What could an affordable and abundant electricity system look like in Aotearoa/New Zealand?

Talk for Waikato Wellbeing
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Outline

1. Symptoms of failure – a quick review of familiar ground
2. Basic economic theory: how to read supply and demand curves
3. A simple supply-demand model of the current wholesale market set-up
4. Thinking about competition for the market versus an all-encompassing cartel: where do distributed renewables and batteries fit in?
5. Designing a market in which residential prices come down
    i. Clearing an arena for genuine competition at local level (downstream of the grid)
    ii. Pricing the six elements of supply to consumers: central generation, central system coordination, transmission, distributed generation and demand response, local network service, retail delivery
    iii. Regulation at retail level – necessary?
    iv. Changing the focus of upstream regulation from protecting asset values to redirecting the use of heritage hydro and setting the priority order for scheduling and curtailment
6. Discussion

1. Symptoms of failure: a quick review of the recent history

Neoliberal transformation of the Aotearoa electricity industry

Before 1986

- An “essential service” collectively provided
- Priced as cheaply as possible to households: wellbeing the goal
- Run by civil engineers committed to optimal planned outcomes
- Integrated monopoly with non-profit objectives

Since 1986

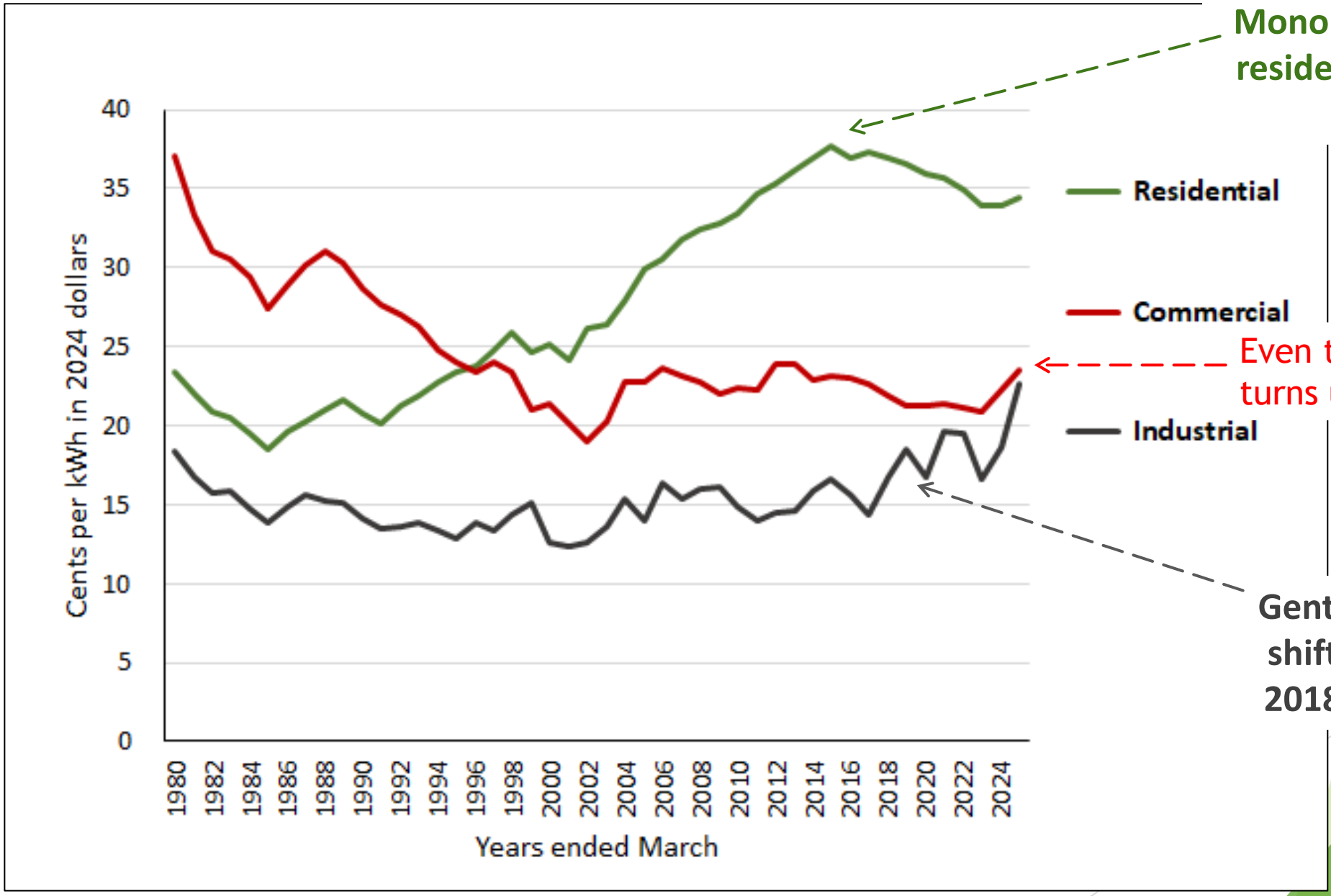
- A commodity allegedly like any other supplied by corporates
- Priced to recover the full cost of the marginal generator plus the monopoly price for each lines-network operator plus a fat margin for dominant retailers
- Run by corporate managers and financial engineers maximising profit and “shareholder value”
- Multiple players in a complicated institutional landscape of
  - some [allegedly but actually not] “competitive” and
  - some [allegedly but actually not] “regulated” markets

The big promise from the electricity “reformers”

- Back in the 1980s the proposition was that corporatising, reorganising, and where possible privatising electricity, would bring gains for consumers because
  - Commercial, profit-driven management would (1) raise efficiency and (2) cut costs
  - Competition or appropriate regulation would (3) force efficiency and productivity gains to be passed through to prices
  - Consumers would therefore enjoy better service and lower prices, while profits could rise under an SOE or private model – sharing the gains from more productive use of resources

5

Real electricity prices (average revenue) 1980-2025



Monopoly pricing hits the residential demand curve 2014

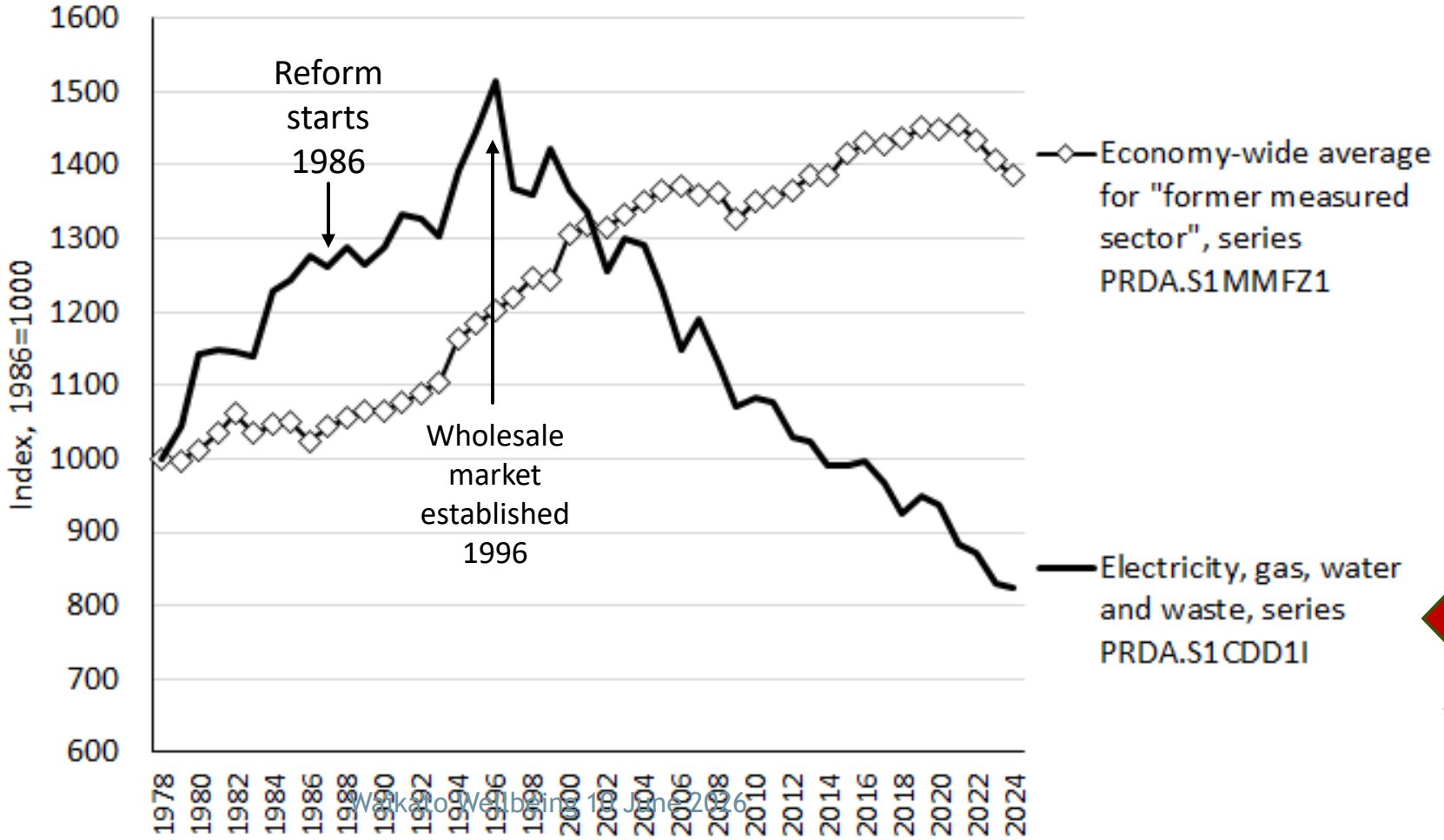
Even the commercial price turns up after 2022

Gentailer price-gouging shifts to industry from 2018, accelerates 2023

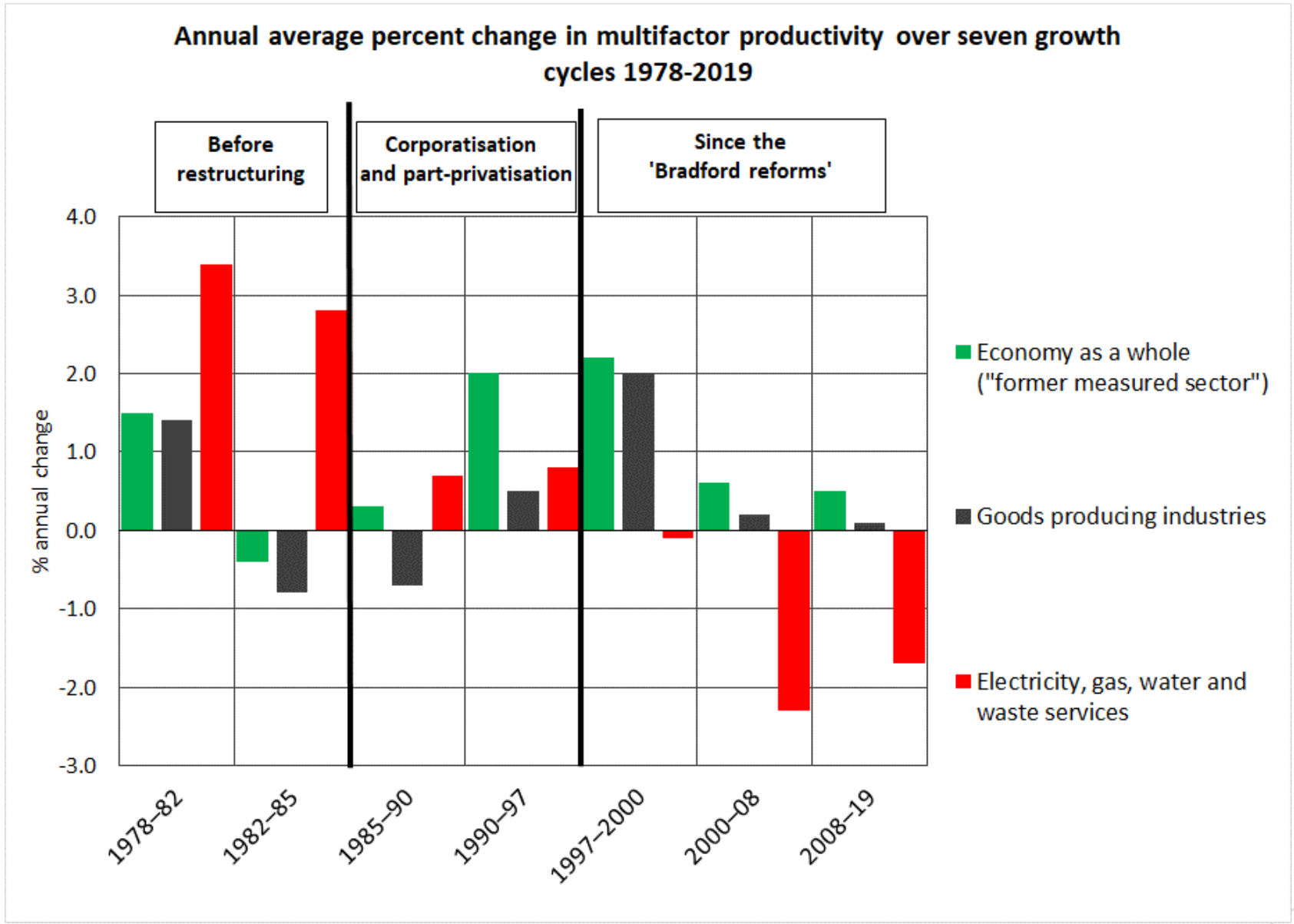
The big promise: corporatisation and privatisation would increase efficiency and hence productivity and so would lower the price

Multifactor productivity: two trends

Source: Statistics NZ Infoshare Table PRD014AA



In 2024:
18% below 1978
35% below 1986
46% below 1996


Annual average percent change in multifactor productivity over seven growth cycles 1978-2019
Before restructuring
Corporatisation and part-privatisation
Since the 'Bradford reforms'
% annual change
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
1978–82
1982–85
1985–90
1990–97
1997–2000
2000–08
2008–19
Economy as a whole ("former measured sector")
Goods producing industries
Electricity, gas, water and waste services

Bottom line: over the past two decades this sector has been loaded up with labour and capital engaged in unproductive activities

Pursuit of profit combined with complicated “competition” games and financial engineering has meant that increasing amounts of labour and capital have been allocated to high-paid sales, marketing, financial management and administrative work that adds nothing to the volume or quality of the electricity reaching consumers

Corporatisation and privatisation have culminated in a gigantic exercise in rent-seeking waste

The reason

The reformers either lacked understanding of the economics of the New Zealand electricity system – or didn't care

They were applying one-size-fits-all cookie-cutter notions imported from the UK and USA where the economics of electricity were different and neoliberal ideas were on the rise

Deregulation opened the door for looting and rent-seeking

Ideology overwhelmed common sense

The outcome 1986-2026

An uncompetitive oligopoly/cartel has been entrenched in control of our most strategic sector

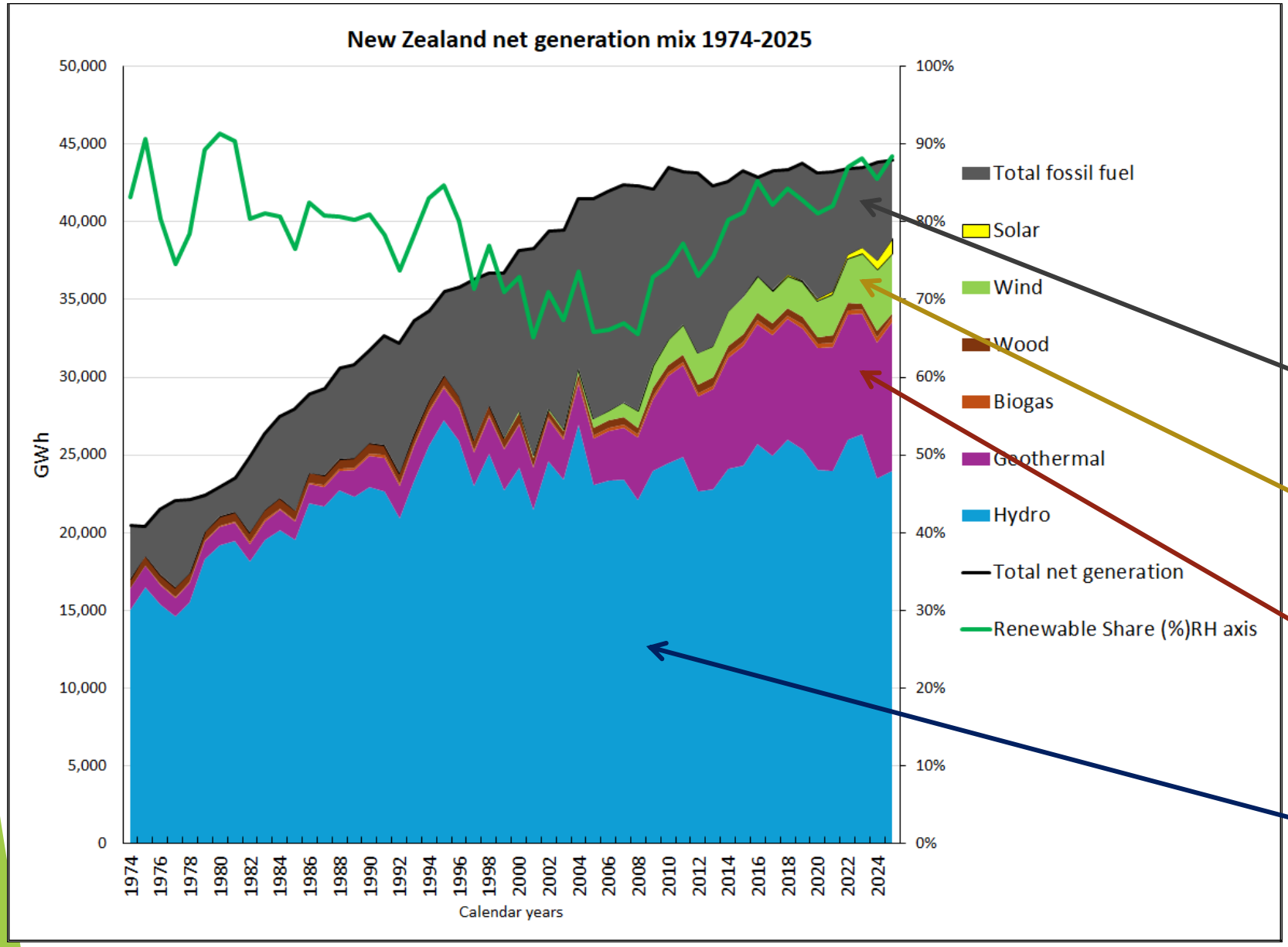
Productivity is down 30% over three decades, gross profits are up 80%

Construction of renewable generation has been slowed down and new entrants to generation are being blocked by anti-competitive practices which are legal under the Commerce Act 1986, and supported by the "regulators" (Electricity Authority and Commerce Commission)

Prices for residential consumers have doubled in real terms and will rise further as the carbon price rises (perverse incentive)

Prices for commercial users are down by a quarter. Prices for industry stayed low until price-gouging started 2017. Countervailing **power** really matters in uncompetitive markets – industry seemed to weaken (except for Tiwai Point, NZ Steel & co)

The electricity industry's strategic goals are hostile to equitable climate-change policy and will block progress unless and until the cartel is broken



Total generation (black line) is nearly flat since 2012.

Renewables share in 2024 was the same as fifty years ago – just below 90% (green line)

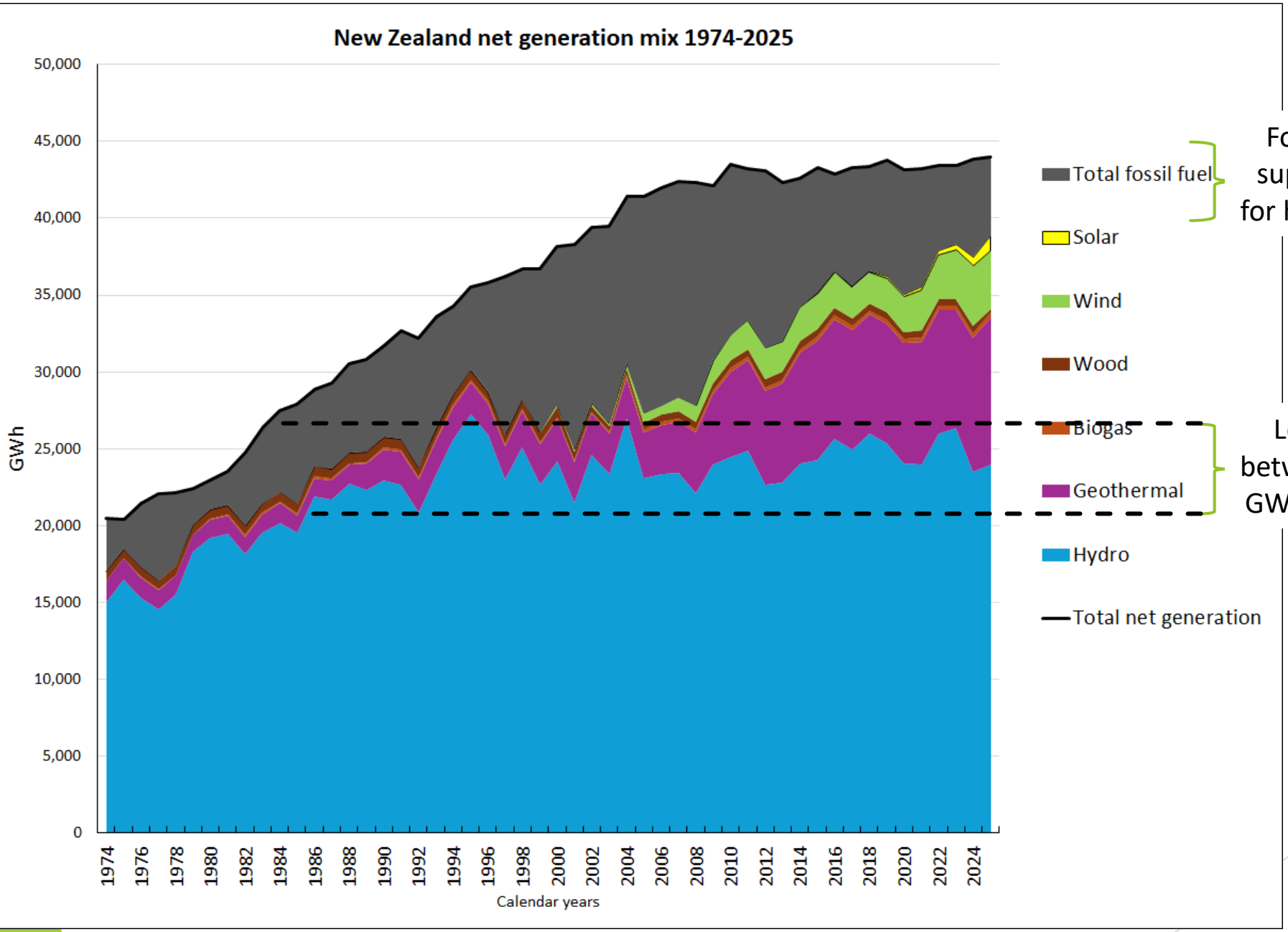
Coal, gas and oil stay stubbornly parked on the margin of supply

Wind is growing but solar has lagged and biomass is minimal

Geothermal has been a big mover since 2000

Hydro development was complete by 1990 => this is now a legacy asset

Dry years or seasons are the big issue for hydro intermittency, currently solved with fossil fuels



Fossil fuels sit on the margin of supply and provide the backstop for hydro over dry years or seasons

100% renewables means pushing this tranche off the margin of supply, or decarbonising it. So what to do with Huntly is a key issue.

Legacy hydro output ranges between 20,000GWh and 28,000 GWh depending on the weather

That's a range of nearly 20% of total generation – intermittency on a seasonal and/or annual scale

The electricity industry's central strategic goal: maximize electricity demand while blocking the path to 100% renewables

So long as fossil fuels stay in the mix, they are at the wholesale market margin and so set the spot price way above the supply cost of hydro, geothermal and wind

So long as fossil fuels are on the margin, every increase in the carbon price - whether via the ETS or otherwise - pushes up the price of all electricity, including renewables

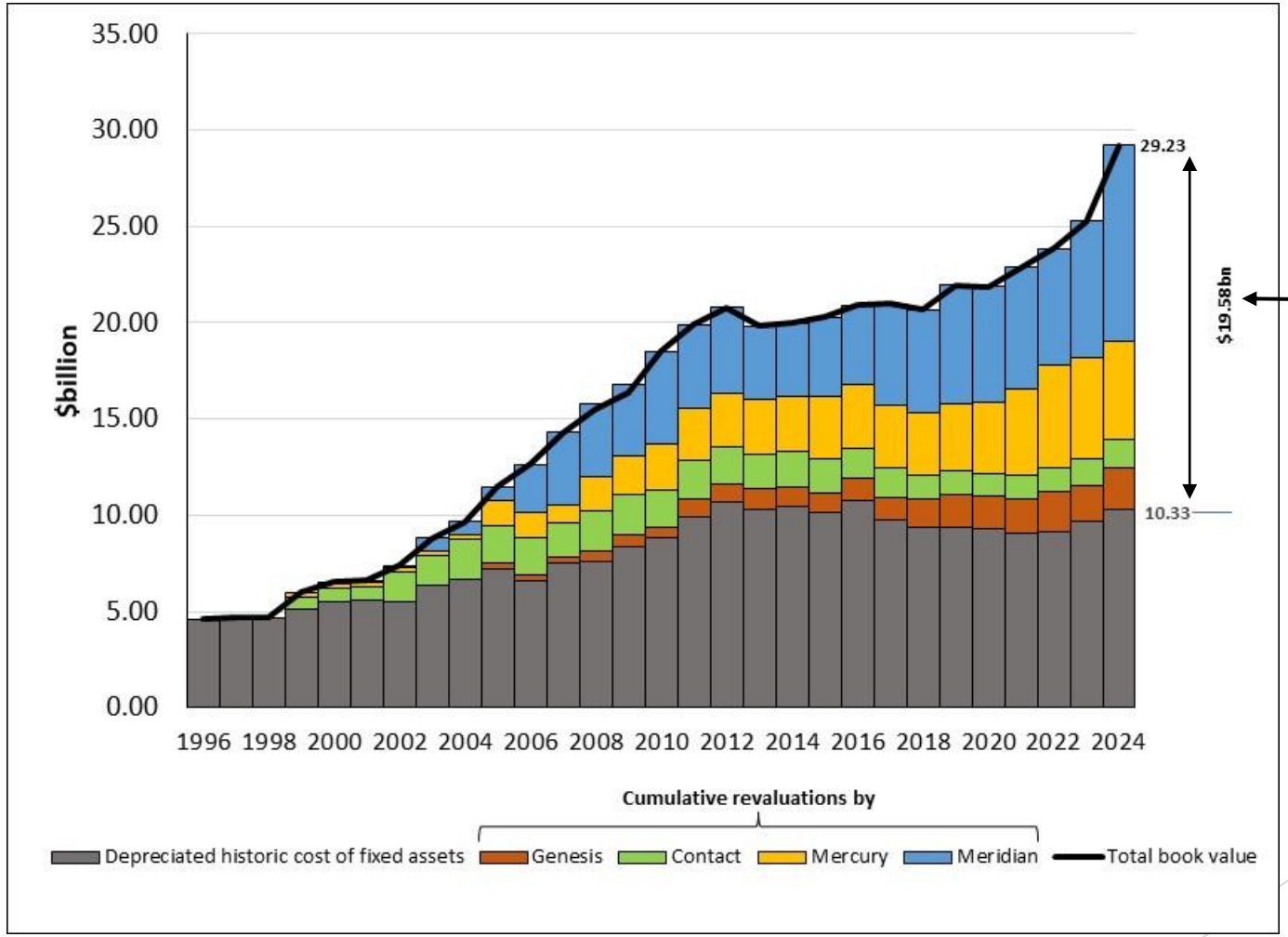
That means wealth transfers to the gentailers as other policy measures seek to drive electrification against the electricity-pricing tide

The commercial (as distinct from lifestyle) viability of small-scale distributed generation such as rooftop and farm-level solar, and small windfarms, is quite sensitive to the price structure facing households: removing the low-fixed-charge regulation was a quick way to make rooftop solar less economic.

A big threat to gentailer profits is the huge potential wind resource, but the gentailer cartel has locked up and "banked" the best sites (plus several hydro options) – only offshore wind remains open

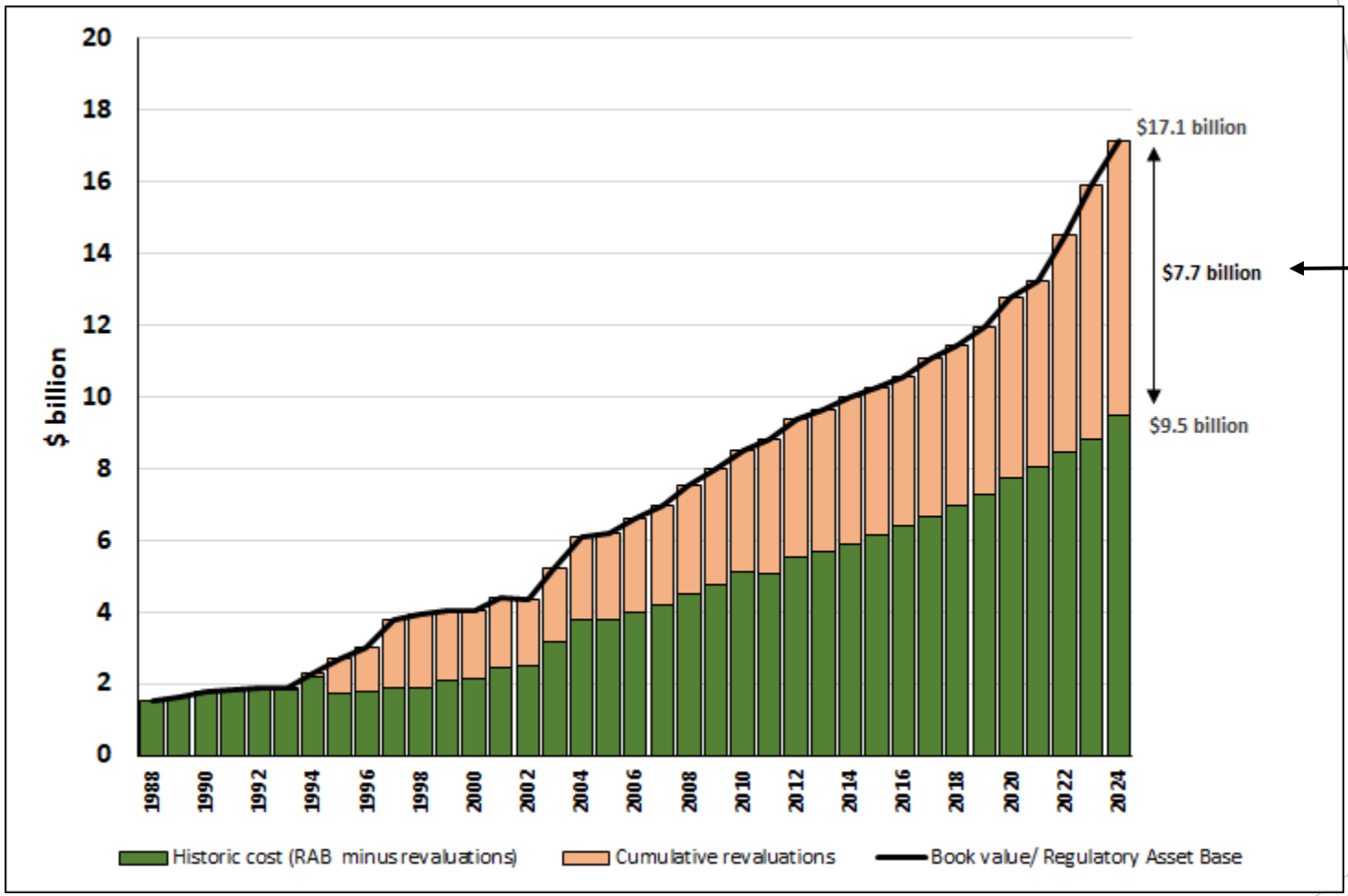
Without institutional change, Government policy is hostage to the cartel's stranglehold

Four gentailers' gains from revaluation of their fixed assets

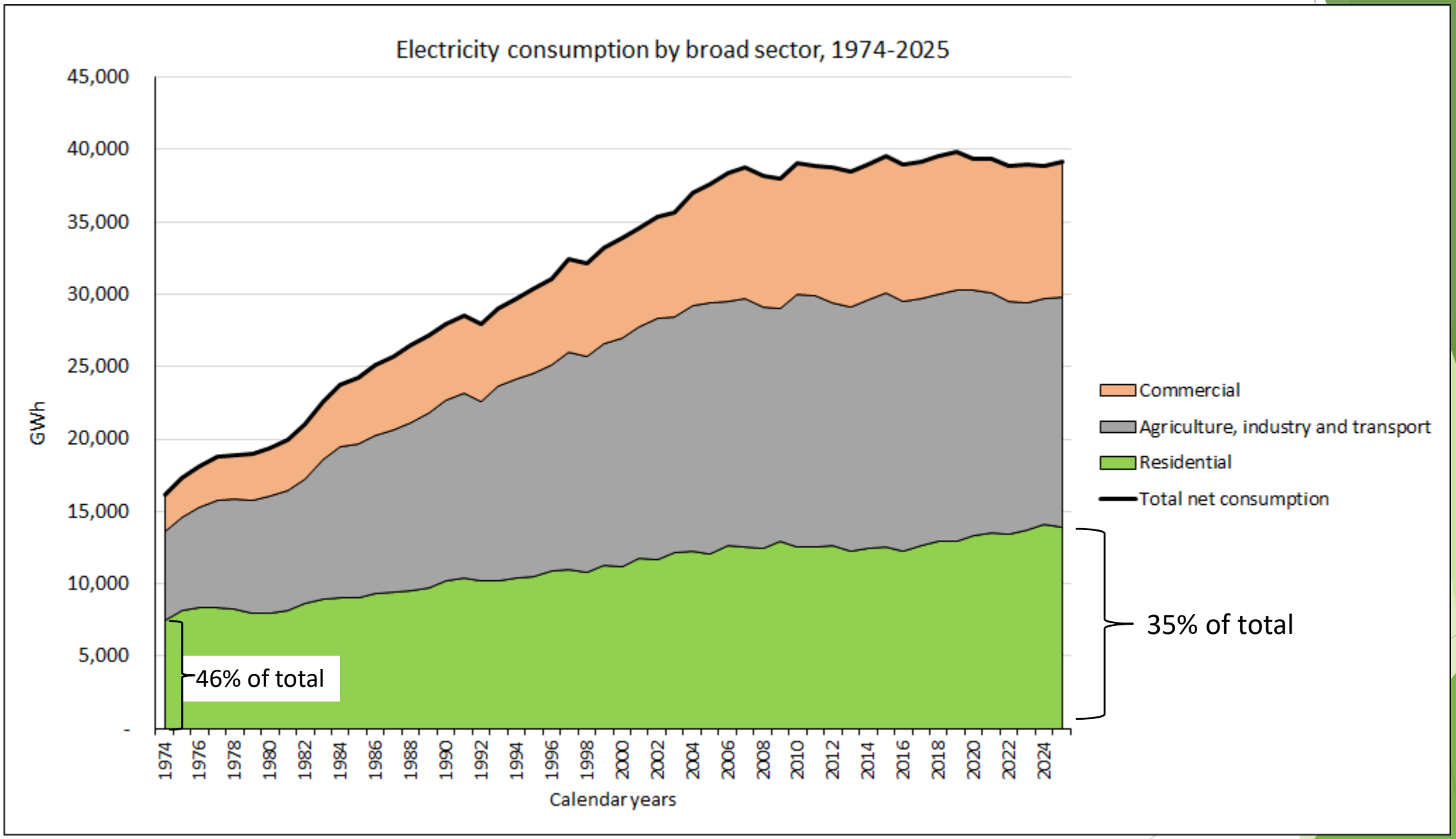


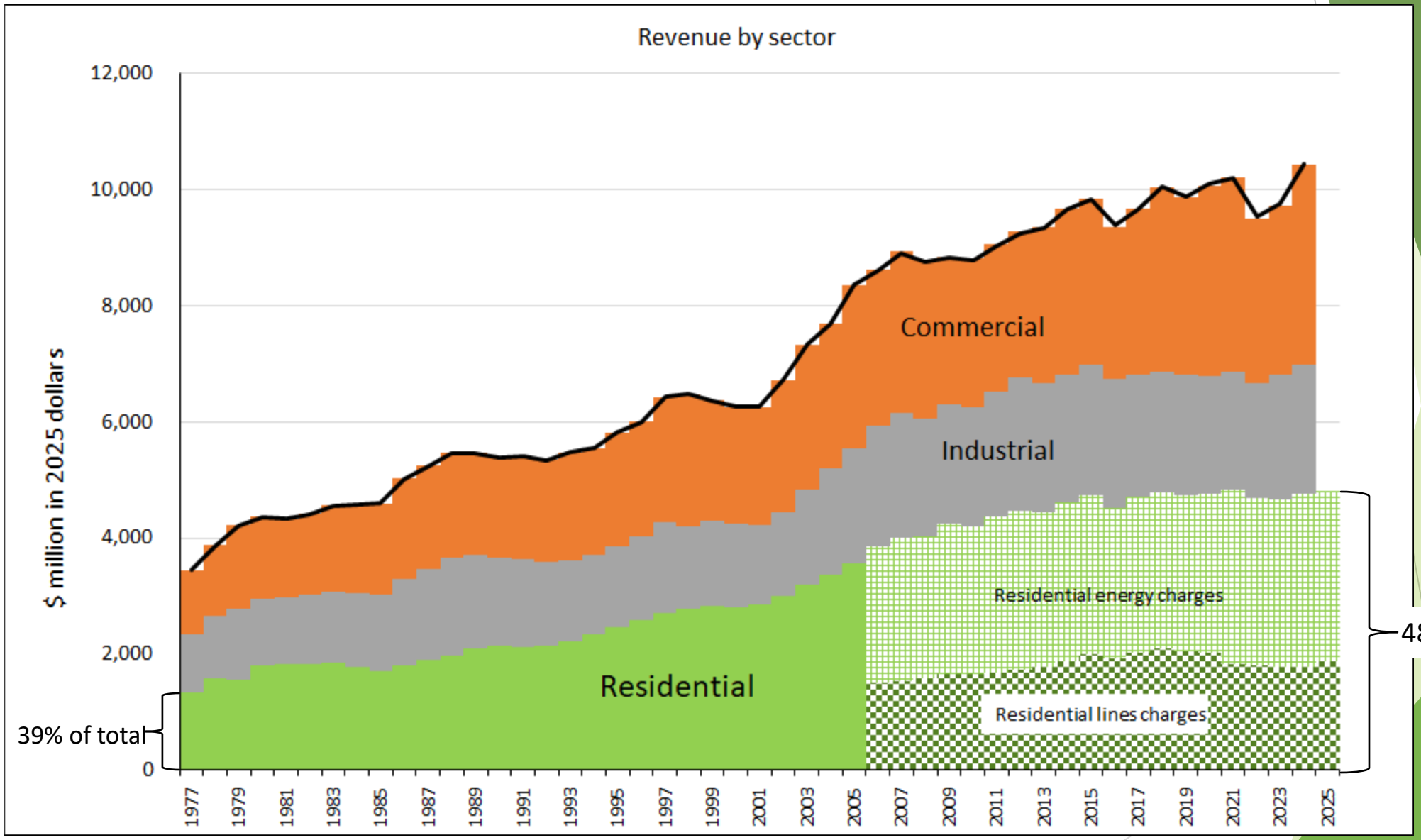
← $19.58 billion

Distribution companies gains from revaluation of their fixed assets

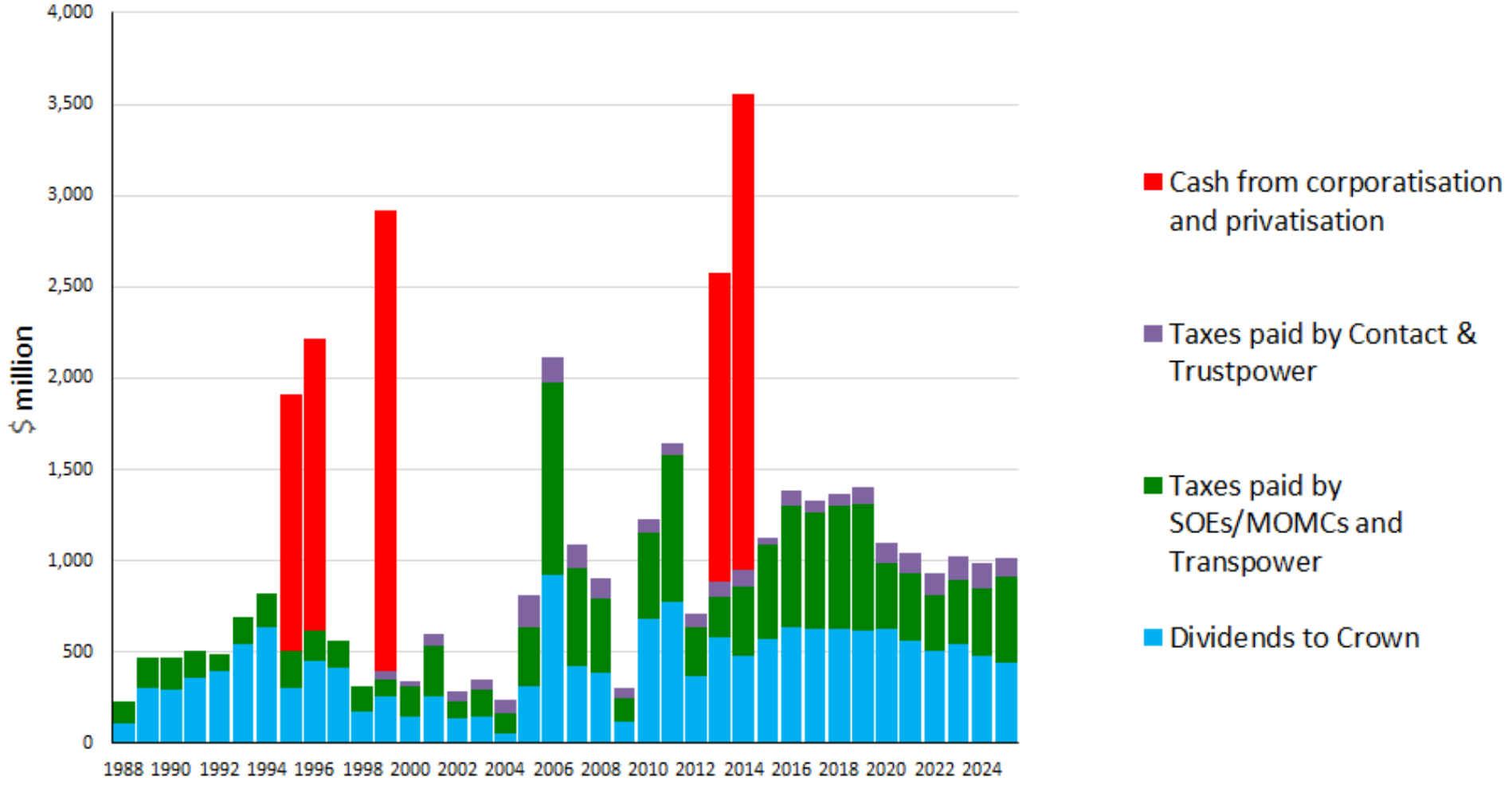


$7.7 billion


Electricity consumption by broad sector, 1974-2025
GWh
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
-
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
Calendar years
Commercial
Agriculture, industry and transport
Residential
Total net consumption
46% of total
35% of total

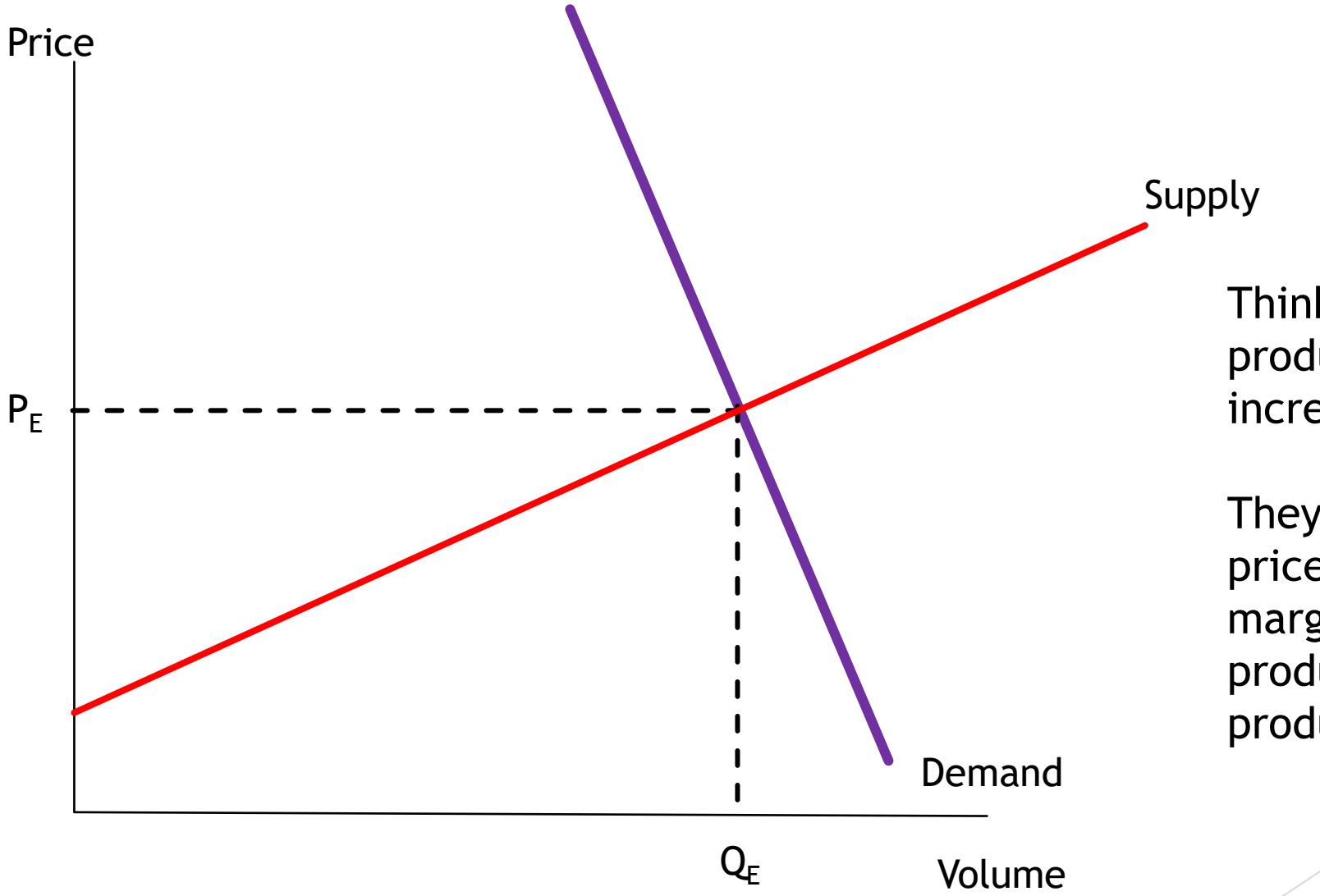

Revenue by sector
$ million in 2025 dollars
12,000
10,000
8,000
6,000
4,000
2,000
0
Commercial
Industrial
Residential energy charges
Residential lines charges
Residential
39% of total
48% of total
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025

Crown cash receipts from gentailers and Transpower 1988-2025



2. Basic economic theory: how to read supply and demand curves

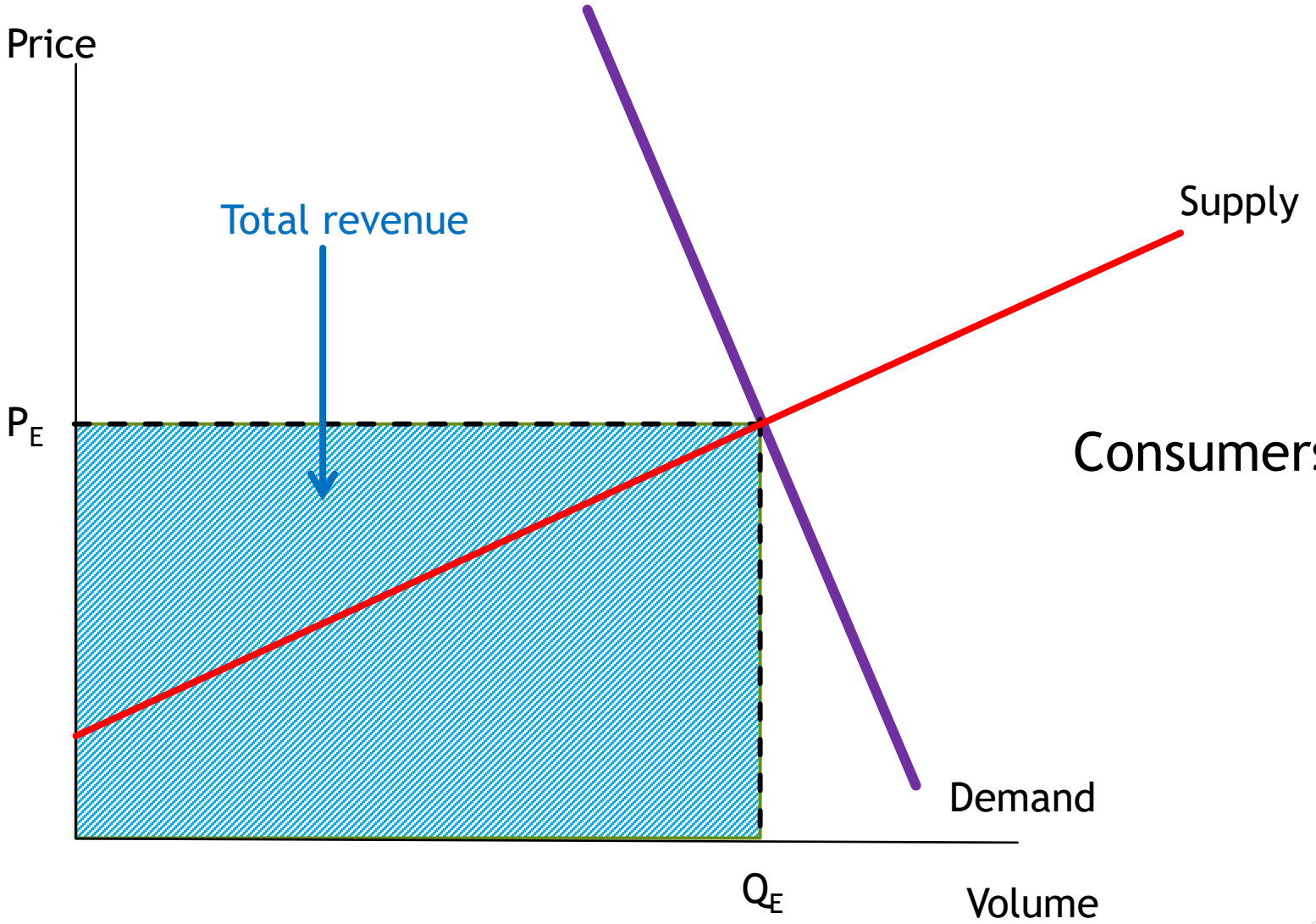
Supply and demand in a textbook competitive market



Think of supply as a series of producers ranked in order of increasing supply cost

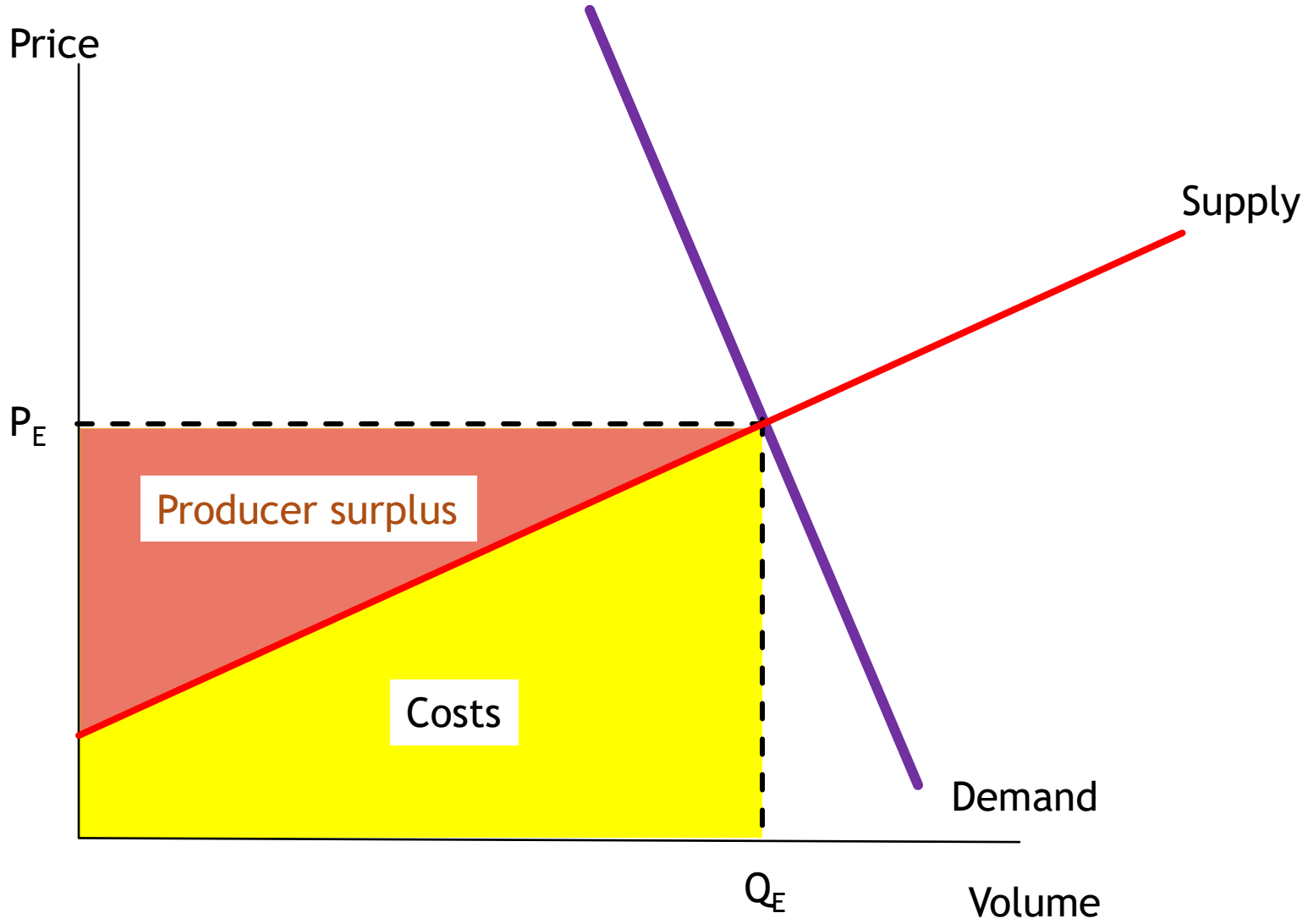
They all get the same competitive price p_E which is set "at the margin" by the highest-cost producer who is able to sell their product

Supply and demand in a textbook competitive market



Consumers pay a total of P_E x Q_E

Revenue has two components

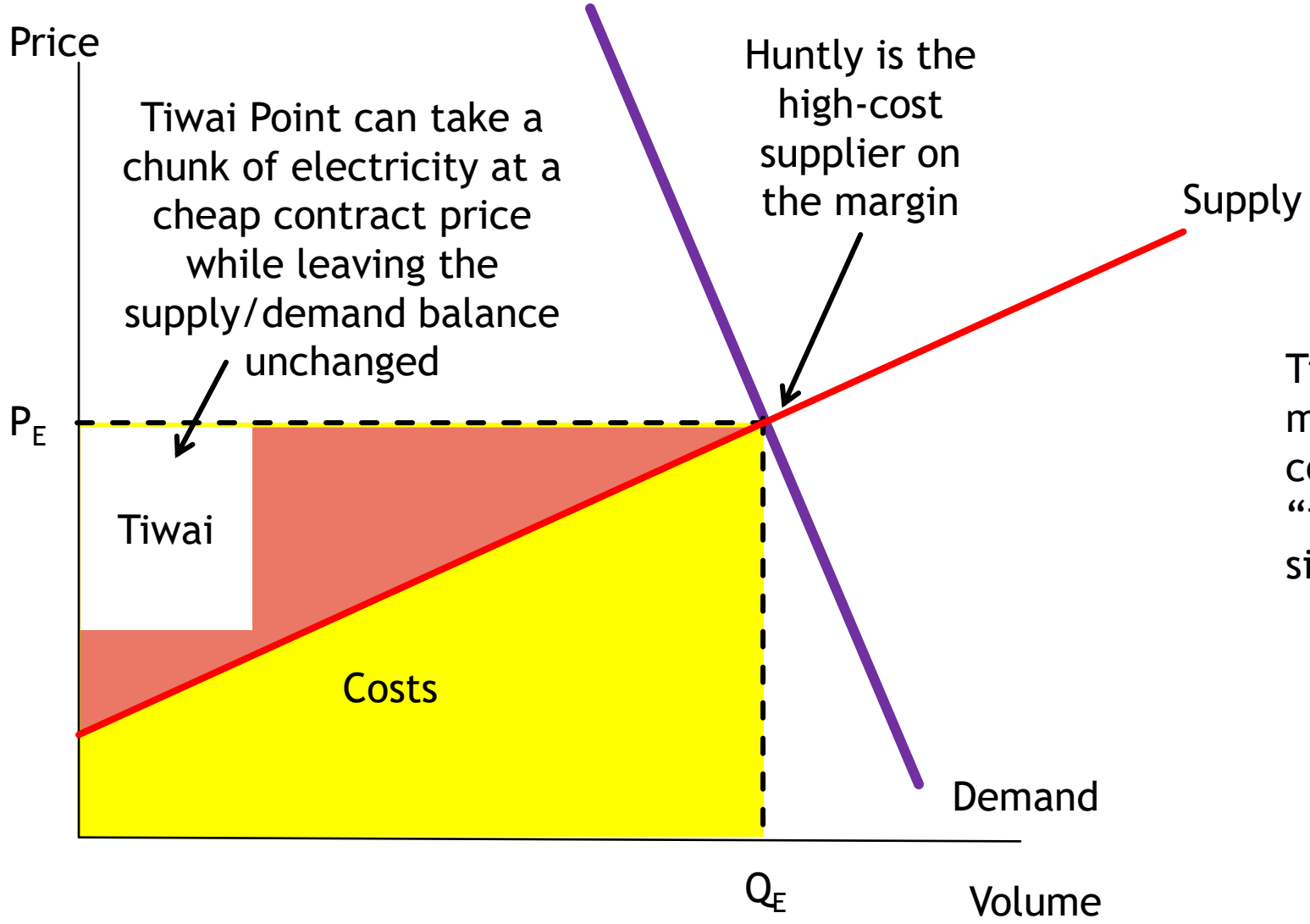


The lowest-cost suppliers get the biggest surplus

When their cost advantage is only temporary this is called “quasi-rent”

When the cost advantage is permanent, that surplus is rent

Simple supply-demand model applied to New Zealand electricity generation



Tiwai illustrates how the market equilibrium can be consistent with "inframarginal" contractual side-deals

A chart from my 1988 chapter in the Royal Commission on Social Policy's *April Report*

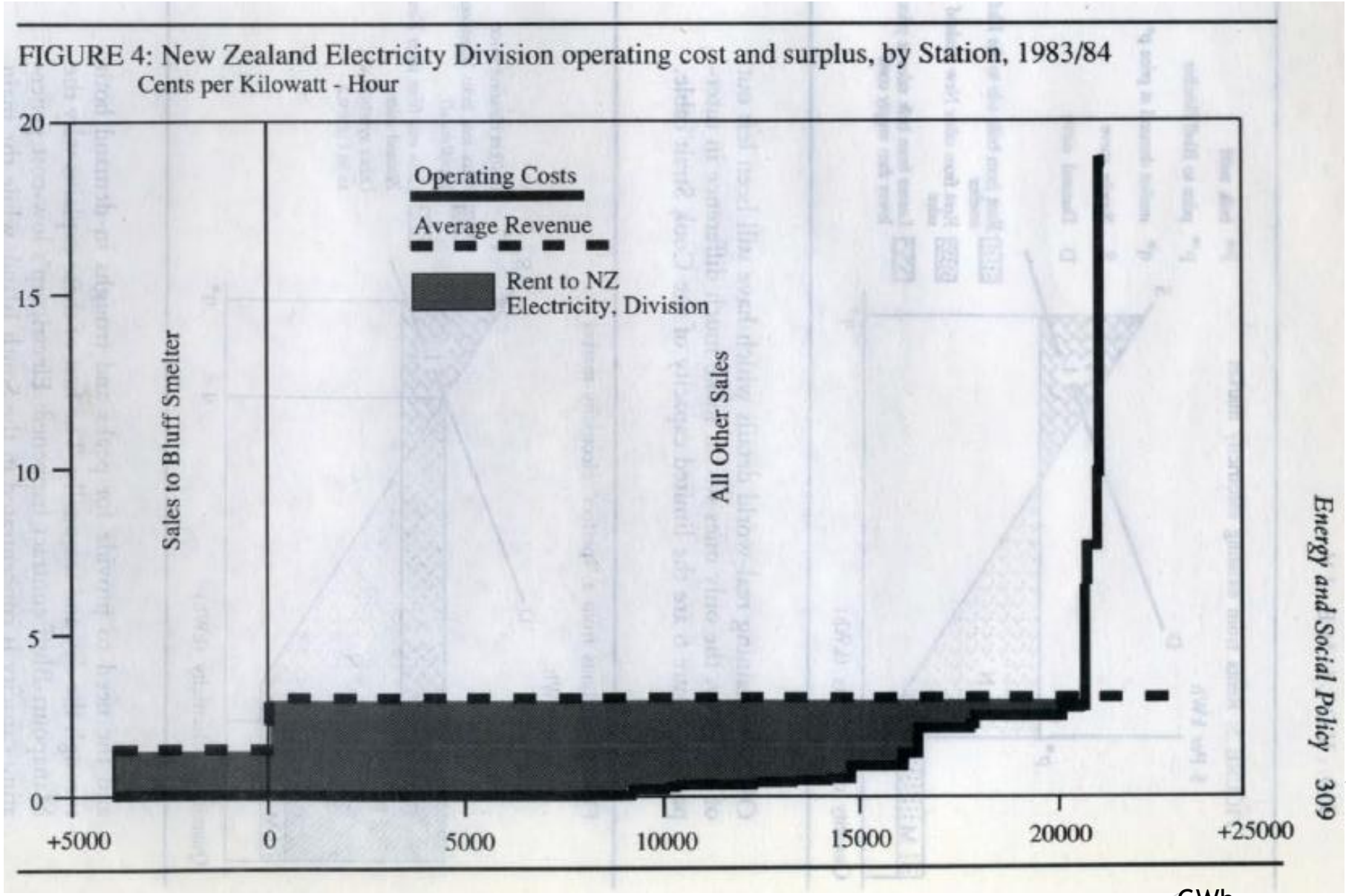
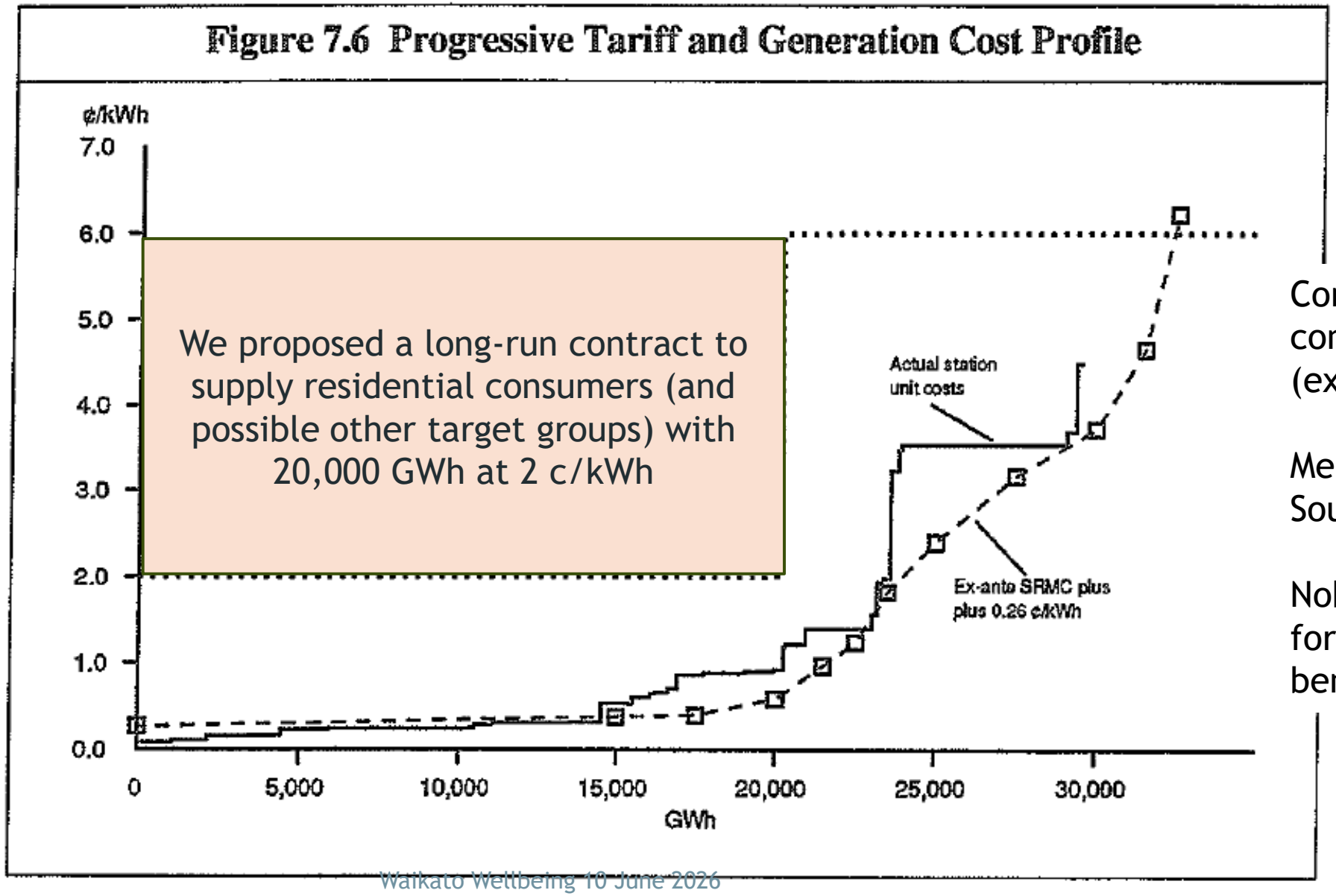


Chart from our 1992 paper *Hydro New Zealand: Providing for progressive pricing*



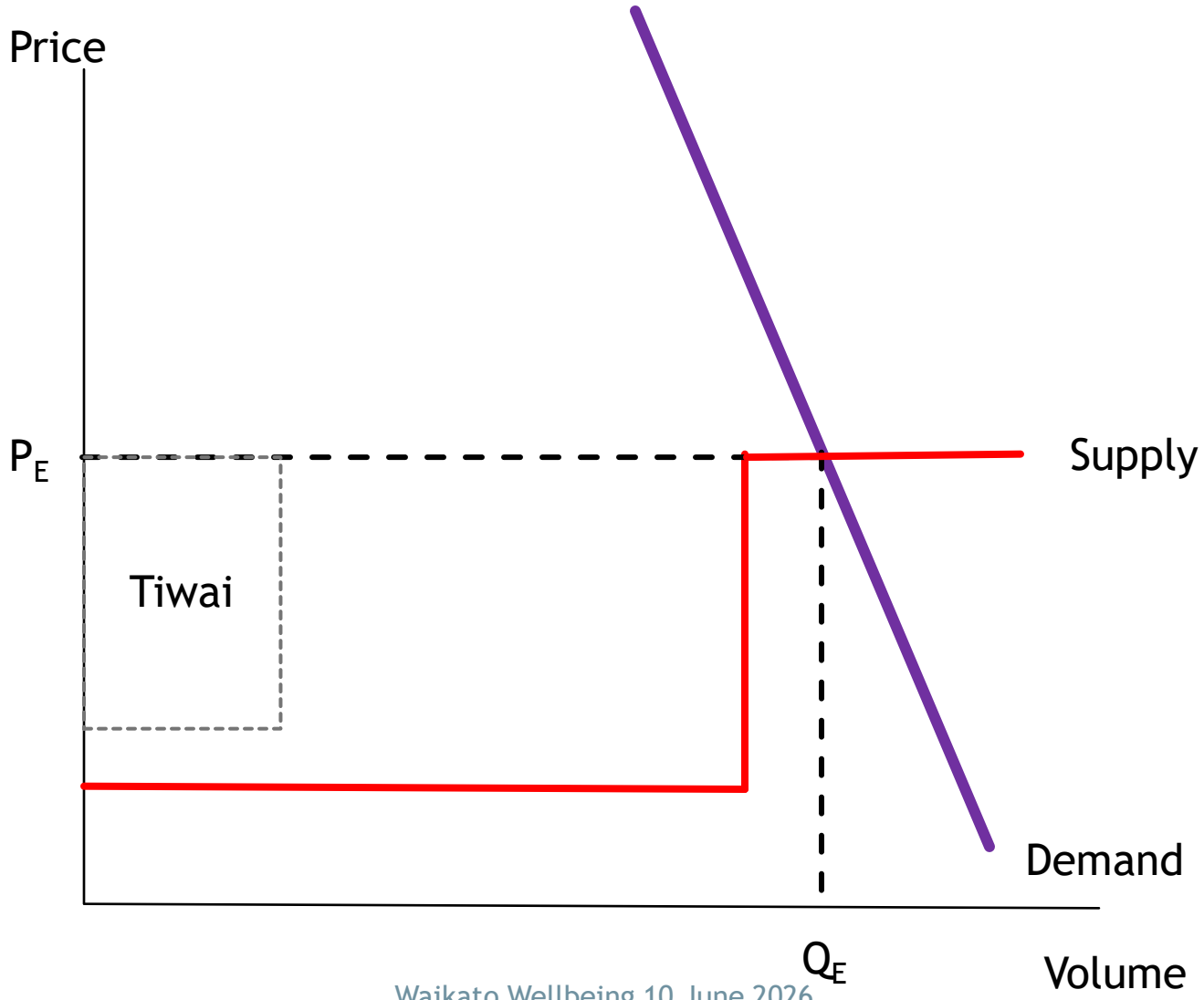
Contact is now entering a new contract with Tiwai Point (extra potline)

Meridian is contracting with a Southland data centre project

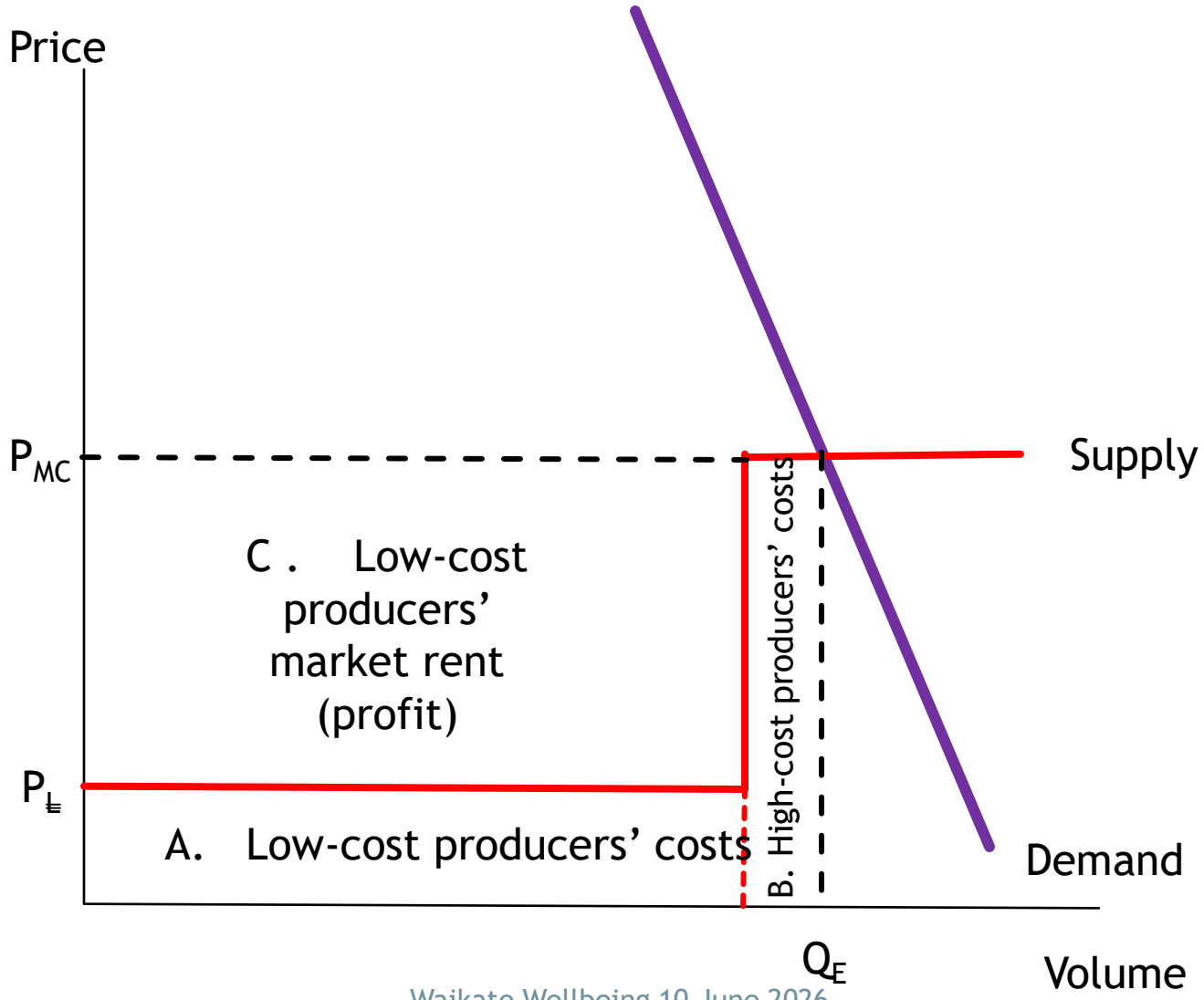
Nobody is proposing a contract for residential consumers' benefit

3. A simple supply-demand model of the current wholesale market set-up

NZ wholesale electricity market



Elements of the supply/demand diagram



- The total cost of supplying quantity Q_E is (A + B)
- The total revenue from selling this quantity at the marginal-cost price P_{MC} is (A + B + C)
- Area C is rent collected by the owners of the low cost plant
- So which is the "true cost" - (A+B) or (A+B+C)?

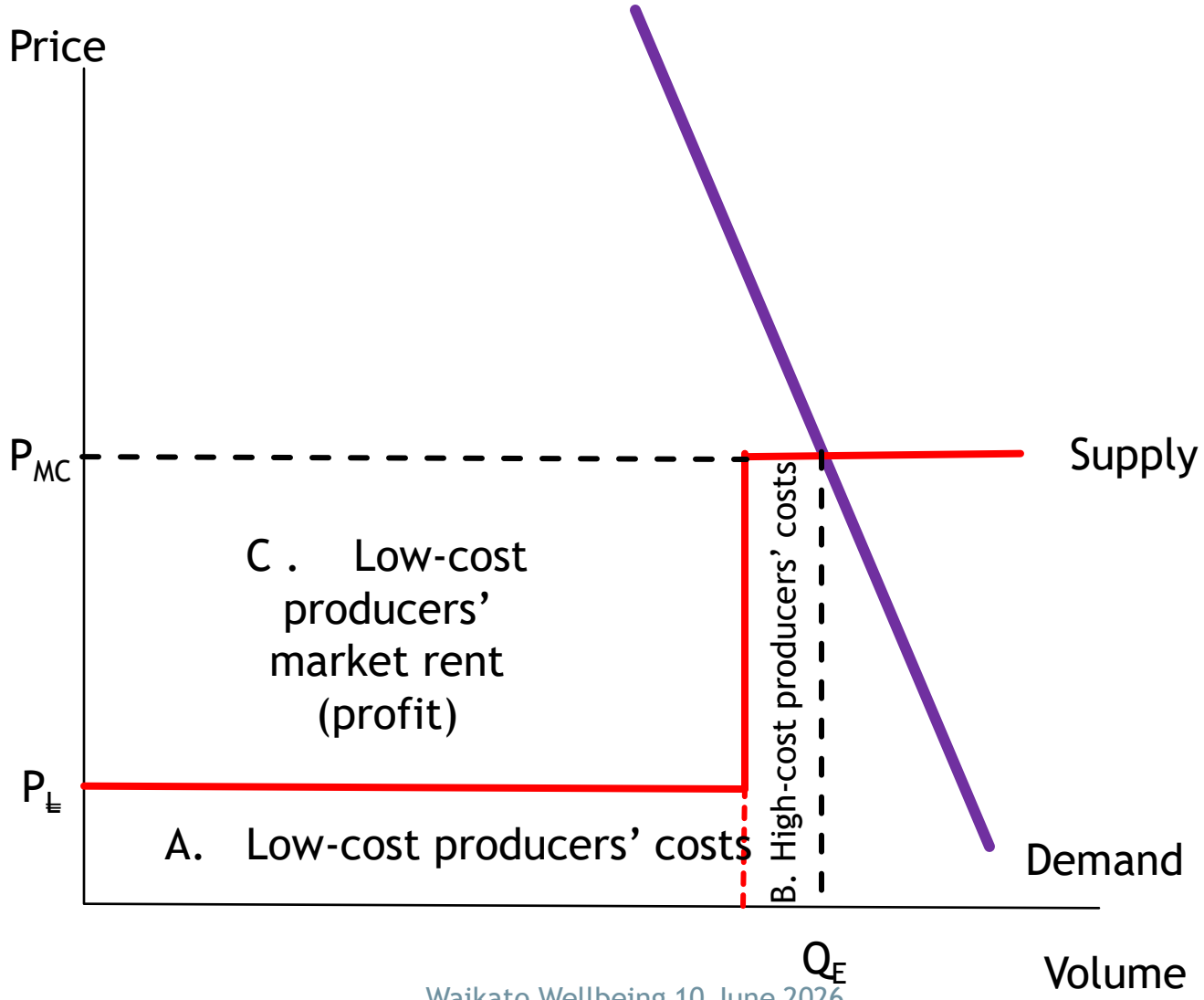
Marginal-cost pricing (Treasury)

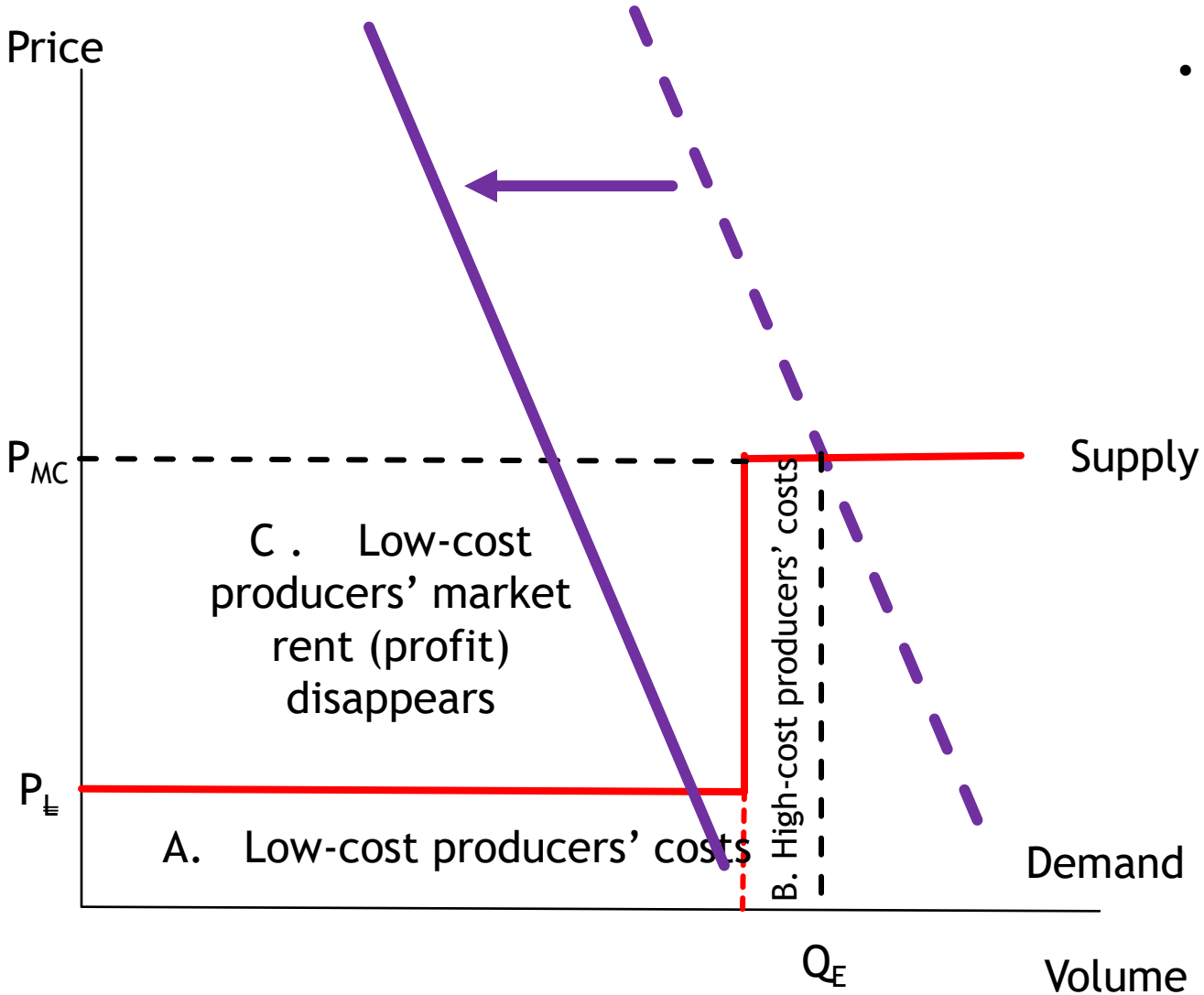
Less happy consumers

Average-cost pricing (NZED)

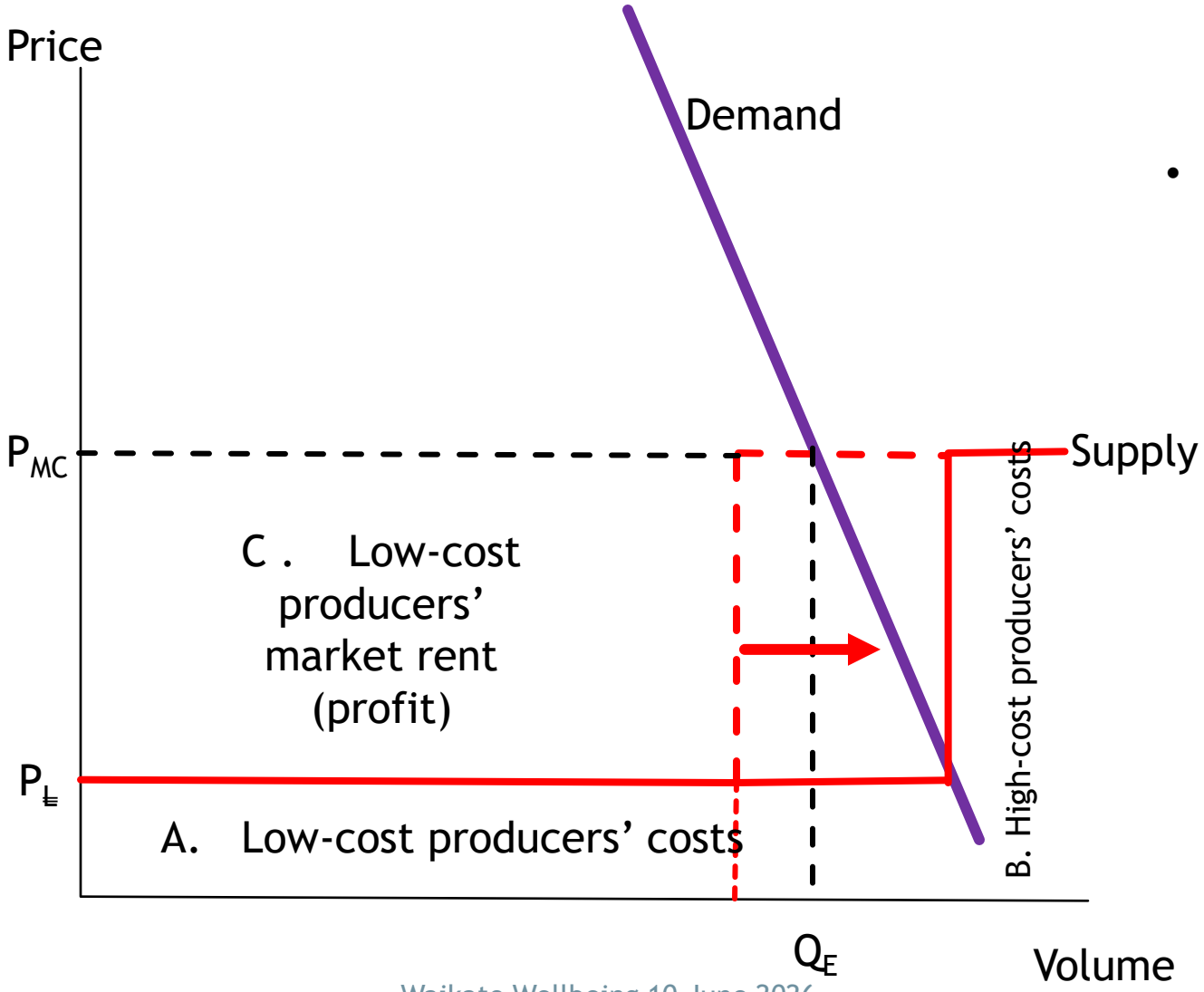
Happier consumers

- Those big profits C rely entirely on having high-cost supply at the margin





- Those big profits C rely entirely on having high-cost supply at the margin
- Shift the demand curve left (e.g. close the Tiwai Point smelter) and the price drops radically to P_L – and so do profits



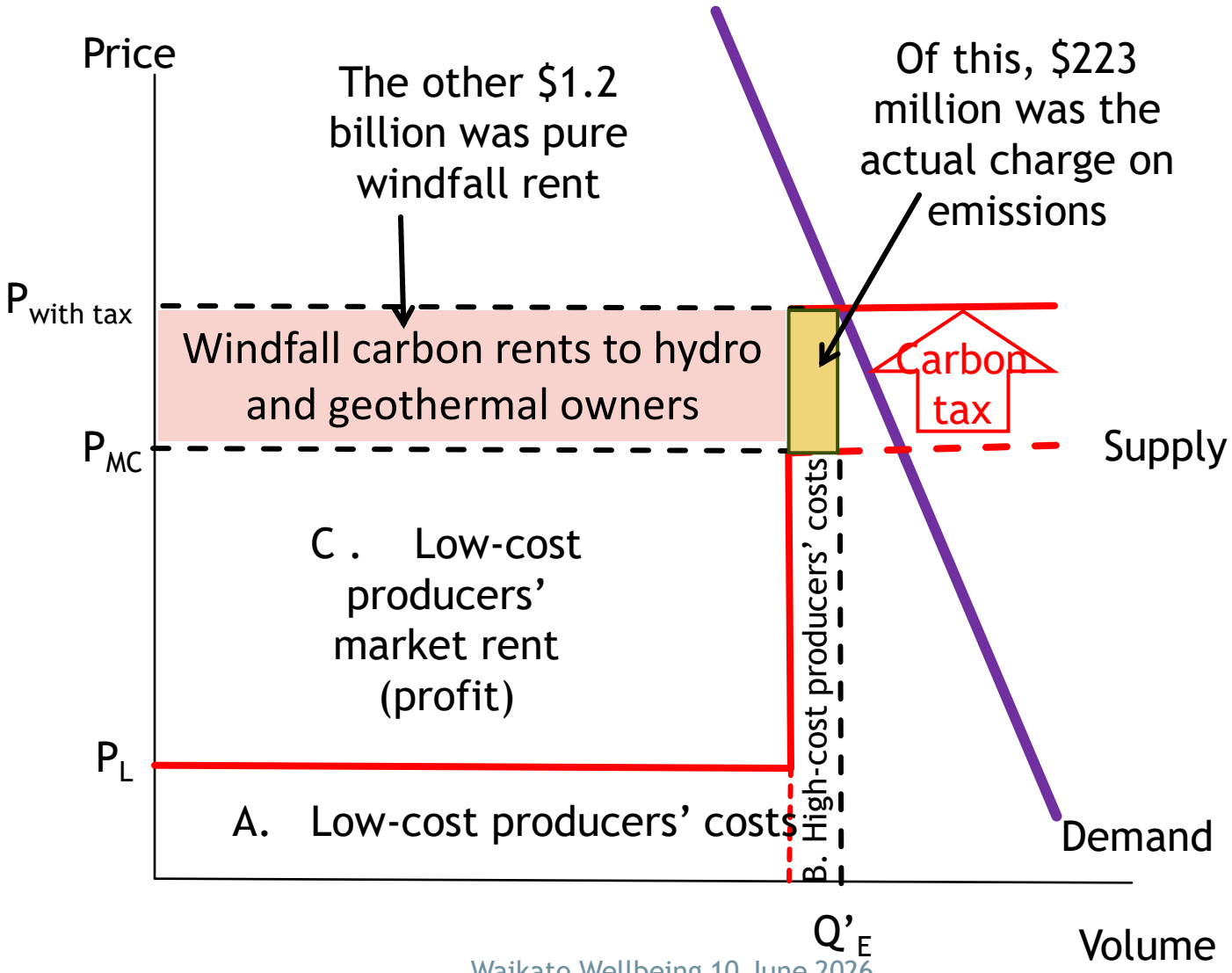
- Add more low-cost supply WITH NO INCREASE IN DEMAND, pushing the high-cost suppliers out (off the margin) and the price drops radically – and so do profits
- Core strategy for Contact, Meridian, Mercury and Genesis is:

Keep demand up (keep the Tiwai Point smelter open and look for more big contract buyers)

Keep supply constrained (don't build too many windfarms, and block rooftop solar if possible)

Now, another wrinkle: carbon rents from NZETS

Frontier Economics' 2025 report estimated total 2024 NZETS cost to consumers was nearly $1.5 billion



Huntly has to pay NZETS costs on its fossil-fuelled generation

Which pushes the price up

and the quantity down a bit

Implication: up to $1 billion (about 10%) of the total amount consumers pay for electricity could be knocked off the total by

i. Taking Huntly out of the market into a stand-alone company providing firming service (Frontier's suggested solution)

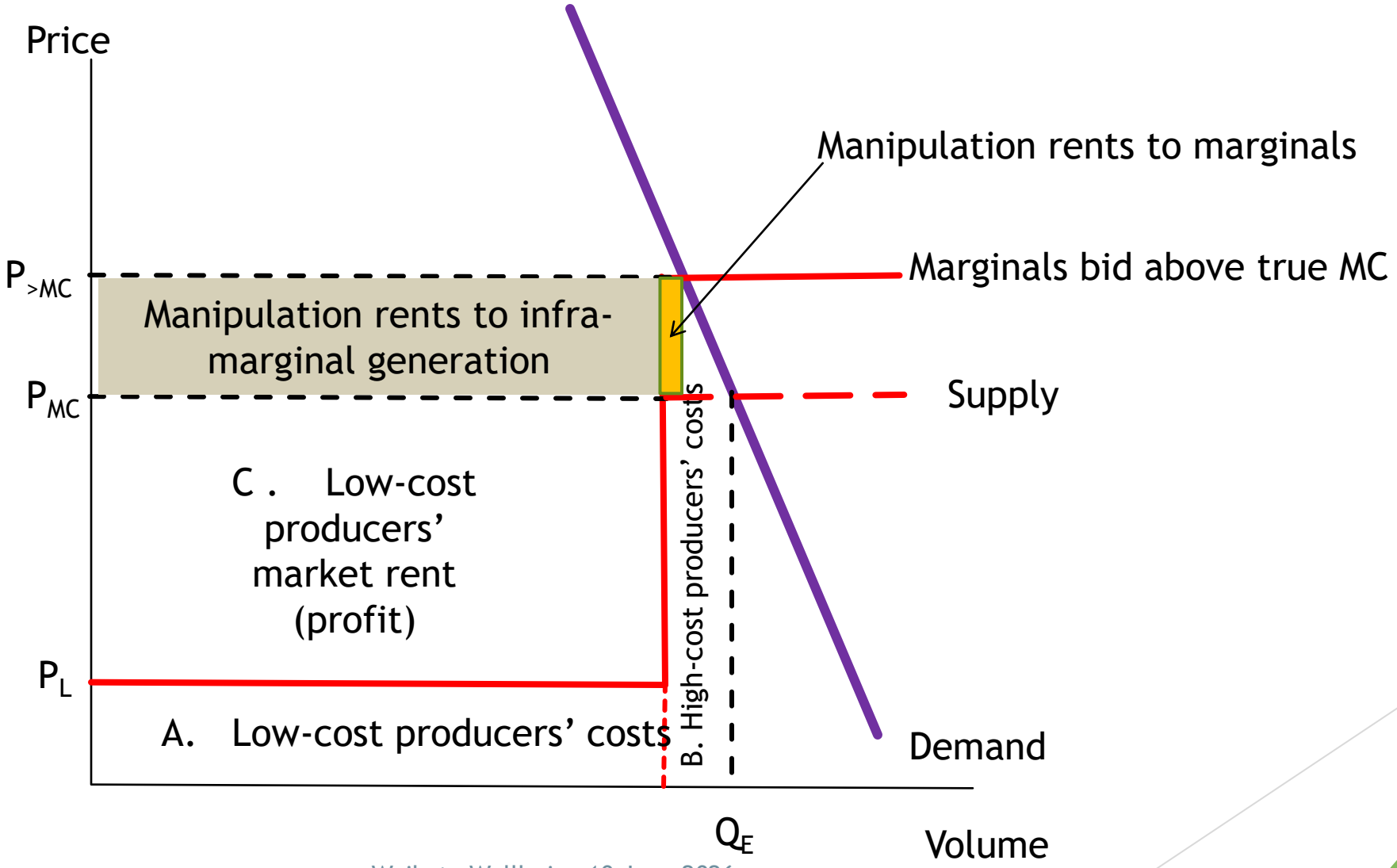
ii. Exempting electricity from the NZETS altogether (like agriculture)(Frontier hinted at this)

iii. Installing enough renewables to push Huntly off the margin

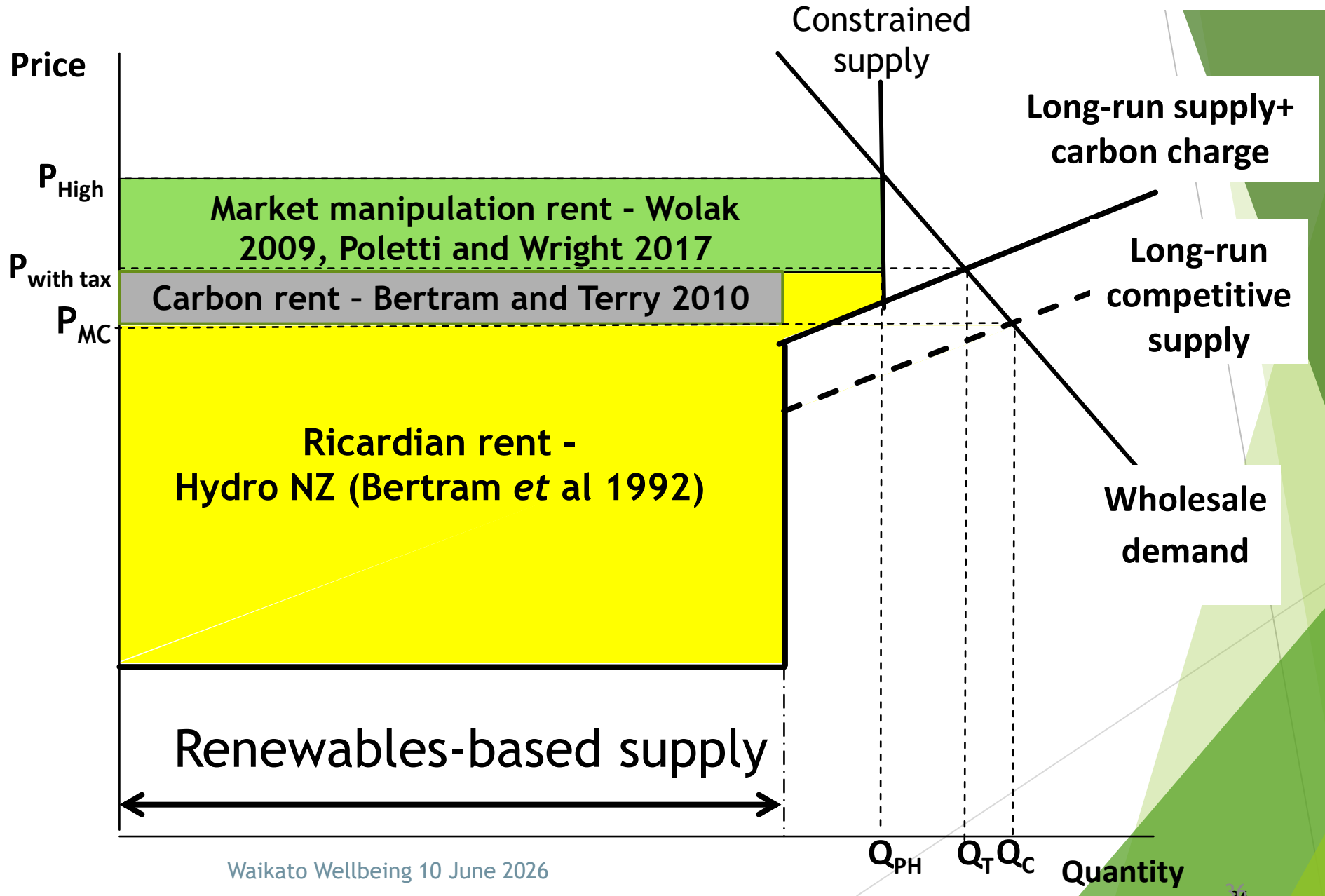
iv. Levying a windfall profit tax on hydro and geothermal owners to claw back the money, and paying it out as a rebate to consumers

v. Other ideas?

Then there's market manipulation rents (Wolak, Poletti). At certain times of scarcity, the marginals bid above their actual marginal cost:

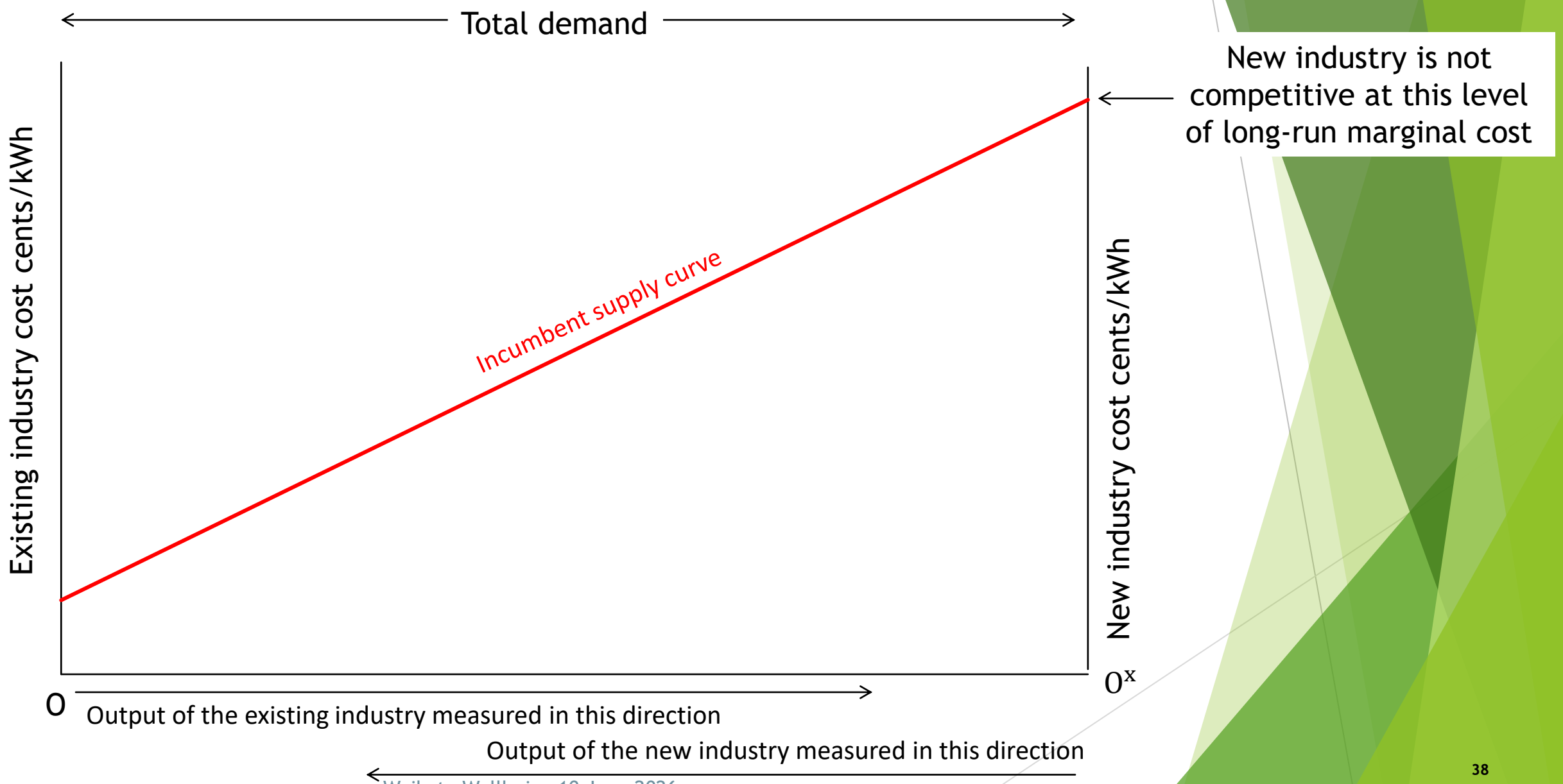


Summing up the three categories of generation rents:

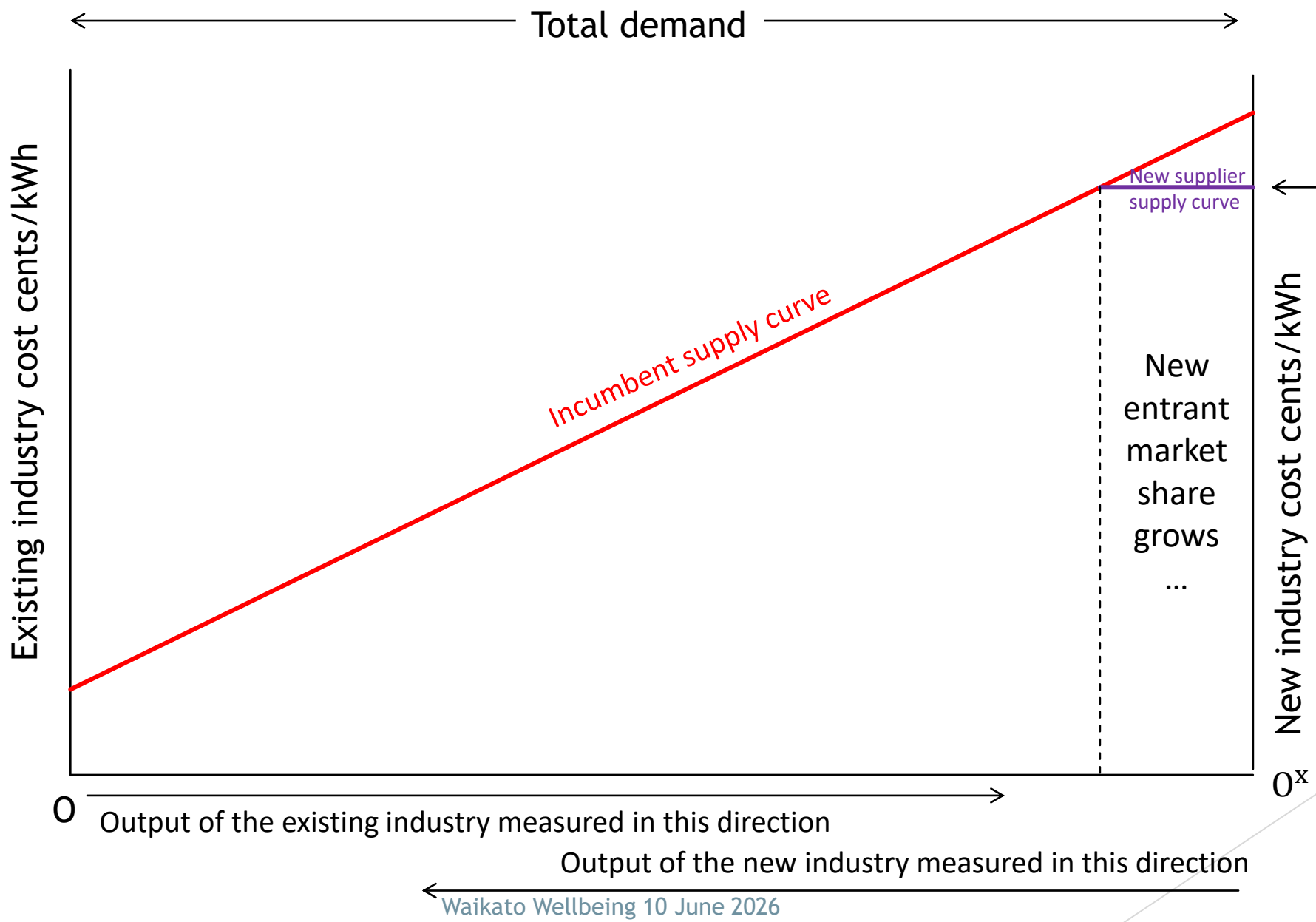


4. Thinking about competition for the market versus an all-encompassing cartel: where do distributed renewables and batteries fit in?

Competition for the market as a competing supplier's costs come down

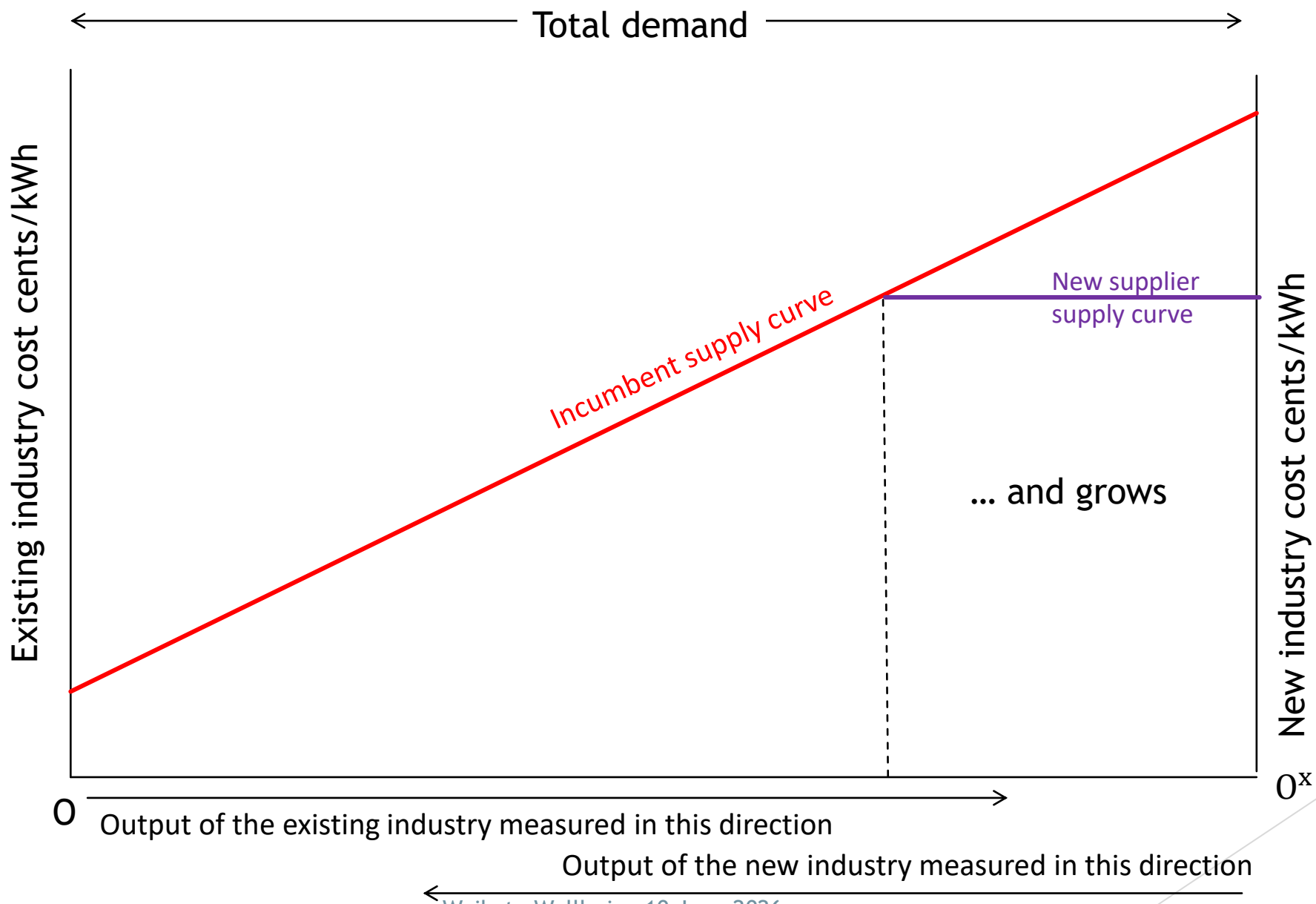


Competition for the market as a competing supplier's costs come down



New industry is competitive at this level of cost

Competition for the market as a competing supplier's costs come down



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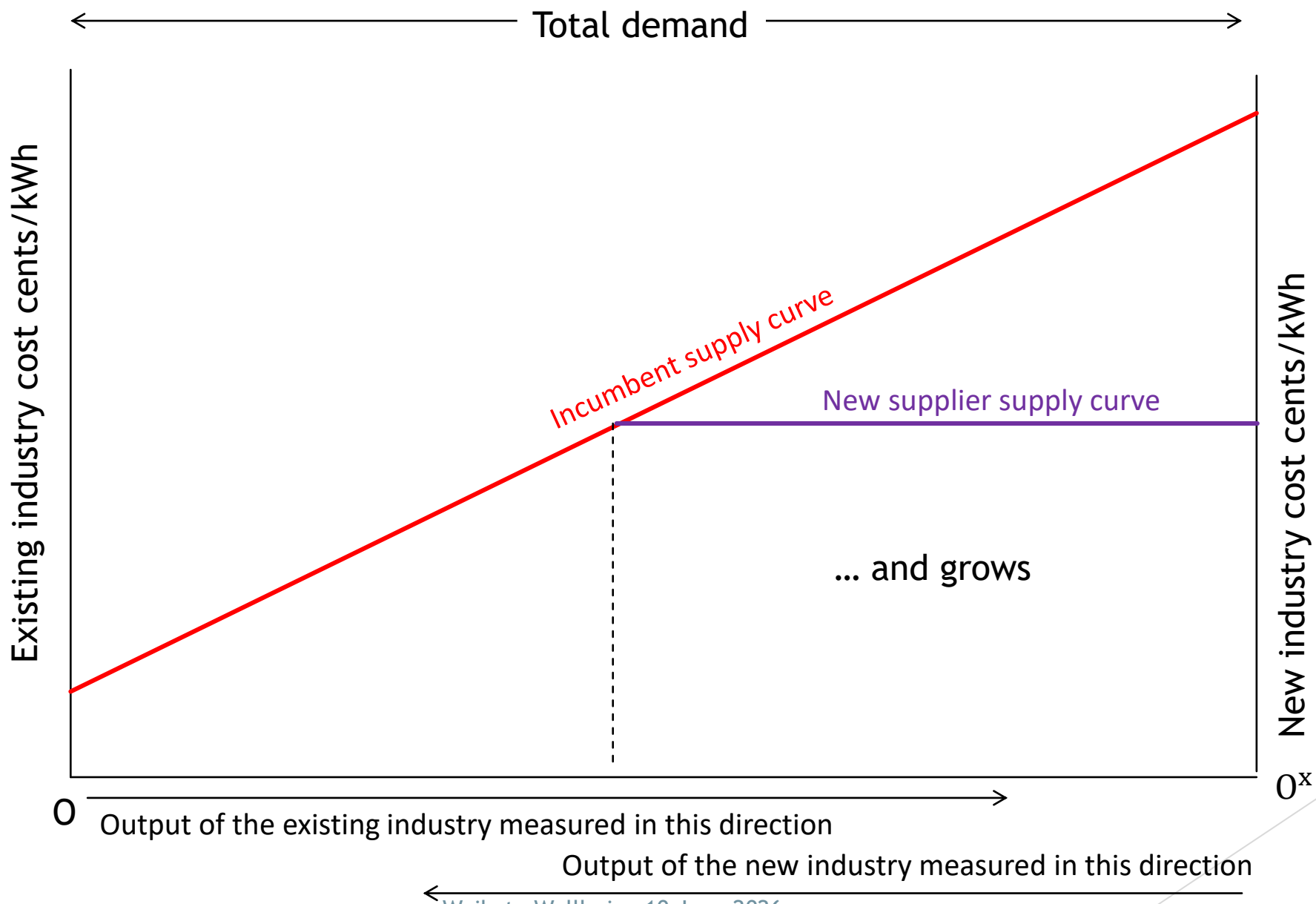

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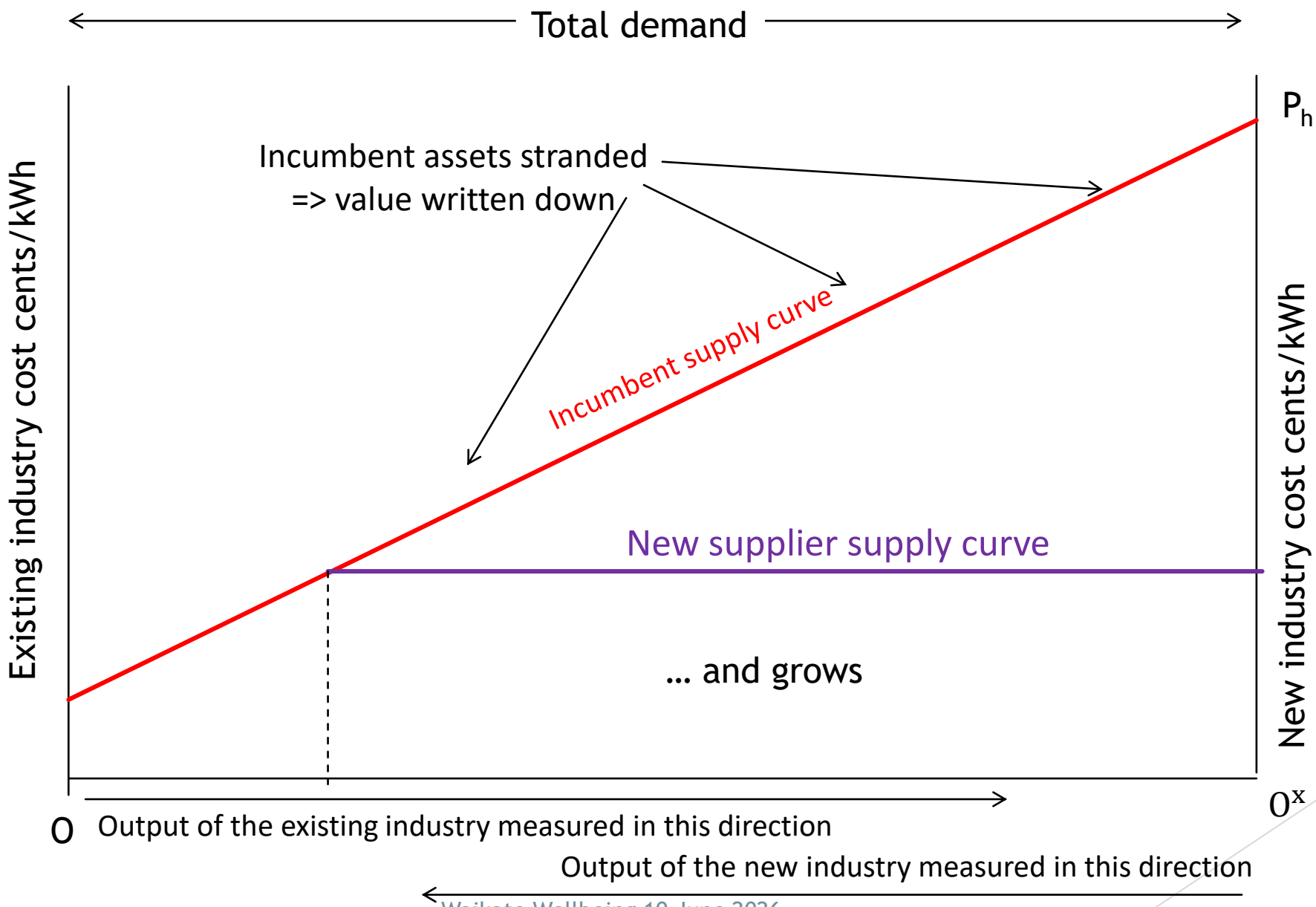
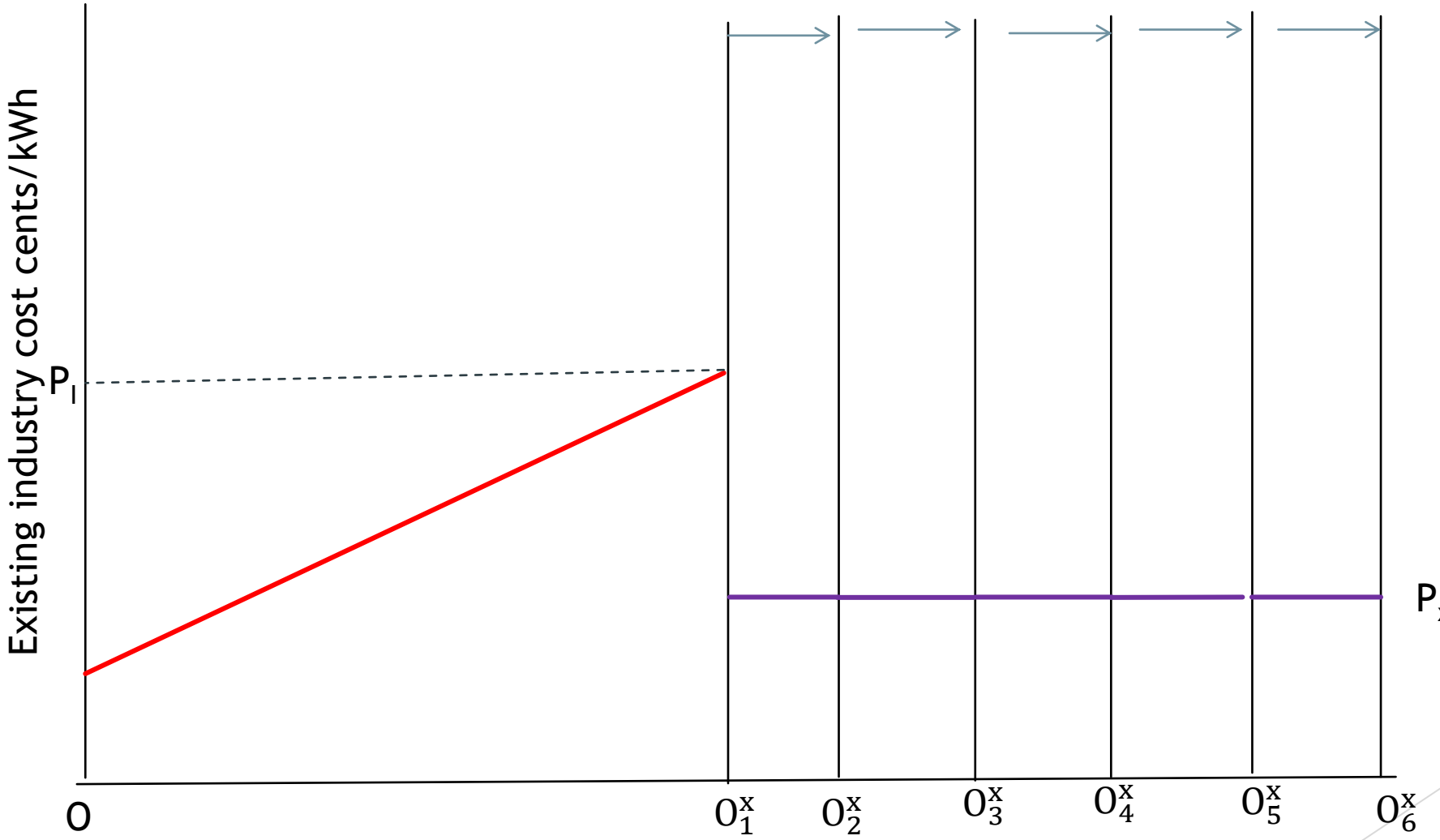


Crucial point here: the price comes down only because the new entrant is outside the incumbent supply curve and so captures market share

Of course, if demand expands as fast as new supply enters, then the game changes (next slide)

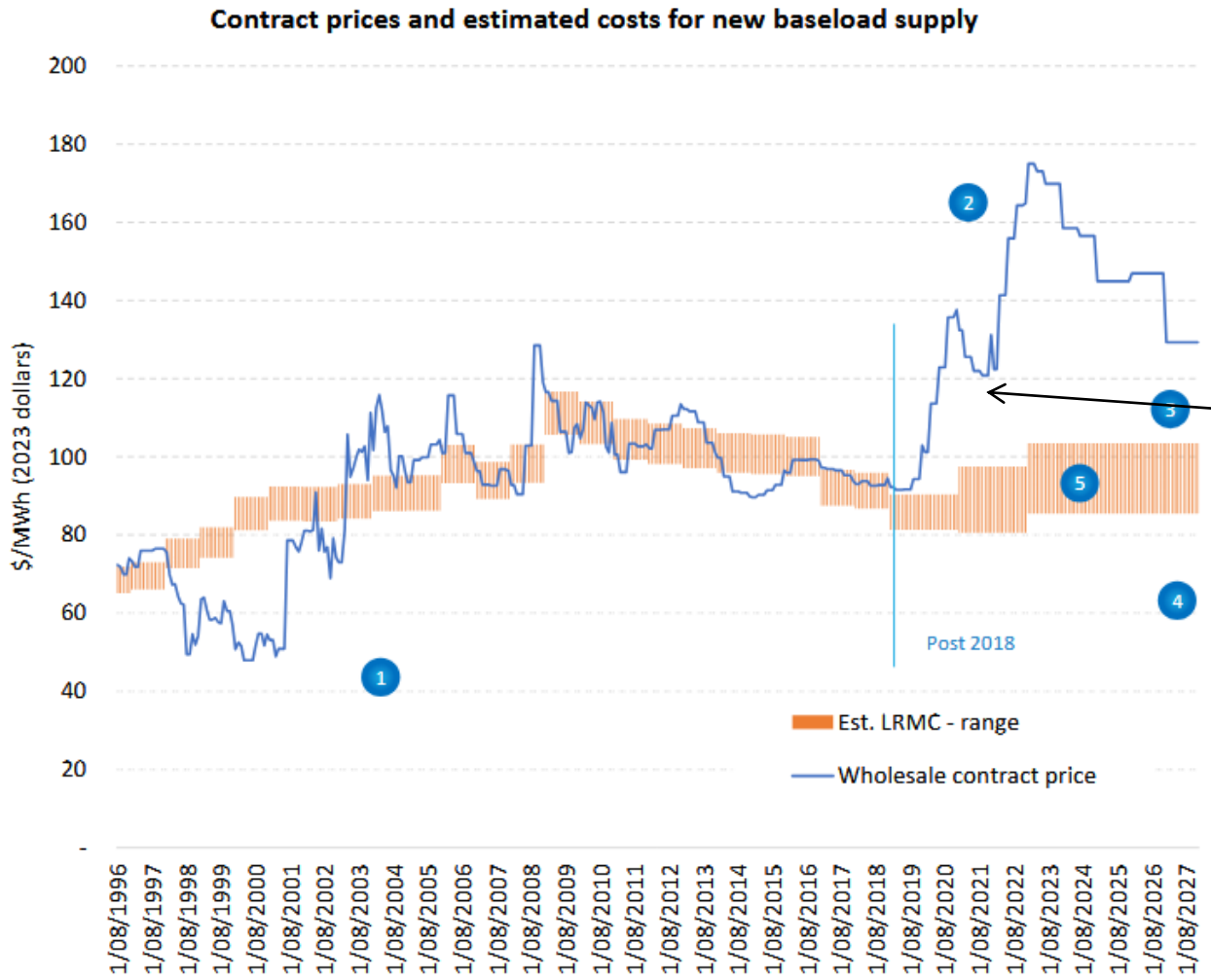
If demand expands as fast as the new outside supply then the incumbent firms can preserve their shareholder value while losing market share – but this requires either segmenting the market or taking control of the outside supply to bring it in-house



Here's the segmented market model, where a lot of prosumers go off-grid and get power at P_x while existing grid-connected customers continue to pay P_I (or contract discounts off P_I)

If Long Run Marginal Cost is increasing, then increased demand means higher price over time, so low-cost suppliers' high profits are secure…

.. but if Long Run Marginal Cost is <u>below</u> the prevailing price then the profits of incumbent producers are threatened



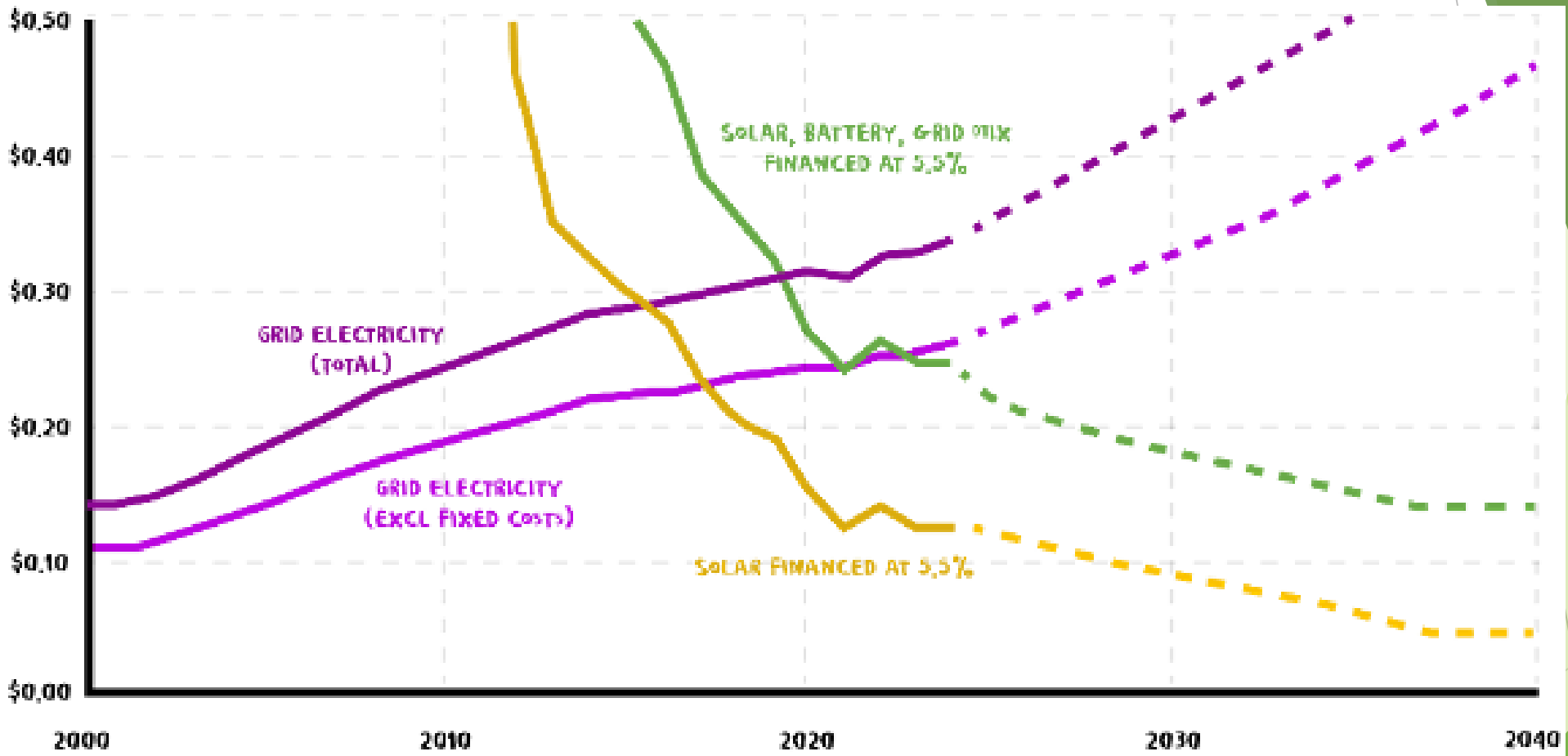
From 2018 on the gentailers were pricing supply contracts way above LRMC

Concept Consulting chart at 2023 from https://www.ea.govt.nz/documents/4414/Generation_Investment_Survey_-_2023_update.pdf

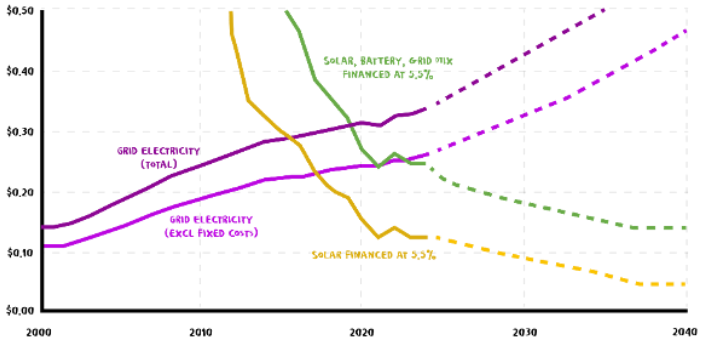
Notes

- Pre-2019 data is from Electricity Price Review Technical Paper – see www.mbie.govt.nz/dmsdocument/4334-electricity-price-review-first-report-technical-paper
- Contract prices post 2019 are for futures contracts quoted on ASX. Excludes data for contracts trading within one year of commence (to exclude hydrology influences). Data are deflated using CPI, with inflation for future years from Treasury forecasts.
- Estimated costs for new baseload supply post-2019 are derived by Concept from multiple sources. See other slides.

Solar versus grid electricity cost trends over time



Source: Mike Casey of Rewiring NZ, *Newsroom* 4 February 2026



The technological frontier is closing in on the New Zealand electricity cartel of gentailers, and big lines companies.

The cost of solar panels and batteries has now crashed to the point where it is cheaper (in an economic sense) to go off-grid than to pay the prices now being charged for grid-supplied power.

That chart is an example of what economists call “competition for the market”, as distinct from competition within a market.

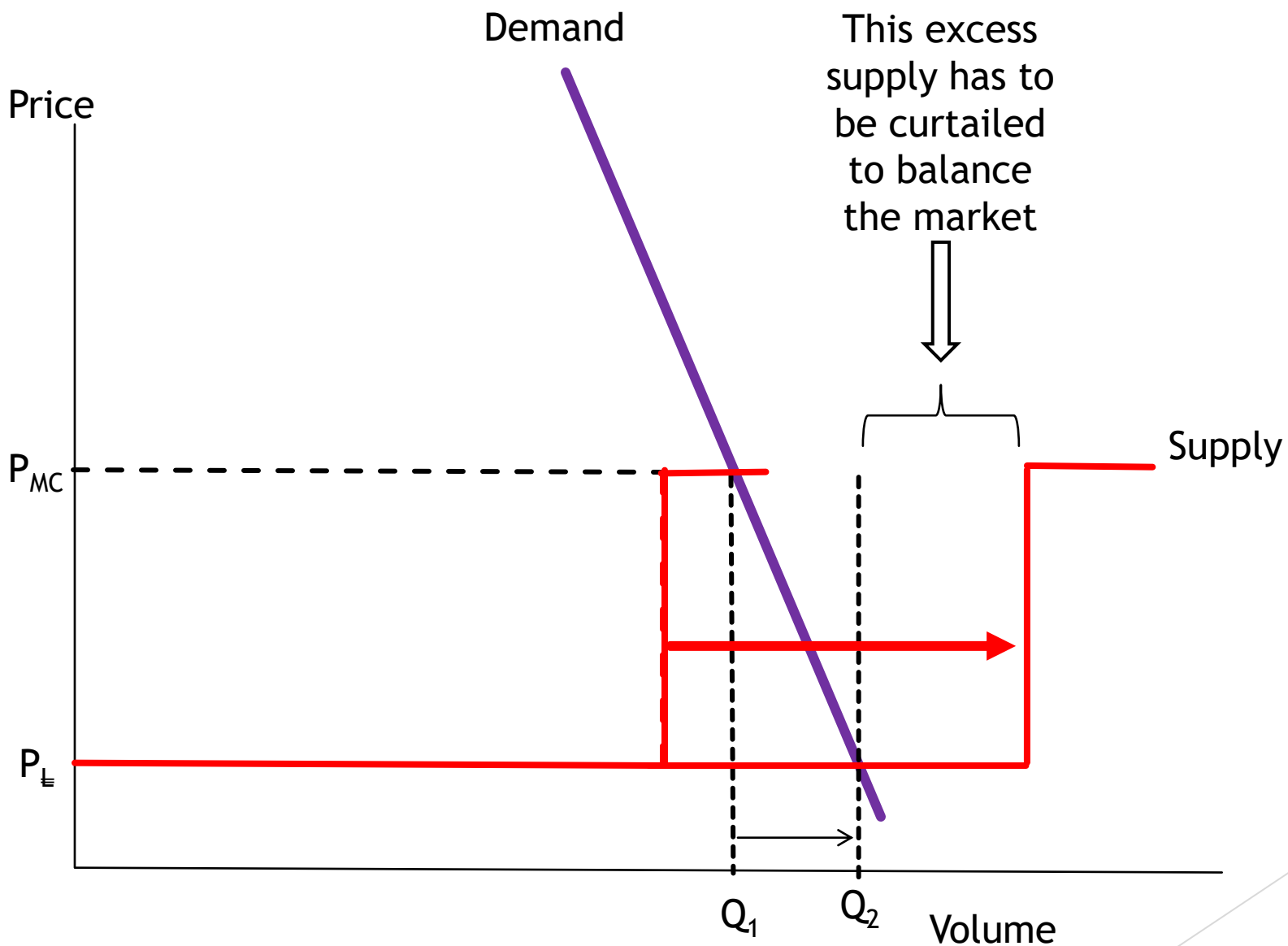
The big threat to the profits of the gentailers and Transpower and the big corporate owners of distribution networks is coming not from competition amongst them, but from the competitive challenge of a completely new source of supply: distributed (decentralised) solar panels, wind turbines, and batteries.

The threat from rooftop and farm-level solar today is like the threat that cellphones presented to Telecom two decades ago. The opposition from the existing industry players, supported by the Government and the so-called “regulators”, is just as implacable – and ultimately just as doomed

The new technologies open up a wide range of new options for consumers both individually and as local collectives

- Essentially, in the long run each consumer can choose between living off-grid or with grid connection
- To keep grid connection the preferred choice, grid electricity has to be priced competitively and offer added value compared with stand-alone individual or community prosumers
- That cannot be achieved with the present asset valuations of gentailers and Transpower => some mechanism for write-offs is required
- The market will eventually do this – by simply stranding un- or under-utilised assets
- Incumbent industry players will obviously want taxpayers to pick up the cost (the usual socialise-the-losses model after decades of profiteering)
- The politics are not easy!

Suppose entry of distributed renewables is confined within the existing market model



The diagram is effectively averaging over periods of scarcity and abundance, with excess "faceplate" capacity in wind and solar that is fully utilised only part of the time

The rules for who gets curtailed clearly depend on the market structure after entry of distributed renewables

- Transpower and gentailer incumbents assume they get scheduled as usual while the distributed solar and wind get curtailed by the local network operator, under the general heading of “demand management”, directed from the centre by the wholesale system operator and implemented at local level by distribution companies.
- But the heritage hydro assets are the prime potenmtial source of battery-type firming for intermittent distributed renewables => there’s a case for systematically curtailing hydro output when there’s an abundance of sun and wind and giving those renewables first place in the dispatch queue
- We’ve done some modelling of this, looking at physical stocks and flows.

Our modelling exercise

Install enough wind and solar capacity to meet projected demand day by day with

- 100% renewable supply (fossil fuels driven off the margin)
- Reliability: no day of outage even in dry years
- Cost minimising: seek an optimal combination of
  - Capital cost of new renewable capacity
  - Minimal spill (foregone opportunity value) of water, wind and solar potential generation

Simplifying assumption for this stage of modelling: within-day mis-matches between supply and demand are covered by hydro within-day flexibility, plus batteries.

Model set-up

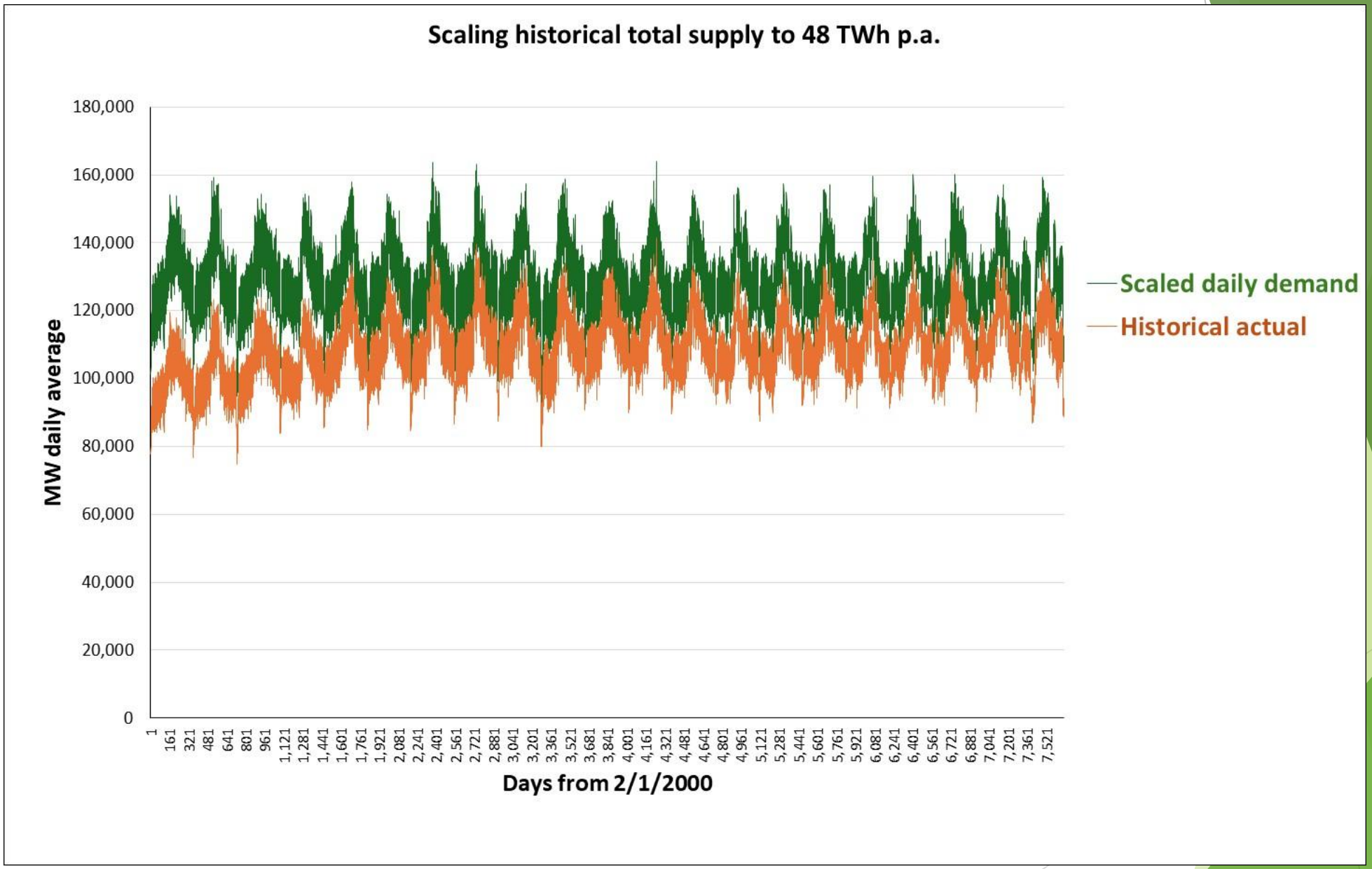
Set annual demand at 48 TWh (the forecast for 2035).

Assemble actual historical New Zealand data on a daily basis 2000-2020 for

- Daily demand: scale the historic daily series up to sum to 48TWh per year
- Hydrology, measured as actual daily output from the legacy hydro system
- Solar and wind capacity factors for each day, derived from hour-by-hour solar capacity factors over a set of New Zealand sites from https://renewables.ninja/
- Geothermal baseload output: actual historical output scaled up to an assumed 1,700MW of capacity

The resulting spreadsheet has 7,670 rows, one for each day 2000-2020

Now build up a generation stack sufficient to have supplied 48TWh p.a. of 100% renewable electricity on every day over that two-decade model period


Scaling historical total supply to 48 TWh p.a.
MW daily average
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1
161
321
481
641
801
961
1,121
1,281
1,441
1,601
1,761
1,921
2,081
2,241
2,401
2,561
2,721
2,881
3,041
3,201
3,361
3,521
3,681
3,841
4,001
4,161
4,321
4,481
4,641
4,801
4,961
5,121
5,281
5,441
5,601
5,761
5,921
6,081
6,241
6,401
6,561
6,721
6,881
7,041
7,201
7,361
7,521
Days from 2/1/2000
Scaled daily demand
Historical actual

Building the generation-fleet stack

Start with existing hydro capacity of 5,400MW, available subject to two constraints:

- Hydro generation may not drop below 800MW, in order to sustain minimum flow levels on the rivers
- Water storage in the lakes at the heads of the rivers has a maximum of 4,500GWh worth of water. If lakes fill beyond this the water is spilled to waste.
- When the lake levels rise above a trigger point, initially set at 3,600GWh, all hydro capacity must be fully utilised to slow down accumulation of water in the lakes

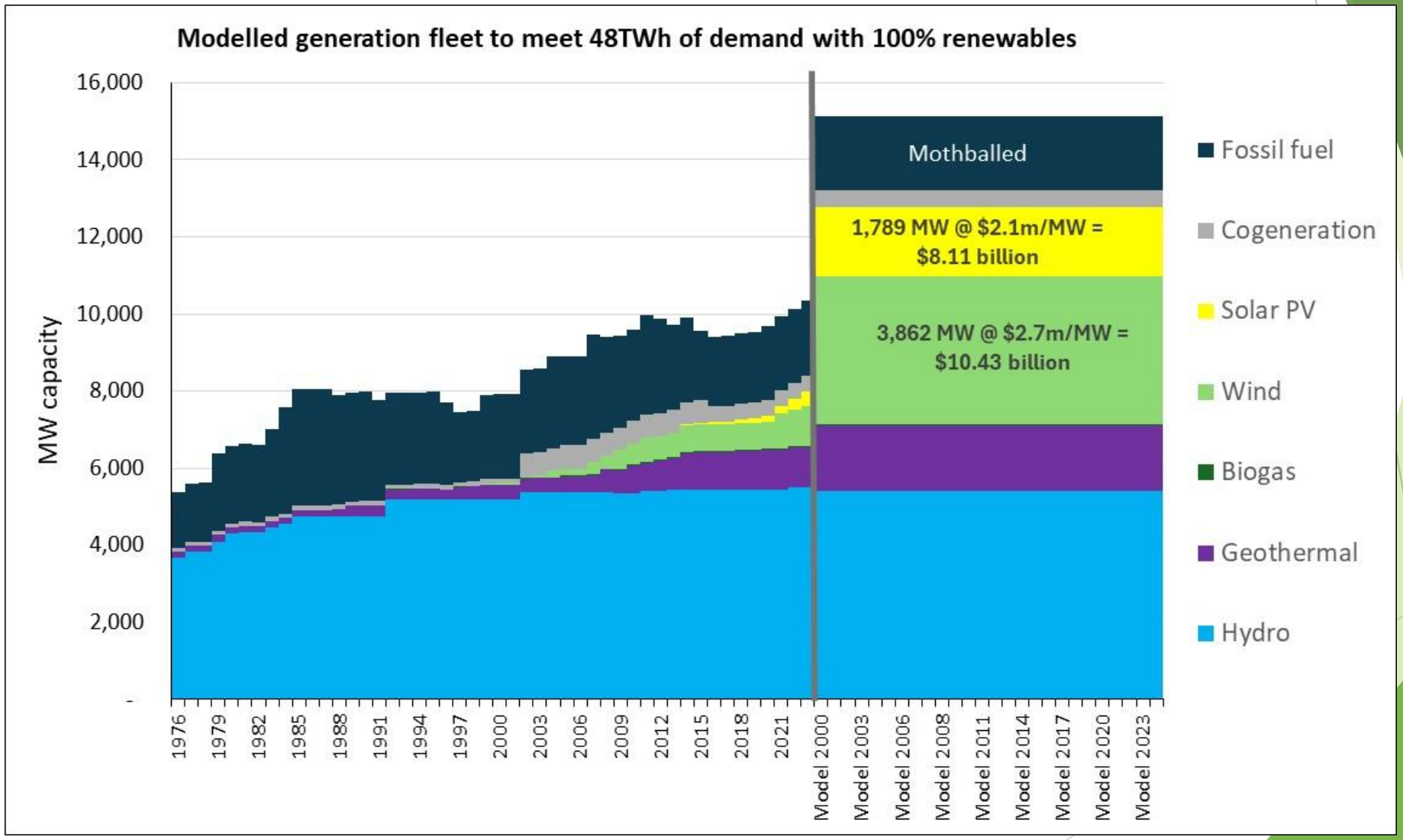
Assume geothermal capacity will have increased to 1,700 MW by 2035 in line with conservative projections for 2035 (hence this is part of the business-as-usual base case)

Asssume biomass capacity remains unchanged with daily output at historical levels

Now add tranches of wind capacity and tranches of solar, operating under the capacity factors from https://renewables.ninja/, until the 100% target is achieved

Example of a model solution for installed capacity

Actual historical data | Model capacity



Hydro re-dispatch

We use the hydro system as a battery backstop to wind and solar

At present the legacy hydro capacity is operated on a profit maximising (and rent-seeking) basis by corporate owners

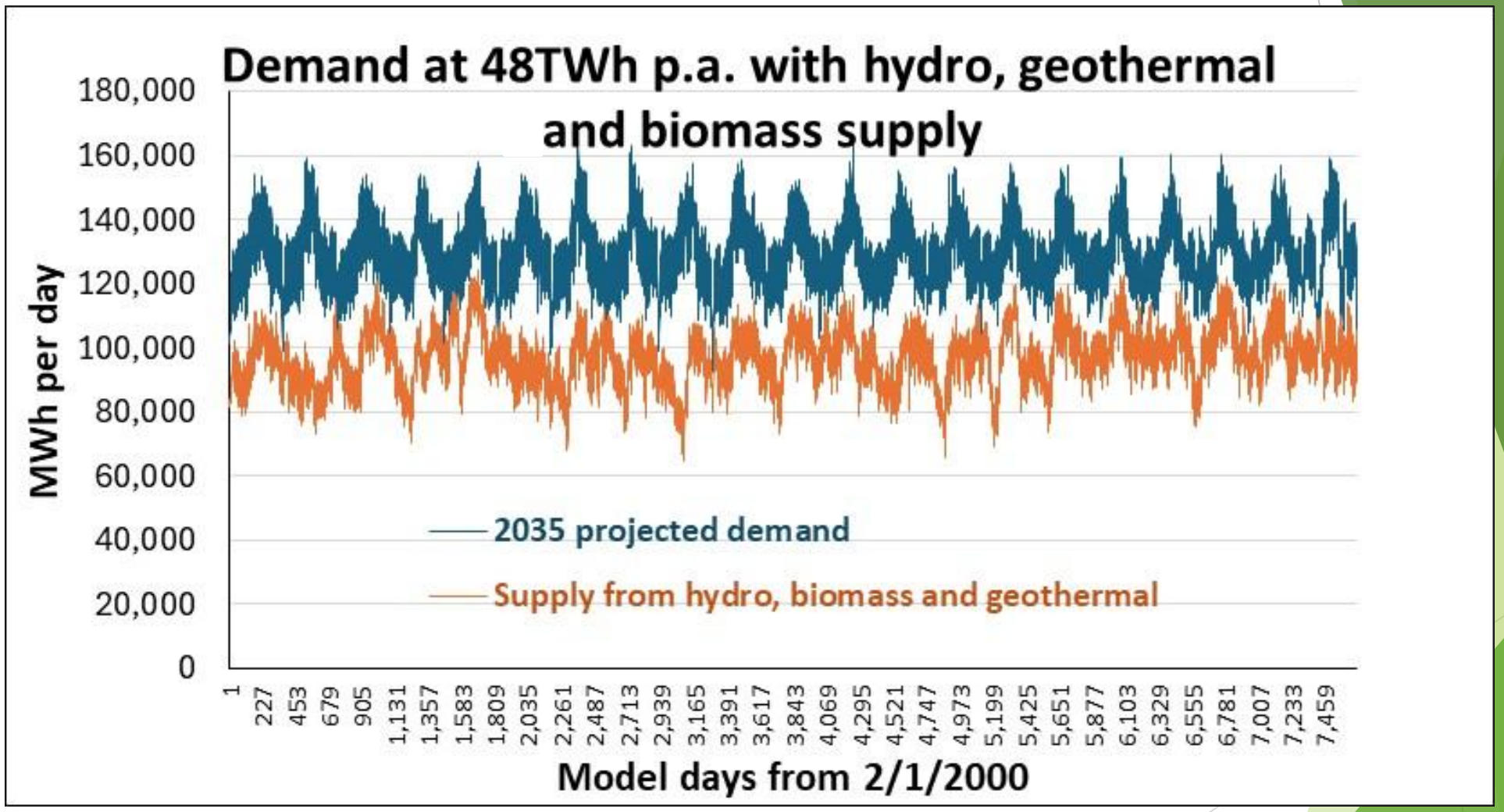
This means its dispatch, done on the basis of actual historical daily output, is not coordinated with the new wind and solar intermittent supply

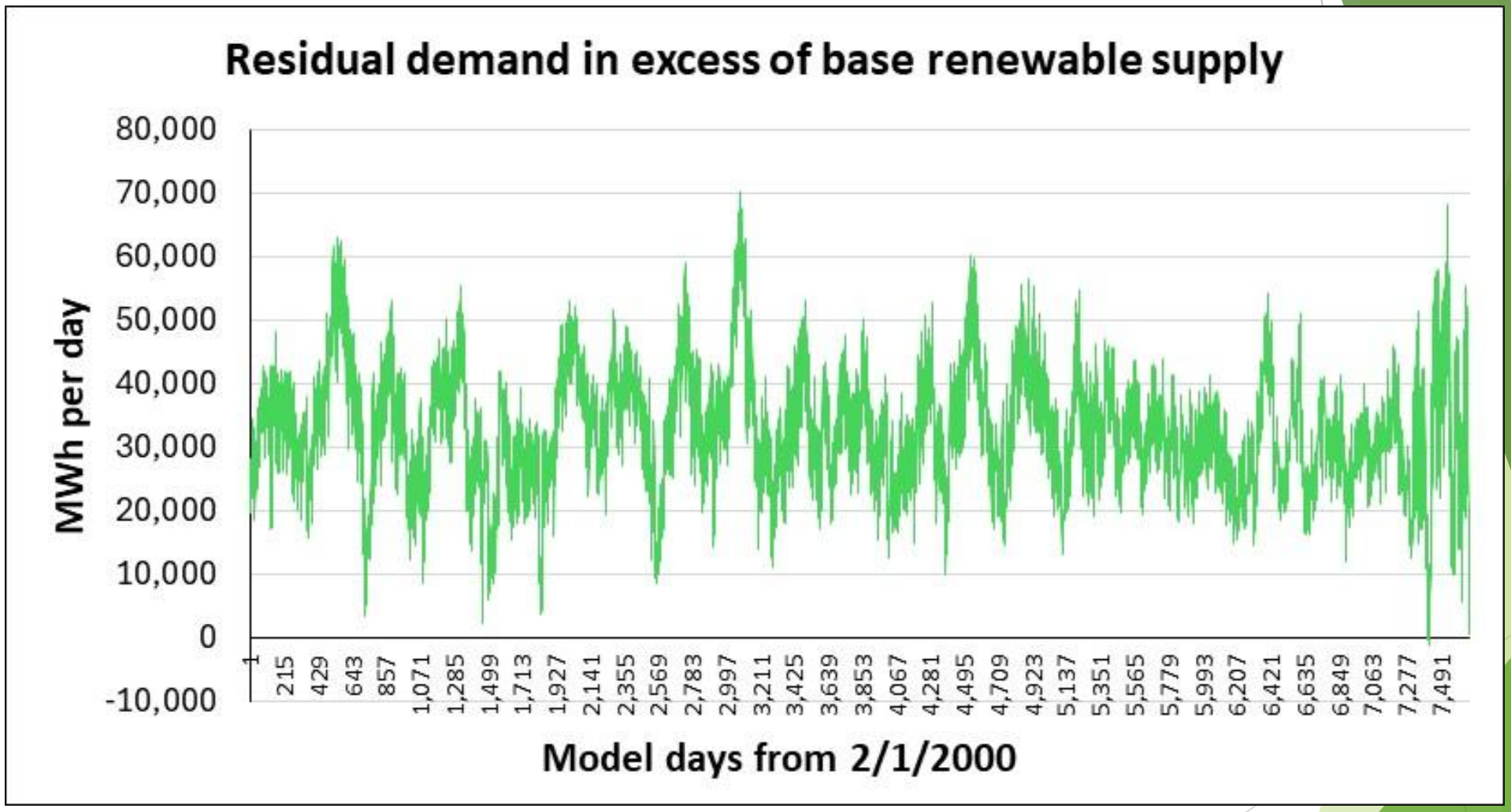
The model therefore re-dispatches hydro capacity, subject to the constraints of rainfall, lake levels and river minimum flows, to counterbalance highs and lows in wind and solar output

Wind, solar and hydro all bid into the wholesale pool at zero, but our model's redispatch procedure gives wind and solar priority, because hydro is the one that has variable storage built in

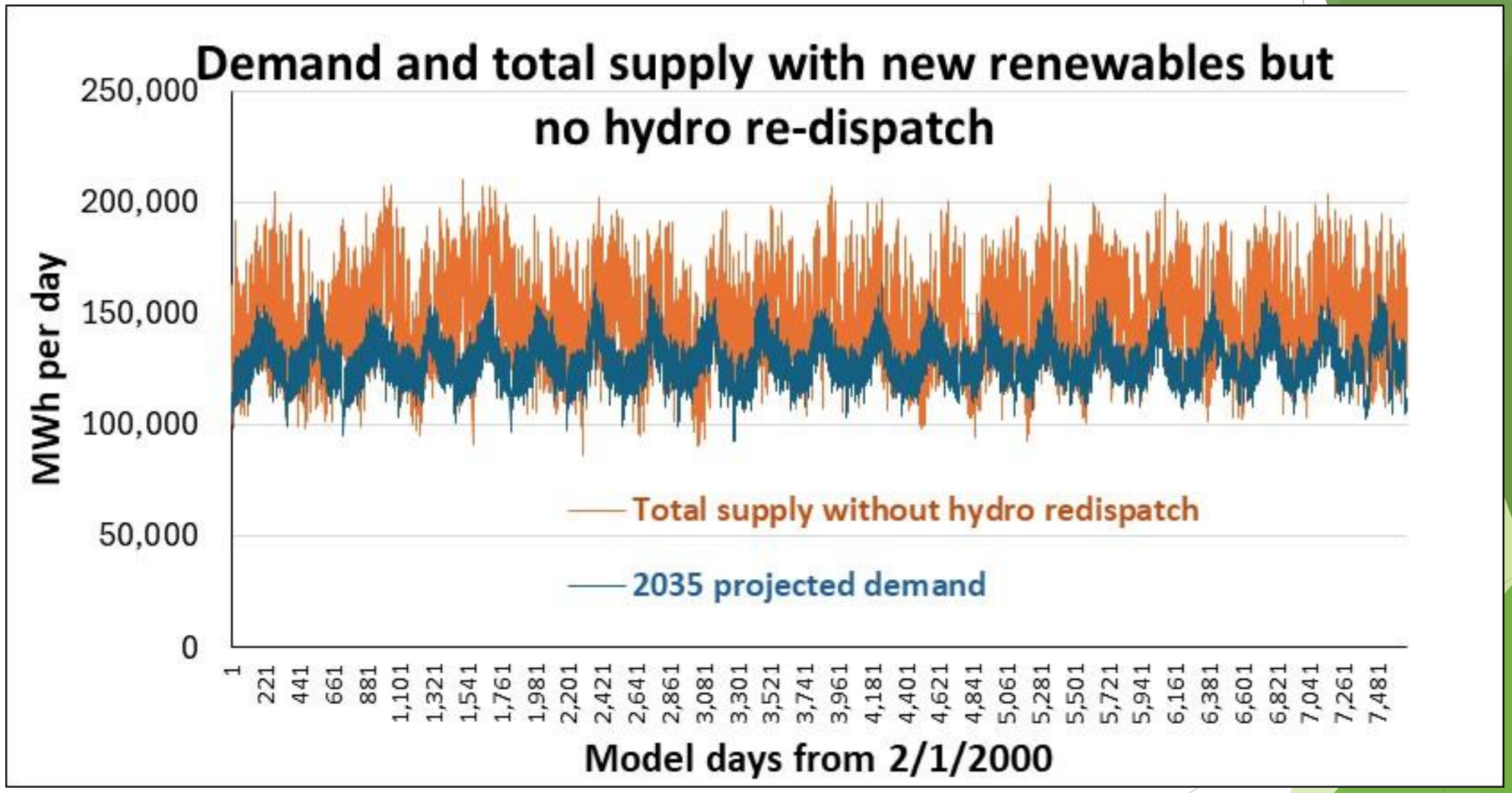
Sample run of the model

Start with

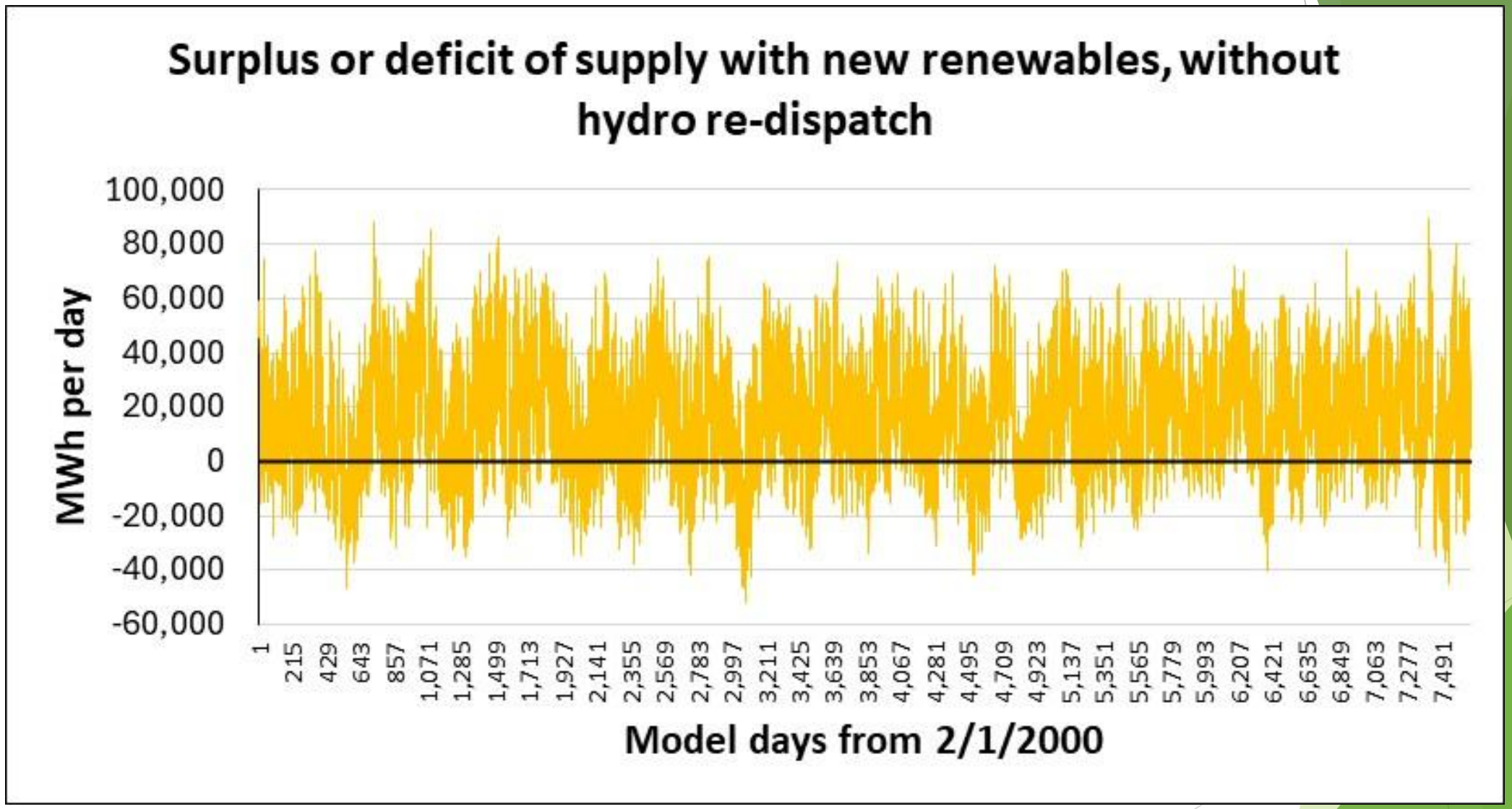

Demand at 48TWh p.a. with hydro, geothermal and biomass supply
MWh per day
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
2035 projected demand
Supply from hydro, biomass and geothermal
1
227
453
679
905
1,131
1,357
1,583
1,809
2,035
2,261
2,487
2,713
2,939
3,165
3,391
3,617
3,843
4,069
4,295
4,521
4,747
4,973
5,199
5,425
5,651
5,877
6,103
6,329
6,555
6,781
7,007
7,233
7,459
Model days from 2/1/2000


Residual demand in excess of base renewable supply
MWh per day
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
1
215
429
643
857
1,071
1,285
1,499
1,713
1,927
2,141
2,355
2,569
2,783
2,997
3,211
3,425
3,639
3,853
4,067
4,281
4,495
4,709
4,923
5,137
5,351
5,565
5,779
5,993
6,207
6,421
6,635
6,849
7,063
7,277
7,491
Model days from 2/1/2000

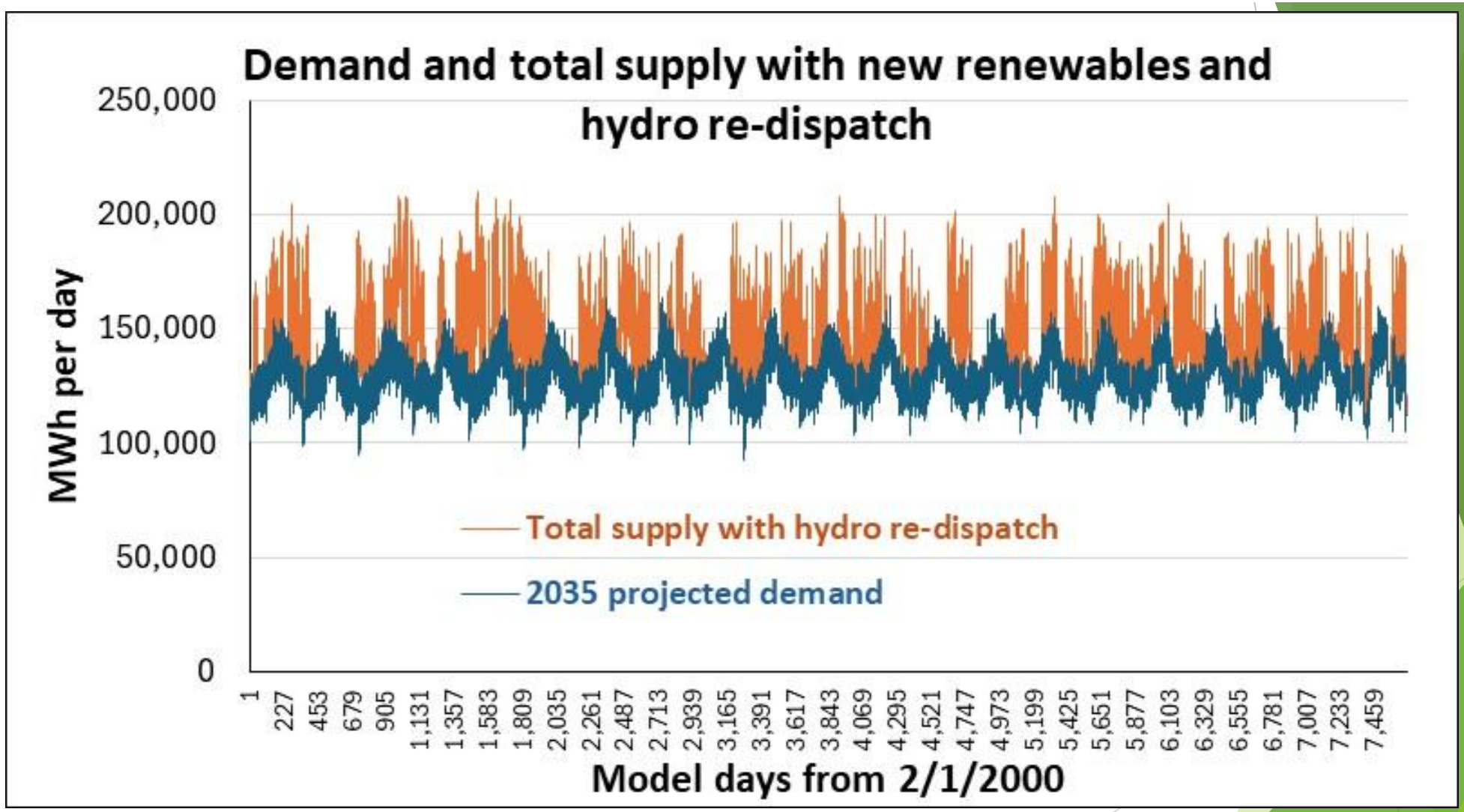
Next step: add wind and solar to the supply:



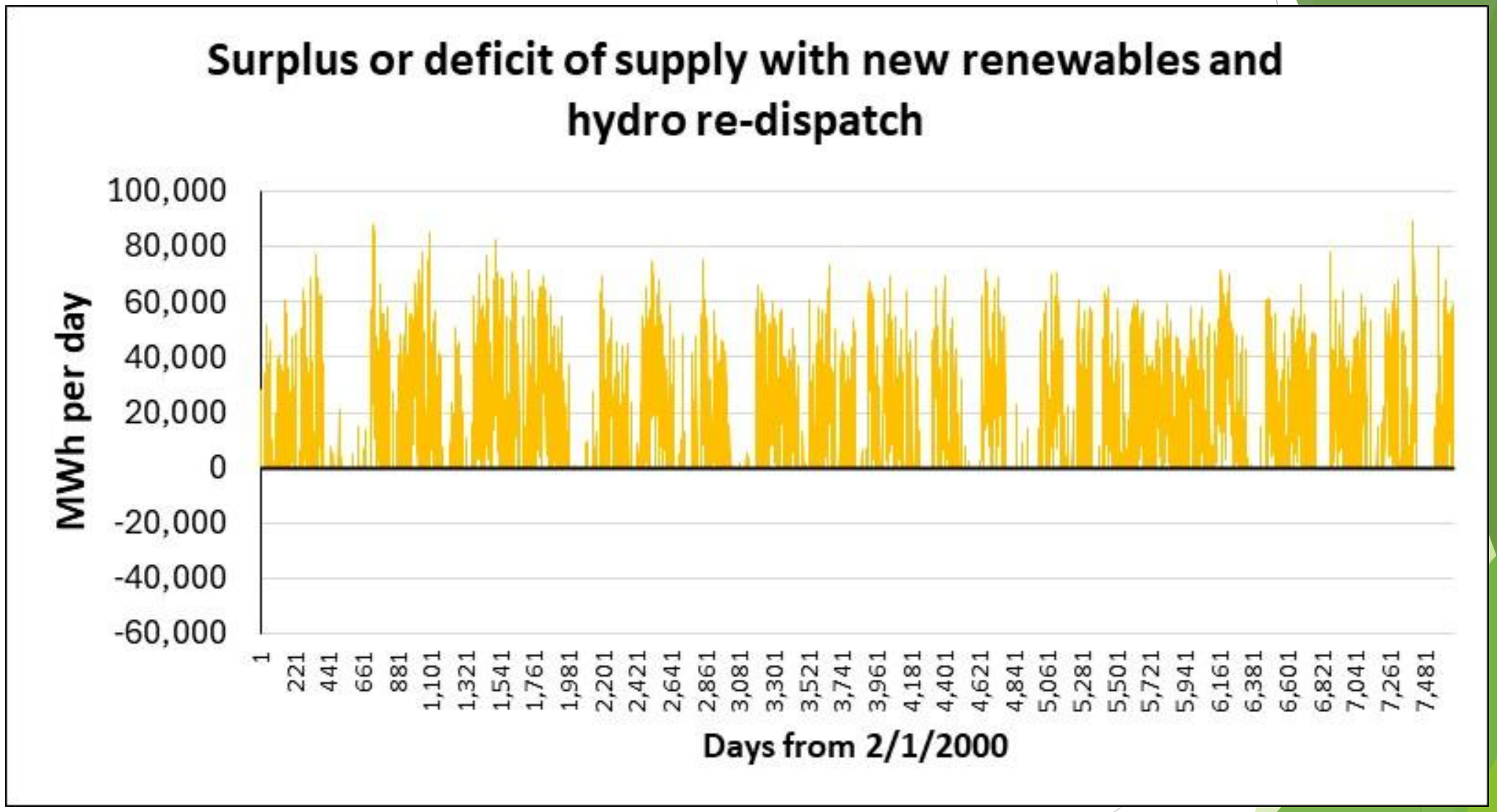
There are still numerous periods when demand exceeds supply:



Now we re-dispatch the hydro system to provide a battery-style backstop to wind and solar:



That brings supply into balance with the day-by-day pattern of demand:



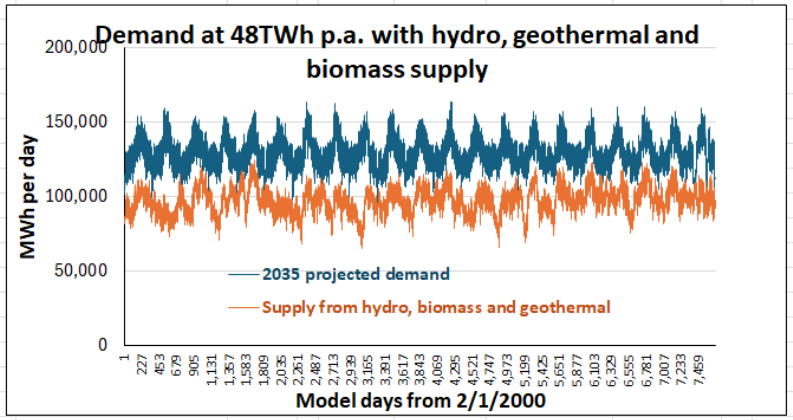
The dashboard shows the detailed results

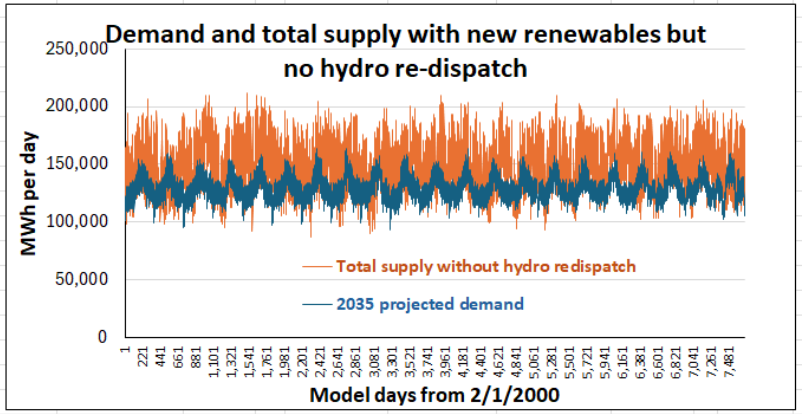
Model inputs

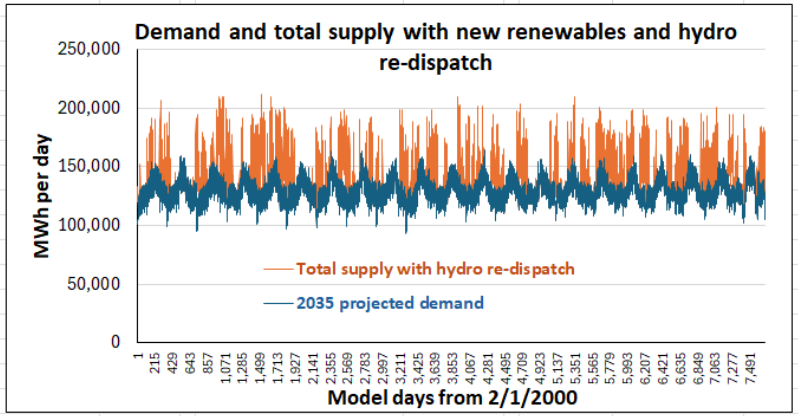
Demand TWh pa	48	Lake level maximum GWh	4,500	Lake level minimum	0	Trigger for hydro limit GWh	4,400	Cost of spill $/MWh	40	Wind capacity MW	3,962	Solar capacity MW	1,789

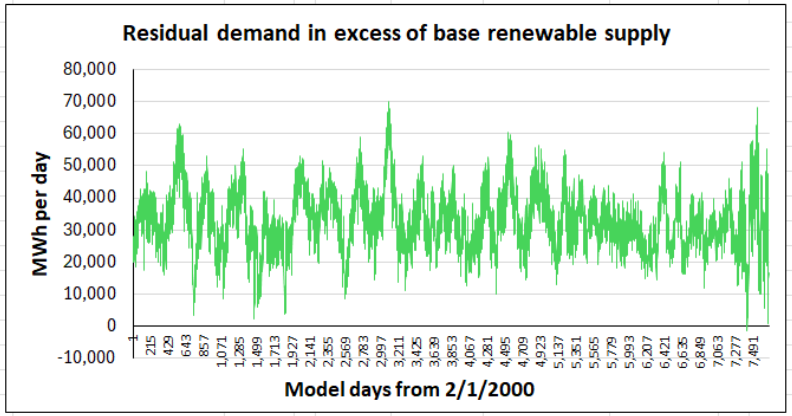
Capital cost of wind capacity	2.70	Capital cost of solar capacity $m per MW	1.75	Existing wind capacity	1,046	Existing solar cap	16,000	372

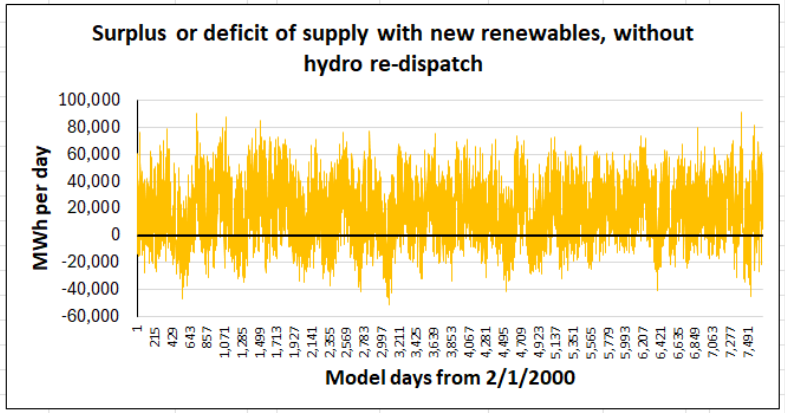
Number of outages (days)	Hydro spill GWh	Wind & solar spill MWh		Total spill MWh	Spill cost $million pa	Wind capex $m	Solar capex $m	Total capex
0	3,068	4,109	39%	7,177	287	7,873.2	2,480	10,353

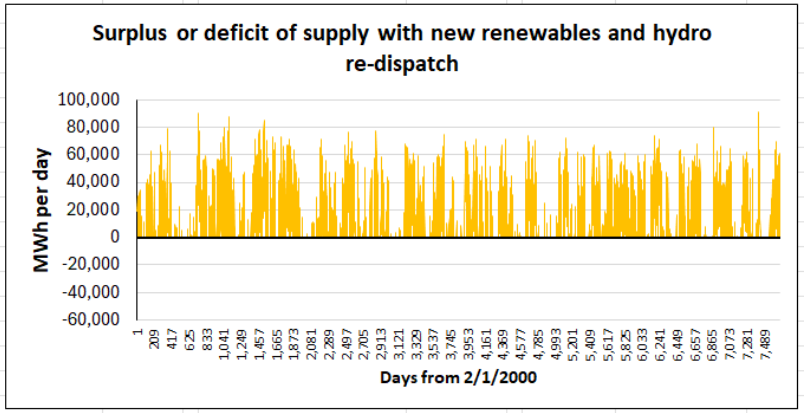












5. Designing a market in which residential prices come down

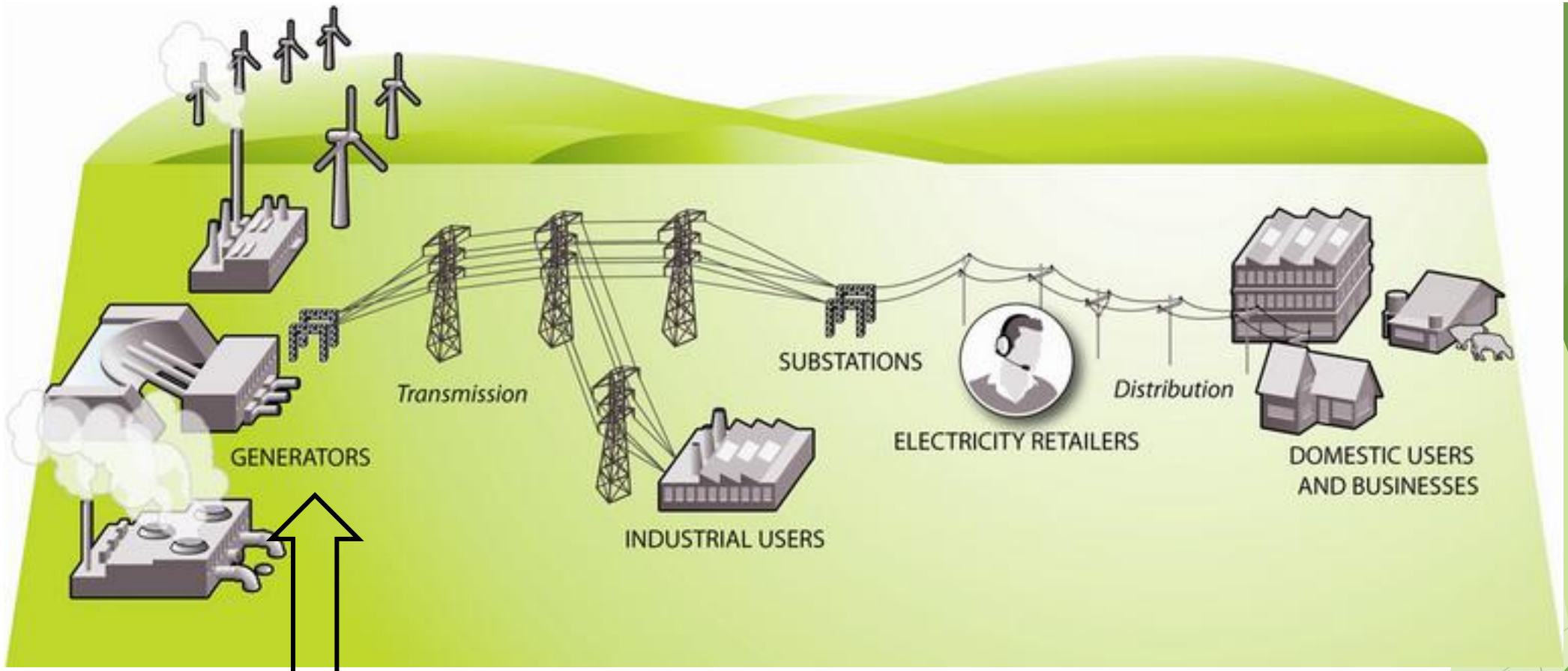
(i)Clearing an arena for genuine competition at local level (downstream of the grid)

From my 2023 submission in response to the MBIE discussion document *Measures for Transition to an Expanded and Highly Renewable Electricity System*, p.12:

> For a small country with limited fiscal resources but ample renewable energy resources spread across our geographic space, the option of decentralised utilisation of those renewable resources by small and medium-scale operators, taking responsibility for their own resource mobilisation, stands out as the logical starting point for prioritisation, unless one is committed above all else to preserving the privileged position of the long-established vested interests in central generation and transmission.

https://geoffbertram.files.wordpress.com/2023/10/bertram-submission.pdf

Here's the official MBIE 2023 picture of the industry - no distributed supply whatever acknowledged

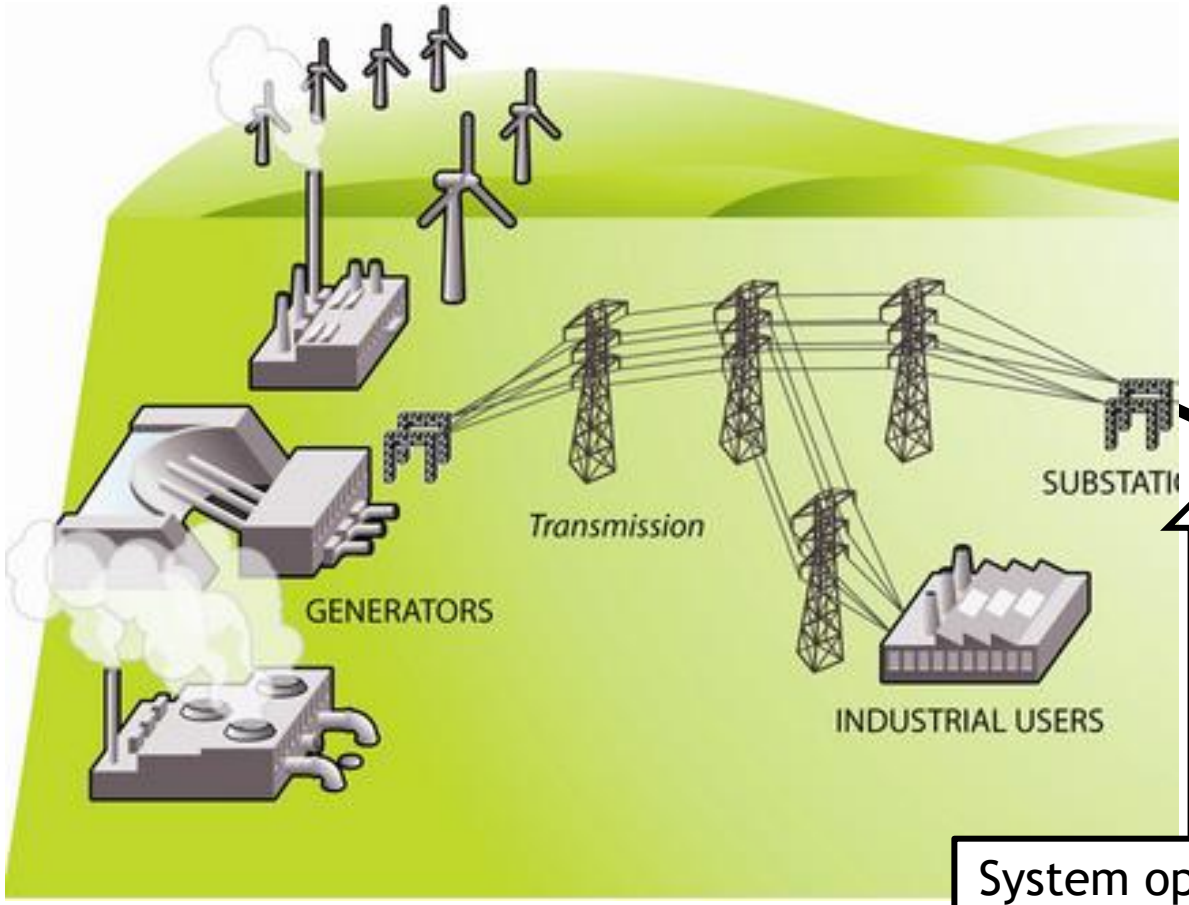


The system operator is here

https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-generation-and-markets/electricity-market/electricity-industry/ copied 4 May 2023.

Here’s an alternative vision

Central/remote generation and transmission



Energy community

Wholesale traders compete here

Local distribution network and independent retailers

Local aggregator /pool with battery to smooth load fluctuation s

System operator/single buyer of remote power could operate here

Distributed generation

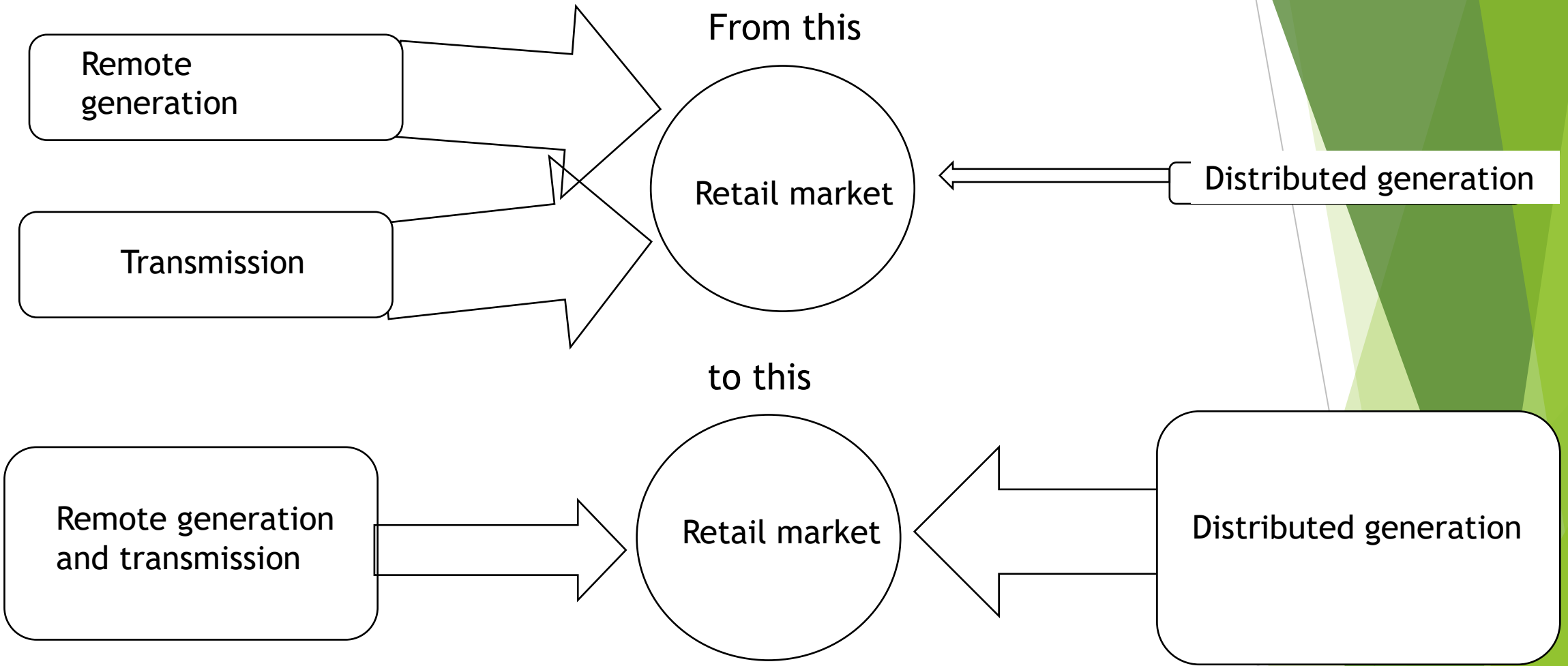
DOMESTIC USERS AND BUSINESSES WITH NET METERS

Homes

Industry

Farms

The technology shift implies institutions set up to fit competition for the market”



Implication: The wholesale market pricing action needs to shift from grid entry to grid exit

- With the distribution lines network as an open-access platform, DG would compete head-to-head with remote generation delivered off the grid
- This would require two changes to the current set-up:
  - Break the vertical integration of generation and retail to open the way for independent retailers using local networks to deliver electricity from the lowest-cost source while forcing generators to sell at arms-length into the retail market;
  - Bundle grid-transmission charges with the spot market wholesale price, not with distribution network fixed charges (but some residual charging arrangement to reflect the benefit of the grid to distributed supply).
- ? kill the lines/energy split at local level to enable community procurement of generation and batteries through the network operator – which would require a non-profit model like the old Electric Power Boards

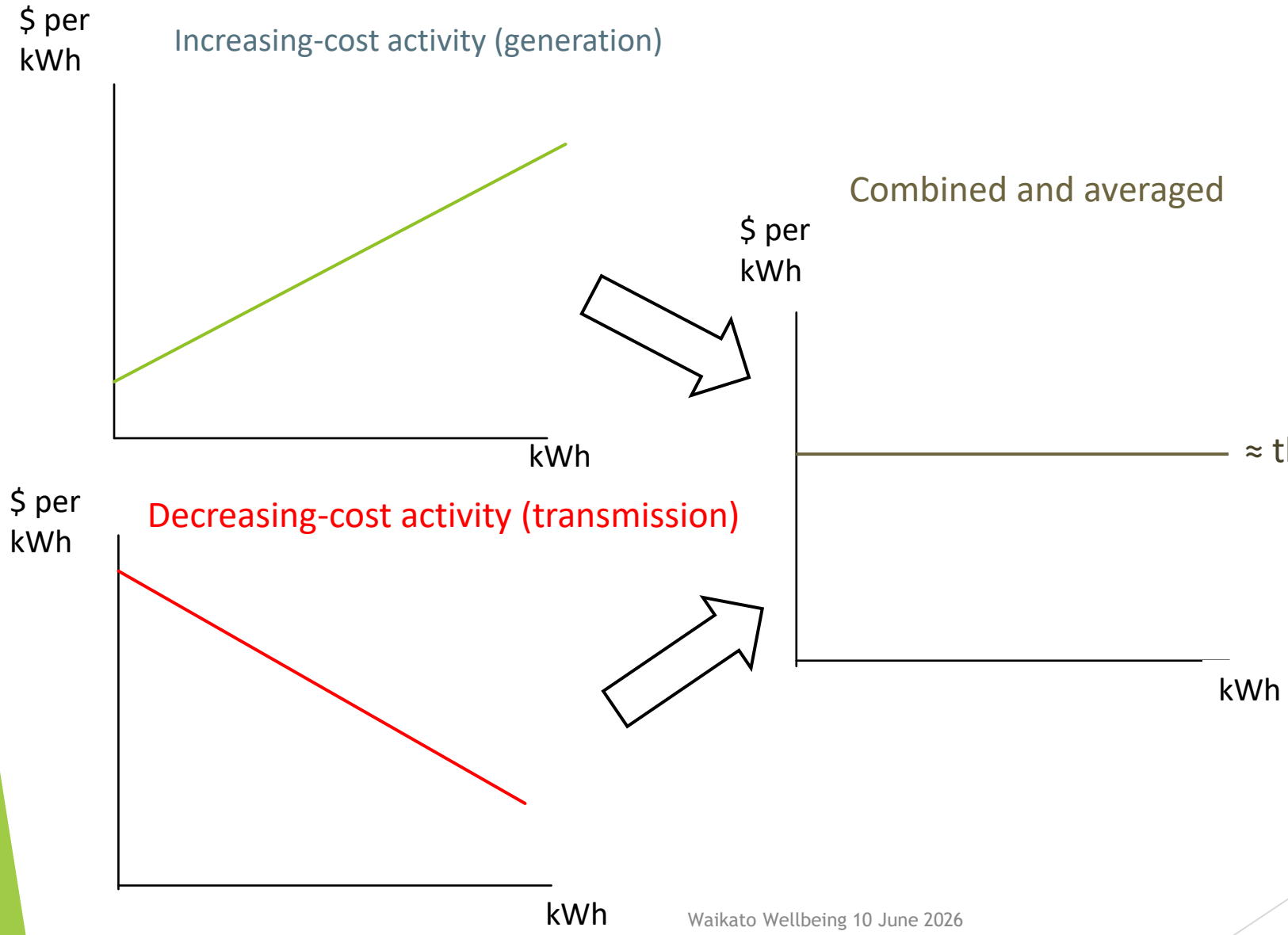
Wrinkles

- Implies decentralised local system operation and coordination, weighing-up the competing sources of supply into each local network maintaining some sort of merit order.
- The relative supply costs of grid versus distributed supply will differ by locality which implies the optimal supply mix will be unique to each distribution network
- Assume that distributed supply is absorbed into the local network up to that network's physical constraints; the call on grid supply at Grid Exit Points would then be the residual demand after cost-competitive distributed supply has been utilised
- Assuming that competing independent retailers are (a) taking distributed supply via their contracted prosumer meters, while (b) drawing on wholesale grid supply to make up their total demand volumes, then some agent would have to be active downstream of (or at) the Grid Exit Point to coordinate the aggregate residual demand on the grid
- At the grid centre, the high-level system operator would have a complex coordination problem, with heritage hydro assets being managed (within their physical constraints) to counter the intermittency of demand at Grid Exit Points
- Handling this through the current market mechanism would require financial compensation for the new role assigned to heritage hydro unless the heritage hydro assets are transferred back to public ownership and placed under the system operator's direct control (but that is politically tough, albeit probably the best long-run solution)

5(ii) pricing the six elements of supply to consumers: central generation, central system coordination, transmission, distributed generation and demand response, local network service, retail delivery

Take first central generation, transmission and coordination

Separation of the old NZED between "competitive" generation (ECNZ) and "regulated" grid (Transpower) ensured higher total price than under the old Bulk Supply Tariff model



This is the full cost of central grid supply that would have to compete against the supply price of distributed renewables

But there is a pile of pricing detail hidden in here – many consultants will be knocking on the door. Ultimately the feed-in rate set for distributed supply will be one competitive benchmark for grid supply to meet – but physical constraints mean that prices will have to be consistent with reality

Key implication: the current direct pass-through of Transpower charges would have to end

- At present the Commerce Commission approves the total revenue Transpower is allowed to collect, and this is then parcelled up by GXP and charged to distributors who pass it straight through to retailer and hence customer bills
- Whether recovered as fixed or variable charges, this penalises distributed supply by forcing owners of, e.g., rooftop solar to pay an effective cross-subsidy to their main competitor
- But without the guaranteed ability as a dominant monopolist to force recovery of its approved total revenue, Transpower's asset valuation might face a write-down – something that should be quite manageable as it is fully state-owned, but would be easier if it weren't operating under the State Owned Enterprise Act 1986.

The other elements of pricing

- Network service could possibly be priced for cost recovery under some political or regulatory constraint (such as the old elected EPB boards)
- Retail services would have a competitive market price
- Distributed supply could well have to face some sort of administered price, given that it is a mix of commercial enterprises and lifestyle household installations with an implicit reservation price of zero for surplus power.
- How the feed-in tariff rate gets set is thus an interesting design issue;
  - One possibility: individual retailers bid for household supply, establishing a sort of competitive market price
  - Another possibility: a regulator either sets the price at which all retailers purchase from households and other distributed producers, or sets the bounds within which power purchase price has to fall
  - Or a development from the status quo: a price is set for grid supply, and distributed supply is priced to parity with appropriate discounts and/or top-ups. This leaves price-making power with the gentailers and Transpower => the benefits from lower LRMC of distributed renewables might be suppressed
  - The commercial (as distinct from lifestyle) viability of small-scale distributed generation such as rooftop solar and small windfarms is quite sensitive to the price structure facing households: for example, the Labour Government's decision removing low-fixed-charge regulation was a quick way to make rooftop solar less economic.

5(iii) Regulation at retail level – necessary?

- Inevitably some pricing boundaries have to be set to get the best possible outcome in terms of affordability and reliability of supply – just leaving the market mechanism to run probably won't do the trick
- At community level the long-run reservation price at which it will be optimal to take advantage of grid supply is set by the off-grid alternative of islanded energy communities, but this is not instantly revealed by market mechanisms – it requires systematic analysis, planning, and decision-making on behalf of the collective. Experience will show where the relevant price floor lies.
    - In the present pre-cheap-battery era an exemplar is the Haast-Jacksons-Bay energy island with its Fraser River hydro scheme backed up by diesel generators. The cost of power to that local community has not been high enough to justify grid connection.
    - In the immediate future the key case would be Top Energy's network where Ngawha geothermal plus solar arrays produce substantial exports to the grid and make an electricity island a real possibility – Transpower has decommissioned the grid north of Kaikohe
- For most local networks it will be optimal to retain grid connection alongside distributed supply while developing the capacity to survive as off-grid islands if central supply fails. That is a task for deliberative planning.

5(iv) Changing the focus of upstream regulation from protecting asset values to redirecting the use of heritage hydro and setting the priority order for scheduling and curtailment

- Here the current ownership and control of the heritage hydro assets is important.
  - If they were still in public hands, as with the old ECNZ, it would be straightforward to give a new mandate to operate the assets as a de-facto battery backstop to intermittent wind and solar.
  - But under the mixed-ownership model there would need to be some financial arrangement linked to requiring the hydro system to meet stabilisation targets rather than profit-maximising ones. The present gentailers' asset valuations are based on profit-maximisation with strong market power and minimal regulation; as policy changes come into view, asset values (share prices) would probably fall and the issue of whether any compensation is due would arise.
- At the same time the task of the system operator would shift from simply dispatching the generation fleet in merit order on the basis of offered supply prices, to treating the hydro system as having a much larger ancillary-service function than at present

Summary: in my thinking, for electricity prices to come down significantly, the Government would need to do at least these four things:

- break down gentailer monopoly power and the sympathetic regulatory regime of the Electricity Authority and Commerce Commission
- resurrect local electrical supply authorities to operate “energy communities” downstream of the grid, combining the cost benefits of local small and medium-scale sources of renewable supply, with local network operators as coordinators
- tender out procurement contracts for large-scale offshore wind, onshore solar and battery storage, owned and operated outside of the gentailers even if the new entrants are incorporated into the existing upstream wholesale market [otherwise become tools for market manipulation]
- and factor the true economics of renewable energy into the market by forcing the established vested interests to genuinely compete in the face of the renewables revolution, e.g. by
  - Ending the direct pass-through of grid charges as fixed retail charges;
  - Pricing centrally-generated power off the grid as a bundled product of energy and transport;
  - Exploiting to maximum advantage the different intermittency properties of solar, wind and hydro

6. Discussion