



Demonstration Project Case Study

Project title: Installation of roof mounted solar photovoltaic (PV) arrays on the NRW buildings estate

Description

Natural Resource Wales' building estate comprises offices, workshops, depots and visitor centres and uses around 3 million kWh of electricity annually. In the financial year 2016/17 NRW generated nearly 74,000 kWh of electricity from existing PV panels installed on building roofs. PV panels provide a renewable source of electricity, reducing greenhouse gas emissions from electricity produced through burning fossil fuels, and decreasing long term electricity costs. To further reduce NRW's electricity related emissions and operating costs, the NRW Environmental Management System and Facilities teams secured Invest to Save funding from Welsh Government to install PV panels on buildings on the estate. Five PV arrays were installed in Spring 2018, expected to generate in the region of 29,394 kWh of renewable electricity annually, and one further array is also being progressed.

Method

In 2016/17 the organisation's EMS team arranged for 15 NRW buildings to be assessed for energy saving opportunities by the Carbon Trust, through Welsh Government's (now closed) Resource Efficient Wales support service. This sub-set of 15 buildings was prioritised because they were considered to be secure in the long term as part of the NRW's on-going accommodation review.

Amongst the recommended energy and cost saving measures were installations of PV arrays on 10 buildings. The EMS and Facilities teams bid for the cost of these arrays and their installation, to the Welsh Government Invest to Save (I2S) Green Growth Fund. I2S supports energy efficiency projects in public service organisations through repayable, interest-free funding.

I2S funding was secured in 2016/17, with some of this funding carried over into 2017/18. An experienced contractor was sought to conduct detailed site investigations, supporting building and electrical works and installations. The specification for the work called for:

- Mechanical and structural surveys of each roof and surroundings including available space, any shading and access.
- Electrical surveys of each building including existing distribution board, earthing requirements, upgrades and cable runs required.
- The subsequent development of construction plans for PV array installation.
- Securing Distribution Network Operator approval for connection to the national grid for each planned installation.
- Installation of PV arrays including supporting electrical and ground works required.
- Hand-over of PV arrays to NRW's building maintenance contractor responsible for overseeing long-term maintenance.

42.7 kWp of solar PV capacity installed across 5 sites

Expected electricity generation: 29,394 kWh / year

Emissions avoided: 14.5 tCO₂e / year

Total project cost: £50,577 (components and fittings) + £17,635 (supporting surveys)

Established carbon saving opportunity

Staff involved

NRW Environmental Management System team
NRW Facilities and Technical Facilities staff

Demonstration Project Case Study

A number of supporting actions were also required to enable installations:

- Commercial energy assessments were carried out by NRW's building maintenance contractor to produce Energy Performance Certificates (EPCs) for all 10 offices to ensure qualification for Feed-in Tariff payments.
- Local Planning Authority advice was sought by the Technical Facilities team to confirm that planning permission was not required, providing installations were within standard industry guidelines.
- Asbestos surveys were carried out by a specialist appointed by NRW to test areas where installations were planned.
- Sign-off of the construction phase plans by a quantity surveyor to meet the Construction (Design and Management) Regulations 2015.

The tender process for a contractor through to appointment and installation took from July 2017 to March 2018.

Outcomes

Solar panels were installed at five NRW buildings in February and March 2018. Installation sizes, actual costs and estimated annual savings are given by office array below:

Office	Installation size (kWp)	Installation cost (£) ¹	Predicted annual savings ²		
			Electricity generation (kWh)	Greenhouse gas emissions (tCO ₂ e)	Cost (£)
Clawdd Newydd	5.4	7,562	3,729	1.5	279
Welshpool	10.8	13,247	8,140	3.4	1,008
Pye Corner	9.99	10,811	8,958	4.4	1,673
Lampeter	5.67	7,495	4,567	1.9	655
Crosshands	10.8	11,462	4,000	3.3	1,543
Totals	42.66	50,577	29,394	14.5	4,879

¹Prices include all components and labour but exclude VAT.

²Predicted annual savings provided in building energy assessments carried out for NRW by the Carbon Trust, and where necessary scaled from predicted installation size to actual installation sizes. Cost savings account for energy savings, Feed-in-Tariff payments and any assumed export income.

The PV panels have an expected life of 25 years and costs and carbon savings will accrue over this period. In addition to the cost of components and installation included in the table, there were survey costs amounting to £17,635. The combined payback period across all installed arrays (including repayment of survey costs) is estimated to be 14 years, over which the investment will be reimbursed. All panels should benefit from Feed-in Tariff payments.

Installations at 3 offices were not progressed beyond the EPC stage because the retention of these buildings is being re-evaluated under NRW's accommodation review. The installation at one office was stopped by the identification of asbestos containing material in the roof space during the site survey. The cost of removing these materials was considered prohibitive to the PV installation, and this was not taken forward. The installation at another office was postponed while we address complications that arose during site surveys (see Learning section for details).

Demonstration Project Case Study

Wider benefits

Alongside emissions savings, the PV panels will reduce NRW's annual operational costs and improve the resilience of these offices to any national grid electricity supply disruptions. Displacing fossil fuel combustion with renewable generation contributes towards the Wellbeing of Future Generations Act goal of a globally responsible Wales and will also provide air quality benefits contributing to the goal of a healthier Wales.

Learning

- Although funding was secured in the financial year 2016/17, the PV allocation had to be carried over to 2017/18 due to the complexity of installing PV at multiple sites as part of one project. The time needed to develop work specifications, secure a contractor, produce detailed site surveys, carry out electrical and structural upgrades prior to installation should not be underestimated. This process should be started as early in the financial year as possible to ensure that complexities identified during site surveys do not prevent installation before the year end.
- Installations at two offices had to be stopped or postponed following complications identified during site surveys: the presence of asbestos containing materials in the roof space of one office, and issues with a back-up generator requiring significant cabling and trench work to enable installation at the second office. This highlights the importance of conducting detailed site surveys and preparing detailed and accurate construction phase plans prior to final allocation of funds to specific PV projects and installers arriving on site.
- Connection issues at sites with back-up generators weren't identified during initial contractor site surveys and had to be resolved later in the process. The presence of back-up generators should be a specific consideration in initial site surveys.
- Lack of records of past electrical installations caused delays at one site and lead to the need for an additional site visit.
- Staff resource both within NRW and the contractor organisation caused delays in installations. Some contingency should be factored into work programmes for installations to allow for any arising staff resource issues.
- Detailed construction phase plans were a crucial part of an effective hand-over of arrays between the installing contractor and the maintenance contractor responsible for the units long-term.
- There was significant staff interest in, and support for the solar PV installations, and in hindsight more internal communications around the installations could have helped to build interest in and support for further emission reduction efforts within the organisation.

Evidence and information

Carbon Trust (2011) A place in the sun. Lessons learned from low carbon buildings with photovoltaic electricity generation.

<https://www.carbontrust.com/media/81357/ctg038-a-place-in-the-sun-photovoltaic-electricity-generation.pdf>

