Clean Energy Insights

Q4 2020

GRAVIS
CLEAN
ENERGY

William Argent, Director
Fund Adviser, VT Gravis Clean Energy Income Fund

William MacLeod
Managing Director, Gravis Advisory Ltd

Contents

Chapter 1: Renewable Energy – Powering Ahead

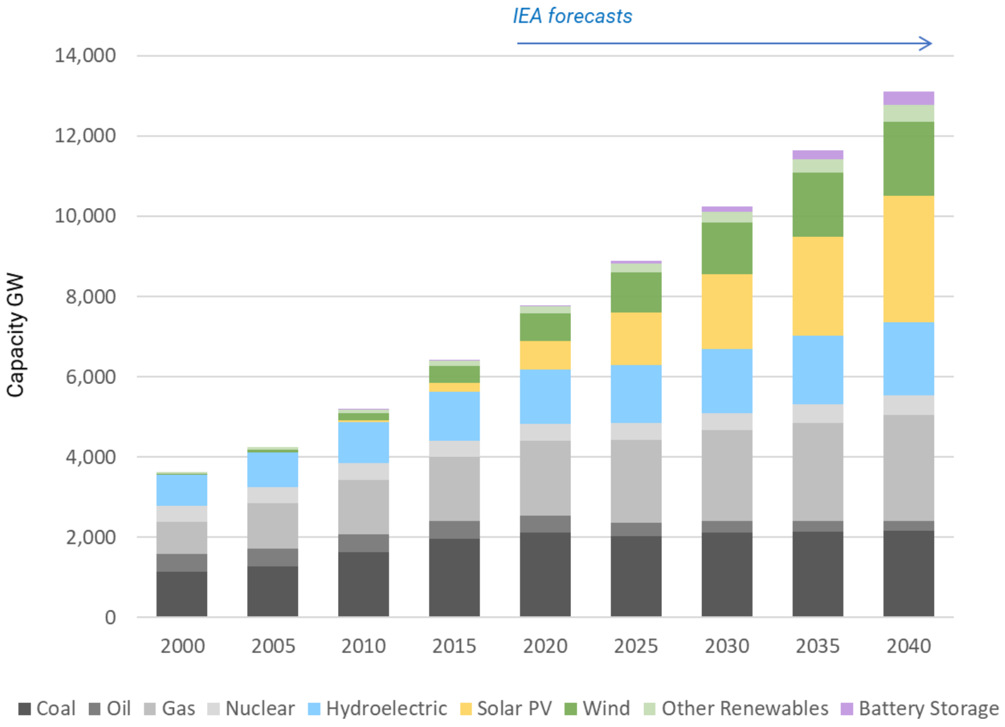
In recent years, investment in all areas of renewable energy has risen rapidly as mankind, around the world, attempts to clean up its act and move to less harmful forms of power generation and consumption. This rapid evolution has been prompted by legislators and the dawning realisation that we can and must do less damage to our precious planet. There is still a very long way to go and we are still at the beginning, so for investors there are plenty of opportunities to participate in and support this emerging, but enduring, transformation.

The early entrant renewable energy companies are already very substantial. They have relatively simple business models and throughout this troubled year they have remained largely unaffected by the market turmoil brought on by the ravages of Covid-19. But to invest globally takes great skill and knowledge of the underlying issues that drive prices and valuations. In the following chapters, Will Argent, Fund Adviser to the VT Gravis Clean Energy Income Fund, has explored five aspects underpinning the renewable energy sector and broader decarbonisation theme.

The areas covered are as follows:

- Power Purchase Agreements (PPAs)
- Power Prices
- Energy Efficiency
- Storage Market
- Macro view and expectations for the future

Forecasters at the International Energy Agency (IEA) anticipate that over the next 20 years $10 trillion will be invested in renewable assets. In the shorter term, by 2024, they expect new capacity installations to bring renewable power to 200m homes around the world.



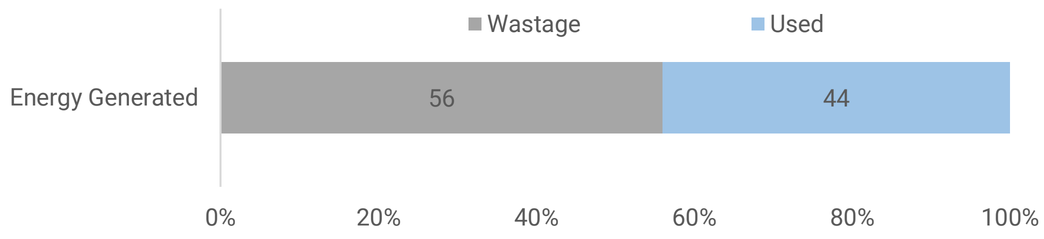
Source: International Energy Agency World Energy Outlook 2019

To encourage the institutional investors with these vast sums at their disposal, long term and detailed financial planning is required. The sector has developed a simple pricing model which provides renewable energy companies with an element of predictability for the value of the electricity they generate. In North America in particular, renewable energy companies negotiate long term contracts with utility companies (and increasingly, large corporates) through which a pre-determined price is agreed. Both parties are able to determine with some accuracy their long term revenues and costs. These contracts are known as Power Purchase Agreements (PPA's), which, as the name suggests, are agreements between two parties for the sale of electricity at an agreed price for an agreed and often lengthy period of time.

For other parts of the world, considerable time and effort has been expended predicting power pricing and the trends to which the sector is exposed. Electricity prices are usually linked to the prevailing and forecast price of gas, which fluctuate depending upon economic activity. Over the last year, electricity price expectations have been under pressure particularly in the early stages of the pandemic, although more recently demand and prices have started to firm up.

Whilst we know that there will always be a market for clean electricity, it isn't always possible to forecast how much is likely to be generated and when, dependent as it is on the weather. A sunny, but breezy day in mid-summer can lead to a huge oversupply when we least need it. In order to harness the increase in intermittent renewable energy production, a new and logical market in industrial batteries has developed in recent years. These batteries enable generators to store excess electricity, before releasing it back into the Grid when generation is below requirements.

Sadly, and like the rest of the world, the UK wastes over 50% of the electricity it generates. The wastage occurs as a result of inefficient transmission, from generator to consumer, as well as during consumption. In the case of fossil fuels, a significant amount of the energy generated is used to aid the burning of yet more fuel. Energy efficiency has recently come into focus, and with numerous areas of the economy required to improve credentials in this regard – as well as the commercial incentive to reduce costs and wastage – we expect to see an increase in capital flowing to the energy efficiency sub-sector.



Source: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/736152/Ch5.pdf

There are many opportunities for investors to participate in the rapidly growing renewable energy sector. The foundations are in place for the wall of money being pumped into the sector to increase significantly, and investors are now able to access this theme in its early stages whilst there are still attractive returns to be had.

To conclude, the five chapters which follow cover some of the aspects and themes we consider to be key and which lie behind the strategy of the VT Gravis Clean Energy Income Fund. We hope you find them of value and interest.

Chapter 2: Power Purchase Agreements (PPA) – what are they?

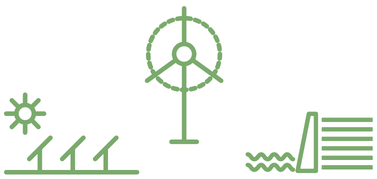
A PPA represents an agreement between a power generator and an off-taker – typically a utility company or other large corporate entity - for the sale/purchase of electricity outside wholesale markets. The PPA will define the commercial terms between the generator and the off-taker, including the schedule for delivery of power, pricing, and ultimate termination of the agreement – the term of which could be as long as 20 years or more.

Although PPAs are not a new concept, their use has grown rapidly in recent years owing to increased penetration of renewable energy technologies. Firstly, as the economics of renewable energy generation have become competitive with conventional forms of power generation, governments have phased out many of the subsidy schemes (Feed in Tariffs, Renewable Obligation Certificates etc.) that initially primed the renewables industry. To underpin the investment required to develop a new renewable energy asset without any form of subsidy and to shore up the financial validity of the project, a power generator will seek to structure a PPA around the asset in order to secure a long-term and stable revenue stream, and to reduce sensitivity to spot power prices. Spot power prices can be volatile, so the PPA reduces an element of uncertainty for both the generator and purchaser, over the long term. Secondly, a growing cohort of corporate entities (and utilities) is seeking to purchase more power from renewable sources as part of their commitment to reduce emissions and build more sustainable enterprises. Multinational tech giants including Amazon and Google have joined large industrial and high-intensity users of electricity such as Siemens, Rio Tinto and Akzo Nobel (historically the main corporate users of PPAs) in building portfolios of renewable energy assets and entering into agreements to buy power directly and indirectly from independent renewable energy generators.

PPAs may be structured in different ways, with flexibility in length of contract, the delivery profile, or the volume to be delivered, for example. With the exception of 'route to market' PPAs, which simply provide a generator with access to sell output at market prices, a common feature is typically that of greater price certainty for both the generator and the off-taker. In addition, renewable energy projects that are 'behind the meter', providing power directly to the end corporate user rather than going via the grid network, may provide scope for cost savings for the off-taker when compared with market rates.

Power Generator

- Incentivised to enter PPA to secure long-term, visible cash flows and to reduce sensitivity to merchant price risk thereby improving the financial risk profile of a project.



Utility Off-Taker

- Utility has its own power generation capabilities and end users/customers.
- Utility enters PPA with renewable generator to balance portfolio and to increase share of renewable generation.
- Utility earns a margin when selling power to consumers.

Corporate Off-Taker

- Enters Corporate PPA with renewable generator to provide power at a known price thereby reducing exposure to volatility in the wholesale market price.
- Direct provision of power to corporate provides security of supply and potential for savings against market rates.
- Purchasing energy from renewable sources helps companies achieve environmental and sustainability ambitions.

When structuring a PPA, the generator and the off-taker must consider how much power is to be delivered and when it is to be delivered. Incorporating these elements will naturally reflect the risk appetite of the counterparties.

Fixed volume PPAs place an obligation on the generator to deliver a pre-defined amount of power to the off-taker over the term of the PPA in return for a fixed price per unit of power delivered. Volume for delivery will be based on reasonable assumptions of the likely output from an asset, however, should volumes fall short of the generator's obligation the generator will be required to purchase the balance in the market.

The delivery profile (i.e. when to deliver) is typically set at very short time periods, such as hourly, and can be viewed as providing baseload power to the off-taker. Baseload is the minimum level of electricity demand over a period of time and does not include spikes when demand may change significantly. Less common, but still possible, are PPA structures that allow for delivery over a far longer period, such as quarterly. A generator accepts greater risk under a baseload PPA owing to the tight schedules for delivery and increased chance of underproduction and subsequent merchant price risk. As a result, the generator will typically be able to strike a higher sales price per unit of power under a baseload PPA.

Other forms of PPA exist which remove the volume and delivery profile risk. Under the terms of an 'as-produced' PPA the off-taker agrees to purchase all (or a certain proportion) of the output from the generator at a fixed price. Since the volume risk is borne by the off-taker and there are no delivery profile obligations, the generator will achieve a lower price for the power generated compared with a fixed volume PPA. 'Route-to-market' PPAs facilitate the sale of power and the off-taker is usually a utility with power trading capabilities. While the generator will not assume any volume or delivery profile risk, similarly to a 'pay-as-produced' PPA, the generator will have no price certainty because the output is sold at prevailing market prices.

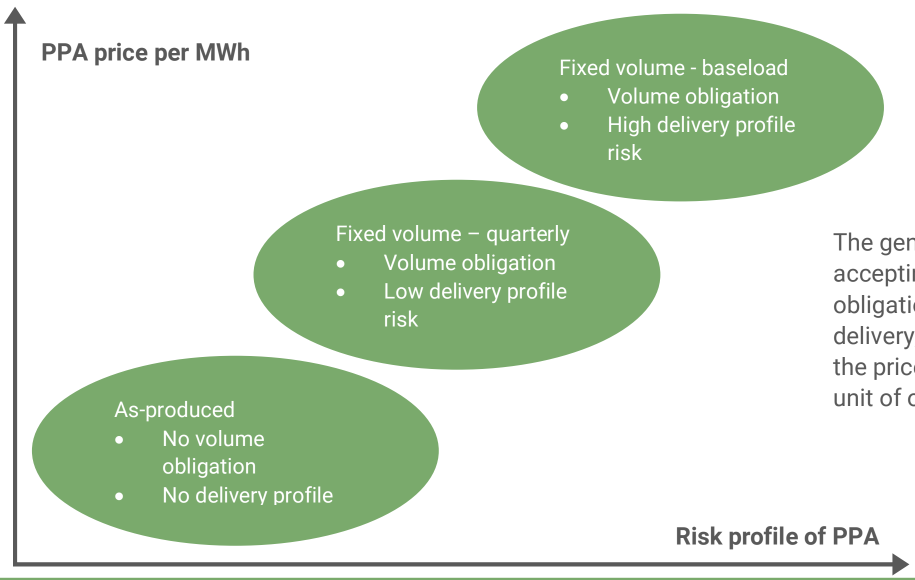
RE100 INITIATIVE

The RE100 initiative is focused on accelerating the global shift towards clean energy supply and zero-carbon grid networks.

The initiative brings together hundreds of the world's most influential companies under one common theme: a desire to procure 100% of the electricity they use from renewable sources.

Companies operating in the industrial and commercial sectors account for approximately 50% of global electricity end use.

By committing to a long-term off-take agreement through a Corporate PPA, credit-worthy companies facilitate the build-out of new renewable energy capacity that may otherwise never have been developed – a dynamic known as 'additionality'.



The generator will be compensated for accepting greater risk. The stricter the obligations around volume and timing of delivery, the greater the risk and the higher the price the generator may achieve per unit of output.

The usage, sophistication and maturity of the PPA market differs between regions and it is clear that areas with lower prevalence of subsidy support, for example, will tend to have a larger, more active PPA market since price sensitivity is greater and developers will seek to de-risk their assets from a financial perspective. With a history of sizeable subsidy support for renewable energy generators (alongside other factors), the UK PPA market remains less mature compared with that of the Nordic countries or North America, for example, and where PPAs have been utilised they have typically been for relatively short contract periods. However, as subsidy support mechanisms have been withdrawn, the UK corporate PPA market and many others across Europe in particular, are beginning to transform and grow.

The demand for renewable energy from corporations has been spurred by sustainability objectives but also by the much-improved economics of renewable energy technologies and more flexible regulation. This has driven a surge in the quantum of corporate PPAs being signed and in 2019 a record 19.7GW worth of contracts were agreed according to Bloomberg New Energy Finance, representing year-on-year growth of c.45%. In 2020, to the end of July, almost 9GW of PPAs have been signed with approximately 60% of that coming from U.S. corporates.

Efforts to decarbonise the global economy will require continued growth in installations of renewable energy capacity and the intermittent nature of wind, hydroelectric and solar power generation, for instance, will result in greater volatility in spot electricity prices. PPAs provide a way to mitigate this price risk for both generators and off-takers and facilitate the development of new renewable projects by improving cash flow certainty.

INNERGEX

(INE CN, CAD$4bn market cap)

Canadian renewables company specialising in the development and operation of hydroelectric, solar and wind assets.

Owns 75 operational assets with installed capacity of 3.7GW.

Example Asset:	Phoebe Solar Project, Texas U.S.
Capacity:	250 MW *Sufficient output to power 50,000 Texan households p.a.*
Commissioned:	November 2019
Transmission network operator:	ERCOT
Off-taker:	Shell Energy North America
PPA expiration:	2031 (12-year term)

Total output from the Phoebe solar farm is sold to the ERCOT power grid.
89% of the energy produced receives a fixed price under a 12-year PPA with Shell Energy North America.
The remainder of the project's output receives a merchant market price.

The **VT Gravis Clean Energy Income Fund** invests in companies that own renewable power generation assets and these companies are highly active in PPA markets. Such contracts have underpinned the income-producing credentials of these portfolio companies and have meant that dividend distributions have been maintained, and in many instances increased, despite the economic contraction induced by the COVID-19 pandemic.

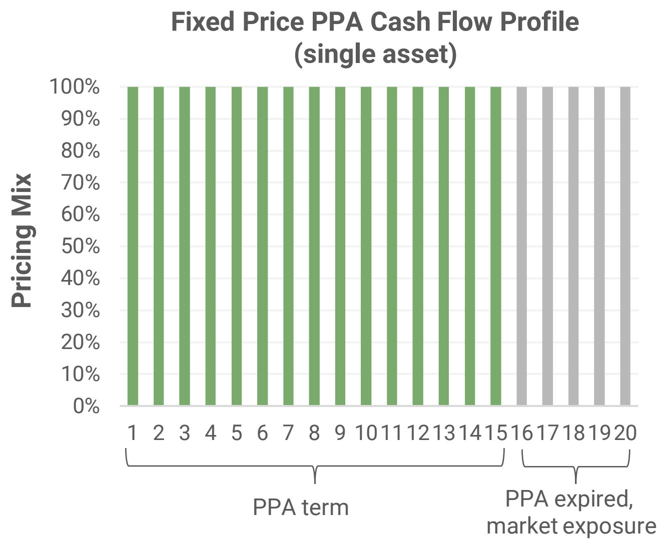
Chapter 3: The Varying Impact of Power Prices

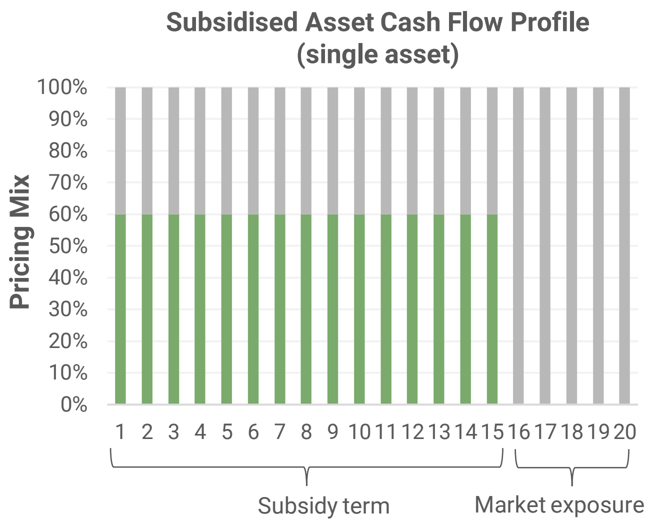
For any renewable power generator, the price of electricity – and indeed forecasts for how the price of electricity will evolve over the long term – will be an important component in projecting the revenue streams that a wind farm or solar park, for example, will be capable of generating over its assumed lifetime.

For companies that own renewable energy assets benefiting from long-term fixed/known price Power Purchase Agreements for the electricity they generate (*see Power Purchase Agreements – what are they?*), there is very little or no sensitivity to fluctuations in power price expectations owing to the fact that cash flows are linked to a pre-determined price. Arrangements like these appear frequently in North American renewables projects where contracts can be >15 years in length. If an asset is still operational at the time of the PPA expiry, the asset owner may re-tender for a follow-on PPA or sell output at market prices. At this point in time, the asset will become exposed to prevailing pricing trends, meaning the new PPA could be priced above or below the prior level. However, assets are valued on a discounted cash flow basis and nearer years account for a disproportionate amount of the overall value of those future cash flows. In addition, companies will typically ascribe a low value to cash flows that may be produced beyond the existing PPA – either by using a high discount rate in order to discount those far off cash flows to a present day value, or by assuming zero cash flow.

In jurisdictions where PPA markets are less developed and long-term fixed price contracts are not readily available, such as the UK, the build-out of renewable energy capacity has been aided by subsidies that provide an element of certainty to the cash flows which in turn incentivise developers to commit to a project. The Renewables Energy Certificate, Feed-In Tariff and Contract for Difference schemes used in the UK, Europe and Australia, for example, assisted in that process by facilitating a payment to the generator per unit of electricity produced, or by providing pricing certainty for the expected output from an asset over a 15-year time horizon (or longer). In this scenario, there remains an element of uncertainty as long-range forecasting is difficult and can lead to inaccuracies.

Example of simplified cash flow profiles for single renewable energy asset (fictional) under long-term fixed PPA and subsidy basis





The 'value' of assets that are developed without any form of certainty to the cash flows (either through a subsidy mechanism or long-term PPA) will be highly sensitive to movements in near-term electricity prices and long-term price projections. Now that renewable energy technologies are in many geographies and cost-competitive with conventional forms of electricity generation, the construction of new, unsubsidised assets is becoming more common. However, the asset owner will need to be prepared to take on material uncertainty for future cash flows. That risk may be considered acceptable: it is widely anticipated that society will become increasingly reliant on electricity to power our lives, for example through the electrification of transport and heat, and increasing digitalisation, and this expectation is likely to ensure that demand will grow – the International Energy Agency forecasts annual demand growth of c.2% per annum between now and 2040 - and that prices will increase in real terms over coming decades.

Renewable energy assets located in different geographies, where subsidies differ, or assets that are of varying 'vintage', since subsidy schemes have adjusted over time, will typically have different cash flow profiles owing to the nature of the underlying mix of fixed (or 'known') pricing and commensurate merchant price exposure. Therefore, companies that own diversified portfolios of renewable energy assets (by geography, by technology and by vintage) will have a unique blend of cash flows and varying degrees of sensitivity to assumptions relating to power prices.

Near term cash flow mix (1 year view):

Innergex Renewable Energy Inc	Aquila European Renewables	Greencoat UK Wind
>95% long-term fixed PPA + government regulated tariff Asset location: North America & France	~75% fixed price + government regulated tariff Asset location: Scandinavia & Iberia	~60% output sold forward + government regulated tariff Asset location: UK

Source: Company data, Gravis analysis

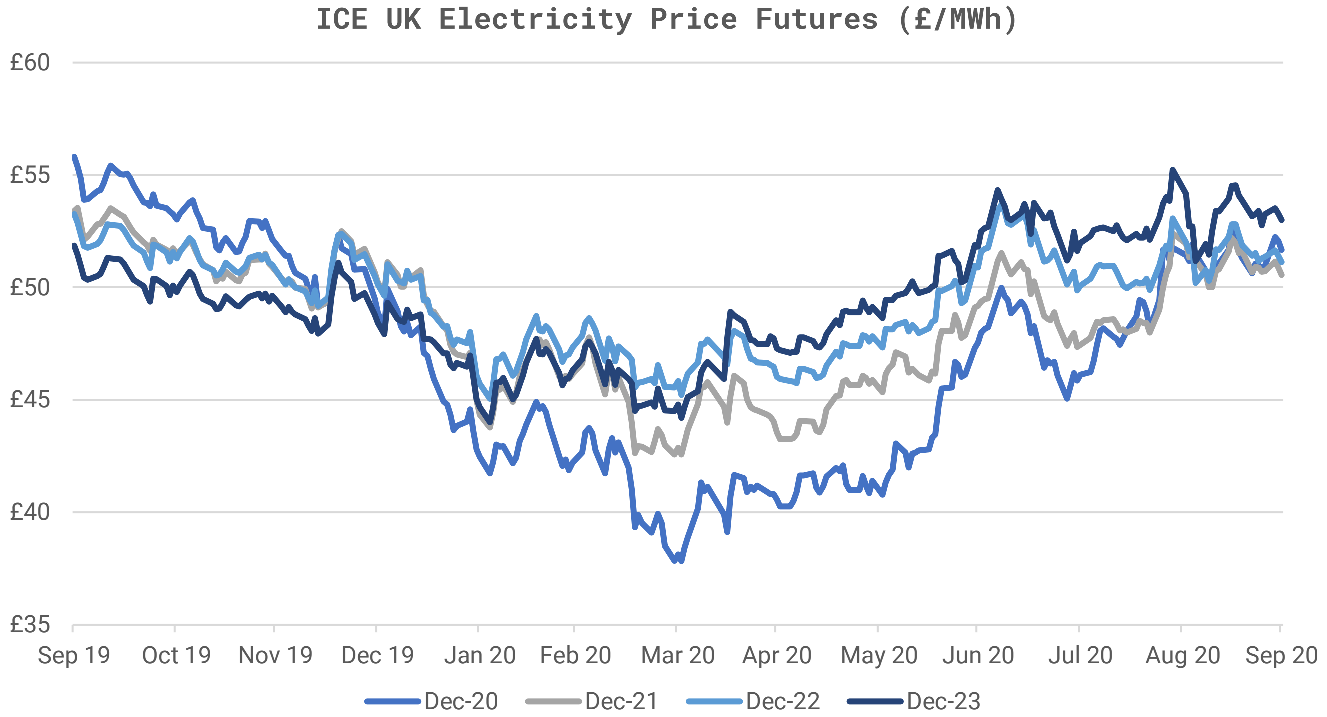
Since asset valuations are calculated by discounting future cash flow expectations, a higher exposure to merchant power prices results in valuations having greater sensitivity to movements in price projections – both near-term and long-term. We observe this clearly in the net asset valuations reported by UK-listed renewables companies on a quarterly basis, which incorporate the latest long-term pricing projections from a small group of energy consultancies. Greencoat UK Wind, a company which owns wind farms located in the UK (typically onshore assets), has historically adopted a strategy of retaining a relatively high level of spot price exposure, so will demonstrate considerable sensitivity to movements in UK electricity prices. In contrast, Innergex, which operates renewable assets predominantly located in Canada and with a very high level of fixed pricing, will be relatively unaffected by changes in expectations for electricity pricing. Aquila European Renewables' current cash flow mix sits roughly in the middle, with approximately 75% of very near cash flows being underpinned by fixed pricing and subsidies. However, Aquila's portfolio moves to a greater proportion of merchant price exposure in coming years and so its near term cash flow profile will become less certain unless the company fixes new PPAs or introduces more assets with contracted pricing into the portfolio.

Over the last year or so, electricity price forecasts have been under pressure, owing to a range of dynamics. On the supply side, a general oversupply of oil and natural gas has weakened pricing (electricity prices are still somewhat linked to the trajectory of gas prices) while on the demand side, the Coronavirus pandemic and resultant cessation of economic activity meant that demand fell sharply during March and through the second quarter of 2020, compounding the price weakness.

Nevertheless, we have observed a sharp improvement in pricing in Europe and the UK since the lows of April/May, with spot prices moving beyond pre-pandemic levels in many areas. Moreover, futures prices have firmed significantly and while futures markets may only 'go out' a few years in key markets, this improvement is of importance. If renewable energy companies value future cash flows based on energy consultancies' price forecasts and those forecasts are at odds with the reality of what may be presently achieved, as we see now, then the challenges and inaccuracies resulting from using long-term price

forecasts to drive asset valuations becomes apparent. For example, if a renewable energy generator removes its price risk for anticipated output in two years' time by locking in prices via a short-term PPA or through futures markets, then any subsequent change in pricing forecasts for that period becomes irrelevant.

The owners of portfolios of renewable energy will typically have energy trading teams who are seeking to lock in attractive prices at opportune moments. The chart below illustrates the movements in UK electricity price futures (December contracts) over one year. Extracting the December 2021 contract, we can see a significant improvement in the price from the nadir in March 2020 to the end of September 2020. Current valuations will still be factoring in prices for 2021 that incorporate futures prices from earlier this year, whereas trading teams could be locking in prices for power output in late 2021 at rates some 20% higher. This demonstrates the potential for significant divergence between prices that are factored into valuations from period to period and what is ultimately achieved.



Source: Bloomberg L.P.

It appears reasonable to anticipate that recent improvements in electricity pricing across the UK and Europe will have a positive impact on asset valuations once incorporated into future cash flow expectations. While very long-term expectations may be relatively unchanged, if not softer, the disproportionate impact of near-term cash flows on the discounted cash flow model is likely to dominate.

One region where pricing has not rebounded strongly as economies have begun to 'open up' is Scandinavia. A wet, mild winter meant that hydro balances were high going into 2020, while lower demand caused by lockdown meant that supply has been easy and price recovery has been slower. Regional factors such as this will ordinarily drive different electricity price dynamics at any given time in different markets. That is in contrast with recent months, where the pandemic has had a homogenous, overarching impact on demand and pricing. In addition, the level of interconnection between two geographic energy markets will also impact how correlated electricity prices are in those markets. For example, the correlation between electricity pricing in Scandinavia and Iberia is close to zero owing largely to very limited interconnection between the two markets. As a result, geographic diversification will typically have a beneficial influence in reducing price risk for a mixed portfolio of renewable energy assets.

The **VT Gravis Clean Energy Income Fund** is well positioned to withstand volatility in long-term electricity price forecasts as a result of its diversified portfolio, which is exposed to companies that own renewable energy assets across a range of geographies, technologies, and contractual counterparties, in addition to a significant bias towards fixed/known revenue streams as opposed to merchant price exposure.

Chapter 4: Energy Efficiency - the 'cleanest' energy is that which is never used

Eliminating energy wastage is an increasingly important area of focus for governments and corporations and forms a key consideration in the transition to a low carbon economy. The concept, which is typically referred to as Energy Efficiency, can deliver a variety of benefits including reductions in greenhouse gas emissions, the need for energy imports (linked to constrained energy supply) and to energy-related costs. Energy efficiency has been dubbed the third pillar of infrastructure investment and is a rapidly growing sub-sector of the global infrastructure market, complementing the ongoing build-out of renewable energy generation capacity.

The opportunities to improve energy efficiency are vast and span all areas of the economy, whether it be the improvement in the performance of buildings, improving efficiencies within energy generation and distribution, or efficiencies linked to transportation and industrial/agricultural production. Sustainable Development Capital (an established specialist in energy efficiency project development) estimates that up to 75% of the original energy resource is lost through the process of generation, transmission & distribution, and end usage. Meanwhile, the International Renewable Energy Agency forecasts that of the $120tn of global energy sector investment required to achieve the ambitions laid out in the Paris Climate Accord, 44% will need to be directed towards energy efficiency.

Buildings: According to the International Energy Agency (IEA), buildings were responsible for 28% of global energy-related CO_2 emissions in 2019, while buildings and the building construction sector combined were responsible for over a third of global final energy consumption – the majority consumed by residential buildings of which most is used to heat space and water. Space cooling and heating requirements, increased use of appliances (leading to higher electric 'plug-loads'), reliance on fossil-fuel based heat and power provision, and insufficient regulation of sustainability and energy efficiency requirements, have all contributed. As a result, buildings offer huge potential for improvement and a consequent reduction in emissions.

Simple policies such as the phase out of incandescent lamps and, more recently, halogen lamps in favour of LED lighting, can drive efficiency improvements. More significant strides can be made through improvements in 'building envelopes' – the components of a building's structure such as insulation, window materials and air sealing – and this is where the largest element of energy-related investment in buildings is being directed.

In terms of emissions reductions, buildings' reliance on fossil fuel-based heating technologies will be a key area of focus. Moving away from natural gas boiler systems in favour of heat pumps (which can also provide a cooling function) is a good example. In the UK and across the Northeast US, commercial and residential properties are highly reliant on natural gas-based central heating systems, with very limited penetration of heat pumps or electric heating systems. By contrast, in Sweden, domestic heating requirements are provided for by heat pumps, electric heating

RENOVATION WAVE

The EU's 'Renovation Wave' Strategy, published this month, aims to accelerate the rate of buildings renovations over the next decade and drive a 60% reduction in emissions from buildings.

The EU's ambitions are to target 35 million building renovations by 2030 focusing on improving energy efficiency performance. The process is likely to cost €275bn p.a. and could create up to 160,000 additional 'green' jobs.

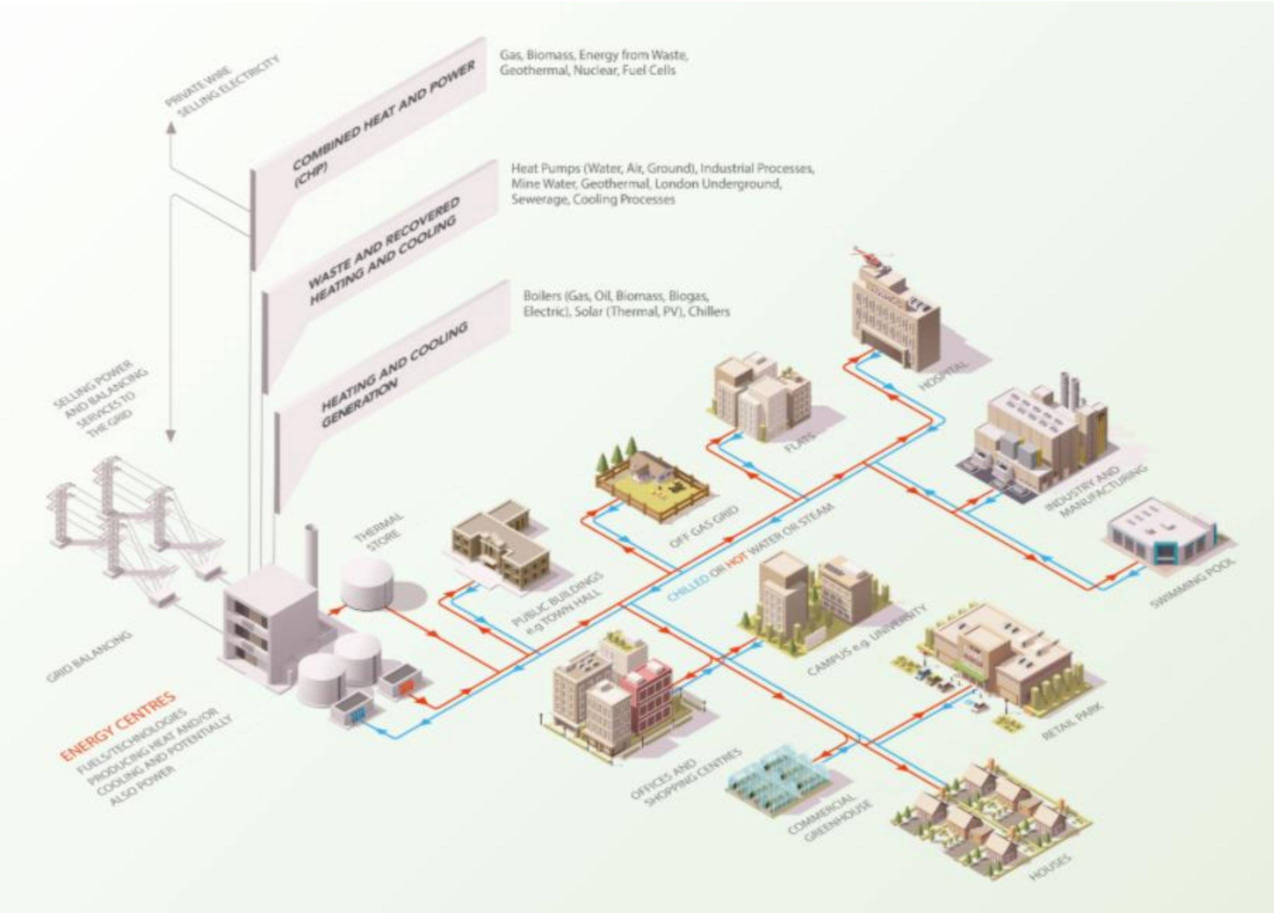
Buildings are responsible for 40% of the EU's energy consumption and 36% of the EU's greenhouse gas emissions from energy. Renovation Wave aims to reduce heating and cooling demand by 18% over ten years.

systems, and most significantly, district heating networks (see below). Reliance on fossil fuel heating systems is largely non-existent.

Energy Generation & Distribution: In many developed economies, and the UK is a good example of this, incumbent power networks are centralised and inefficient. That is to say, electricity is generated at very large scale facilities, such as fossil-fuel driven power plants and nuclear power plants, or large scale hydroelectric facilities and wind farms, that are typically sited in remote locations, far away from the end-users. They are typically connected to a network of high-voltage transmission lines before being distributed at far lower voltage to many ultimate end users in multiple locations. During this process there is significant wastage: much of the energy content of fossil fuels is wasted in the process of power generation, conversion losses (when energy is converted into different forms), and through transmission losses as the power is distributed across long distances. A good illustration of this is provided by the US Energy Administration, which shows that in 2019 more than 60% of the energy used for electricity generation is lost in conversion:
https://www.eia.gov/totalenergy/data/flow-graphs/electricity.php

A more efficient (and less polluting) energy network for the future is one that is decentralised. This term broadly refers to energy that is generated away from the main grid and may refer to energy-from-waste plants, district heating and cooling projects, combined heat and power plants (CHP) or smaller scale renewables including biomass, solar or geothermal assets. Decentralised networks can serve individual buildings or serve communities as large as cities and will ultimately reduce inefficiencies associated with centralised networks, reduce carbon emissions, and reduce energy costs in the medium to long-term.

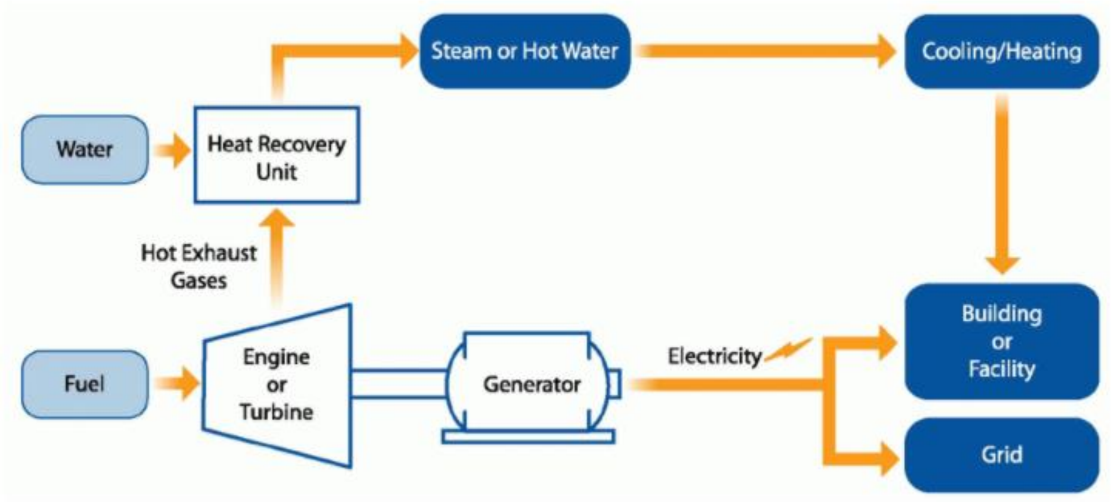
Example: District Heating Network



Source: BEIS, Triple Point

District heating plants provide higher efficiencies, lower costs, and better pollution control than localised boilers, reducing carbon emissions. Heat generation accounts for approximately a third of the UK's carbon emissions. The UK government has established a £320m investment programme, called the Heat Networks Investment Project (HNIP), to help deliver more district heat networks alongside the private sector, which may introduce an additional £1bn of investment.

Example: Combined Heat & Power Plant



Source: US Environmental Protection Agency

Combined heat and power (CHP) is a highly efficient process that captures the heat by-product of the electricity generation process. A CHP plant generates heat and power simultaneously and can reduce carbon emissions by up to 30% compared to conventional generation via a separate boiler system and electricity sourced externally.

CHP systems are highly efficient, making use of the heat which might be wasted when generating electricity and catering for heat requirements that would otherwise require additional fuel to be burnt in a separate boiler. For many companies with commercial or manufacturing facilities, or for residential communities, CHP can offer the most significant single opportunity to reduce energy costs and to improve environmental performance.

Transportation: The transport sector has the highest final energy consumption of all sectors and its reliance on fossil fuels makes it a major source of greenhouse gas emissions. In terms of efficiency, the opportunity comes from the lower cost (over time) of alternatives such as electric vehicles (EVs) vs. conventional petrol/diesel vehicles where the cost of the electric charge over 100 miles may be some 75% cheaper than petrol. The electrification of transport using batteries (and hybrid solutions), alongside renewable energy generation technologies, is an option for rail and light-duty road transport (i.e. cars, buses, and smaller HGVs). A shift toward EVs will require considerable investment in developing networks of public charging points and this is emerging as an investible area within the energy efficiency infrastructure theme.

Notwithstanding tougher regulations from central policy-makers relating to energy efficiency requirements in buildings or emission reduction targets, for example, corporate entities and local authorities are incentivised to undertake energy efficiency initiatives owing to the achievable cost savings as well as sustainability ambitions (an increasingly important aspect of corporate strategy). The increased focus on energy efficiency provides scope for the private sector to inject capital into projects that generate returns linked to the savings delivered to the end client or can simply be structured for the provision of long-term capital. Energy efficiency projects typically attract long-term, infrastructure-like cash flows and in the prevailing environment such opportunities are likely to be highly sought after.

The **VT Gravis Clean Energy Income Fund** has identified investable opportunities within the global energy efficiency sector, through publicly listed companies. These entities provide exposure to diversified portfolios of energy efficiency projects which typically attract long-dated, availability-based cash flows to the investor while providing cost and emissions benefits to counterparties operating in a variety of segments of the global economy or representing governmental entities.

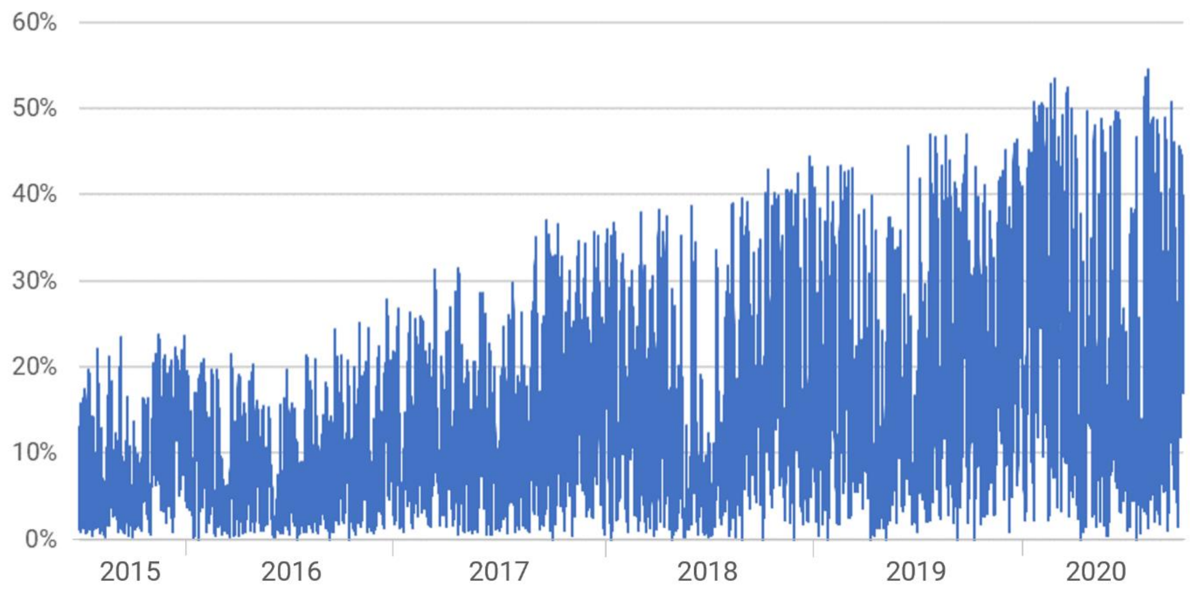
Chapter 5: Energy Storage Solutions – how to harness renewable energy generation

The transition towards low carbon, renewable energy generation is building momentum globally. While renewables are expected to contribute significantly towards meeting climate change objectives, the transformation in the way we generate electricity to power our everyday lives nevertheless poses challenges to existing energy transmission networks. This is because renewable energy generation is intermittent: wind speeds are temperamental and therefore wind generation oscillates, irradiation levels are not always sufficient to deliver solar power generation (and solar generation is 'offline' at night), and rainfall patterns (among other factors) impact hydroelectric power generation.

By contrast, conventional forms of power generation, such as that produced from burning fossil fuels or by nuclear power plants, for example, are generally capable of providing a far more reliable and continuous supply to meet 'baseload' power requirements – that is to say the minimum amount of power required at any given time. The relative unpredictability of renewable energy generation, combined with its increasingly dominant position in the energy mix is why, in the UK for example, there remains a need for natural gas and nuclear power stations in order to help balance the supply and demand requirements of the grid. However, investment in energy storage solutions will provide scope for the full potential of renewables to be harnessed, by capturing output during times of high generation and smoothing the delivery of power to the grid.

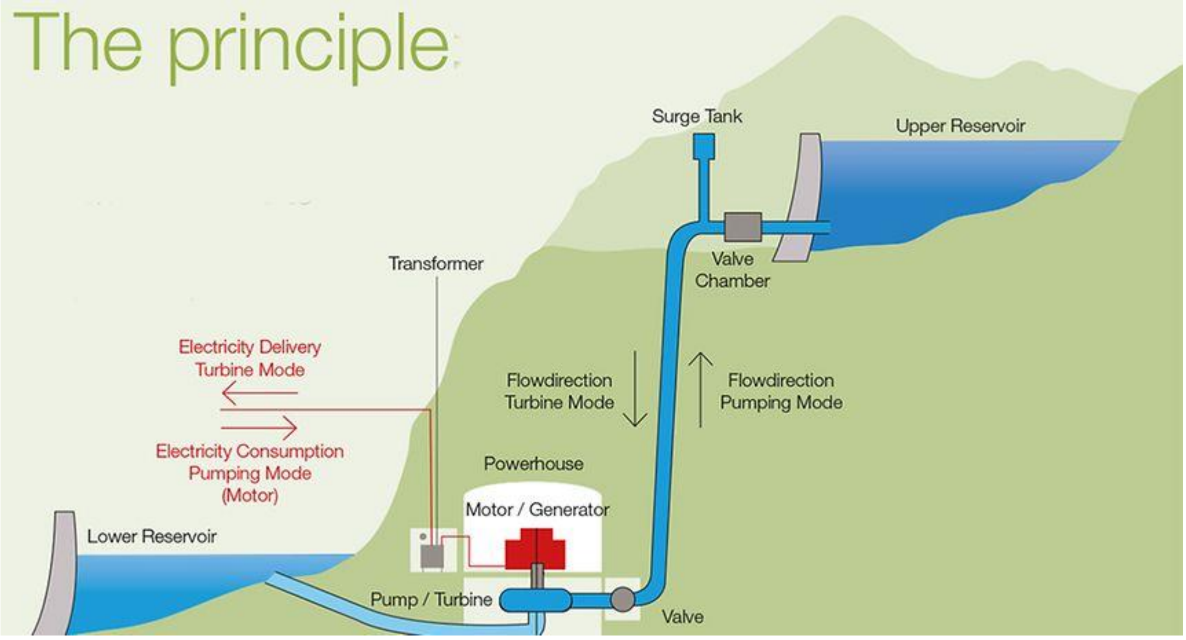
The chart below shows the percentage of total UK electricity generation from wind power, 1st July 2015 to date. The grid is balanced within 30-minute periods (i.e. 48 discrete periods per day). The data shows (1) growth in overall generation from wind reflecting rapid project deployment, (2) wind power generation is highly volatile, which creates challenges in balancing supply and demand.

Wind Power: Percentage of Total Generation

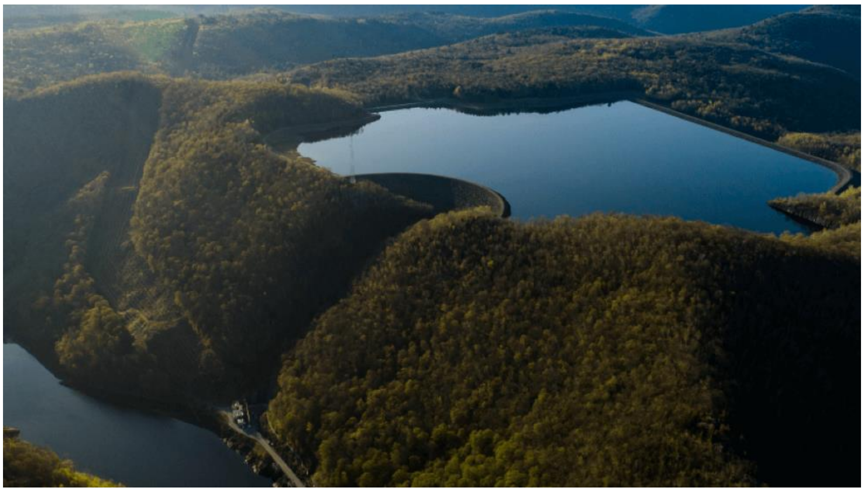


Source: ELEXON Portal, Balancing Mechanism Reporting Service

Pumped-Storage Hydroelectricity. The oldest form of large-scale energy storage, the use of pumped-storage hydropower can be traced back to c.1900 in Italy and Switzerland. The principle of this method is simple: two reservoirs are required, each located at different altitudes. When water is released from the upper reservoir to the lower reservoir it is channelled through a turbine and generator to create electricity. The water is then pumped back from the lower reservoir to the upper reservoir and represents a store of gravitational potential energy until the water is released once again. Pumped-storage hydropower can provide a dynamic (i.e. proportionate) response to balancing grid requirements, offering critical backup during periods of excess demand.



Although the losses associated with the process of pumping water back to the upper reservoir results in pumped-storage being a net consumer of power overall, if used in conjunction with sources of renewable energy generation it can help to resolve the intermittency issues associated with wind or solar power generation (described above). Using low-cost surplus, or off-peak electric power, to run the pumps – for example, when wind generation is above grid requirements – it can be stored for periods of higher demand, which will typically be associated with higher electricity prices.



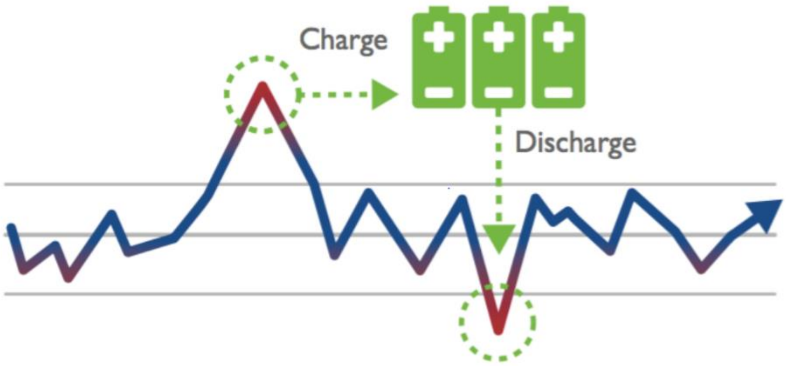
The 600 MW Jack Cockwell hydroelectric storage station located in northern Massachusetts is owned by Brookfield's renewables division.

The facility plays an important role in providing flexibility and stability to the electrical grid.

Pumped-storage hydroelectricity accounts for over 90% of the world's existing storage capacity, but the development of new solutions such as battery technologies now provides alternative options. The geographic requirements for pumped-storage (and hydroelectric power generation in general) means that batteries will prove more scalable in some areas. The world's largest pumped-storage assets are located in the U.S., China, Japan and Continental Europe, although the Dinorwig power station situated in Snowdonia national park, which was commissioned in 1984, is the world's tenth largest hydroelectric scheme.

Battery Storage Solutions. In recent years, cost-effective battery-storage technology has emerged as a solution to the intermittent nature of renewable energy generation by storing electrical energy as chemical energy. The majority of utility-scale battery assets use Lithium-ion technology, which is currently the most cost-effective and possibly most versatile option, being capable of adaptation to cater to both small scale applications, like powering an electric vehicle (EV), or multi-megawatt grid-scale applications able to power thousands of homes.

Grid-scale battery-storage assets can store energy at times of oversupply and release that power back into the grid during periods of higher demand. This ability to import and export power rapidly can help keep, for example, the UK grid's electrical frequency at 50Hz.



The UK electricity grid is maintained close to a frequency of 50Hz.

Batteries can be employed to provide or absorb power as required.

There are multiple revenue streams available to battery-storage operators (below is not an exhaustive list) and unlike renewable power generators, revenues attracted by battery storage assets are not linked to absolute power prices.

- Firm Frequency Response – the battery asset provides a rapid and dynamic response in reaction to changes in the grid's electrical frequency, by either importing or exporting power.
- Asset Optimisation (trading) – supply and demand on the grid is balanced within discrete 30-minute periods. A battery operator can buy power during periods of excess supply (lower prices) and sell power during times of high demand (higher prices) thereby profiting from the margin. In the UK there are structural pricing dynamics throughout the day with a clear trough in prices during the day and a peak in the evening.
- Capacity Market – the battery operator receives a fixed fee, on an availability basis. The battery asset must be available to deliver power to the grid whenever called upon.

In addition to standalone battery assets, battery storage is increasingly being integrated alongside renewable energy generation assets. The introduction of storage capacity allows the wind or solar farm operator greater flexibility over when power is sold, rather than simply being required to sell output as it is generated (when there may also be risk of curtailment if generation is too high). This provides the operator with scope to sell electricity at better prices as well as store excess production rather than wasting it.

Tesla 100 MW Powerpack battery storage system integrated into the 99-turbine, 309 MW Hornsdale Wind Farm located in Jamestown, South Australia and developed by John Laing and Neoen.

The addition of battery storage has enabled the site to provide frequency control services to Australia's national electricity market in a region that has suffered from power shortages.

The build out of energy storage solutions will not only save wastage and the need for fossil fuel power generation capacity, but will also help to reduce energy-system costs. The UK's Electricity System Operator (ESO), National Grid, has (at the time of writing) paid more than £190m of constraint payments to wind farm generators in 2020. These payments are made when the supply of electricity from wind is too high and – without sufficient storage capacity – there is no choice but to curtail output to balance the grid. This has been particularly acute during 2020, owing to the reduction in electricity demand associated with the economic shut-down. Ultimately, these constraint costs are borne by the consumer and without more storage capacity, planned growth in offshore wind installations in particular will potentially drive constraint payments even higher.

Unsurprisingly, National Grid refers to battery storage as a ‘vital tool’, that will play a wide range of roles in balancing the grid. It appears likely that the availability of regulated revenue streams for battery operators will broaden. The potential to lower constraint payments and the build-out of storage capacity is likely to put downward pressure on wholesale electricity costs over time, owing to the fact that battery assets will help to smooth the deployment of power throughout the day, charging at off-peak times and discharging in the evening, for example, when there is a peak in demand.

Moving towards a zero-carbon energy system in the UK will depend on a significant increase in battery storage capacity. The National Grid forecasts that UK battery storage capacity could reach 2.3GW in 2025, which would represent growth of approximately 160% compared with the 0.88 GW of capacity available at the end of 2019. On a global view, energy consultant Wood Mackenzie anticipates that global energy storage capacity will grow at a compound annual rate of 31% between now and 2030, even factoring in a slight dip in 2020 owing to the impact of the Coronavirus pandemic on activity levels. This would see the global battery storage market reach 741 GW cumulative capacity, of which the U.S. will account for approximately half.

Separately, as more consumers switch to using electric vehicles, the concept of Vehicle-to-Grid (V2G) will become important – a smart charging system whereby V2G would supply energy back to the home or grid in times of demand and recharge at more optimal times.

There are clearly a range of benefits to come from an increase in global storage capacity. As renewable energy sources begin to reach a tipping point in terms of their contribution to the electricity supply mix, these storage assets will represent critical energy infrastructure in the future world of high renewables penetration.

The **VT Gravis Clean Energy Income Fund** invests in energy storage assets through the ownership of publicly traded companies. This includes specialist energy storage companies that own and operate free-standing, utility scale battery storage assets and pumped hydro assets, as well as renewable energy companies that have integrated battery storage capabilities within operational wind and solar projects.

Chapter 6: A Cleaner Energy Future

The focus on a 'green agenda' has gained significant momentum in recent years. Despite the challenges faced by society and the global economy at this time, the desire to move towards a more sustainable and low-carbon economic model has shown no signs of abating. If anything the transition has been bolstered, and potentially accelerated, as a result of the stimulus packages being proposed and deployed by governments, which have clear biases towards the development of sustainable projects, for example, in energy and transport.

The direction of funding towards sustainable projects is clearly aligned with the move towards achieving 'net zero' (i.e. an environment where any residual greenhouse gas emissions are completely offset by removals, through activities such as carbon capture and storage), a target being adopted increasingly by governments around the world. While the UK was the first of the G7 group of major economies to commit to achieving net zero, (following recommendations from their official adviser, the Committee on Climate Change) it has been joined by a growing cohort of countries who have committed themselves to similar ambitions.

To date, eight countries, which cumulatively account for ~4.4% of global energy-related CO_2 emissions, have signed net zero targets into law, typically by 2050: Norway, Denmark, New Zealand, Sweden, Hungary, France, the UK and Germany. However, this group is likely to increase substantially with many governments proposing legislation or introducing new policy measures. There is also scope for more concerted efforts. For example, the European Commission (EC) is working towards a bloc-wide net zero emissions target agreement as part of its 'Green Deal', which was published in December 2019 and described by EC President Ursula von der Leyen as being "Europe's man on the moon moment". The overarching objective of the Green Deal is to achieve a 'climate neutral' Europe, with the 'net zero' target enshrined in law. Renewable (and other low carbon intensity) energy generation targets will be a major component of the Green Deal but there is also a focus on renovating buildings and toughening up regulatory requirements as part of energy efficiency measures, targeting transport-related emissions through tougher emissions standards for vehicles, and acceleration in the development of the infrastructure required to encourage a greater transition to electric vehicles. Europe wants to be a front-runner in climate friendly industries and clean technologies. As a whole, the bloc is responsible for almost 8% of global energy-related CO_2 emissions.

The US is a notable omission from the list of major economies with federal-level climate change commitments and notably the Trump administration set out plans to withdraw from the Paris Climate Accord. However, the lack of federal ambition has not impeded climate change targets at a more localised level. Policies including carbon pricing, emissions limits, and energy efficiency mandates have been adopted at the state and regional levels in order to help reduce greenhouse gas emissions, develop clean energy resources, promote alternative fuel vehicles, and promote more energy-efficient buildings and appliances.

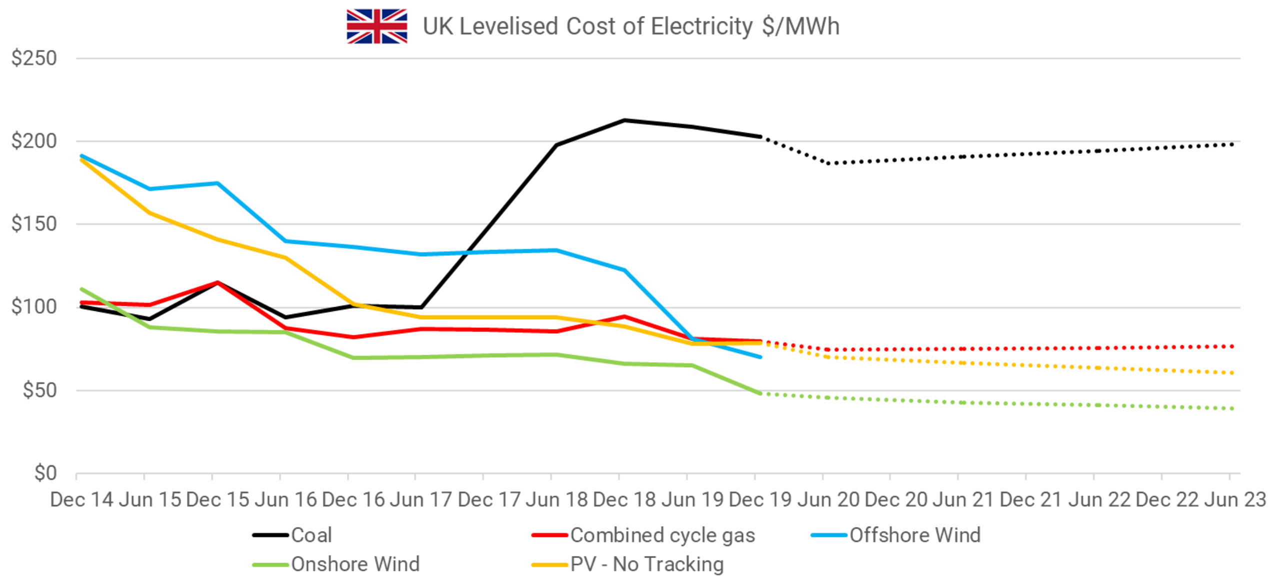
In sum, twenty-three states (plus the District of Columbia) have adopted specific greenhouse gas reduction targets, while an even greater number have introduced policies (such as the renewable portfolio standard or clean energy standard) that require electricity utilities to deliver a certain amount of electricity from renewable or clean energy sources. The state of California has led the way, passing a law in 2018 to ensure that by 2045 all electricity is generated by renewable sources. The state also targets net zero CO_2 emissions by the same year. Although specific targets and policies diverge between different states, the prevalence of these targets demonstrates widespread support for climate action.

Significant capital deployment is required to deliver on existing and planned policies relating to climate change. The International Renewable Energy Agency (IRENA) forecasts that the global energy sector will require cumulative investment of $110tn to 2050, including expenditure on energy system infrastructure required as part of the adaptation to a reliance on renewable forms of power generation. This represents, on average, 2% of global gross domestic product p.a. over the period.

The types of investments will be in stark contrast to historic norms, with a shift away from the fossil fuel sector towards energy efficiency, renewable power generation and related enabling infrastructure. As we discussed in our recent chapter about energy efficiency, investment in reducing energy intensity will be critical as part of reaching climate change objectives. Meanwhile, the share of renewable energy generation would increase from around a quarter of global energy supply, to two-thirds in 2050. In addition, the anticipated transition to electrified forms of transport and heat means that electricity is likely to become the central 'energy carrier' and as a result gross electricity consumption would more than double, according to IRENA.

In support of emission reduction ambitions, many governments have introduced varying forms of support to prime the clean energy sector. In the UK, for example, the government has used subsidy mechanisms such as Renewable Obligation Certificates to underpin large proportions of expected revenues for renewable energy assets and has more recently employed a contract-for-difference model to underpin offshore wind developments by providing a floor price for the electricity produced. In the US, tax equity incentives have been used to encourage private investment in renewable energy projects.

Although the focus of this piece has been on governmental policies and the shift in focus of authorities towards climate goals, there are other factors driving the build out of renewables and sustainable infrastructure assets: notably corporate sustainability initiatives and the falling cost of renewable energy generation. High profile corporates like Amazon and Google recognise the increasing awareness of consumers in matters relating to sustainability and the environment and that is driving 'additionality', i.e. investment in renewable energy generation capacity that would not otherwise be developed under governmental targets. But it is not all about perception or climate change initiatives. The rapidly falling cost of renewable energy technologies means that in many regions wind and solar power generation is cost-effective even relative to the most efficient forms of conventional power generation. The decision to develop new wind or solar capacity instead of a natural gas-powered plant, for example, is in a growing number of instances, one of economic sense.



Source: Bloomberg New Energy Finance

The chart above shows the Levelised Cost of Electricity in the UK for a range of power generation types over time. The measure aims to standardise the cost per unit of output over an asset's lifetime *including all associated costs (e.g. construction, maintenance, decommissioning). Common forms of renewable energy generation are now economically preferable to conventional forms of energy generation when considering new capacity. (Dotted lines are forecasts).*

The outlook for the clean energy sector is positive and the industry is likely to see a long-term structural growth trend. This is good news for successful companies operating in the supply chain and related service industries, but it is also an attractive dynamic for infrastructure investors looking to gain exposure to long-dated and reliable cash flows from long-life assets. The pipeline for capacity growth in infrastructure such as energy generation assets (for example wind farms and solar parks), energy efficiency projects and energy storage solutions is very sizeable and this is the type of investment targeted by the **VT Gravis Clean Energy Income Fund**. There is a large and growing investible universe of publicly listed companies operating in the clean energy infrastructure space, which benefit from long-dated, contracted cash flows linked to portfolios of such critical assets.

Conclusion

We hope you have enjoyed this series of chapters exploring the economics and prospects of the renewable energy sector in which the **VT Gravis Clean Energy Income Fund** invests. To recap the document explores the following:

- Power Purchase Agreements (PPAs)
- Power Prices
- Energy Efficiency
- Storage Market
- Macro view and expectations for the future

There are many moving parts in the renewable energy sector, with many new technologies in situ and in development – as Will Argent has highlighted on the preceding pages, the anticipated investment in all things renewable and clean is starting to resemble a gold rush. We hope, in this instance, we have demonstrated how we aim identify the 'seller of shovels' rather than the prospectors. When trillions of dollars are hurled at a sector, innumerable businesses pop up, hoping to take advantage of the flow of capital and we believe our job, and the expectation of our investors, is to create and manage a portfolio of stocks which are steady, stable and potentially rather dull.

Our task is to manage an income fund, which by its very nature means our focus must be on companies that own assets that are largely already in place, generating electricity, and therefore cashflow. By investing in renewable power generation assets, and in particular companies whose income is often secured by power purchase agreements, the Fund is able to deliver attractive dividends to investors. Comfortingly, these dividends have continued, and look set to continue, despite the environment of dividend cuts and suspensions induced by the COVID-19 pandemic.

The Fund is well positioned to withstand volatility in long-term electricity price forecasts due to its diversified nature, with exposure to companies around the world, owning a variety of assets which have a blend of pre-agreed price agreements, as well as open market prices. To date, the portfolio is exposed to companies that own c. 1,200 separate renewable energy projects.

The chapters exploring energy efficiency and the storage market provide examples of newer opportunities. The Fund's holdings in the former offer further diversification with the additional benefit of long-dated, availability-based cash flows which help sustain the dividend. There is also potential for rapid growth in this sub-sector of the global infrastructure market, as it is one that is utterly key to achieving the ambitious targets laid out in the Paris Climate Accord.

Energy storage assets, owned by publicly traded companies, enable the electricity generation sector to smooth the delivery of dependable and reliable energy, from an inherently unpredictable 'feedstock'. There is a growing need to manage the delivery of electricity into the grid, which has naturally led to the development of storage facilities for the excess, followed by a planned release when the electricity is needed. The energy storage sector is very much in its infancy and this sub-sector is one of great interest to the Fund.

Overall, the outlook for the clean energy sector is very positive and the industry is likely to see long-term structural growth. There is a vast pipeline of renewable energy generation assets, energy efficiency projects and energy storage solutions, and a growing universe of publicly listed companies operating in the clean energy infrastructure sector. These are exactly the types of assets in which the VT Gravis Clean Energy Income Fund seeks to invest.

Contact Information

Will Argent
Fund Adviser
020 3405 8552
william.argent@graviscapital.com

William MacLeod
Managing Director
07836 695442
william.macleod@graviscapital.com

Ollie Matthews
Sales Director – South
07787 415151
ollie.matthews@graviscapital.com

Robin Shepherd
Sales Director – North, Scotland & NI
07971 836433
robin.shepherd@graviscapital.com

Nick Winder
Sales Director – North West & West Midlands
07548 614184
nick.winder@graviscapital.com

Cameron Gardner
Sales Manager - London
07835 142763
cameron.gardner@graviscapital.com