Ashton Hayes Community Energy CIC

Benefits of PV Systems at the Primary School and Sports Pavilion through reducing Electricity Supply Costs and potential Further Optimisation.

Data from August 2022 to January 2023

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- Analysis of School Electricity Generation, Import and Export.
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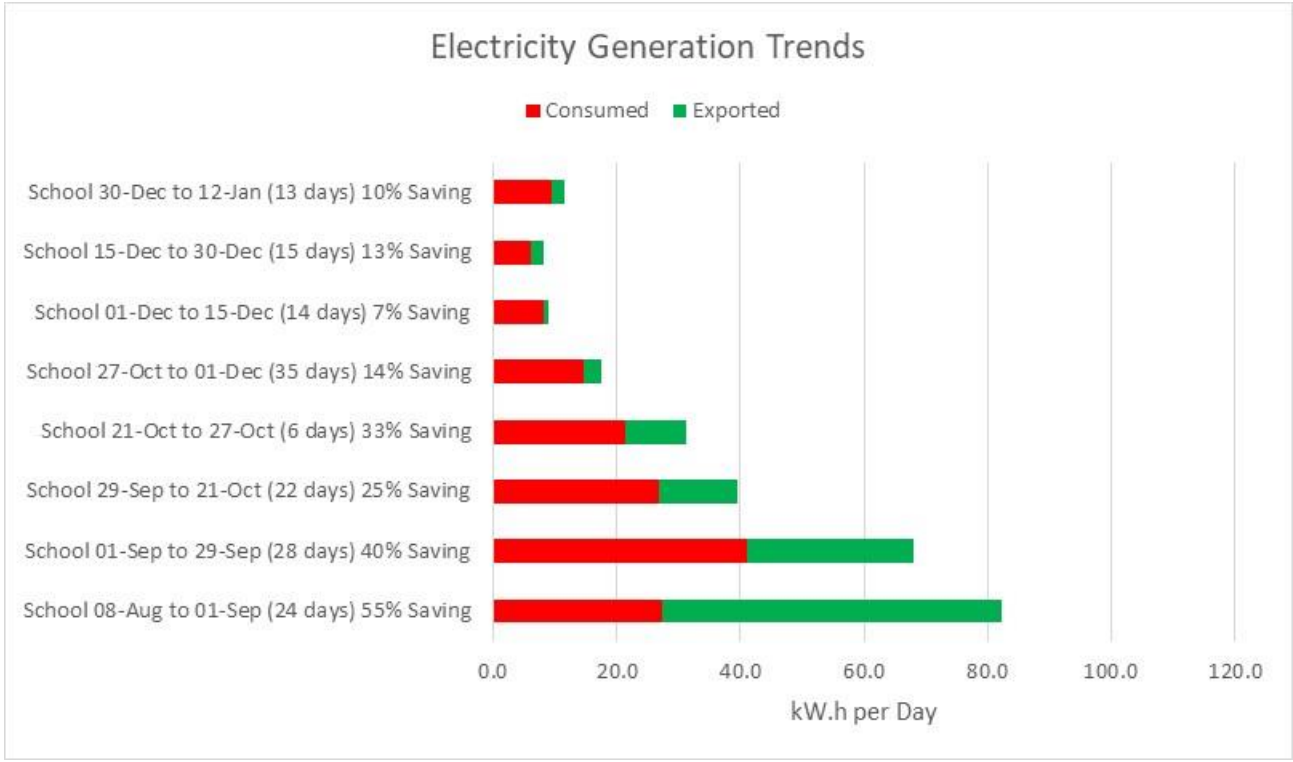
    - Baseline (overnight) consumption.
- Analysis of Pavilion Electricity Generation, Import and Export.
  - How well does generation match use?
  - Is it possible to Optimise the Hot Water and Heating schedules?

Primary School

School Electricity Generation, Import and Export - 1

Electricity Generation Trends:

- Eight periods **roughly** cover August holidays, Term time in September, Term time in October, October half-term (including one term day), Term time in November, Term time in December, Christmas holiday, Term time in January.
- Periods are of different length, so values expressed on a “per Day” basis.
- The Total (combined) bar length shows average Daily Generation, which clearly reduces through August, September, October etc. and reaches a minimum during the Christmas holidays.
- The Red bar shows how much, on average, of the Daily Generation is being Consumed by the School.
    - This is low in August as there was little school activity during the day.
    - This increased in September as the school day activities were able to consume the power being generated.
    - This has dropped again in October as the reduced Generation has not been able to keep up with demand.
    - By November, almost all of the generation is being consumed as there is no sunlight outside of the school day.
- The Green bars show the remaining part of the PV generation, which is consequently Exported to the grid.
    - In August, when there is minimal school activity (only holiday club), a significant proportion of the generation is being exported.
    - During the first half of the Autumn term, there is still a reasonable amount of export, coming from the weekend (2 days a week ~30% of the time), sunshine hours outside of the school day and periods during the afternoon when generation exceeds demand.
    - By half-term, the export is being limited by the base-level consumption at the school. This is roughly 2kW (~20kW.h per day) and so even with the school closed, there is only a limited amount of energy being exported.
    - During December term-time, practically all of the generation is being consumed. Even during the weekend, the base-level consumption leaves nothing for export.



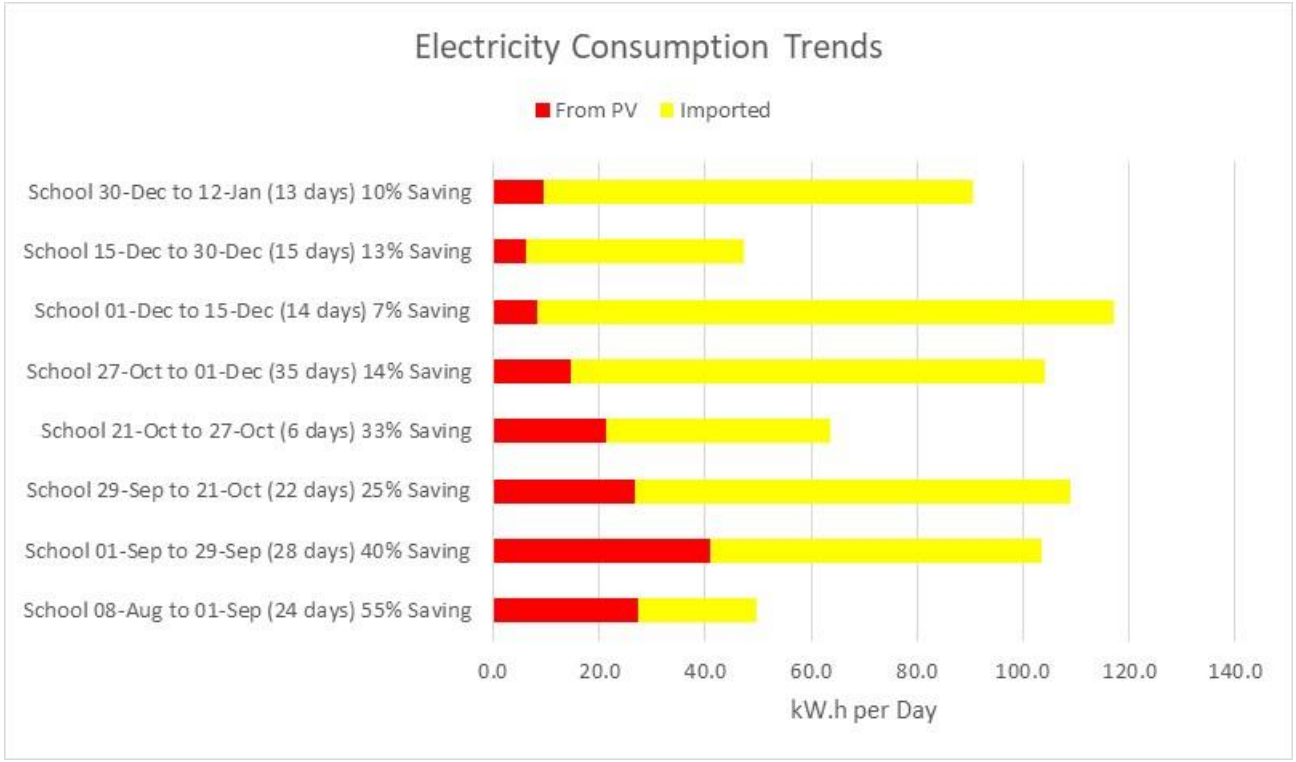
Summary of Generation over the Period as a whole (157 days):

- 5941 kW.h of electricity has been Generated (average 37.8 kW.h per day)
    - 3,358 kW.h was Consumed (57%)
    - 2,583 kW.h was Exported (43%)

School Electricity Generation, Import and Export - 2

Electricity Consumption Trends:

- The same eight periods are covered and values expressed on a “per Day” basis.
- The Total (combined) bar length shows average Daily Consumption.
    - This is low in August when the school is closed.
    - This more than doubles in September due to the school activities.
    - This shows a further small increase in October, as might be expected.
    - Consumption drops over half-term.
    - The remaining term-time in November (some mild conditions) and December (one very cold period) are comparable with the October term-time consumption.
    - Consumption drops over the Christmas holidays.
- The Red bars are the same as in the Generation graph, previous page, and show how much, on average, of the Daily Generation is being Consumed by the School.
- The Yellow bars show how much Electricity must be Imported to cover the daily consumption requirements.
- The % Savings (in the bar labels) represent the proportion of the daily consumption that is provided free by the PV generation.
    - This was 55% in the August holiday period but drops for the subsequent holidays:
        - 33% over half-term.
        - 13% over Christmas holiday.
    - During the term-time it steadily drops as the days shorten:
        - 40% in September.
        - 25% in October.
        - 14% in November.
        - 7% in December.
        - 10% in January (2 weeks)



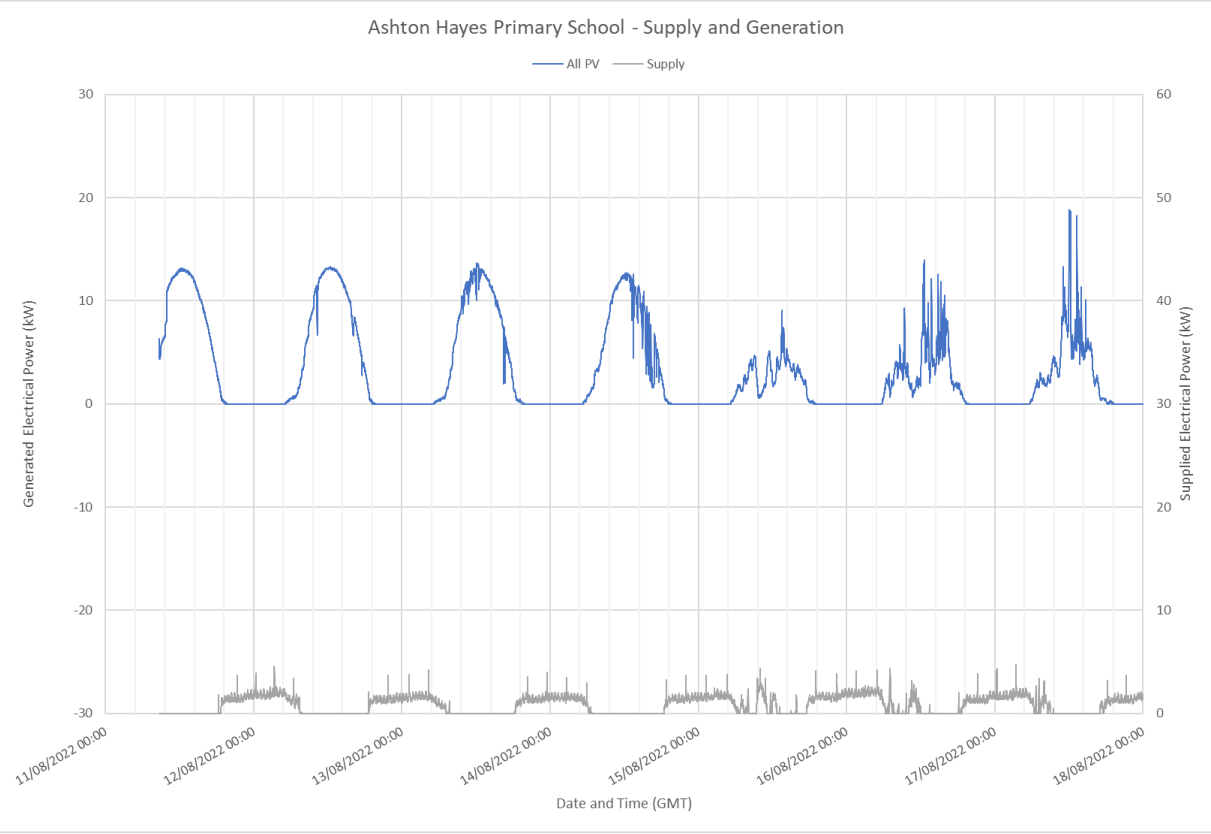
Summary of Consumption over the Period as a whole (157 days):

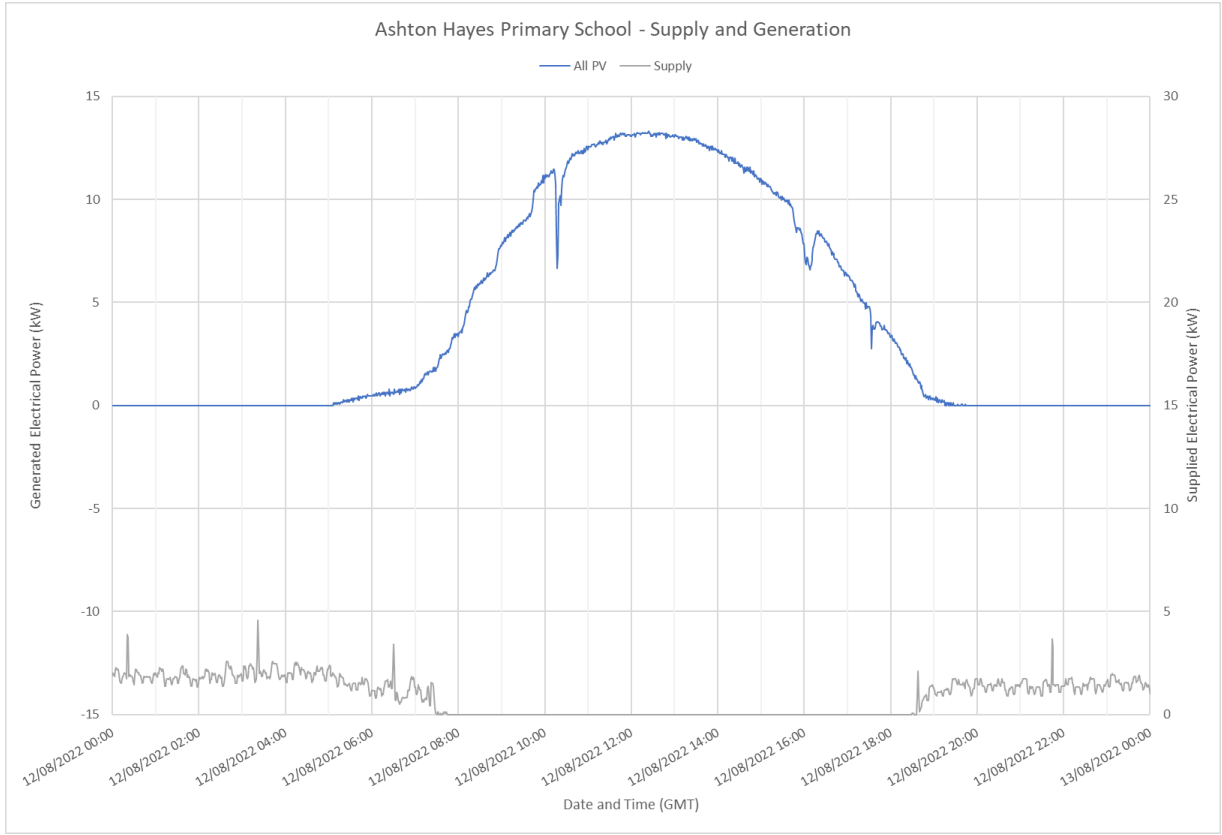
- 14,048 kW.h in total was Consumed by the School (average 89.4 kW.h per day)
    - 3,358 kW.h was provided by PV Generation (24%)
    - Requiring 10,690 kW.h to be Imported (76%)

School Electricity Generation and Supply during some typical days – August

One Week of data:

- This is a week in August.
- There was a high level of sunshine during the first 4 days.
- On almost every day, the supply (import) dropped to zero for 11 hours each day.
- Over night there is a reasonably steady consumption of about 1.5 to 2.0 kW
- Also, there are spikes in consumption on a regular basis – about every 3 hours.





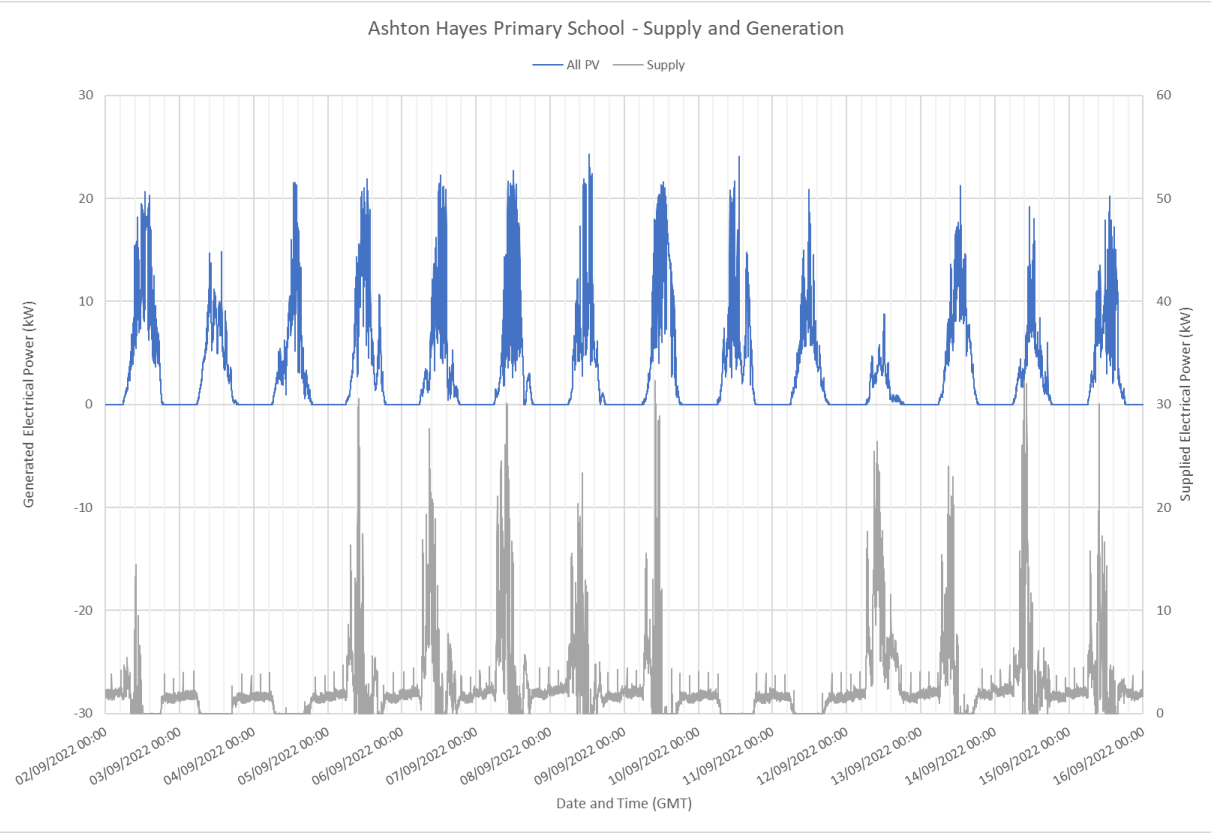
One Day of data:

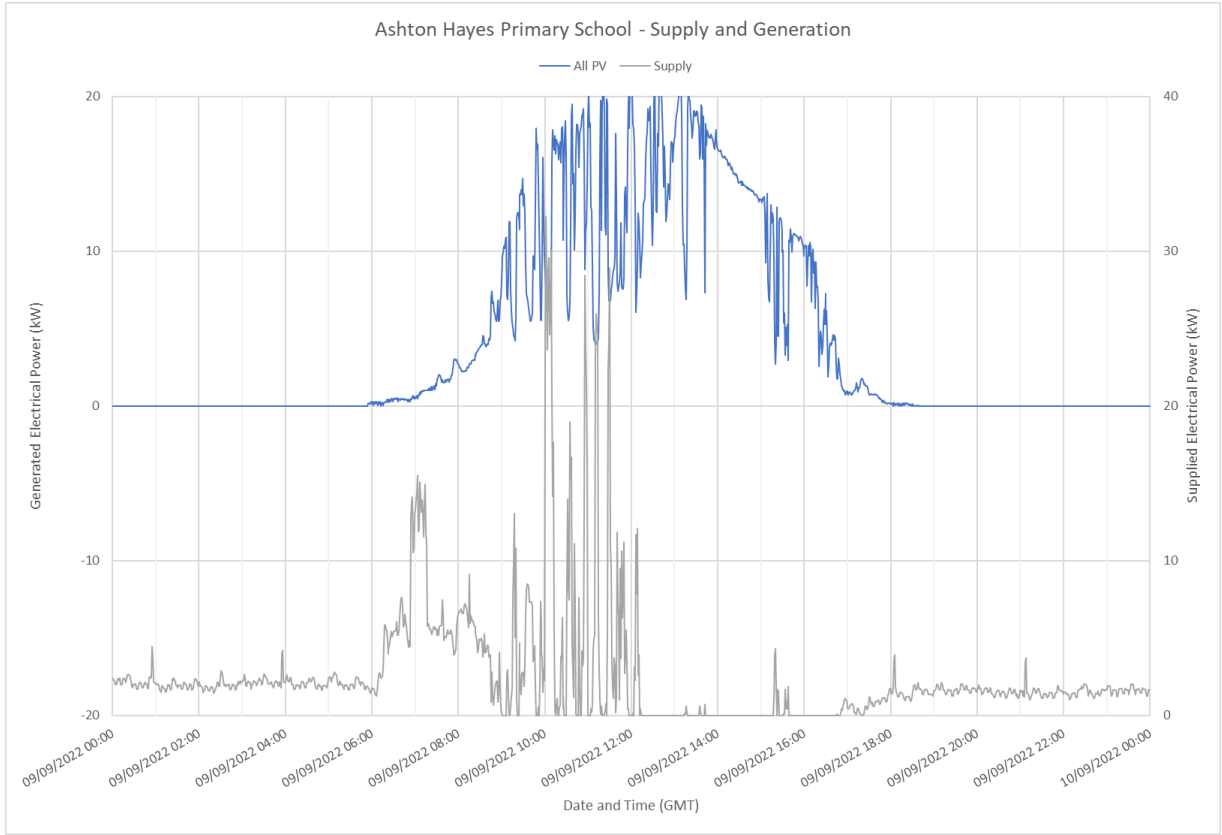
- This is from 12th August.
- This day had a high level of sunshine.
- Generation becomes significant from about 7am GMT (8am BST) and ends before 7pm GMT (8pm BST).
- The spikes in consumption briefly add about 2kW to the consumption.
- Note. At this time, only one-third of the 2016 system was operational.

School Electricity Generation and Supply during some typical days – September

Two Weeks of data:

- These are two weeks at the start of September.
- There was a reasonable level of sunshine on most days, apart from the 12th September.
- At the weekend, zero Import is seen during the day, similar to the August holiday period.
- On school days, there is significant electricity Import during the morning period. However in the afternoon it is sometimes possible for the Generation to exceed Demand.





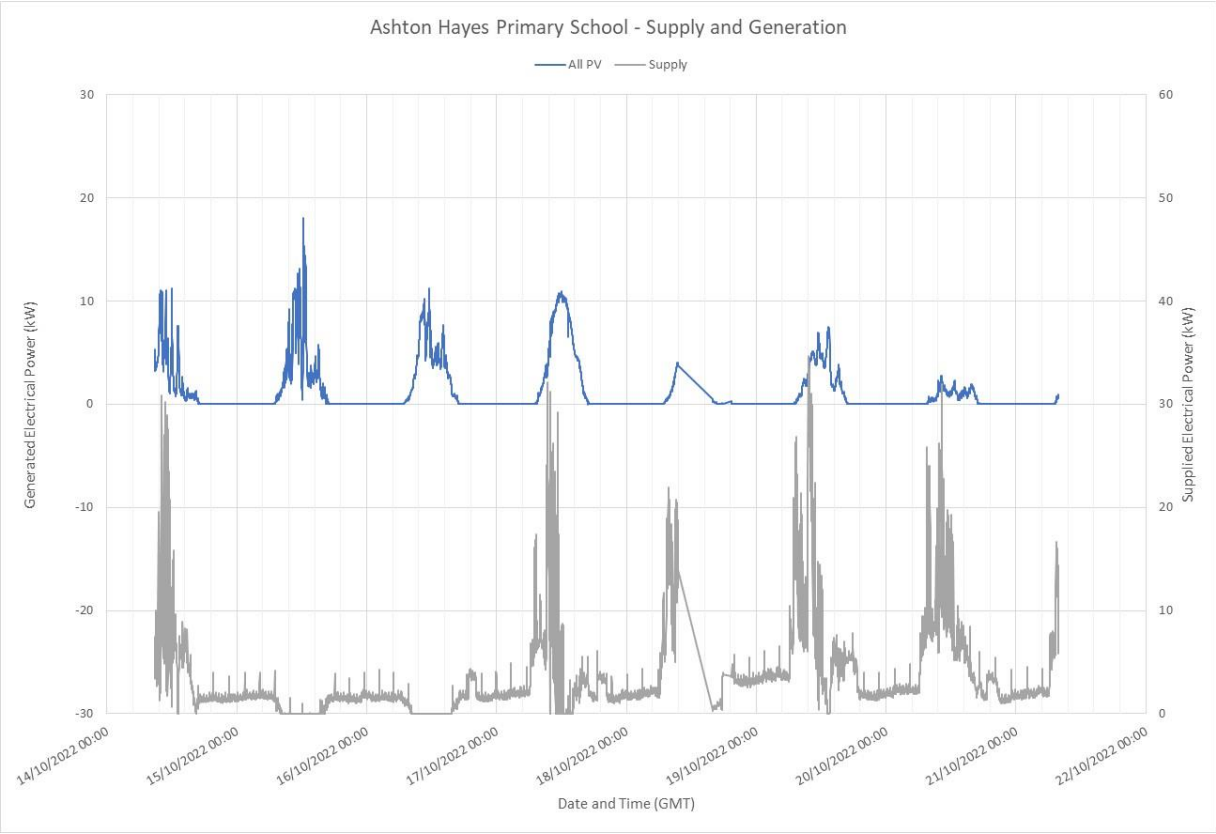
One Day of data:

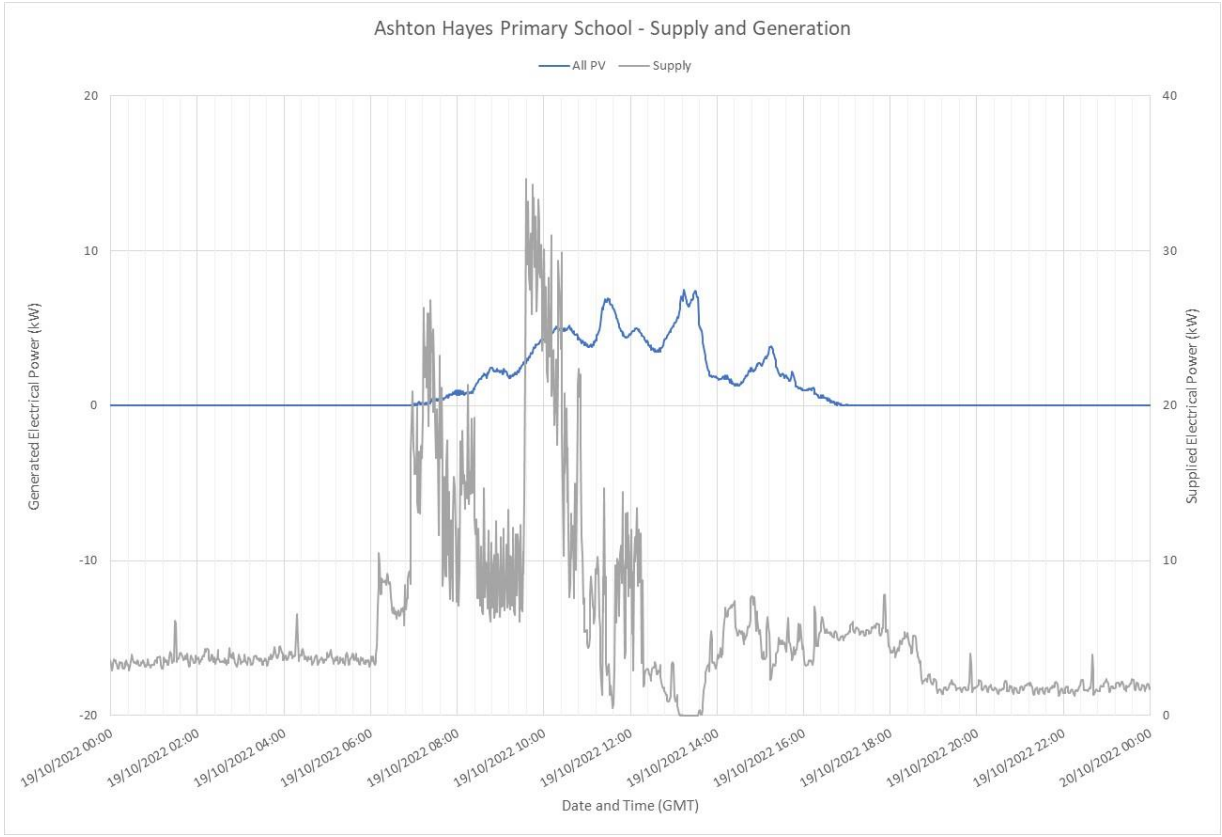
- This is from 9th September.
- This day had a high level of sunshine.
- Demand increases significantly from about 6am GMT (7am BST) and even more at about 7am GMT (8am BST). During the rest of the morning, up to 12 GMT (1pm BST) the Import is variable, partly due to the variability in Generation, but can exceed 30kW.

School Electricity Generation and Supply during some typical days – October

One Week of data:

- This is a week in mid-October (including a power cut on 18th October).
- There was a moderate level of sunshine on most days, decreasing at the end of the week.
- At the weekend, zero Import is still seen during the day.
- On school days, there is significant electricity Import during the morning period. Even in the afternoon it is rare for the Generation to exceed Demand – exception 17th October.





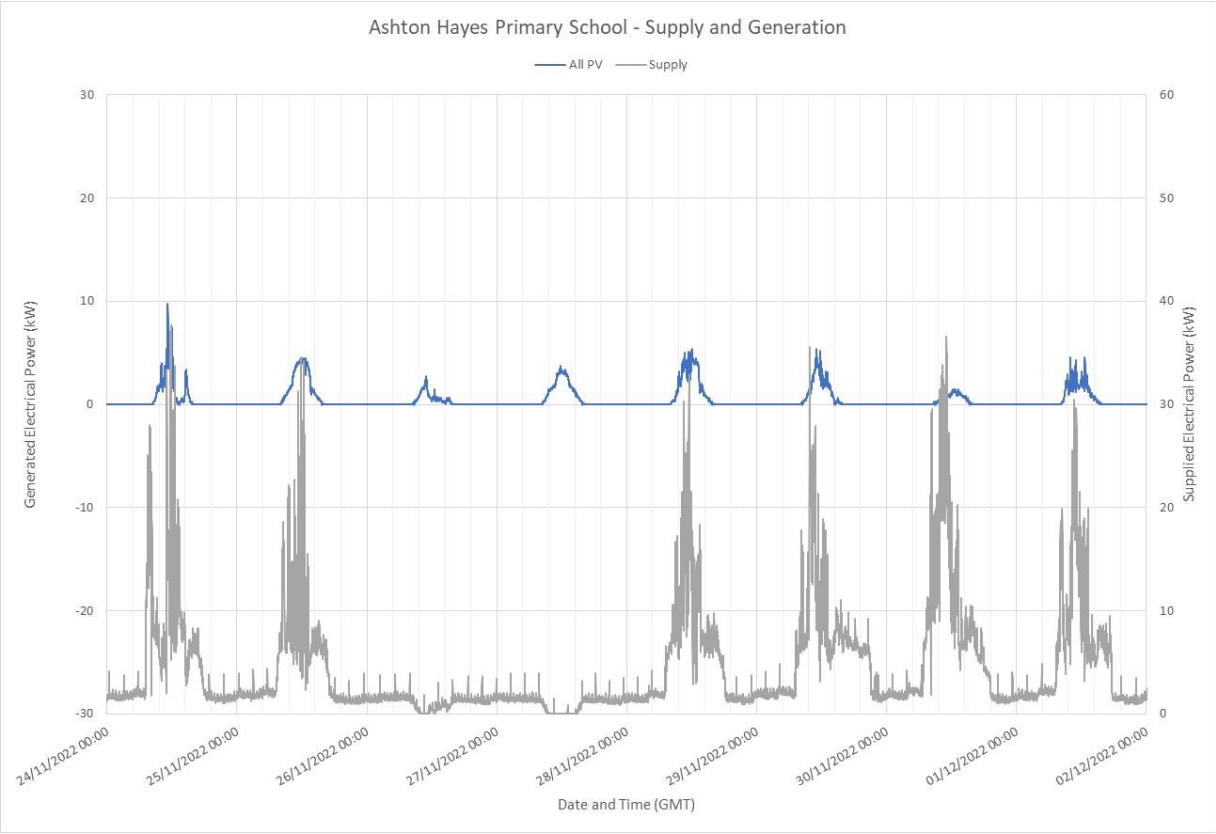
One Day of data:

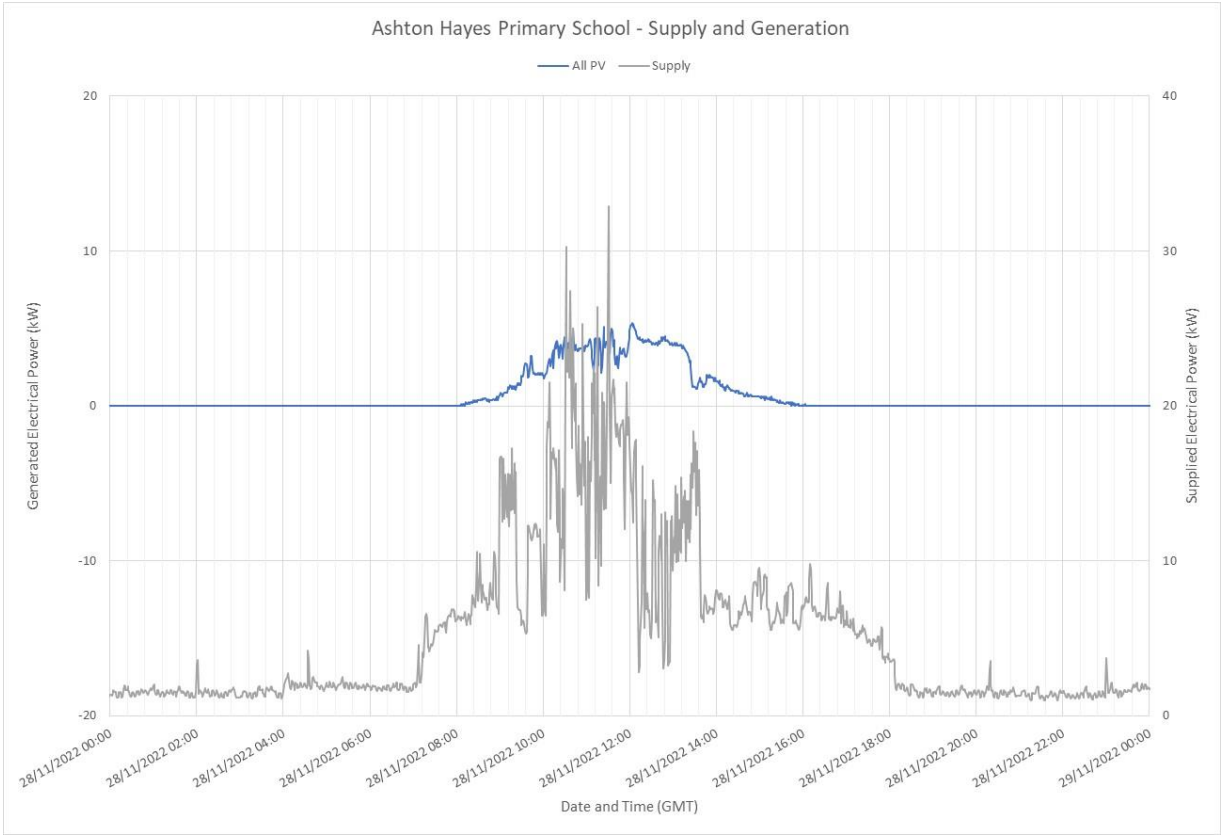
- This is from 19th October.
- This day had a moderate level of sunshine.
- Demand increases significantly from about 6am GMT (7am BST) and even more at about 7am GMT (8am BST). During the rest of the morning, up to 12 GMT (1pm BST) the Import is variable, and can exceed 30kW.
- There is a short period of Export after 13 GMT (2pm BST).

School Electricity Generation and Supply during some typical days – November

One Week of data:

- This is a week in late-November.
- There was a moderate to low level of sunshine on most days.
- At the weekend, zero Import is still seen during one of the days.
- On school days, there is significant electricity Import during the morning period. Even in the afternoon it is not possible for the Generation to exceed Demand.





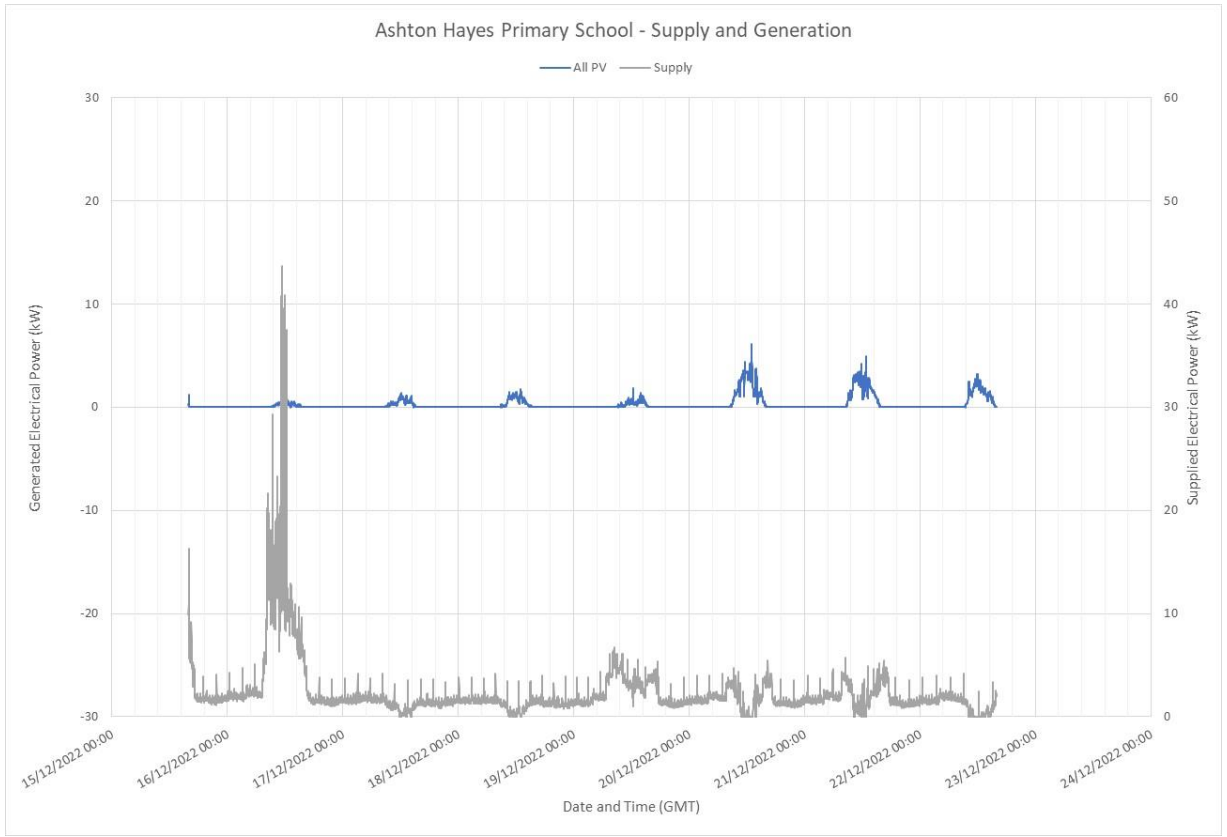
One Day of data:

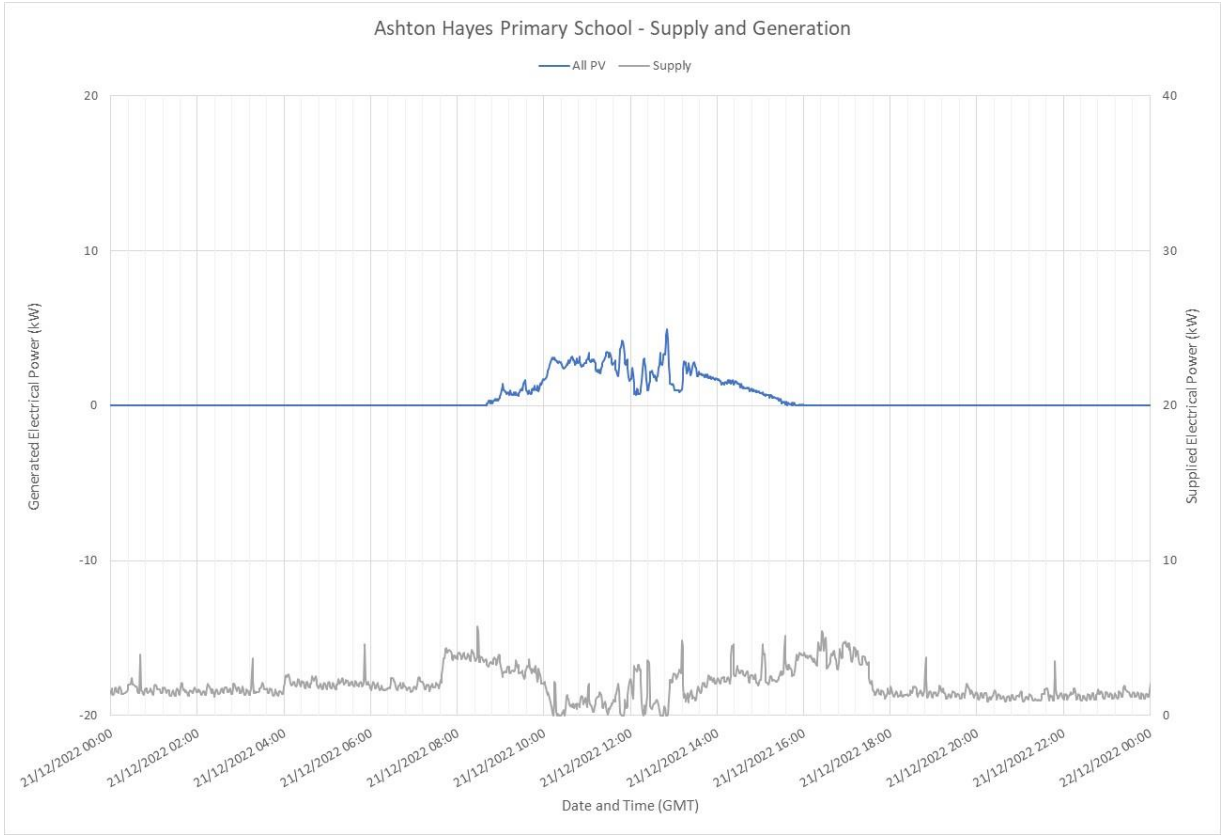
- This is from 28th November.
- This day had a moderate level of sunshine for the time of year.
- Demand increases significantly from about 7am GMT and even more at about 8.30am GMT. During the rest of the morning, up to 12 GMT, the Import is variable but high, and can exceed 30kW.
- There is zero Export on this school day.

School Electricity Generation and Supply during some typical days – December Holiday

One Week of data:

- This is a week in the Christmas holiday in December (apart from Friday 16th December).
- There was a very small level of sunshine at the start of the week.
- There is still a small amount of activity at the school during the first week of the holiday (from 19th December), shown by the moderate level of Supply.





One Day of data:

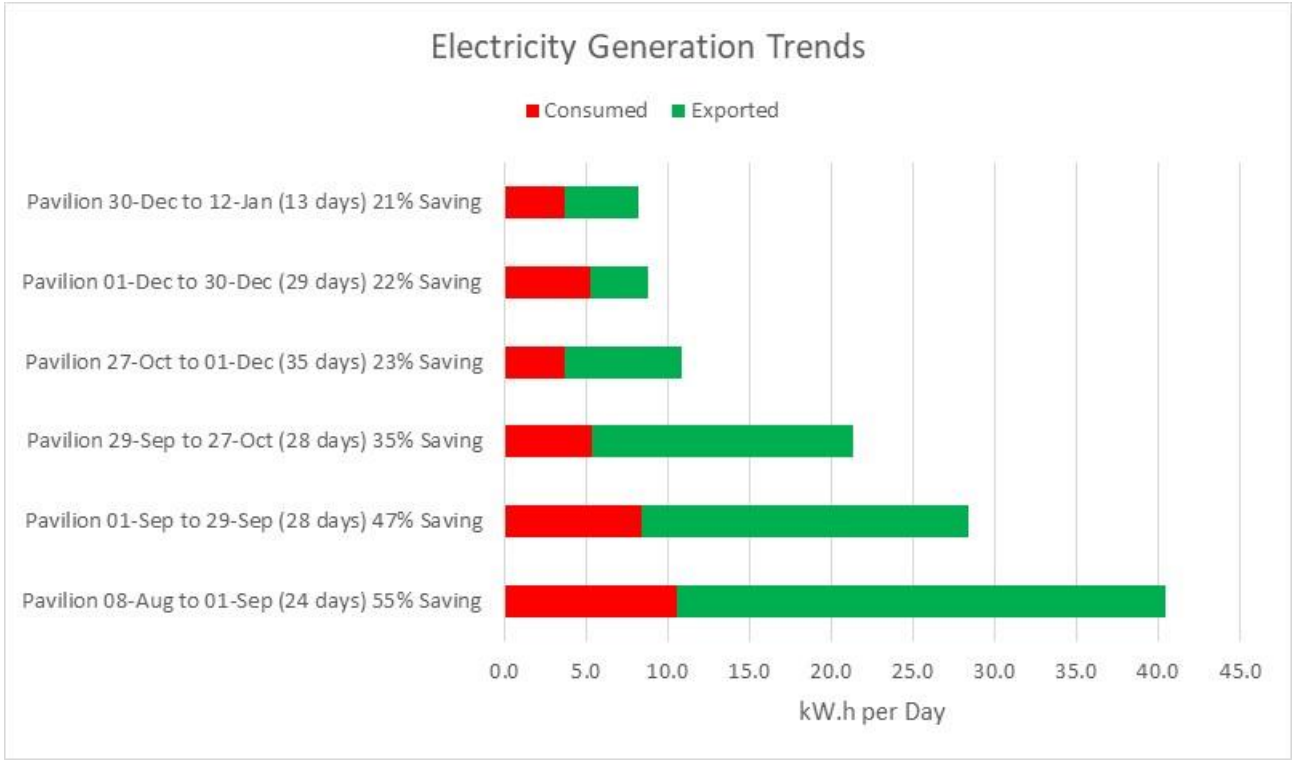
- This is from 21st December.
- This day had a moderate level of sunshine.
- Demand increases from about 7.30am GMT and continues through until 5.30pm GMT. The Supply during this period is reduced by the electricity Generation, but this is not at a sufficient level to produce any sustained electricity Export.

Sports Pavilion

Pavilion Electricity Generation, Import and Export - 1

Electricity Generation Trends:

- Six periods **roughly** cover the six months August 2022 to January 2023, inclusive.
- Periods are of slightly different length, so values expressed on a “per Day” basis.
- The Total (combined) bar length shows average Daily Generation, which clearly reduces through August, September, October etc. and reaches a minimum during December and the first two weeks of January.
- The Red bar shows how much, on average, of the Daily Generation is being Consumed by the Pavilion.
    - This is somewhat confused by a switch in the hot-water and heating strategy in late September.
        - During the summer months (until late September), the Heat Pump is purely providing hot water and it timed to use the electricity generated during daytime.
        - When the heating is put back on in September, the first hot-water boost is timed for the low-rate night period so that the heating is given priority for the majority of the daytime period. (If the heating and hot-water are both in demand, the hot-water will take priority and the underfloor heating will not be supplied).
    - Thus from late September the amount consumed is partly related to the heating demand, which is most evident from the very cold period in December.
    - In the months with longer days, there is the opportunity to supply more of the daily background consumption (fridge, freezer and security systems). Thus there is some relationship between the amount consumed and the amount generated.
- The Green bars show the remaining part of the PV generation, which is consequently Exported to the grid.
    - During most months, more than 50% of the generation is being exported.
    - During December, the heating was in much greater demand during the daytime, hence there was less electricity available for Export.



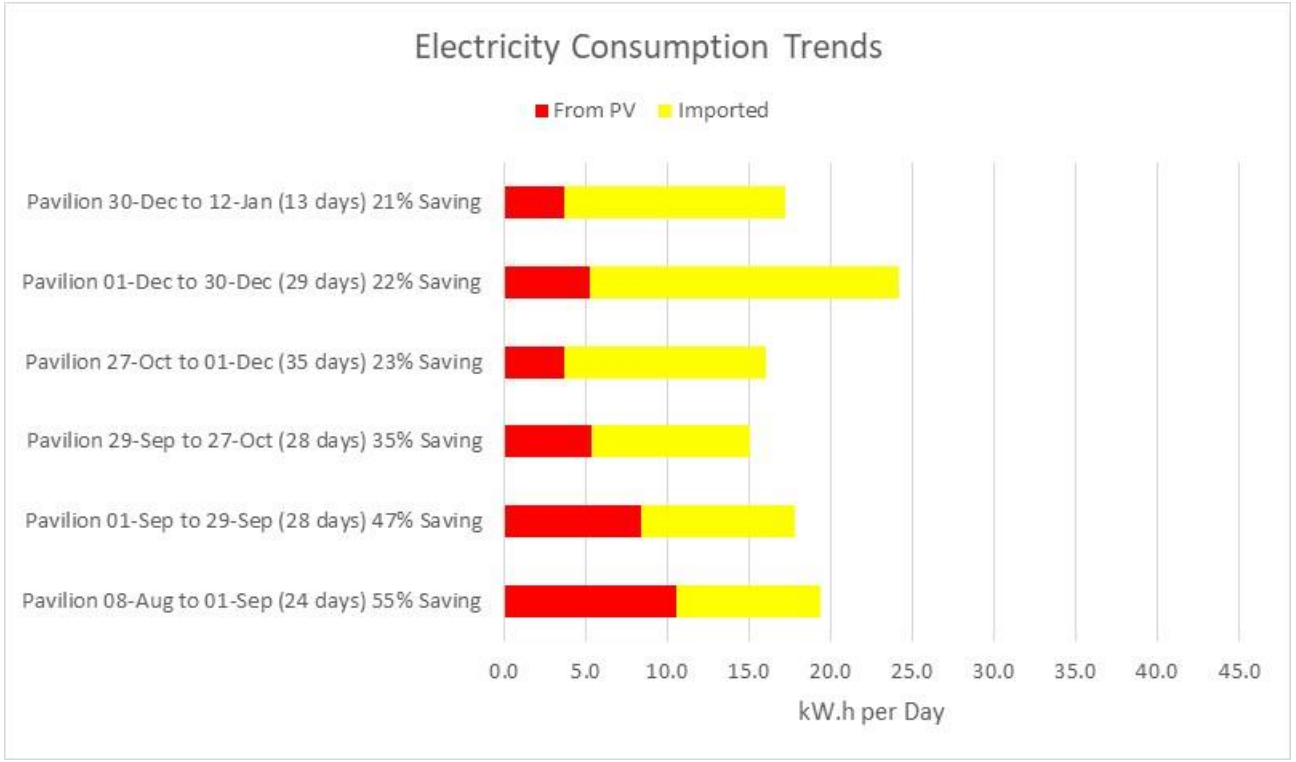
Summary of Generation over the Period as a whole (157 days):

- 3106 kW.h of electricity has been Generated (average 19.8 kW.h per day)
    - 969 kW.h was Consumed (31%)
    - 2137 kW.h was Exported (69%)

Pavilion Electricity Generation, Import and Export - 2

Electricity Consumption Trends:

- The same six periods are covered and values expressed on a “per Day” basis.
- The Total (combined) bar length shows average Daily Consumption.
    - This has remained relatively constant over the six month period.
    - The one high month is December, due to the cold period.
    - The drop in October, may result from the hot-water and heating schedule change: Prior to this change, the hot-water was being allowed to be maintained during much of the daytime – between 8.30 to 10.00 and 14.00 to 16.30. Since the set temperature (60°C) is very close to the heat-pump maximum, the heat-pump can continue to run for extended periods trying to obtain this limit. In October, this was limited to two one-hour periods, one from 6.00 and one from 14.00 GMT.
    - Additionally, in October and November, the weather was relatively mild, so the additional demand for heating was low or zero.
- The Red bars are the same as in the Generation graph, previous page, and show how much, on average, of the Daily Generation is being Consumed by the Pavilion.
- The Yellow bars show how much Electricity must be Imported to cover the daily consumption requirements.
- The % Savings (in the bar labels) represent the proportion of the daily consumption that is provided free by the PV generation.
    - This appears to change in relation to the length of day, and may reflect the ability of the generated electricity to cover the background electricity consumption (from the fridge, freezer and security system).
    - It is likely to be affected (increased) by the heating demand, so my be relatively higher in December due to the one cold period.



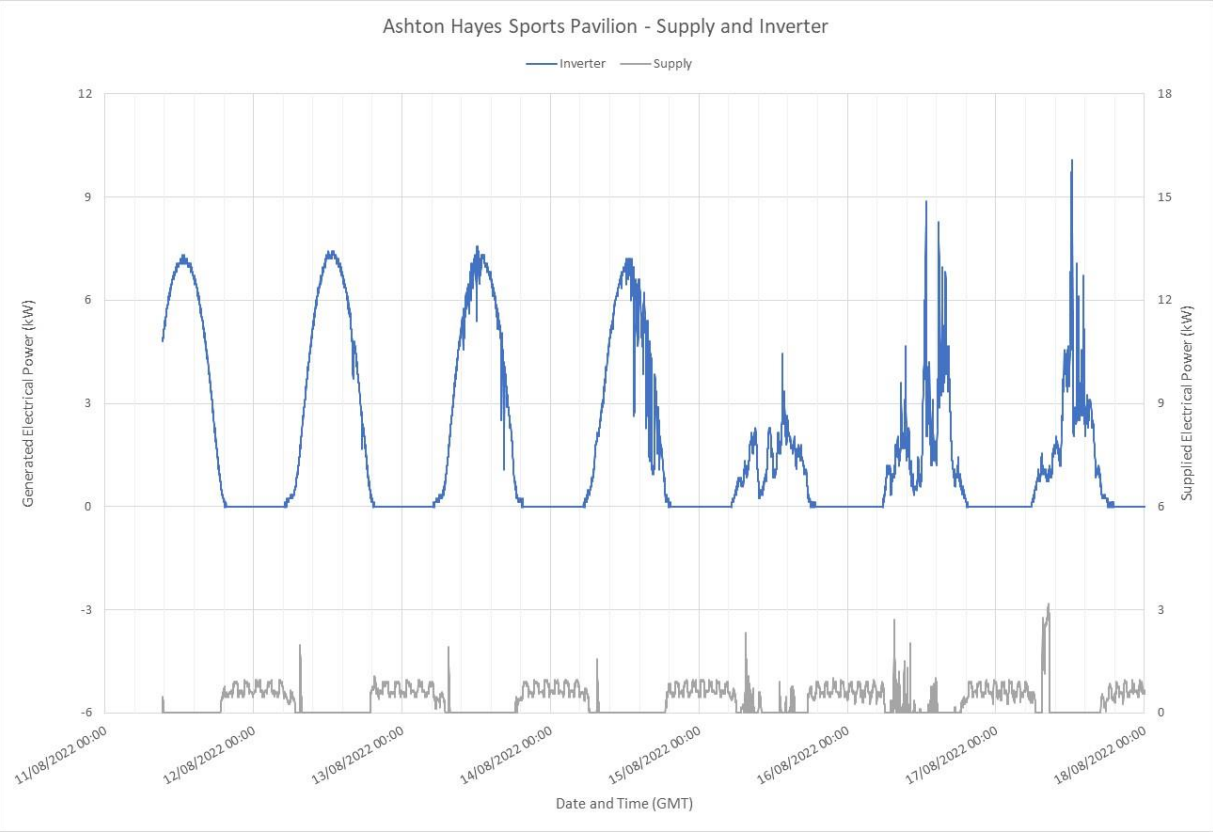
Summary of Consumption over the Period as a whole (157 days):

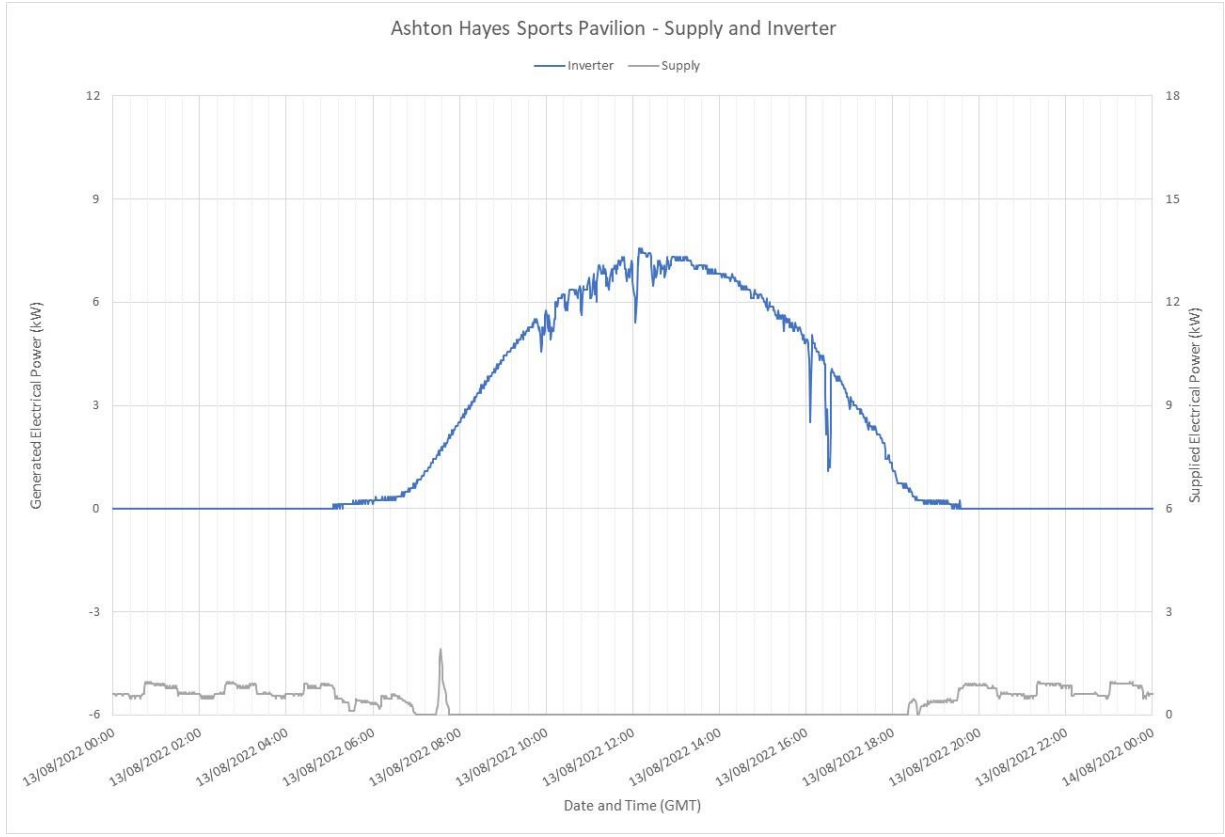
- 2,874 kW.h in total was Consumed by the Pavilion (average 18.3 kW.h per day)
    - 969 kW.h was provided by PV Generation (34%)
    - Requiring 1,905 kW.h to be Imported (66%)

Pavilion Electricity Generation and Supply during some typical days – August

One Week of data:

- This is a week in August.
- There was a high level of sunshine during the first 4 days.
- On almost every day, the supply (import) dropped to zero for 11 hours each day.
- Over night there is a reasonably steady consumption of about 0.5 to 1.0 kW
- Also, there are increases in consumption on a regular basis – about every 2 hours.





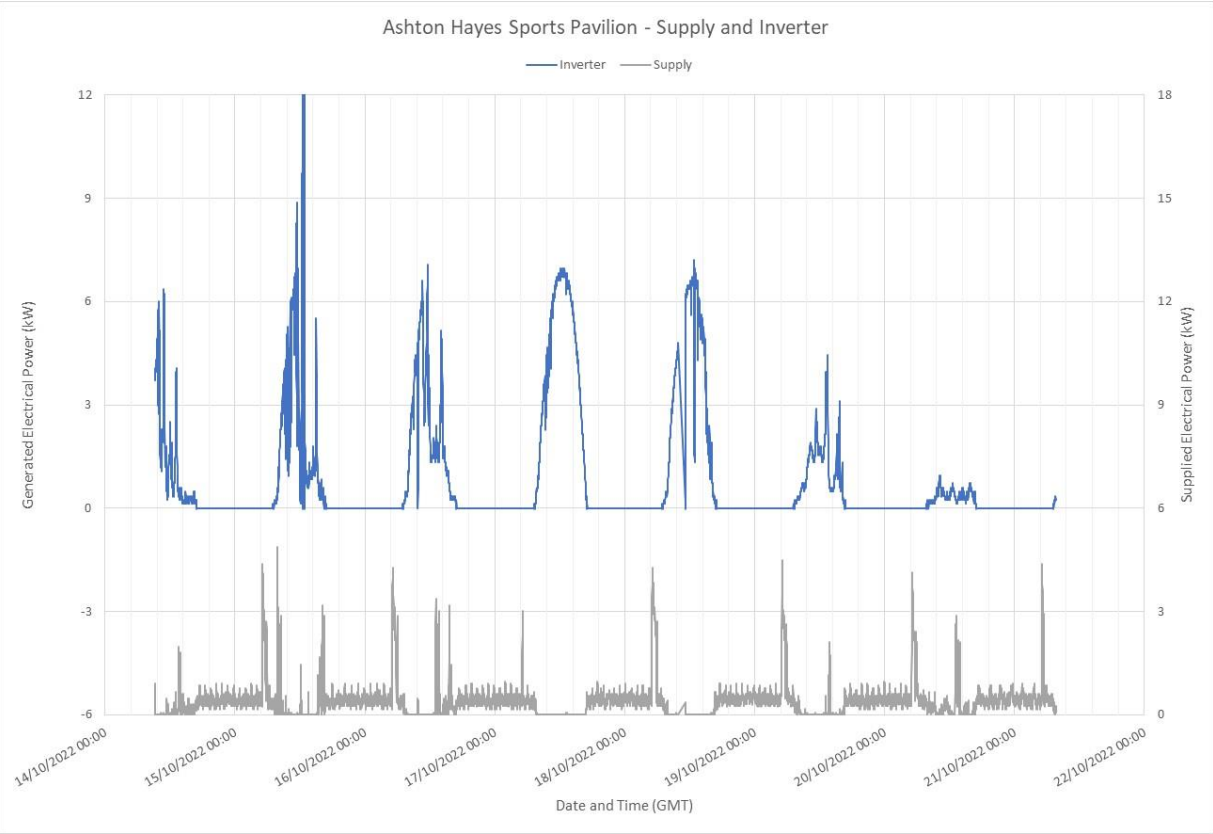
One Day of data:

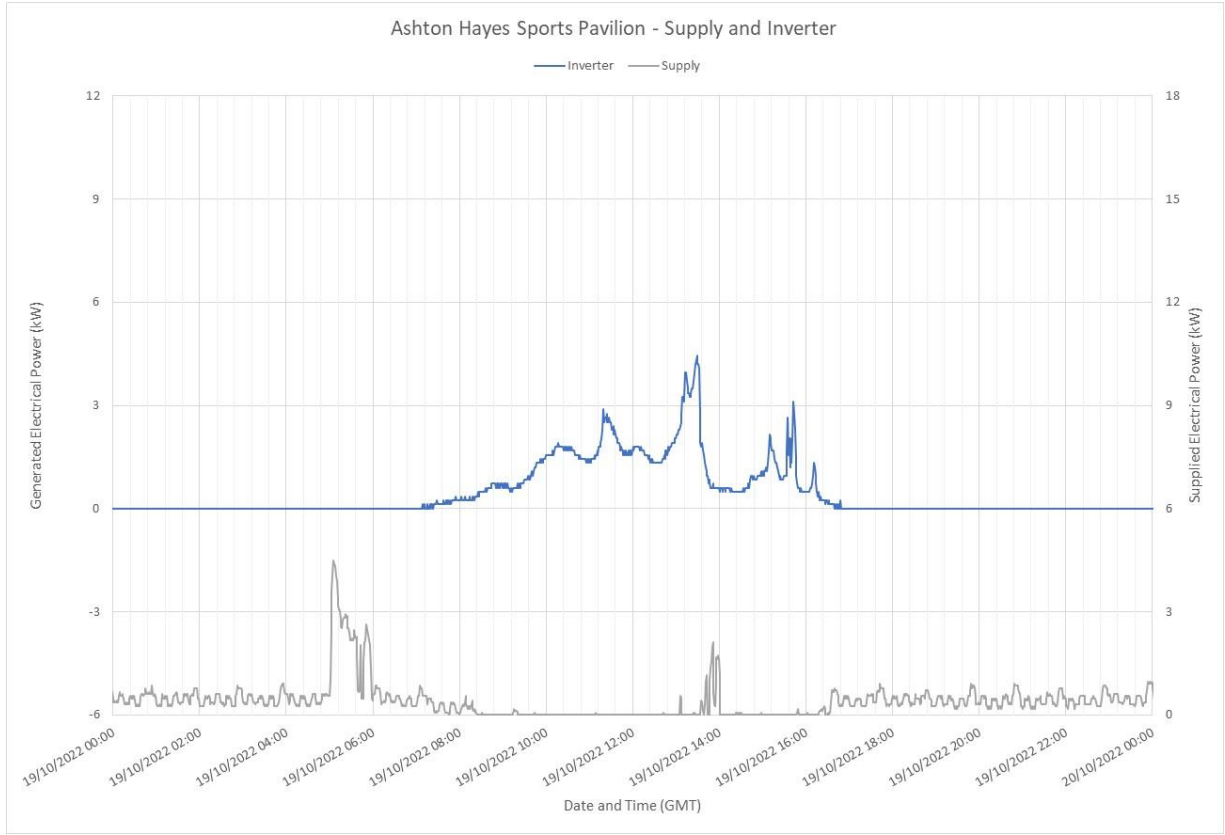
- This is from 13th August.
- This day had a high level of sunshine.
- Generation becomes significant from about 7am GMT (8am BST) and ends before 7pm GMT (8pm BST).
- There is a spike in consumption about 7.30 GMT (8.30 BST) which may come from the heat-pump, although this would have started operation at 7.00, so may actually be the kettle.

Pavilion Electricity Generation and Supply during some typical days – October

One Week of data:

- This is a week in October.
- There was a high level of sunshine during the middle of the week.
- On almost every day, the supply (import) dropped to zero for part of each day.
- Over night there is a reasonably steady consumption of about 0.5 to 1.0 kW
- Also, there are increases in consumption on a regular basis – about every 2 hours.





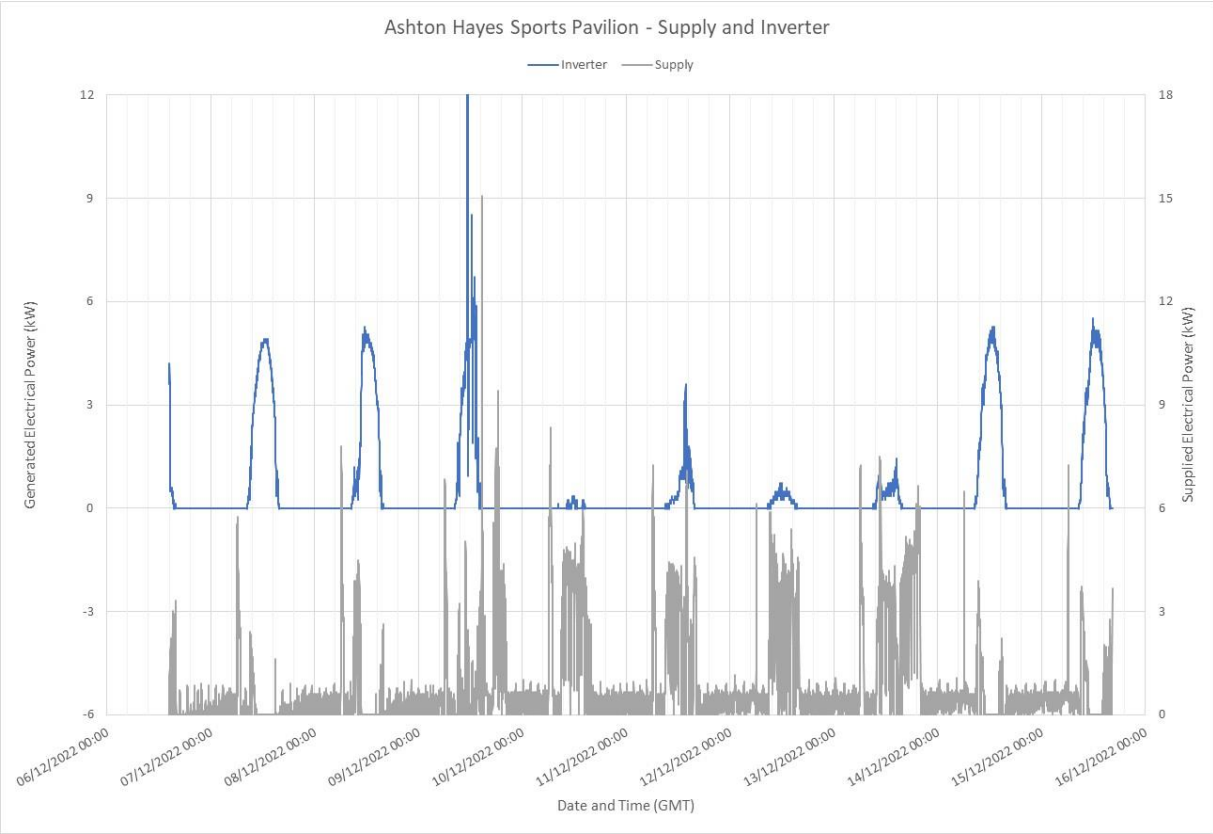
One Day of data:

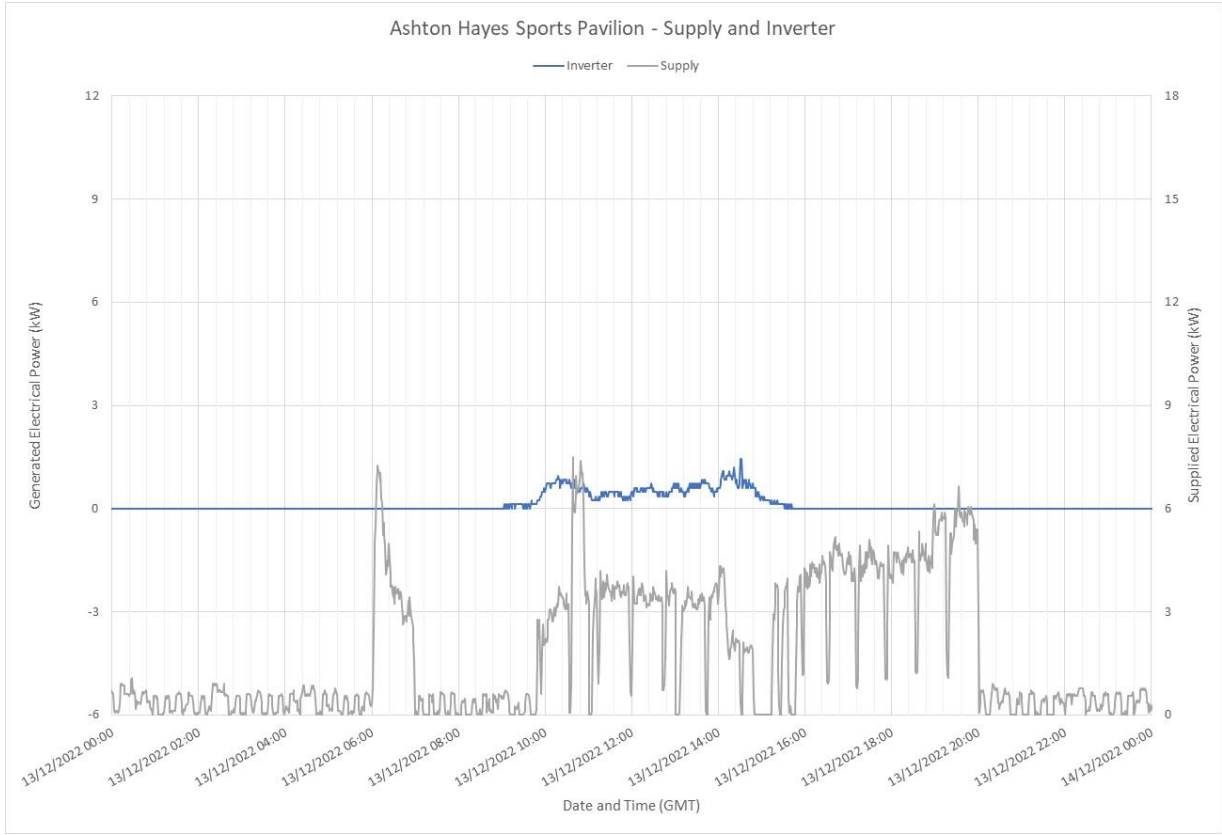
- This is from 19th October.
- This day had a low level of sunshine.
- Generation becomes significant from about 9am GMT (10am BST) and ends about 4pm GMT.
- Consumption increases at 5am GMT when there is demand for the heat-pump to bring the hot-water tank up to temperature. This can be seen again after 1am GMT as the generation drops and is insufficient for the heat-pump demand.

Pavilion Electricity Generation and Supply during some typical days – December

One Week of data:

- This is a week in December when the weather went cold.
- There was a high level of sunshine at the start of the week, but snow then obscured the panels for several days.
- There was a high heating demand during this period which may have been covered in part by the generation, except when the panels were snowed over.
- Over night the supply is identical to the earlier months.





One Day of data:

- On the13th December there was reasonable sunshine, but the panels were covered in snow.
- Consumption increases at 6am GMT when there is demand for the heat-pump to bring the hot-water tank up to temperature.
- Heating demand is delayed (for some reason) until about 9.45, but continues then until 20.00. Normally, the heating would turn off at 16.00, but there must have been some event after 16.00 that required heating.