



Westmill PV Plant Asset Management

Q3 2015 - July, August, September

Westmill Solar Co-op Ltd.

Issue and Revision Record

| Revision | Date | Originator | Checker | Approver | Narrative |
|----------|------------|------------|---------|----------|-----------|
| 01 | 16/10/2015 | DS | SMG | JH | Final |
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Awards and Recognitions



ACQ Magazine:
 ‘UK Technical Advisor of the Year’
 2014, 2012 and 2009



Finance Monthly Magazine:
 ‘UK Renewables Advisory Firm of the Year’
 2014 and 2010

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Executive Summary

OST Energy has been appointed by Westmill Co-operative to undertake the Technical Asset Management for the PV Plant Westmill Solar Farm. The Operation and Maintenance services are provided by Abakus Solar AG.

In the third quarter of the year the plant performance was overall good. The generation was above the P50 expected yield and the adjusted generation based on the irradiation measured on the site in July and September, and slightly below in August. The irradiation over the period in the site was greater than expected only in September. During this interval of time the plant had monthly Performance Ratios (PRs), including and excluding downtimes, above the target level of expected and guaranteed PRs.

The CCTV system incurred electrical damage to the infrared and colour cameras group and it was requested that remedial works took place, which was concluded on 2nd October.

The alarm system suffered damage due to infestation of rodents and ants. Westronics is waiting to receive the last parts for conclude the repair works. Unipart and Elite security did not register any security issue and verified the absence of intrusions.

Between August and September, Western Power Distribution checked and replaced one of its meters. A report was requested but in the time of writing this report OST have not received any documentation.

In general we consider that Abakus has responded efficiently to issues in relation to plant performances, sometimes they have been slow to respond to requests but always with good answers.

1 Introduction

OST Energy has been appointed by Westmill Co-Operative (the Client) to undertake Technical Asset Management for the Westmill Solar PV Farm (the Plant) in UK.

The Operation and Maintenance (O&M) services are provided by Abakus Solar AG who also act as the EPC contractor.

The document is a quarterly review of the Plant operational performance, including the following items:

- Plant Performance Analysis
- Production
- Irradiation
- Performance Ratio (PR)
- Availability
- Plant Operations
- Other Items
- Actions after the board Meeting
- Actions after Semi-annual Site Visit
- Other Actions
- Conclusion and Recommendations
- Plant Performance
- Monitoring System
- CCTV and Alarm System
- Performance of the O&M Contractor

2 Plant Performance Analysis

In this section, the performance of the Plant is displayed with analysis and comments. OST have analysed the production, irradiation, PR and availability and checked the main events affecting the Plant.

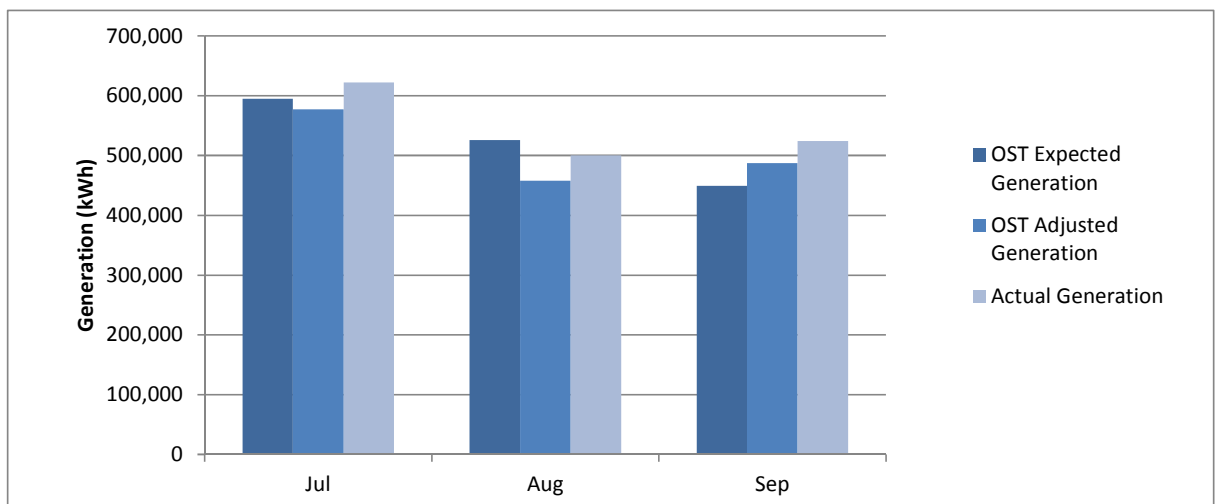
2.1 Production

Table 1 and Figure 1 shown below, includes the expected yield, the expected adjusted generation and the generation measured on site by the Project monitoring system. The plant production, adjusted with the current irradiation and availability, is always in excess of the OST Predicted values.

Table 1: Monthly Generation

| Month | OST expected yield (kWh) | Adjusted OST expected yield (kWh) | Actual generation (kWh) | Delta actual gen. vs expected gen. (%) | Delta actual gen. vs adjusted gen. (%) |
|----------------------|--------------------------|-----------------------------------|-------------------------|----------------------------------------|----------------------------------------|
| July | 595,213 | 577,406 | 622,400 | 4.57% | 7.79% |
| August | 526,089 | 457,690 | 500,050 | -4.95% | 9.26% |
| September | 449,188 | 487,597 | 524,550 | 16.78% | 7.58% |
| Q3 2015 total | 1,570,490 | 1,522,685 | 1,647,000 | | |

Figure 1: Month by Month Generation



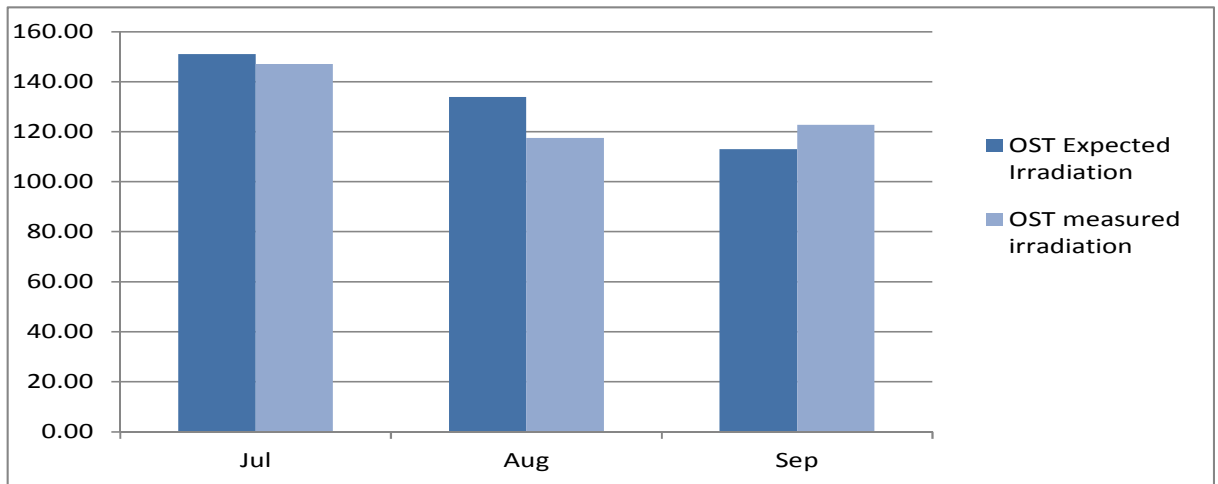
2.2 Irradiation

Irradiation has been measured using the two in-plane pyranometers on the Plant. As per O&M contract the pyranometers were cleaned each month.

Table 2: Expected P50 irradiation (from OST yield study) and measured irradiation

| Month | Expected P50 irradiation (kWh/m ²) | Irradiation measured from monitoring system (kWh/m ²) | Delta (%) |
|-----------|------------------------------------------------|-------------------------------------------------------------------|-----------|
| July | 151.00 | 147.13 | -2.56% |
| August | 134.00 | 117.53 | -12.29% |
| September | 113.00 | 122.71 | 8.59% |

Figure 2: Comparison between Expected P50 irradiation and measured irradiation



2.3 Performance Ratio (PR)

The following Table 3 and Table 4, Figure 3 and Figure 4 show Plant PRs (including and excluding downtimes) which have been verified against the irradiation and generation data. The Plant performance was always above the guaranteed level for each month.

Table 3: PR analysis including downtimes

| Month | PR guaranteed (%) | OST expected (%) | Actual PR incl. downtimes (%) | Delta (%) |
|-----------|-------------------|------------------|-------------------------------|-----------|
| July | 78.20 % | 79.04 % | 84.83 % | 7.32 % |
| August | 78.20 % | 78.73 % | 85.32 % | 8.37 % |
| September | 78.20 % | 79.71 % | 85.72 % | 7.54 % |

Figure 3: Comparison between OST expected and actual PR (incl. downtimes)

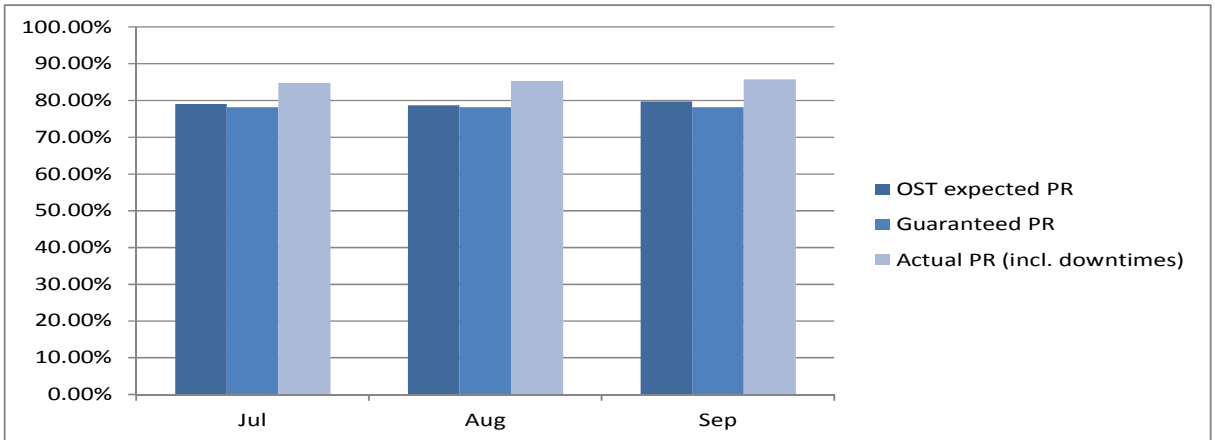
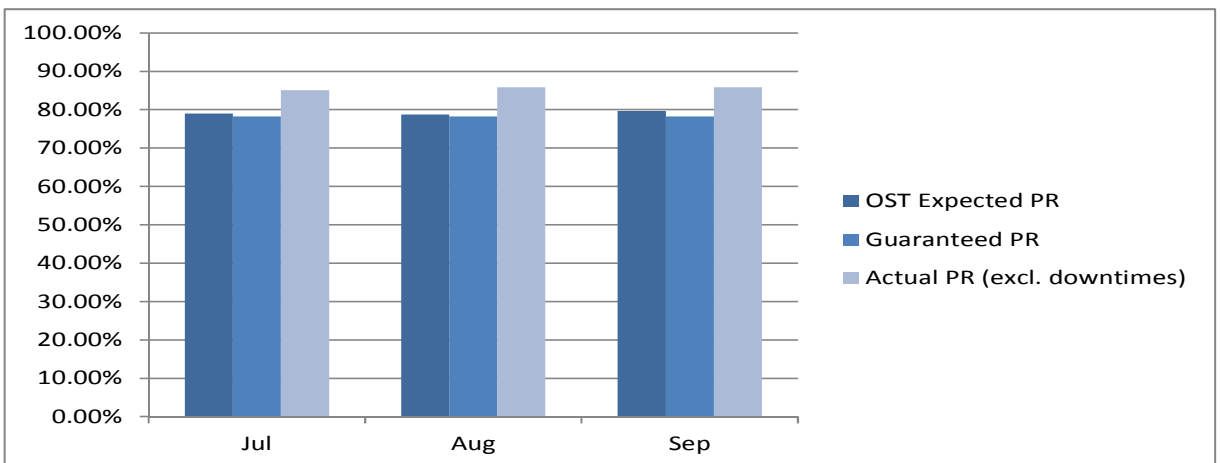


Table 4: PR analysis excluding downtimes

| Month | PR guaranteed (%) | OST expected PR (%) | Actual PR excl. downtimes (%) | Delta (%) |
|-----------|-------------------|---------------------|-------------------------------|-----------|
| July | 78.20 % | 79.04 % | 85.12 % | 7.69 % |
| August | 78.20 % | 78.73 % | 85.88 % | 9.08 % |
| September | 78.20 % | 79.71 % | 85.86 % | 7.71 % |

Figure 4: Comparison between OST expected and actual PR (excl. downtimes)



2.4 Availability

Table 5 below shows the Target and Actual availability of the plant during this period.

Table 5: Target availability and actual availability (from Abakus Operational Reports)

| Month | Target availability (%) | Actual availability (%) | Delta (%) |
|-----------|-------------------------|-------------------------|-----------|
| July | 99.00 % | 99.56 % | 0.57 % |
| August | 99.00 % | 99.19 % | 0.19 % |
| September | 99.00 % | 99.96 % | 0.97 % |

In July, August and September only a few events affected the plant generation as shown in Table 6. The availability was always above the 99% target level.

3 Plant Operations

Table 6 outlines the operations and status of recorded incidents and events that affected the plant during this quarter. In general we consider that the O&M Contractor has responded efficiently to any issues in relation to plant performance.

Table 6: Incident List

| No. | Description | OST Comments | Progress/Status |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1 | Westronics inspection of the alarm and CCTV system in June highlighted damages due to infestation of rodents and ants. Westmill Board have authorized the repair works. | At the time of writing this report, Westronics are waiting to receive the remaining parts to complete the required works. The works completion is expected within October. | Ongoing |
| 2 | On 29 th June Unipart were informed of an issue to one infrared CCTV and one colour camera. | Westronics checked the cameras and sent a quotation of £14,720 for replacement works. The Board accepted the quotation on 9 th September. On 2 nd October the cameras had been fixed and were fully functional. | Closed |
| 3 | On 4 th July a short communication issue affected the monitoring system. | JTH (O&M sub contractor) and Skytron checked the monitoring system and found there was an issue with the provider. | Closed |
| 4 | On 26 th July the string combiner box (CB) 4.4 was not operative. | The O&M replaced a CB fuse. | Closed |
| 5 | Inverters had shown short downtimes from 28 th to 31 st September. | SMA switched off the inverters during maintenance. | Closed |
| 6 | On 26 th August the O&M Contractor attended to some diodes tests to PV modules and strings to CBs 2.1, 6.2, 7.3, 7.5 | According to tests one PV module should be replaced. Abakus is managing the substitution. | Ongoing |
| 7 | On 26 th August Western Power Distribution (WPD) visited the site. | As result of the site visit, WPD replaced one of the two meters in 3 rd September. OST requested a report of this intervention and are still to receive this at the time of this report. | Closed |
| 8 | From 27 th to 28 th August the O&M Contractor checked the rusted parts of the plant. | Some parts were repaired. | Closed |

| | | | |
|----|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 9 | On 28 th August there was a temporary downtime to inverter 2. | It was caused by a blown DC fuse that was then replaced. | Closed |
| 10 | On 14 th September inverter 4 stopped communicating. | Abakus stated this was due to a faulty Ethernet switch inside the inverter and is attending to the replacement. However the inverter was operating. | Ongoing |
| 11 | On 30 th September the inverters were intermittently downtime. | Maintenance activities affected the inverters generation. | Closed |
| 12 | The monitoring system continued to register a small and low visible fictitious production during the course of the night. | Despite attempting to resolve the issue in different ways the O&M Contractor has not found a solution. This event is not affecting the plant but does not permit an accurate Generation measurement via the monitoring system. | Ongoing |

4 Other Items

4.1 Actions after the Board Meeting

Table 7 shows comments and answers raised at the previous board meeting.


Table 7: Actions and considerations after the Board Meeting


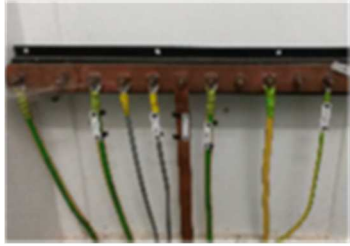
| Board discussions, decisions and actions | OST considerations |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Since this report OST has been in contact with Westmill Solar as security cameras on site have been damaged. OST are currently procuring quotes for the damage. | Westronics provided a quotation of £14,720 for the repair works which was approved on the 9 th September. Westronics concluded the repair works on 2 nd October. |
| Tom Parkinson (member of Westmill Board) asked to OST if the blown transformer was related to SSE being reconnected to the grid. | The O&M Contractor found that due to the outage the Emergency STOP button issue was discovered. |
| It was noted that Abakus had raised concerns about sheep being grazed on the site. Westmill Board thought the site had been built sheep safe. Ethex (Commercial Asset Manager) will ask OST for clarity on this. | Sheep can accidentally bite low, thin cables together with the grass and damage aluminium mounting structures, which is not the situation in Westmill Plant. |

4.2 Actions after semi-annual site visit

Table 8 below shows what OST have reported on the actions the O&M Contractor conducted after the semi-annual site visit in June.

Table 8: Site visit items

| No. | Description | OST supporting Comments | O&M contractor actions |
|-----|------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Various trips recorded by ABB Medium Voltage control unit (G59). |  | Abakus analysed the G59. There are two dissimilar power generators connected to the same DNO station (wind turbines and solar farm). This can determine some interferences. OST forwarded the test result to the Wind Farm suggesting to check for possible G59 trips also in the turbines stations. |

| No. | Description | OST supporting Comments | O&M contractor actions |
|-----|--------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 2 | Signs of oxidation in various ground cables joints between PV tables. |  | Abakus repainted the joints as corrective maintenance activities. |
| 3 | Missing torque sign in the ground cables joints inside the Client cabin. |  | The O&M Contractor is going to attend to this point. |

5 Conclusions and Recommendations

The plant output from July to September was always above the expected P50 energy yield adjusted for actual irradiation and availability. This indicates that the overall performance of the plant was good in this period.

During the second quarterly the plant had a short communication issue with the provider on 4th July. Missing communications from SMA inverter no.4 since 14th September till present is due to an internal issue that Abakus and SMA have scheduled to resolve this month. The monitoring system has continued to register a small and low visible fictitious production during the course nights despite the checks. The O&M Contractor has not found a solution yet.

An infrared and colour camera of the CCTV system had electrical damage and a replacement was requested. The Board approved the Westronics quotation of £14,720 in September and the repair works were concluded on 2nd October. Westronics is waiting to receive the last parts for completing the repair works to the alarm system. Unipart and Elite security did not register any security issue and verified the absence of intrusions.

In general we consider that the O&M Contractor responded efficiently to any issues in relation to plant performance. They have been slow to respond to requests in few times but always with good answers. JTH has still provided generator meter pictures. However OST requires photos of the first and last day of the month whereas JTH provides these at different periods of the months, as a result OST cannot obtain accurate generation figures.

OST confirmed the good Plant performance from October 2014 to September 2015 and approved the Annual Performance Premium paid to Abakus of £154,302.59.



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