Gleneagle Investment Trust (Equity Fund)

July 2023 Review

Summary

I must apologise for the late release of this note, but we had a very unusual situation with Helios. I didn't want to send out the note showing a negative print for the month, when I wasn't able to comment on the one stock causing the poor performance.

At the start of the month, the major shareholders had been putting pressure on Helios to make changes to fix the poor news flow. The company has now agreed to changes at Board level and an announcement was finally made to the market yesterday.

Helios

Shareholders have been getting frustrated from the complete lack of news flow, the continuous unexplained delays and of course the declining share price. With each new month without any news or updates, no explanations for the lack of news, and a rushed quarterly report that only referenced old information, it is unsurprising that the stock price has been under pressure.

They say the definition of insanity is doing the same thing over and over and expecting different results. Leaving the situation unchanged and expecting communication to improve thus fell into the definition of insanity. Gleneagle, along with other major shareholders, took active steps to enhance the Helios Board with the appointment of Mark Lochtenberg as a Non-Executive Director. Mark is a proven executive with experience at getting things done and keeping the market updated.

Gleneagle was also instrumental in appointing Mark to the Board of another ASX listed company. Following his appointment, the stock went up 500% over the next six months. We are optimistic he can make a similar impact with Helios.

Energy Storage

If the world is going to move to a mostly renewable future, we are going to need a lot of energy storage. While wind energy can be available anytime day and night, the most reliable source of renewable energy comes from the great fusion reactor in the sky. As more solar farms are being rolled out, the next problem will be how to store the energy so we can 'time-shift' it's availability to when the sun is not shining.

Over the last couple of years, I've been building a home battery system – a 45 kWh system, equivalent to about 3 Telsa power walls. It all started when I saw that Amber Electricity was offering wholesale electricity prices to regular homes, and with a background in both Engineering and Arbitrage, I had a vision of turning my electricity bills into a source of income. With 40 solar panels on my roof, and a battery big enough to power my home with excess to sell, I had visions of reaping large rewards. But as they say, nothing teaches you more about a subject than by doing, and the devil is always in the detail.

It is a 48V system consisting of 3 banks of 16x 2800aH Lithium iron phosphate cells, custom battery management system (each cell is monitored to stop over or under charging), off the shelf Victron inverters, with custom software to buy and sell to the grid as the price updates every 5 minutes. It can generate 10KV of electricity on-demand on two phases. I have left room for a 3rd phase expansion.

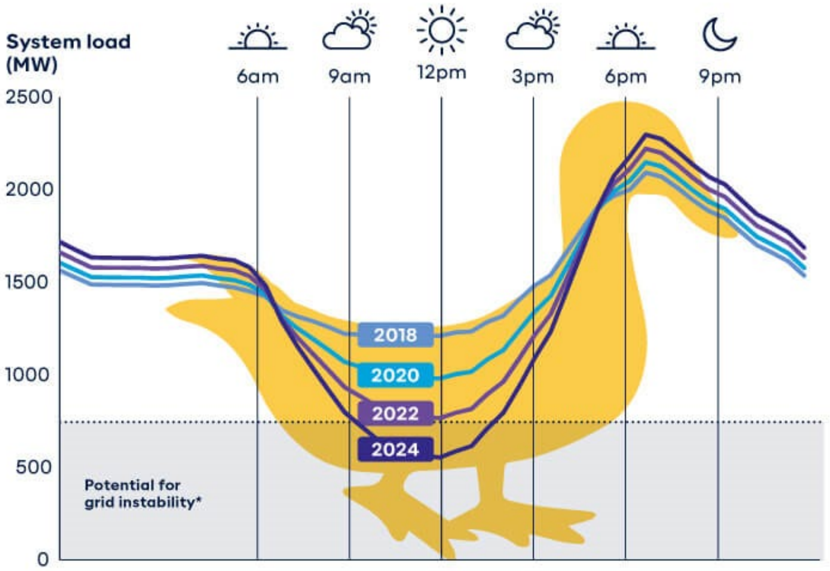
My electricity bills this time last year were about ~$1000 per month, and now running at around $400. Not great, but not terrible. It's only been working for the last 3 months, so I'll report back how things change over the summertime, but let's talk about some of the learnings.

Once I started writing this section, I realised that this is a much larger topic than I expected. I thus present the points in summary form.

- Grid capacity, (the means to transmit the electricity via poles, powerlines, transformers etc.) will likely have to increase around 200% in the coming decades if the world is to support electrification of home heating and EV charging.
- As people transition to using Electric Vehicles, your EV could potentially double as a home battery. The current most popular EV is the tesla model Y – which a battery capacity for the base model of 75 kWh (more than double my system). The trade-off is that using your car battery as a home battery will increase the rate at which the battery cycles, reducing its life span. If buying a used EV, look at the battery cycles as well as the number of km's driven.
- Renewable energy production hubs are often much further from end users, which will require additional transmission lines.
- The world is going to need a lot more conductive material – e.g. copper. Aluminum can be substituted for copper, but you require about 64% more area to same the same conductivity.
- Grid fees kill most of the arbitrage opportunities for the home user. This is uniquely an Australian problem. The grid charges around 15c from whoever puts electricity into the grid. You pay when you take it as providers pass on the cost, and you pay when you export.
- Just as an example, let's assume each city or suburb provided a 'free battery' big enough to power all the homes in the area. Each home is then invited to store their excess solar in the battery and use it later. With the grid fees charged as they currently are, each home would pay 15c to export the power to battery during the day, and then 15c to take it back in the evening (as the battery would have to pay another 15c to put the power back on the grid – which would obviously be passed onto the user). A 30c fee is almost as much as most people currently pay for retail electricity with no battery. Thus, grid fees kill any idea of providing common batteries at scale.
- Much of the grid is privately owned, so it's not going to be easy to change this costing model.
- There is a large deviation between how much solar is harvested in the summer and winter. This changes a lot depending on your latitude, but you produce way more in the summer than in the winter. To go fully renewable, the world will need to produce enough renewables so that winter production covers our needs, which means large excesses when everything is generating, especially in the summertime.
- Even with excess renewable capacity, the sky is not always clear, nor does the wind always

blow. Backup baseload power will still be required. The world seriously needs to have a sober discussion on carbon free baseload power (nuclear energy) if they want to eradicate CO2 production.

- On sunny days, it is not uncommon to see wholesale prices go to zero. Feed-in prices go negative. Windy days also, but not **too** windy.
- At peak usage times, it is not uncommon to see price spikes where wholesale prices go above $10 per kWh. In about 100 days of operation, I have witnessed around 5 price spike events that generally last around 30-60 minutes. They tend to always occur around 5:30pm.
- General electricity demand tends to follow a 'duck curve' as illustrated below. As more renewable energy comes online, the demand for this energy reduces, which tends to be during the day. The grid responds to the changing demand by updating the price, which occurs every 5 minutes.



Source: https://www.synergy.net.au/Blog/2021/10/Everything-you-need-to-know-about-the-Duck-Curve

- As a general rule, when a commodity gets cheaper, behavior changes tend to drive further increase in its usage, and I've seen it first- hand with electricity. After installing the battery and declaring to the wife that we should be saving money on electricity now - the clothes dryer is now used almost exclusively, and the central heating stays on. The hidden costs of maintaining a happy wife.
- A fully charged battery contains a vast amount of energy, which has serious risks of thermal runaway (fire) if released uncontrollably. Battery fires can be very difficult to put out once started. Fire suppression systems must be factored to the cost of batteries. One company I am following closely is US based Enovix which has a novel patent for preventing thermal runaway with their brake-flow technology, but still needs to prove it can scale.
- Some battery chemistries are prone to off-gassing and toxic fume generation when over-charged.
- Lithium based batteries should have a battery management system to prevent under or overcharging on a cell-by-cell basis. A chain is only as strong as its weakest link, so to, a battery pack is limited by its lowest capacity cell. Overcharging, undercharging, and operating outside of temperature range can seriously reduce the battery life or cause thermal runaway.

- Lithium based batteries can only operate in temperatures from 0C to 45C, however optimally, the temperature range is narrower than this. Heating/cooling systems can add to the cost of these systems. Different battery chemistries should be selected in regions outside these temperature ranges.
- High energy density comes at a cost. EV's want high energy density so the battery cost per kWh is higher. Home/Grid storage systems are less sensitive to size, so are generally lower cost per kWh.
- There are many different battery chemistries suitable for grid/home battery systems – there are generally trade offs between price, efficiency, number of cycles etc. Eg. Sodium ion, molten salt, & flow batteries.
- Battery efficiency should generally be compared to pumped hydro efficiency – which is around 80%. That is, for every 10 Joules of energy you put into a pumped hydro system, you should get at least 8 Joules out.
- Battery life is generally stated as the number of cycles a battery can be used and still maintains 80% of its original specification. There are literally hundreds of methods currently being worked on to improve lifespan.

Hydrogen

If you look at storing energy by using hydrogen from an efficiency point of view, at first glance it appears like a terrible idea. You take water (H20), split it using electrolysis (which is not efficient), take the hydrogen, dump the oxygen, then either compress the hydrogen to extremely high pressures or liquifying it (both with require a lot of energy), and to convert back to electricity use a hydrogen fuel cell. While there are promising developments to improve efficiency in both electrolysis and hydrogen fuel cells, the round-trip efficiency is still only around 50%. At best it might reach 70% in the future. Lithium based systems are well over 90%.

So why would anyone want to use hydrogen?

The most compelling argument I see is that we the world is going to over-build renewable energy production capacity so that we have enough winter production. This means vast over-capacity for the rest of the year, especially the summertime. Most energy storage systems are limited, eg once you charge a battery, you can't add any more to it. So, I believe much of the excess power generation can be directed towards hydrogen generation.

Efficiency considerations become meaningless when you consider it's better to extract 50% of something than to throw 100% of it away. Thus, I strongly believe Hydrogen will play a part of the renewable energy mix in the future.

If you have any questions or comments, please drop me a line at tim.muirhead@gleneagle.com.au.

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