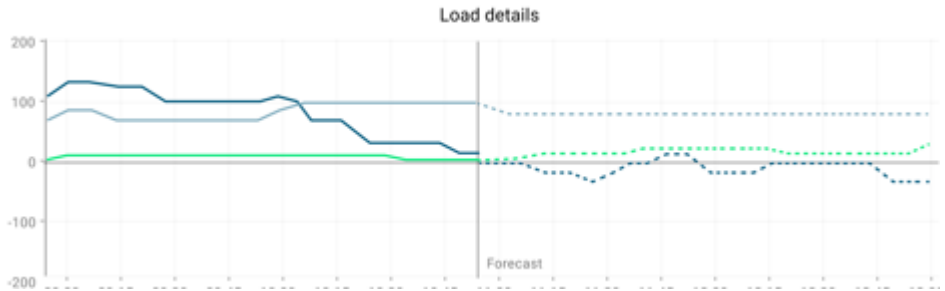
Blunter and more urgent: distributors must curtail distributed generation at scale when system security demands it. QLD from Feb 2023; VIC Stage 1 from Oct 2023. Not an envelope - a switch.

FLEXIBLE EXPORT LIMITS

AER final response, July 2023

The pendulum swings back: dynamic, customer-level limits as the enduring mechanism rather than the emergency one.





Same purpose every time: protect the network. What differs is the instrument - and the instrument depends on what you can see.

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TWO WAYS TO PROTECT THE NETWORK

The instrument you reach for depends entirely on what you can see

WHERE THE METERS ARE: PROTECT BY CURTAILMENT

- Calculate a limit per connection point
- Send it to the inverter; measure the response
- Take generation off the network, customer by customer
- Precise - but it throws energy away, and it needs a meter at every premises



WHERE THE METERS AREN'T: PROTECT THE TRANSFORMER

- Instrument the asset; put storage behind it
- When solar pushes back through the transformer, do not curtail it - absorb it
- Every kilowatt-hour the community generates is still generated
- Nothing is wasted. Some of it is simply time-shifted.



Protect by curtailment, or protect by absorption

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FAIRNESS FELL OUT OF THE PHYSICS

Remembering why this is being done

THE ENERGY IS A BY-PRODUCT

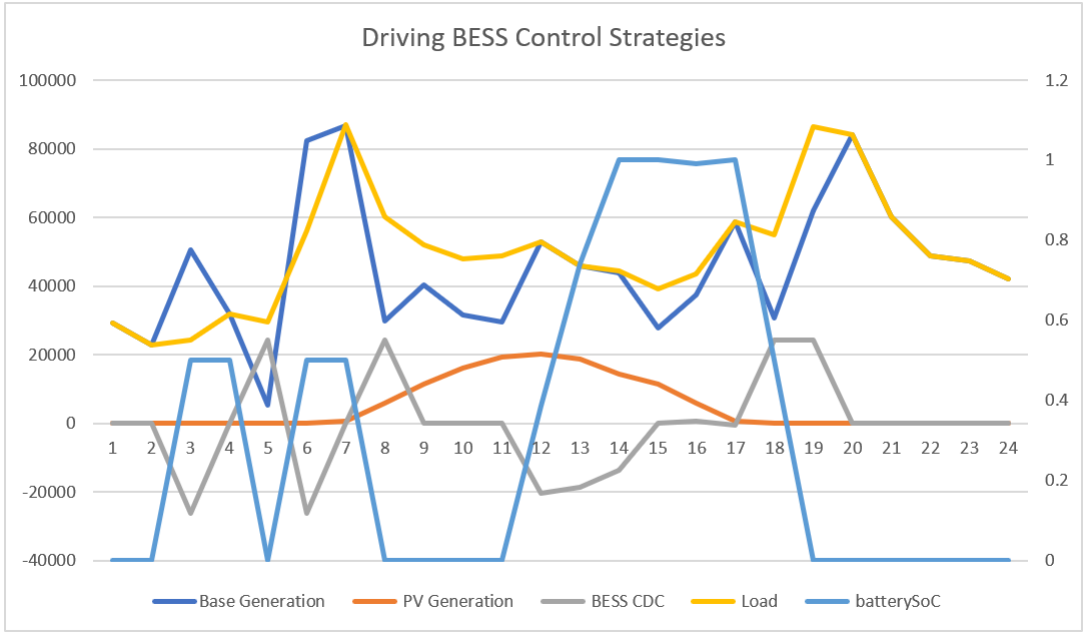
The goal was to protect the transformer. What ends up in the battery is what is left over after the network has been made safe.

IT CANNOT STAY THERE

The battery has to be emptied overnight so it is ready to absorb again the following midday. The cycle only works if the storage is released.

RELEASED TO WHOM?

Shared equitably among everyone behind that transformer - solar and non-solar, owner and renter, house and apartment.



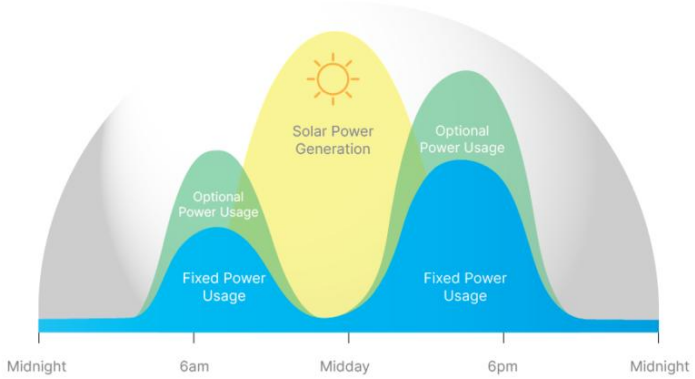
An annual dividend to every customer in the trial area, whether they own PV or not

SO WHICH WILL WIN?

I genuinely do not know - and the better question is which is more resilient to what comes next

SOLAR IS A MIDDAY PROBLEM

- Backflow at noon is the binding constraint today
- Curtailment answers it precisely, customer by customer
- But you cannot solve an import peak by turning down generation



ELECTRIFICATION IS AN EVENING ONE

- When EVs arrive in volume the constraint becomes coincident charging load after work
- A curtailment mechanism has nothing left to curtail
- A battery installed to absorb solar is fully charged exactly when the evening peak arrives



My instinct: the approach born of constraint may prove the more durable one

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WHAT IS CERTAIN

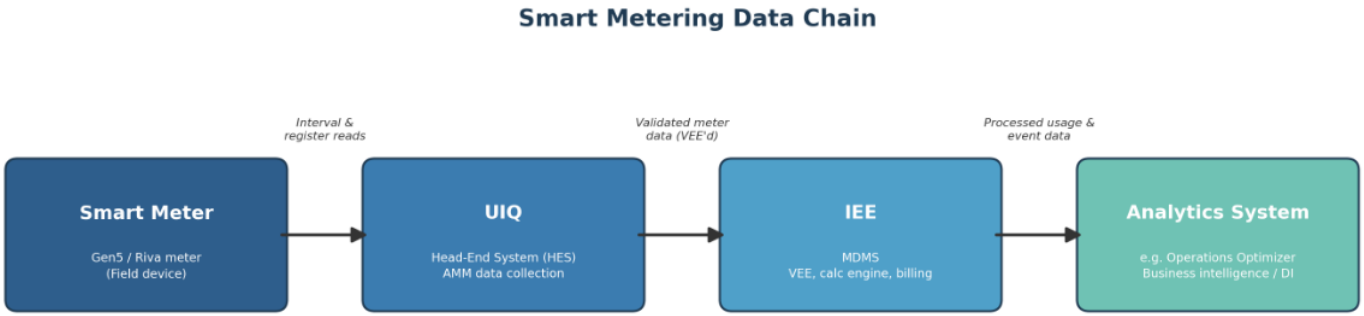
Whichever road you take, two things are required - and neither is optional

1 HIGH-QUALITY SMART METERING DATA

Note I did not say a meter at every house. Whether you gather it at 30 points or 3,000, it has to be accurate, timely enough to act on, and trustworthy enough that an operator will decide on it at two in the morning. A measurement you do not trust is worse than no measurement - it creates the illusion of visibility.

2 GRID EDGE INTELLIGENCE

The ability to make sense of that data and execute control where the physics is actually happening. Neither approach is a monitoring exercise. Both are control loops. Sensing without the ability to act is an expensive way to document your own problems.



Everything else is built on those two foundations

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Thank You

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