Warrington Solar – Case Study

An investment of £60mn to build 60MW of solar generation and a 27MW battery, Warrington Solar is an ambitious subsidy free renewable project led by Warrington Borough Council. It demonstrates what can be achieved in a post-subsidy environment by a local authority with ambition and the correct partners. The investment is forecast to produce significant returns to the Council over the project lifetime.

It is also notable that the solar farms are not in the same area as the Council, illustrating the fact that the national electricity market allows benefits from investment in generation outside of the immediate vicinity.

1. Summary

Warrington Solar is a commercial, subsidy-free grid-scale solar generation project, wherein two full constructed solar arrays, one paired with an electricity storage units, will be purchased by a Council with extensive experience of the solar generation and energy markets. Power will be sold to the Council via a sleeving deal, and to the open market, while the battery assets will be used to deliver grid services and time-shift generation to peak power consumption periods.

The project will cost in the order of £60mn, this sum being funded through the Council's capital budget by borrowing. Around £210mn is expected to be returned over the 30-hyear project lifetime, giving rise to a £150mn surplus which Warrington will invest in front-line services.

Project partner Gridserve intends to deploy EV charging superhubs adjacent to each solar farm, providing clean, green and low-cost power directly from the solar arrays to EVs.

2. Description

Claimed to be the most advanced solar project in the country, Warrington Solar consists of two large solar farms, one of which will be paired with a battery storage system. The £62.34mn investment will build a 34.7MWp solar farm with a 27MW battery near York, and a second phase consisting of a 25.7MWp solar farm near Hull. The farms will use partner Gridserve's single-axis tracking bifacial solar modules, in a UK-first for large-scale generation.

Figure 1: Solar farm example

Source: Modernize

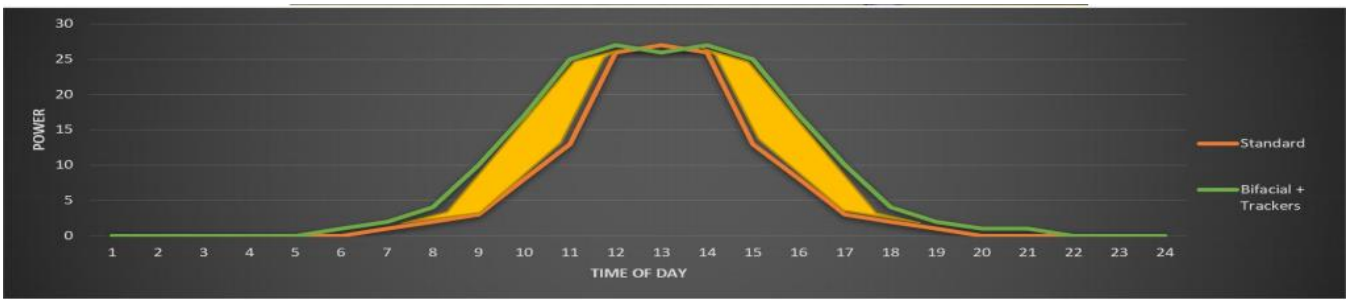
The project, which is being built in a post-subsidy environment, is anticipated to deliver £150mn in profits over a 30-year lifespan. Generation will initially be traded in the markets, with the Hull project intended to provide power to the Council itself through a sleeving deal, saving £2mn a year.

Construction is currently underway on the York site, on 198 acres of low-grade agricultural land. The facility is expected to be complete in October 2019. The second site will be built following this on 131 acres of low-grade agricultural land near Hull.

Gridserve intends to site the first two of its planned "Electric Forecourts" as part of a £1bn development of 100 such sites across the UK. The Electric Forecourt will host 24 car chargers at capacities of up to 500kW, in addition to MW-scale chargers for buses and heavy vehicles. Batteries will support the delivery of power to all bays simultaneously when required. Construction is due to commence before the end of 2019.

Using the most advanced technologies available – bifacial and sun-tracking modules – is anticipated to deliver 20% more power. It will also reduce price cannibalisation effects, with more power produced outside of peak fixed-panel generation hours. Figure 2 shows expected generation from the panels compared to conventional fixed panels.

Figure 2: Generation profile of bifacial tracking panels vs standard fixed panels



Source: Warrington Borough Council

While no aspect of the project could be considered truly innovative on its own, it is the first time that this combination of high-production panels with batteries using modern commercial arrangements to sell power and low-cost public money to invest in assets has been seen, and the project shows what a local authority can do when motivated and enabled.

3. Participants

Leading the project is Warrington Borough Council. The Council has previous experience of solar generation through a project which installed solar arrays on 3,000 social houses owned by the Golden Gate Housing Trust and arrays on several schools, public and commercial buildings, including the Warrington Wolves Rugby League stadium. The Council also launched solar investment bonds in which several local authorities invested.

Gridserve will build the assets and operate them once complete, on a develop-build-operate model. It has developed over 100 grid-scale renewable energy projects in the UK. As the Council will only buy and own the assets once complete, Gridserve has secured development finance from Investec Bank and Leapfrog Finance.

Warrington will purchase the assets through two special purpose vehicles, which it will own fully.

4. Financials

Warrington Solar is a completely commercial investment by the Council, which has not benefited from any grant funding or subsidies to develop.

While not the first subsidy-free solar farms in GB, when commissioned the York and Hull sites will be some of the largest. A subsidy-free model will expose the Council to long-term fluctuations in wholesale electricity prices. However, it will insulate itself from these effects by the deployment of a battery on the York site to time-shift generation, and by using the power from the Hull site itself.

This latter technique is often performed by large corporate power consumers, who are looking to insulate themselves from fluctuations in power price of 15-20 years, while also delivering green credentials. It is referred to as a corporate power purchase agreement in these situations. By investing in the asset directly, rather than simply agreeing to buy power from it, Warrington has shifted this model slightly, ensuring that profits remain in its hands.

Warrington is funding the purchases through loans attached to its capital programme but has noted that the cost of this would be more than offset by the profits of the venture.

Figure 3: Costs and revenues of Warrington Solar project

Line item	York (no battery)	York (battery)	Hull
Capital cost	£37.3mn	£41.2mn	£21.1mn
30-year surplus	£79.3mn	£222.7mn	£71.3mn
Average annual surplus	£2.6mn	£7.3mn	£2.4mn
Internal rate of return	8.21%	16.28%	11%
1-5 year average annual surplus	£0.05mn	£2.9mn	£0.5mn

Source: Warrington Borough Council

Profits over 30 years from the project are quoted as £150mn, with additional benefits arising from a community benefit fund. Gridserve will contribute £100,000 to this, and Leapfrog Finance will add £85,000/year, for a total of around £2.25mn. The fund will be used to deliver social and environmental benefits in Warrington.

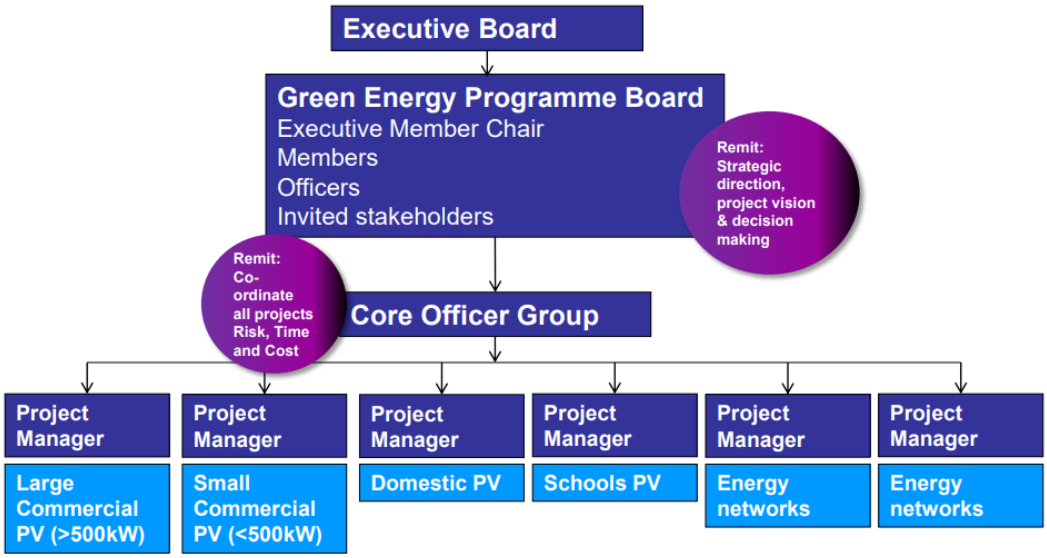
Profits will arise to the project from sale of electricity to the Council and to other offtakers through the national markets. The Council also forecasts a £1mn/year saving on electricity costs through its sleeving deal, though any cost savings which achieves below market rates will effectively cut the profits of the project by that amount, as it is selling power to itself.

Gridserve also notes that in its profitability assessments, it has set multiple potential revenue lines at zero in order to deliver conservative figures. It therefore expects to be able to overdeliver on its profit forecasts.

5. Replicability

Persistence has been key to the project, with the investment in the site near Hull coming after a deal to buy a similar site near Cirencester in Gloucestershire fell through due to connection issues. The council has come to the position of being able to make these investments following a period of capacity-building. Its previous projects and other energy investments have supported a team of energy-literate project managers (set out in Figure 4).

Figure 4: Warrington Borough Council internal delivery team



Source: Warrington Borough Council

Developing this capacity is a long-term ambition, and other Councils may be well-advised to follow a similar trajectory of engaging in smaller projects to build experience in solar generation development. Sustaining this capacity will also require ongoing development projects, and Warrington may look to partner with other local authorities or offer services in the future to deliver further investments.

It is also notable that the Council partnered with an experienced developer and experience bridging investors to deliver the project, adding additional expertise where required rather than attempting to bring all necessary capacity in-house.

Importantly, this project did not require any special conditions to implement: the Council was able to be flexible in terms of location. With between 1.1GW and 4GW of additional solar deployment expected in GB over the period to 2030 by SolarPower Europe, there is the potential for dozens if not hundreds of similar projects to be delivered by local authorities over this period. Depending on ambition, subsidy-free solar is believed to be viable in capacities of 6MW upwards in current conditions; integrating batteries is also expected to become more common as costs fall and the economics are better understood.

Gridserve also intends to roll out EV chargers near to the solar farms, connected directly by private wires. The economics of EV charging are again currently poorly understood, with the market still nascent at best. However, millions of additional EVs are expected on the road by 2030, creating a wider market for charging services. Generally, the economics of private-wire supply to consumers are far superior to selling power over the public networks; we therefore expect that similar projects should be viable in the near future.

Certainly, Gridserve and other companies such as Pivot Power believe that this will be the case, as they are undertaking substantial investments in these fields with Gridserve targeting £1bn investment to build 100 charging sites within five years; Pivot Power is targeting £1.6bn investment to build 45 sites with 50MW batteries and 100 EV chargers each. With these investments, and major programmes from oil majors such as BP and Shell, the public charging market may soon be saturated, but local authorities own assets such as park and ride sites which could prove perfect for EV charging.

6. Future outlook

Falling costs

The business case for solar PV without subsidy has now been made, following rapid falls in the cost of equipment. The cost per kW fell by 99% from 1975 to 2015, according to a December 2018 study by MIT. The International Renewable Energy Agency (IRENA) forecast falls of a further 50% from 2015 to 2020. BEIS forecast in November 2016 in its Electricity Generation Costs report that grid-scale solar costs would fall to £67/MWh by 2020, £63/MWh by 2025 and £60/MWh by 2030.

More recently, the Solar Trade Association (STA) published statistics in December 2018 showing that costs had already fallen to £50-60/MWh; it forecast that the cost of grid-scale solar would drop below £40/MWh by 2030. With year-ahead baseload wholesale prices for power around £58-60/MWh (as of May 2019), this indicates solar will be increasingly economically viable.

Grid congestion

With growing amounts of generation capacity connected to the distribution networks, many of these are becoming constrained and not able to accept new generation connections. While all six of the GB DNOs are rolling out smart technologies and initiatives to allow further generation to connect, the costs and timelines for new connections are generally lengthening. Developers will need to be flexible about where and when they connect new generation in order to minimise costs, and to seek opportunities to deploy projects including flexibility services.

GSEEH is currently looking to commission a tool which will allow developers to identify suitable locations for new generation assets.

Cannibalisation

However, with huge volumes of solar power on the market, and more expected to be rolled out, this could lead to extremely low power prices during times of peak solar generation. This phenomenon is known as price cannibalisation, and is described in greater detail in a free Insight Paper produced by Cornwall Insight which can be found here.

In simple terms, the over-supply of solar power during the middle of the day reduces power prices to the point at which solar generation becomes uneconomic. The answer to this problem is being able to control when a generator exports power by storing in batteries or using power on-site (e.g. in electrolysers or EV charging points).

Storage

Similarly to generation assets, the cost of energy storage assets is expected to fall precipitously in coming years. IRENA forecast in 2017 that lithium-ion batteries, the most common of the new electricity storage technologies, would fall in cost to around $200/kWh by 2030; since then individuals such as tech entrepreneur Elon Musk (who runs battery, solar and car company Tesla) have forecast cell prices as low as $100/kWh 2018 and battery pack prices of $100/kWh by 2020.

Many other energy storage technologies are also in testing, ranging from "flow" batteries, which can store power for much longer periods, to compressed air or even gravity storage systems. This range of competition is likely to result in electricity storage costs which continue to fall over the foreseeable future, making it more economically beneficial to pair these technologies with grid-scale solar arrays.

EV rollout

There are currently just over 200,000 EVs in the UK, as April 2019. National Grid projects in its Future Energy Scenarios that there will be over 11mn by 2030 and potentially 36mn by 2040. A substantial national rollout of EV chargers will therefore be required to keep them charged. Four types of charging are expected – at home, at work, during journey and destination. At home charging is not likely to be an avenue for energy investment, but at work charging for company vehicles may present an opportunity, driving additional power demand at distribution centres and vehicle depots.

During journey and destination charging both present additional opportunities for local authorities, either partnering with other organisations as in the Warrington Solar/ Gridserve project to rapid-charge on transit routes, as discussed here, or at destination sites such as park-and-rides (see Cambridgeshire Mobilising Local Energy Investment case study).