Introduction

October 2023 marks Infradebt's 10th anniversary (our 40th newsletter won't go out until next quarter). In 10 years we've seen a fair bit (certainly the email list for this newsletter has changed!), but as ever, infrastructure keeps throwing up interesting challenges, issues and opportunities, and this newsletter covers a range of these including: home batteries; the death *there is no other choice* (TINA); infrastructure valuations; and renewables and energy market volatility.

One emerging issue at present as we go to print is rising base rates and falling inflation expectations leading to substantive increases in real interest rates – it's certainly something we'll be paying close attention to as we head into next quarter.

10 years has only been achievable because of the support of our clients, service providers and long-time advisers, together with the continued enthusiasm and dedication of our personnel. Thank you to each of you – we're here because of you.

Markets Update

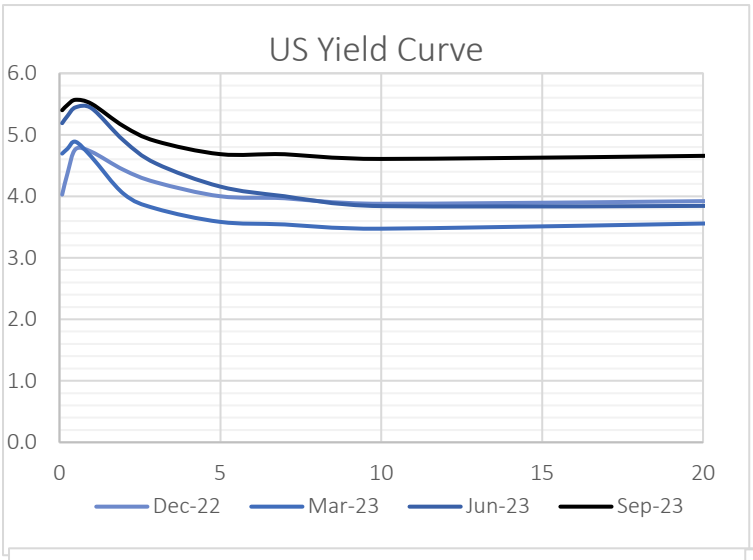
The market's focus remains on whether central banks will be able to pull off the ever-illusive soft landing. During the closely watched Jackson Hole Symposium in August, Jerome Powell acknowledged that US inflation was falling as hoped, coming in at 3.3% p.a. in July, but reiterated the Federal Reserve's commitment to finishing the job of returning inflation to target and their willingness to keep rates higher for longer. The US federal funds rate target is currently sitting at 5.25-5.5%, with the most recent hike having occurred in July.

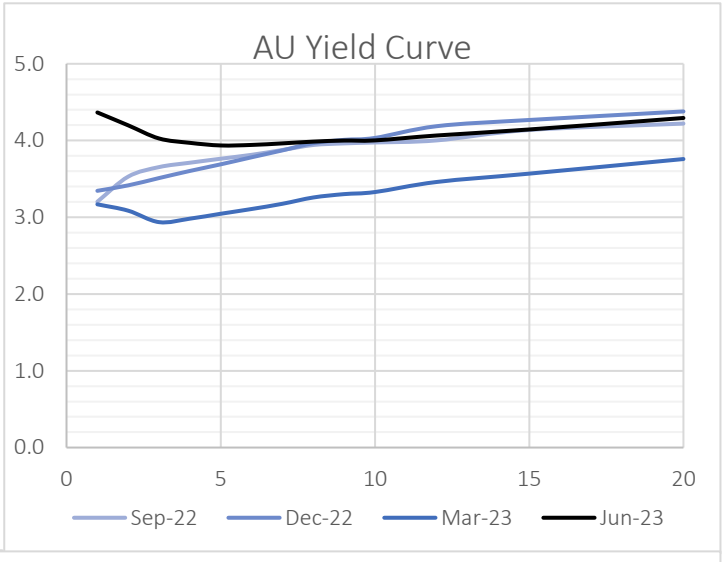
Debt markets added a little spice to the market in the final weeks of the quarter. US bond yields climbed to levels not seen since 2007, with the US 10-year yield reaching 4.6% as we go to print. The spike in yields is likely driven by investors beginning to accept that rates will indeed be higher for longer.

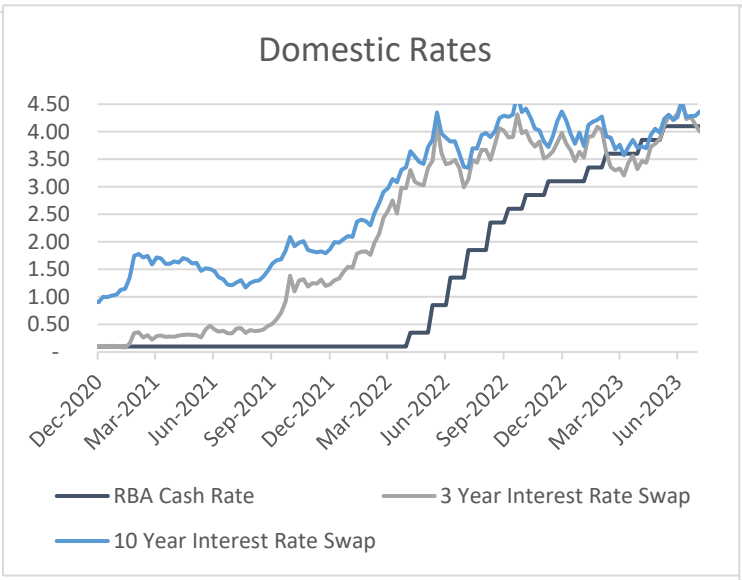
Higher fuel prices saw the headline annual inflation rate for August increase to 5.2% from 4.9% in July. However, core inflation continued its decline, falling to 5.2% for August compared to 5.5% from July meaning the probability of the RBA increasing the cash rate from 4.1%, where it has been sitting at since June, in its October meeting remains low.

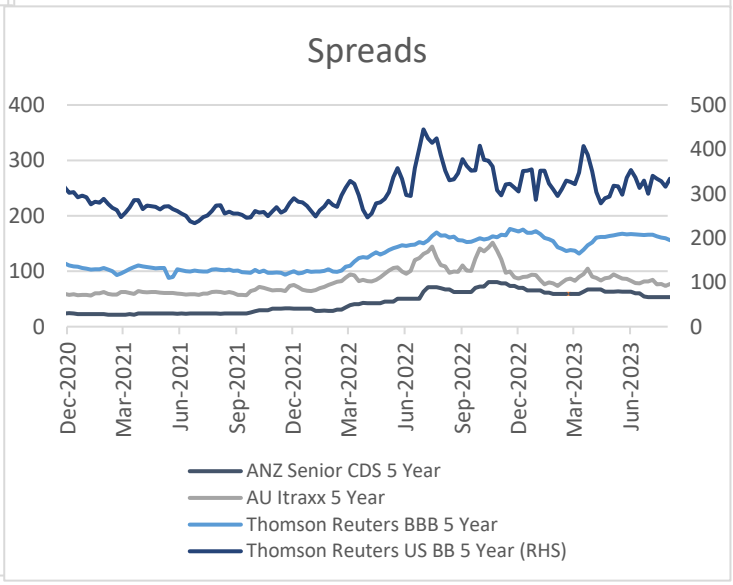
Domestic rates now sit below those in other developed economies resulting in the Australian dollar falling from around 68 to 63 US cents over the quarter. The market is anticipating future hikes and the domestic yield curve remains flat. The yield on the Australian 10 year is presently sitting at 4.51% (the highest its been since 2011). A sustained increase in oil prices and weakness in the Australian dollar over the coming months will put more pressure on prices (inflation) and could provide ground for future rate hikes by the RBA.

On the credit spread front, despite the rapid increase in base rates (and thus increase in debt servicing costs), spreads remain relatively flat – i.e. the market is not yet getting nervous.









Sources: Refiniv Eikon

New issuance and refinancing

Detailed below is publicly available infrastructure debt issuance for the quarter:

Date	Borrower	Instrument	Size ($m)	Term (Yrs)	Pricing
June	Genex Power	Loan	35	3.5	-
June	Royal Adelaide Hospital PPP	Loan	2150	4	-
July	CleanPeak Energy	Loan	-	-	-

Date	Borrower	Instrument	Size ($m)	Term (Yrs)	Pricing
July	Transurban	Loan	500	10/12	BBSY + 180/200
July	Lightsource BP	Loan	423	5	-
August	ElectraNet	Loan	550	7/10	-
August	IX Infrastructure	Loan	1040	3.25/5.25	-
August	Port of Melbourne	Loan	475	6	BBSY + 130
September	EletraNet26	Loan	550	7/10	BBSY + 155/175
September	APA Group	Loan	750	7/10	BBSY + 170/195
September	Epic Energy	Loan	300	3/5/7	-
September	Beryl solar farm	Loan	-	-	-
September	Newgen Power Kwinana	Loan	304	3/5/10	-
September	Australian rail track corporation	Loan	260	2.75	-
September	Royal North Shore PPP	Bond	450	13	-

Equity and other news

- Macquarie's The Infrastructure Fund, State Super and Australian Retirement Trust are looking to sell their combined controlling stake in Queensland Airports Limited, which owns airport at Gold Coast, Townsville, Mount Isa and Longreach.
- Pacific Equity Partners has acquired a 50 per cent interest in LMS Energy from metal recycling company Sims. LMS is country's largest landfill gas operator, with 36 biogas-to-energy facilities, 26 biogas flaring facilities and six solar projects.
- Tetris energy is looking to sell all of its 3.4 gigawatt early-stage development portfolio containing 12 projects across wind, solar and battery storage.
- Lighthouse Infrastructure is looking to raise $400m for its Lighthouse Energy Alternatives Fund which will invest in large-scale solar and wind assets.
- AirTrunk is considering an initial public offering that would value the tearaway data centre business at well north of $10 billion on an enterprise value basis.
- Dutch infra investor DIF Capital is looking to sell a 'handful' Australian renewable assets including their stake in Bright Energy Investments.
- Renewables developer Edify Energy has been sounding investors for a 185-megawatt battery energy storage system in Victoria.
- Listed gas pipelines owner APA is raising $750m at $8.50 a share to buy Alinta's Pilbara assets which includes Port Hedland power station (210 megawatts), Newman Power Station and associated battery (238 megawatts and 35 megawatts), the Chichester solar farm (60 megawatts) and Goldfields gas transmission pipeline.

- Energy Development Corporation is selling its development stage Bucca project including a 97-megawatt solar farm and co-located 110-megawatt battery. EDC believes the project will be functioning by November 2024.
- The equity capital markets team at UBS launched an $NZ800 million ($735 million) million block trade in Auckland International Airport shares on Thursday on behalf of Auckland Council.
- Apollo Global and CIMIC have sold down substantial holdings in Infrastructure service provider Venita, booking profits on positions they have held since IPO in 2021.
- Igneo Infrastructure Partners has acquired Victoria's Karadoc Solar Farm from German renewable energy developer BayWa r.e.
- South Korean owned Hanwha Energy Australia as hired Azure to find an investment partner for its NSW solar and battery portfolio.
- Patrizia has acquired a 100% interest in Australian Embedded Network provider, Active Utilities, on behalf of superannuation fund Prime Super.
- Renewable energy developer Carbon Resilience has hired ICA partners as sell side advisor for its portfolio of eight predevelopment wind, solar and hydrogen projects located across central and northern Queensland.
- TRUE infrastructure is looking to raise $20 million to acquire AustralianSuper's holdings in two infrastructure vehicles managed by London-listed Foresight Group.
- Macquarie's The Infrastructure Fund is sounding the market for its 7.19 percent stake in Perth Airport.

Sources: Refiniv Eikon, AFR

Unlisted Asset Valuations – What can Infrastructure investors learn from property – Case study of the Charter Hall Long WALE REIT

Over the years, super funds' allocations to unlisted assets have grown. Today about 25%, or $650 billion of the $2.6 trillion invested across all APRA regulated or government superannuation assets is held in unlisted assets. A key driver of the sectors ever-growing thirst for unlisted assets is the potential *illiquidity premium*. Super funds believe they are well placed to capture this premium thanks to their underlying members long-term investment horizon.

While the long-term risk adjusted returns of unlisted assets are celebrated, the valuation process for unlisted assets is controversial. Unlike in public markets where the value of listed assets is appraised daily as a result of the transaction[1] activity of a multitude of independent market participants, unlisted assets are only valued as frequently as funds' policies require them to be. Historically this has been infrequently as once a year.

Valuers commonly base their valuation for unlisted assets on public market comparisons or precedent transactions over a period of time, together with other valuation methodologies (eg DCF analysis at *market* discount rates). Hence appraisal valuations, while attempting to look forward, are inherently anchored on historic data. This averaging process (valuers are trying to estimate the average value that an asset could be sold for, not the 'best price') inherently averages out some volatility in prices. Cynics will say using historical data leads to out of date, or inaccurate, valuations, and allows super funds to get away with hiding losses during market downturns.

The current rate hiking cycle, which one would expect to lead to falls in unlisted asset valuations, has drawn greater attention to this issue. So much so that APRA has called for super funds to value their unlisted assets at least quarterly.

While four is indeed a bigger number than one, quarterly valuations still allow for a disparity between 'true' and appraised values. If only there was an asset that had both a market value and an appraised value? Enter Charter Hall

[1] Transaction based valuations for listed shares may be imperfect reflections of the value of holdings especially if the equity is traded infrequently. For example, one trade for a single share of a relatively illiquid equity at month's end may end up determining the value for a much larger holding. However, this may not fairly reflect what this larger holding could be sold for.

Long WALE REIT (CLW), an ASX listed Real Estate Investment Trust, that owns a portfolio of real estate which is then leased to tenants for long periods of time – on average 11.2 years. While not a true infrastructure business, it's "infrastructure like" as it produces stable long term cash flows, many of which are tied to CPI, with high upfront capital expenditure, but low operational expenditure (high operating margin). Also, like infrastructure assets, the value of CLW's property portfolio is very sensitive to interest rates.

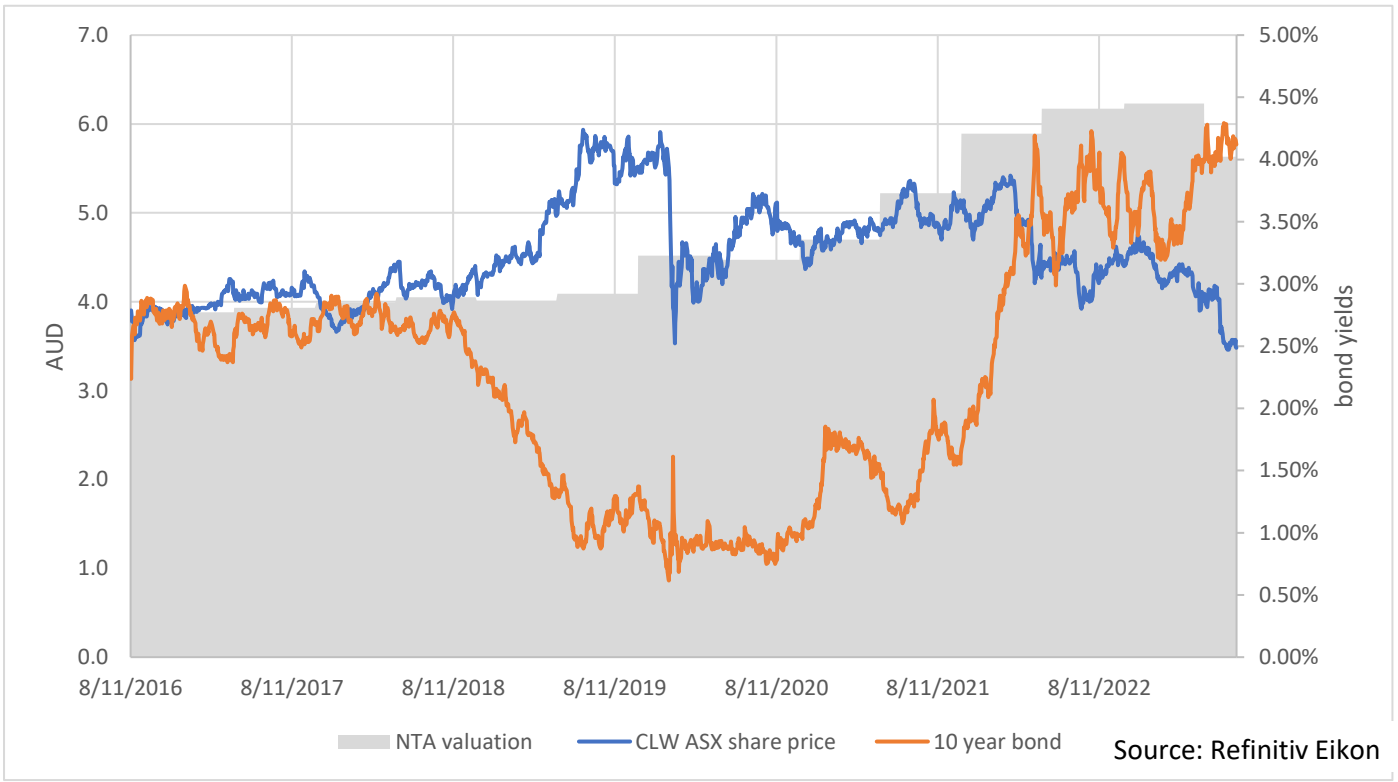
In theory, the price of CLW shares should be equal to the market value of its underlying property assets less debt – known as net tangible assets or NTA. Under CLW's accounting policies, they update estimates of their property assets twice a year, in December and June, using DCF and income capitalisation methods, performed by either by an independent external valuer or internal valuers with relevant qualifications.

In theory, the share price of CLW and its NTA per share should be equal. But as Einstein said "In theory, theory and practice are the same. In practice, they are not." At the core of the difference is the inherent lag introduced by a valuer's opinion. Thus, at turning points in particular, valuers need to see evidence of changed transactional values before they have evidence to support a change in appraised values.

Here we see CLW's share price since IPO in November 2016 compared to the semi-annual values of NTA per share and the 10-year bond yield. Not surprisingly, the stock listed at an almost identical value to its NTA per share. They stayed similar through most of 2017 and 2018, while interest rates remained stable.

Then, when rates began to fall in late 2019, the stock began to rise but NTA per share didn't really move until late 2020. NTA per share caught up to the share price in 2021.

But in 2022, when we entered our current hiking cycle, the share price began to fall while NTA per share stayed high. CLW shares have fallen 20.6% over the 12 months to 19 September 2023 (the date of writing of this article) whereas NTA per share only fell 8.75% over FY23. The most recent NTA valuation is 64% above the current share price suggesting that CLW's appraisal valuation has much further to fall to catch up with public markets.



Source: Refinitiv Eikon

The gap between CLW's share price and appraisal valuation of its assets, which has been widening over the past few months, clearly demonstrates that investors' opinion towards property is souring compared to the opinion of valuers. If history is any guide, the appraised values are likely to follow public investor opinions back down to reality. In reality, real interest rates have risen significantly and are looking to be higher for longer, which has, and will, take its toll on the value of assets with long duration cash flows i.e., infrastructure and property. Investors should remain cautious about appraised infrastructure equity valuations, and in particular, have a laser like focus on the reasonableness of the equity discount rate and WACC estimates used by valuers in valuations. Overall, investors should be prepared for falling valuations in private markets.

Sources:

https://www.afr.com/companies/financial-services/apra-expects-quarterly-unlisted-asset-valuations-by-big-super-20230720-p5dpzd#:~:text=There%20is%20about%20%24650%20billion,equity%20(start%2Dups).

https://www.afr.com/companies/financial-services/apra-targets-valuations-of-unlisted-superannuation-assets-20230201-p5cgze

Renewables cause volatility

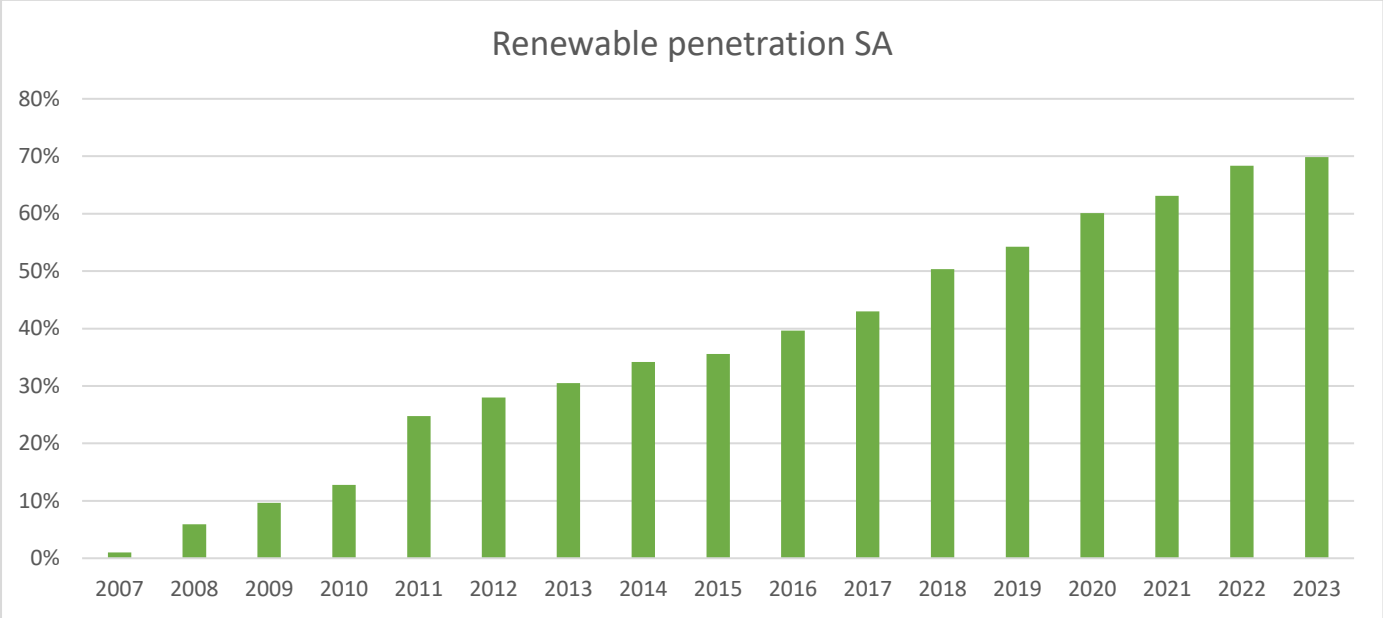
There is frequent public debate about whether the rollout of renewables causes lower or higher electricity prices. Like many issues on climate – this discussion often descends into a doctrinaire and polarised debate. For the record, the simple answer to this is that renewables have a lower levelised cost of energy than fossil fuel powered generation (even including transmission and storage) and, thus, are cheaper. Where the debate gets confused is that we are in the middle of a once in a generation rebuilding of our power system (after chronic under investment over the past 25 years) and this necessarily costs more (compared to the alternative of just coasting on a depreciating capital stock). Thus, costs are up, but they are up by less than if we rebuilt the electricity system with something much more expensive.

Putting this debate to one side, a more interesting question is whether increasing renewables penetration causes more volatile electricity prices.

Infradebt's view on this is a firm yes.

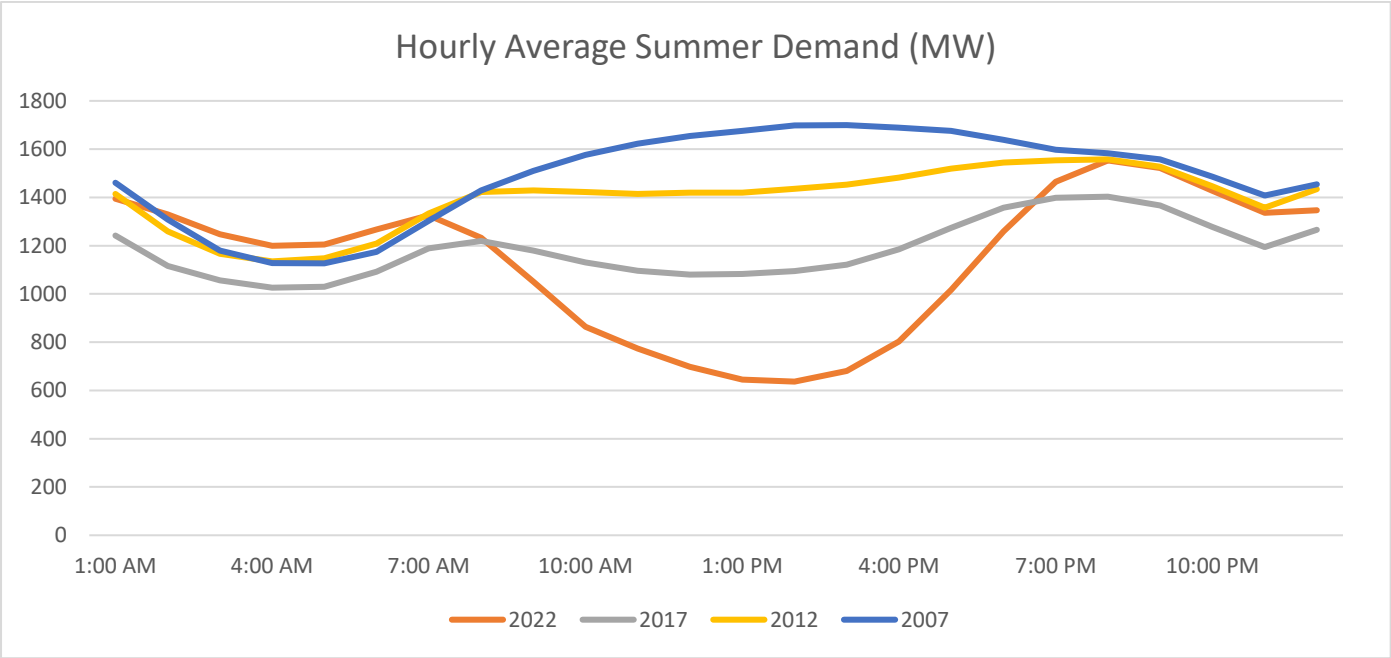
Let's use the South Australian grid as a case study for this, and then close with some quick remarks on the implications/opportunities from more volatile electricity prices.

In the last 20 years, the South Australian grid has transformed from 1% renewables to approximately 70%. We have even seen continuous periods of operational demand being met by 100% renewable generation during the last two summers. The chart below shows average yearly renewable penetration since 2007.

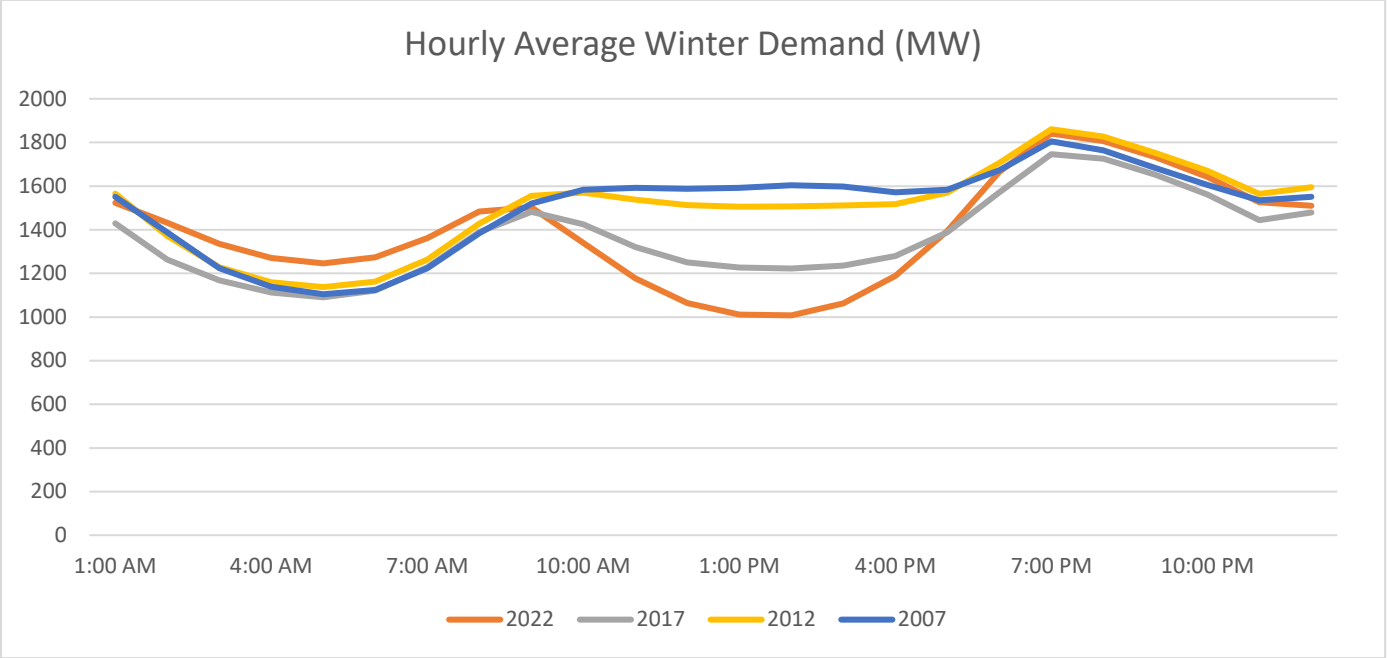


Source: NEM Review

Now let's look at the electricity demand in South Australia over the same period. The major trend, that can be observed from the charts below, is that operational demand during the middle of the day has significantly fallen due to the increased uptake of rooftop solar. However, there has been no major shift in demand during the morning and evening peak hours. Electricity demand during peak hours, when the sun is not shining, has not changed materially over the years. Economic and population growth have basically been offset by energy efficiency.



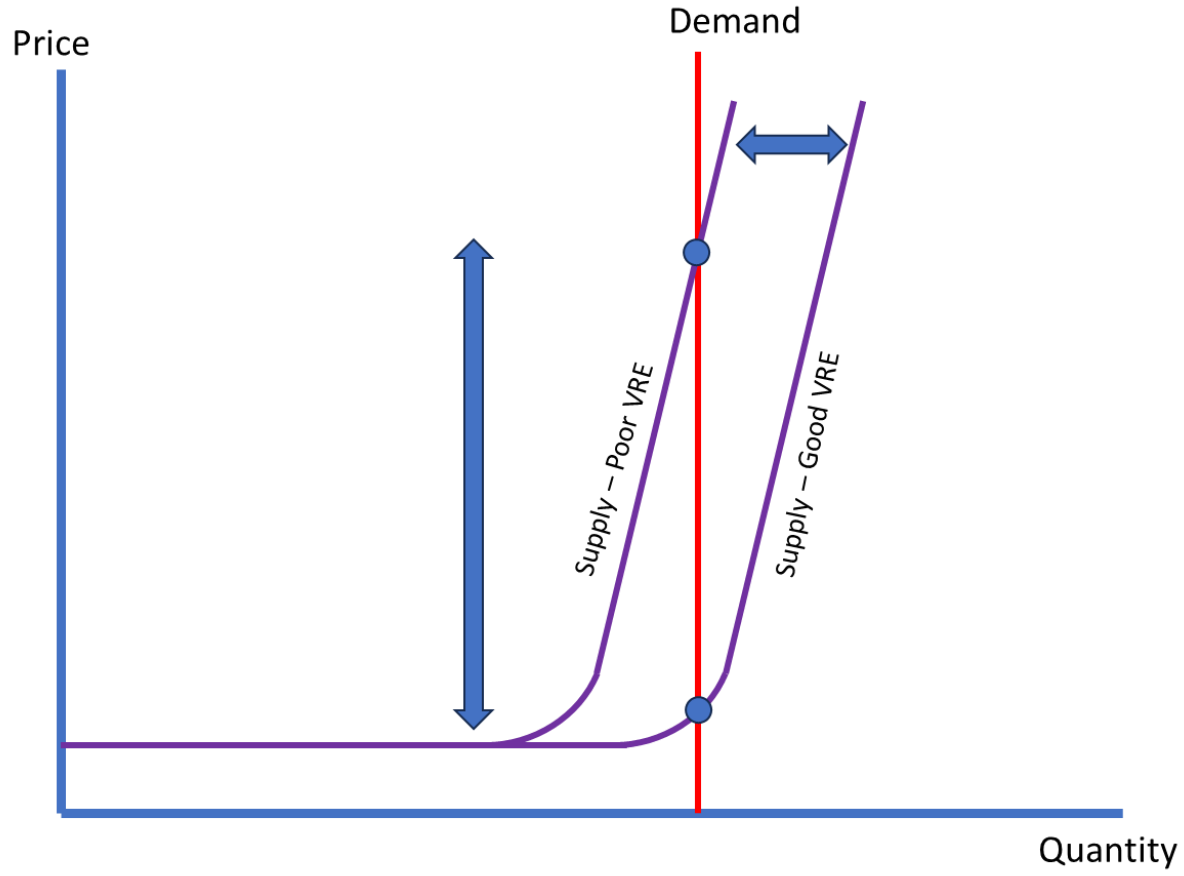
Source: NEM Review



Source: NEM Review

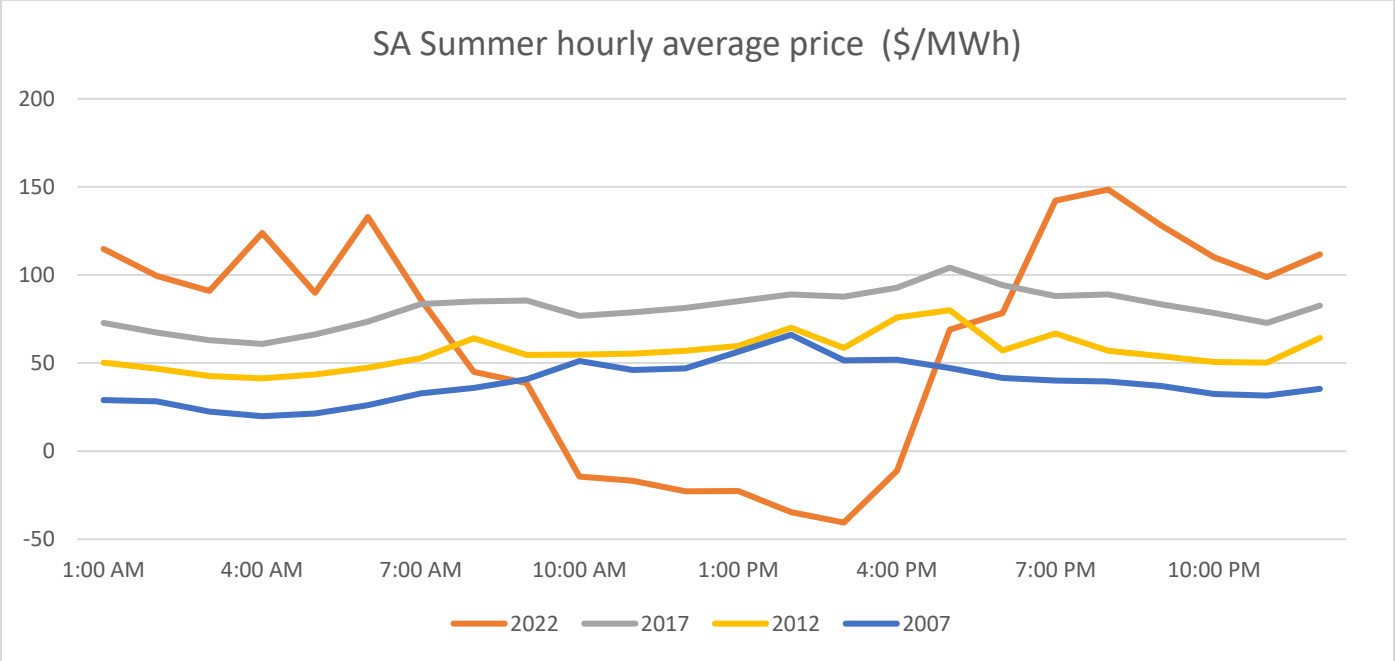
The chart below summarises supply and demand dynamics for electricity. On a 5 minutely basis, when AEMO procures electricity to meet demand, demand is essentially fixed (ie a vertical demand curve).

The supply curve is kinked. Renewables have essentially zero marginal operating cost and so the portion of supply driven by renewables is an essentially flat supply curve (perfectly elastic). However, as you transition from renewables to fossil fuel fired generation (and start incurring fuel costs) the supply curve bends up. Furthermore, as demand gets closer and closer to the maximum level of output, scarcity pricing cuts in and the supply curve turns further and further vertical (inelastic).

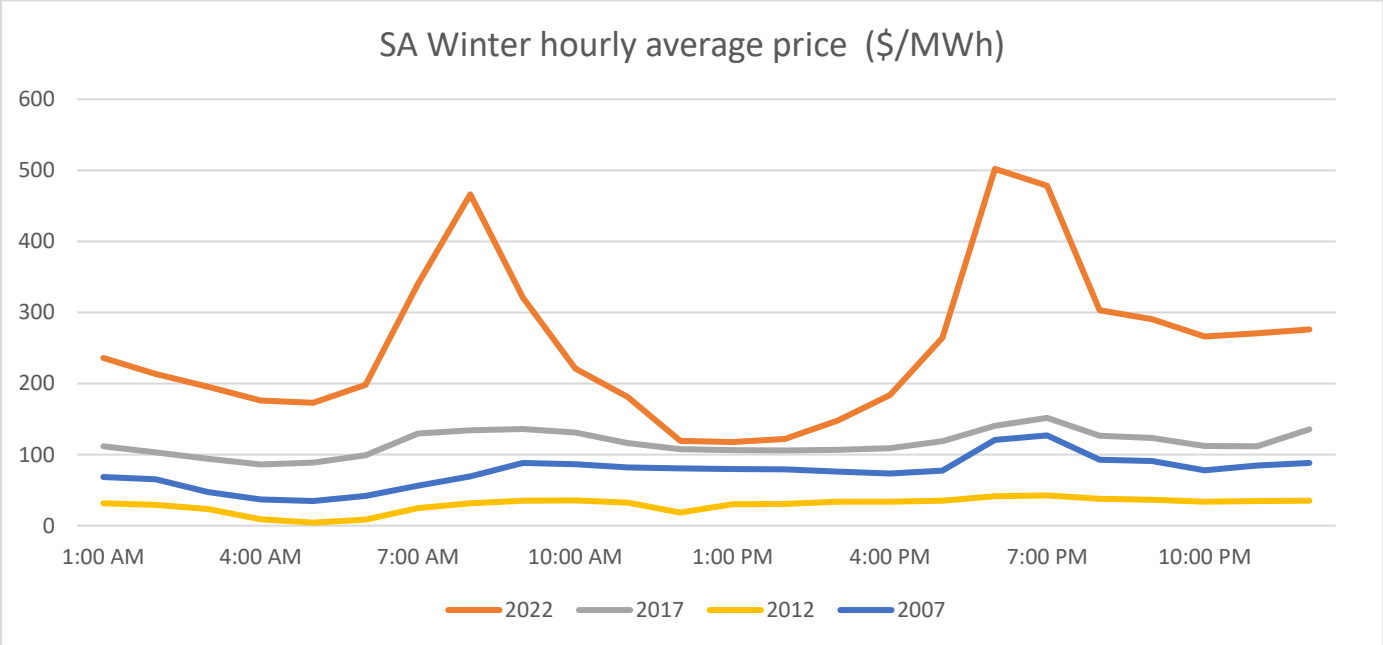


Within this framework, increases or decreases in supply of variable renewable energy (VRE) will effectively shrink or extend the flat portion of the supply curve and shift the steep portion of the supply curve to the left or right. The key insight from this, is that because the demand curve is vertical, and the fossil fuel portion of the supply curve is quite steep, even modest shifts in the availability of renewables will result in quite large swings in prices. Small supply changes lead to large price outcomes.

To support this mental model, we analysed the average hourly prices in South Australia during the day over a 20 year period. The charts below show a duck curve in prices – with lunchtime prices moving lower (on the back of rooftop solar) and evening prices moving higher (as increasingly peak demand needs to be met by increasing scarce dispatchable generation).



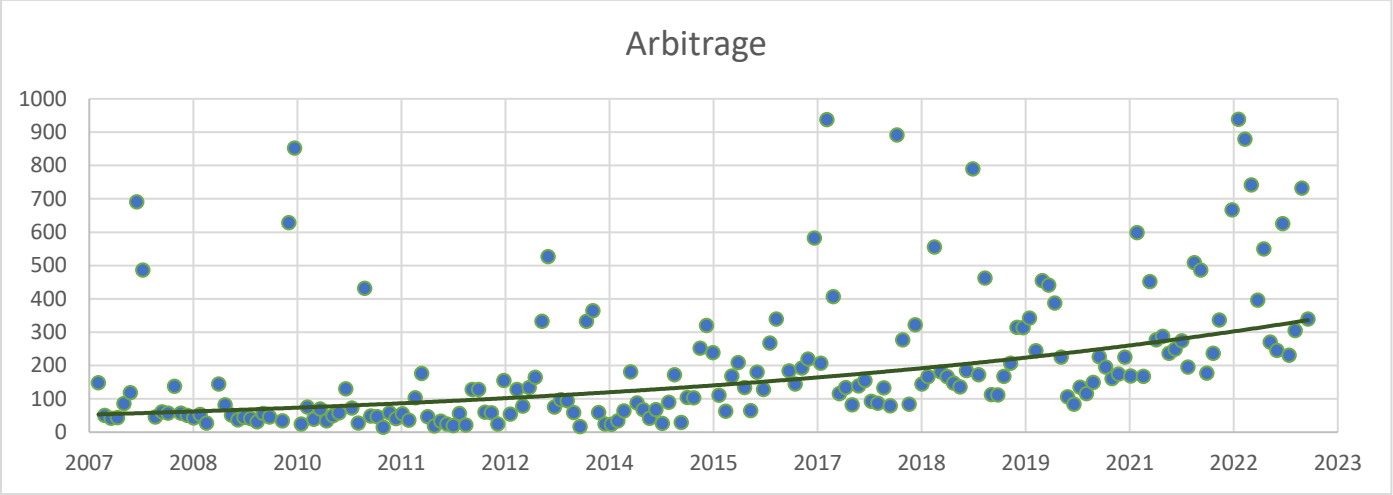
Source: NEM Review



Source: NEM Review

This price volatility creates a new set of opportunities and challenges for generators and loads in South Australia. Batteries will be the golden geese (or should we say ducks) as they benefit from cheap charging power from low daytime prices and can nimbly dispatch into the high prices of the morning and evening peaks.

We have run an interesting scatter plot to prove the point in case. The chart shows the monthly average difference between the two hours of highest prices and lowest prices each day (the effective the daily revenue available to r a two-hour battery operating on a perfect foresight basis). It is worth noting that this chart excludes revenue available through Frequency Control and Ancillary Service (FCAS) markets.



Source: NEM Review

The chart shows the steady growth in intraday price volatility as renewables penetration increases (growing from 1% to 70% on a trend basis over this 16 year period or a 70 times increase!). While SA has led the charge with renewables take up, reflecting its strong wind resource and the dynamics of the Renewable Energy Target coupled with a small SA based coal fleet that was quickly displaced, – this trend is likely to be mirrored across the rest of the NEM as the market heads towards Labor's 82% 2030 target.

While the rewards for batteries from more volatile electricity prices are clear, there are a couple of other dynamics worth noting:

- There will be a big difference between load/time weighted average electricity prices and dispatch weighted average electricity prices for different generators. In particular, the more a VRE generator is correlated with underlying load (rather than other VRE generators) the higher will be its realised dispatch weighted price.
- from a load perspective, there is a significant reward for electricity users to shift their load from peak hours. Flexible loads will enjoy much lower cost of energy than firm loads. With smart charging for electric vehicles and smart air-conditioning units that are able to cool and heat the house during the middle of the day, consumers will be able to change the shape of the demand curve – effectively making it flatter. If hydrogen becomes a substantial portion of load, flexible electrolysis demand will also aid in changing the shape of the demand curve to take advantage of the excess variable renewable energy during the middle of the day.

The End of TINA

All the children say

We don't need another hero

We don't need to know the way home

All we want is life beyond Thunderdome

Tina Turner (November 26, 1939 – May 24, 2023) We Don't Need Another Hero 1985

First, some important context:

- Tina Turner was a singer, songwriter and actress. She was known as the "Queen of Rock and Roll" and despite being American was extremely popular in Australia in the 1980s on the back of an extremely successful ad

campaign for rugby league. Her second stint of fame, when she was in her 40s, culminated in a role in Mad Max 3 – Beyond the Thunderdome part of the seminal Mad Max movie franchise. Tina Turner died in May 2023 at age 83.

- TINA in financial markets refers to There Is No Alternative. TINA refers to the dynamics that applied between February 2009 and April 2022 when the low level of official interest rates forced investor to invest heavily in risk assets. Financial markets TINA died in in 2023 on the back of 500 basis points of US rate rises over 14 months.

While TINA is dead - for infrastructure investors, we still don't fully know what life will be like *beyond the thunderdome* of negative real policy rates.

The TINA era was characterised by very low policy interest rates and, hence, very low debt funding costs. Target equity returns also were bid down by the hunt for yield. For example, during the era of sub 2% cash/bond rates, it would not be uncommon for a project to have a cost of debt of sub 4% and for equity to be targeting as little as 7% (for a "core" infrastructure project). This translates to a weighted average cost of capital (WACC), depending on the leverage level of the project, of around 5.5%.

Today, with cash and bond rates in the low 4% range in Australia, senior debt is commanding 6.5% returns. That is, near as dammit to what equity was happy to receive two years ago. Equity return requirements are ratcheting up as well – into the high single digits for low risk projects and well into the teens for higher risk endeavours. This means the WACC for my stereotypical core project above has probably moved from 5.5% to 8%.

So what you say. That doesn't sound too bad. Infrastructure returns were OK for the year to 2023 and this stuff is all independently revalued and so there is nothing to see here. Don't worry about infrastructure – what you really should be worrying about is office real estate!

Maybe. But interest rates are like gravity, and while the impacts aren't necessarily immediate – as Wile E Coyote knows – it does cut in eventually.

Let's work through the maths of a 2.5% increase in WACC from 5.5% to 8% on notional set of 30 years of inflation linked cash flows.

If the cash flows don't change and the WACC goes from 5.5% to 8% then the enterprise value falls by 25%. This is on an ungeared basis. Clearly the hit to equity would be larger.

But you say – infrastructure projects have interest rates swaps on their debt – and this will protect against higher interest rates. OK let's assume the project has fully swapped its base rate risk for 10 years. This reduces the loss from the rise in the WACC to 19% (rather than 25%). Yep better – but hardly a life saver.

But what about inflation, for infrastructure projects with strong inflation linked revenues, they will have benefited from a windfall gain from the higher than expected inflation over the last two years. If we assume that inflation moderates back to 2.5% from here (which is what we need for there not to be further rate rises) then this windfall inflation will have lifted the profile of future revenues for an infrastructure project by around 10% compared to the profile of a couple of years ago. This is very valuable, because a moderation in the rate of inflation doesn't involve a fall the level of prices and, hence, an owner of an inflation linked infrastructure project gets to capture the benefit of a permanently higher path of cash flows. A 10% boost in cash flows, mathematically boosts value by 10% and so the combined WACC and price level shock would result in a net 12% capital loss (again on an unlevered basis).

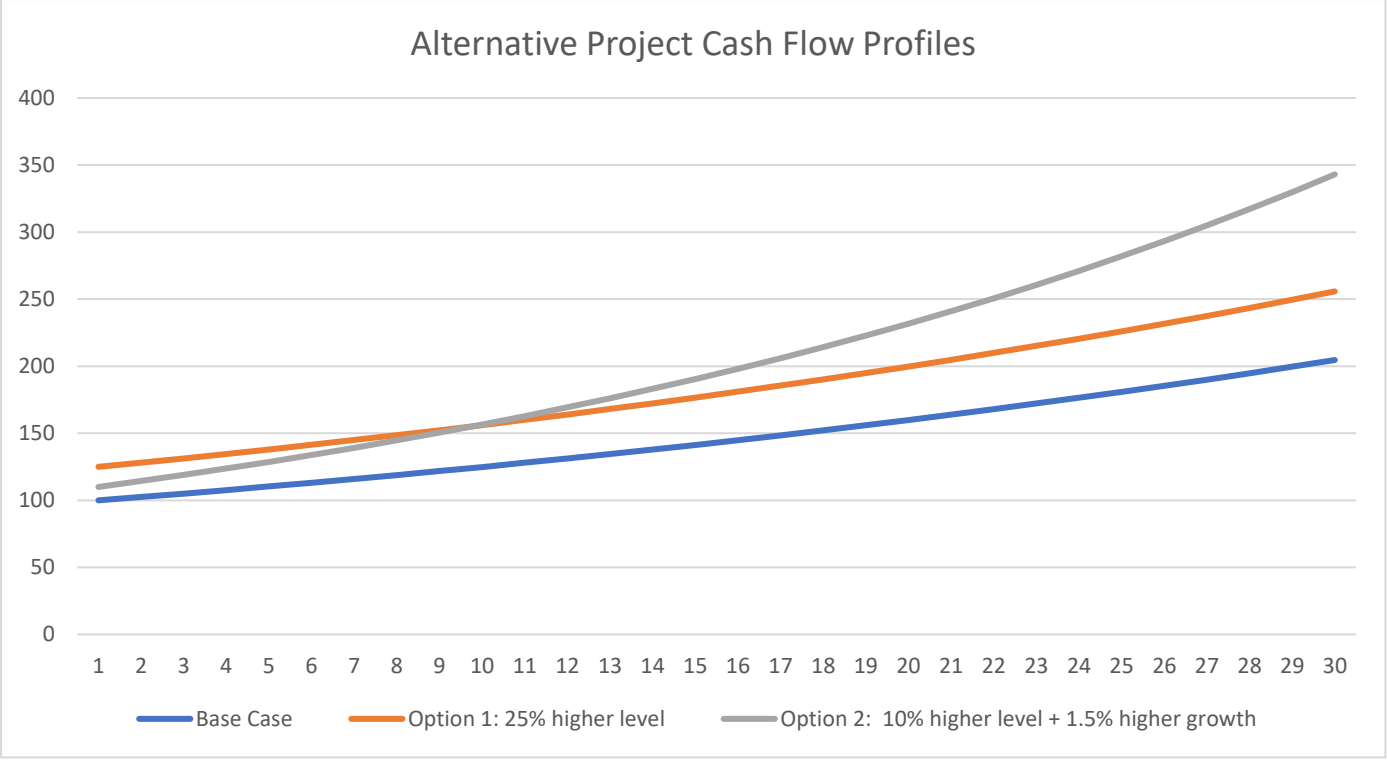
This is a lot better – but still seems a fair bit worse than the rolling 12 month to 30 June 2023 returns for infrastructure are showing.

It also highlights the importance of what happens to cash flows in combination with the interest rate shock. For example, if you look at commercial real estate, and office property in particular, its future cash flow outlook has

actually weakened, and so rather than mitigating the underlying WACC shock, office building valuations are likely to face compounding shocks of weaker cash flows discounted at higher WACCs.

Turning back to infrastructure, how is it possible to show a positive rolling return in the face of a 2.5% WACC shock (putting the concept of fudging the numbers or deferring recognition to one side): project cash flows need to rise substantially more than 10% compared to the prior path. In ballpark terms, you need:

- the new path of project cash flows to be permanently 25% or more higher than projected a couple of years ago (see option 1 in graph below). This seems challenging in general – but is potentially conceivable in areas such as energy which have seen significant pricing changes. However, if you came to me and said you had a toll road or a port that had magically increased its revenues by 2-3 times (an already very high rate of inflation), I would be a bit suspicious.
- Both higher levels and higher rates of growth. Another scenario is that the changed inflation environment has not only lifted the price level but also future revenue growth. For example, a 10% level shift and permanent 4% (rather than 2.5%) growth rate would offset the WACC shock hit (see option 2 in the graph below). To believe in this, you need to believe that 4% inflation would just see interest rates stopping where they are, rather than heading on to 6%!
- Regulated utilities are a special case within infrastructure. Most economic regulation regimes provide for the allowance of revenues to be directly linked to interest rates. Thus, for these assets, the higher interest rates should feed into revenue (albeit potentially over quite a long period of time) and this puts the question of RAB multiple premiums to one side.



All of this highlights a perverse dynamic. Central banks have raised interest rates to fight inflation. Higher rates imply a higher cost of capital. This higher cost of capital is itself potentially inflationary in capital intensive sectors such as infrastructure. Some infrastructure asset owners may be able to dodge the effects of higher rates by passing through the cost of higher WACCs to underlying customers through higher usage charges.

TINA is dead and there is no avoiding the pain – the question is just who and how (and when).

Economic case for home batteries

What is a home battery?

Home batteries are an accessory that can be added to home rooftop solar systems. Like all batteries, they let you save energy so it can be used later. The battery can be charged when roof top solar systems are generating excess electricity during the day that would otherwise be fed back into the grid. The battery is then discharged when required, usually during the evening when power prices are the highest and roof top solar systems are not generating electricity. Hence, batteries can reduce a household's power bills and reliance on the grid.

Why would you want one?

Some are attracted to home batteries as they reduce a household's dependence on the grid and provide insurance in the event of a blackout (until the battery runs out of course). Some are solar/electrification fans who are proud to be early adopters of a new technology and are unphased by the high cost. Of course, the appeal of home battery storage for the masses is cheaper power bills. But given batteries are (currently) very expensive, how much money can one actually save after accounting for this cost?

What battery options are out there currently?

Currently almost all home batteries on the market are lithium-ion batteries. Historically, lead-acid batteries were used on remote off grid power systems, but these are now considered out-of-date compared to this more efficient and compact lithium-ion. Home batteries available on the market today can store from 3 kWh to up about 14 kWh with prices, including installation costs, ranging from about $2,500 for the smallest capacity to about $14,000 for a higher capacity battery.

How much money can you save?

We have modelled out a household's annual savings from a home battery and the payback period for the cost of the investment.

We have assumed.

- A 10 kWh battery costs $12,000
- 85% round trip efficiency
- Once a day cycle i.e., it is charged and discharged once over 24 hours
- A peak price of $0.36795 and feed in tariff of $0.08 for the battery. These numbers are based off historical data of retail energy prices and solar export tariffs in Canberra (provided by ActewAGL)
- A battery degradation profile

Using these inputs, the net revenue from cycling a 10kWh battery in its first year once per day would be:

Peak price x battery capacity = $0.36795 x 10 = $3.6795
Less
Feed in tariff x battery capacity / battery efficiency = ($0.08 x 10) / 0.85=$0.941176
Therefore
Net daily benefit = $3.6795- $0.941176= $2.74

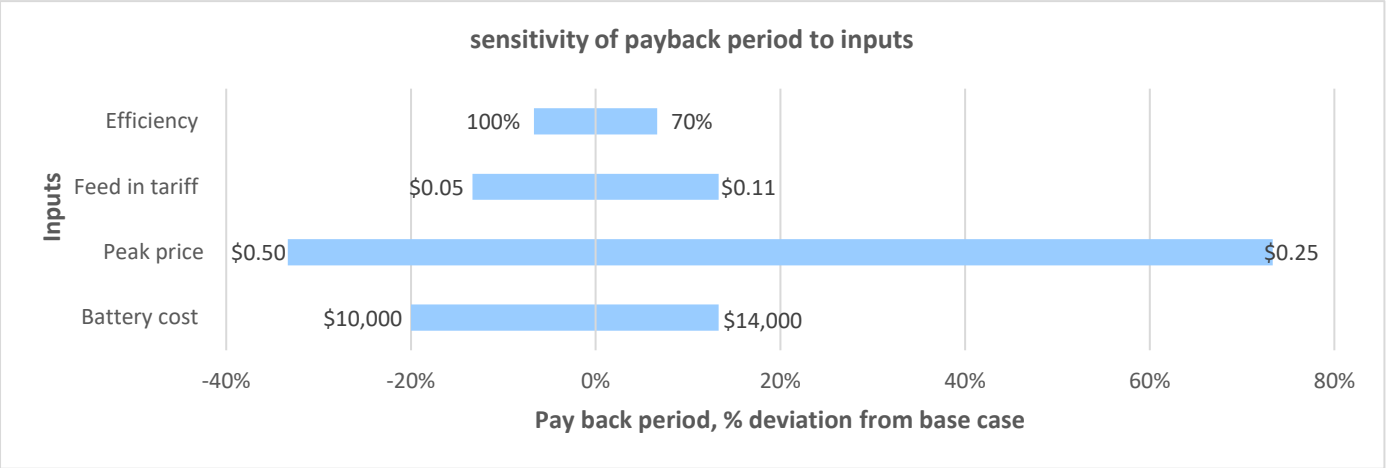
Based on these inputs, the payback period for the battery is about 15 years. The economics would be somewhat better in other states (for example, South Australia) where electricity prices are higher.

For mass adoption of batteries to occur the payback period probably needs to fall to 5-10 years (this is around the payback period of rooftop solar). This requires some combination of:

- Lower battery costs
- Higher peak electricity prices
- Lower solar export/feed in tariffs

- Efficiency

The following graph shows how changes in these inputs (seen in the labels next to the bars) impact the battery pay back period as a percentage deviation from the base case.



As we can see, the payback period is most sensitive to changes in the peak price and cost of the battery. It is highly likely that home battery system costs will fall (for example, grid scale batteries are about half the cost) and increased deployment will probably also see installation costs fall.

How do home batteries compare to other renewable infrastructure?

Why do home batteries not make economic sense when home roof top solar and utility scale batteries are mostly seen as worthwhile investments?

Firstly, rooftop solar systems have been around for longer, so have already enjoyed the falls in price that come with time (cost deflation through manufacturing/productivity enhancements, supply chain, design). Roof top solar also lets households avoid all network charges associated with grid consumption. Home batteries let households avoid these charges when discharging during peak times, but not when accounting for the opportunity cost of charging the battery with excess solar that could have been sold back to the grid. Utility scale batteries make more financial sense mainly because of simple economies of scale. Larger batteries cost less per kWh. Also, they can charge and discharge at wholesale prices, without retailers taking their cut.

Where does this leave us?

While renewable energy fanatics will keep the market for home batteries alive, we shouldn't expect to see the mass adoption of home batteries anytime soon. For home batteries to become common place in an Australian home we need the price of a batteries or the feed in tariff to fall significantly.