Maximising Benefits from PV

A Guide for Social Landlords

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ABOUT THIS GUIDE

Introduction

This guide aims to help social landlords maximise the savings their tenants get from PV installations. Drawing on recent Changeworks research (see below), the guide provides best-practice recommendations for planning and implementing PV projects. Guidance is flexible to adapt to the needs and resources of individual social landlords.

It is aimed at:

- Social housing PV projects where the PV feeds directly into tenants' homes, not communal areas.
- New or existing PV projects (although some sections are most relevant for the former).
- Staff responsible for energy improvements in social housing. However, it is strongly recommended that tenant-facing staff (e.g. tenant liaison officers or energy advisors) are involved in the development of PV projects. Some sections of the guide, such as the Background Information in Section 1, may be particularly useful to them.

Changeworks research

We recently conducted research into the experiences of social landlords and over 120 social housing tenants with PV[1]. This work was funded by the eaga Charitable Trust. The project measured savings arising from over 100 PV installations in social housing and worked with social landlords assessing the viability of PV in their stock. A leaflet for tenants was developed to explain how changing their electricity use could help them get the most out of PV. This is intended to be used alongside this guide.

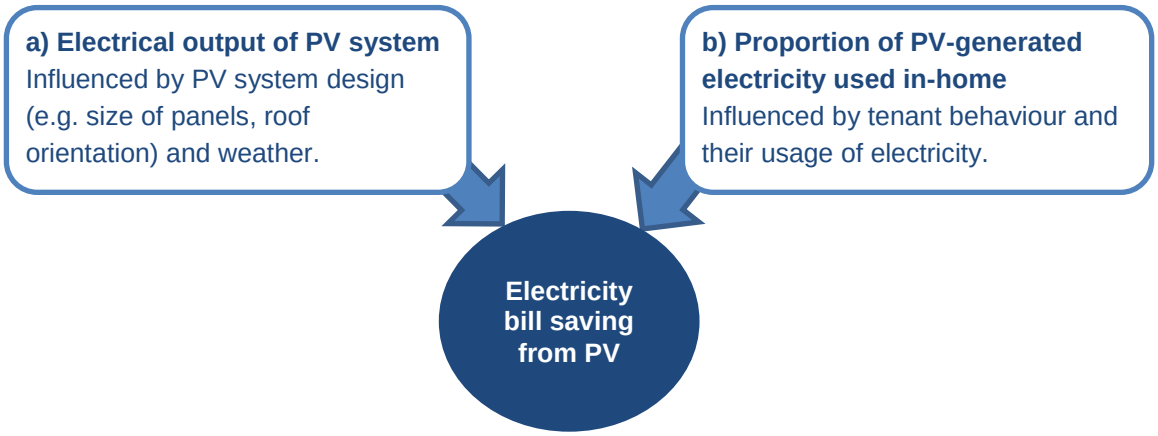
Whilst the research highlighted that PV can be an effective way of reducing tenants' energy bills and contributing towards fuel poverty alleviation, it also found that tenants often lack a basic understanding of how to get the most out of PV. This means that the bill savings tenants achieve are often not maximised.

[1] http://consultancy.changeworks.org.uk/research.html

Guide contents

The aim of this guide is to **increase the bill savings tenants realise from PV**. As shown in Figure 1, savings are determined by two over-arching factors: (a) electrical output from the PV system and (b) the proportion of this that is used in-home.

Figure 1: Factors influencing bill savings realised by tenants



A full explanation of how PV works and how savings are impacted is contained in:

SECTION 1: BACKGROUND INFORMATION
- Useful information to know before proceeding with a PV project: how PV works, pros and cons of installing PV and typical savings arising from PV

The following sections of this guide then show you how to influence the two over-arching factors shown in Figure 1:

SECTION 2: SELECTING PROPERTIES AND TENANTS FOR PV ➢ How to design a scheme to ensure maximum benefit for tenants by identifying appropriate properties and tenants	This helps determine: *a) Electrical output* *b) Proportion used in-home*
SECTION 3: TENANT GUIDANCE AND SUPPORT ➢ How and what advice to provide to tenants to ensure they can maximise the benefits from PV	This helps determine: *b) Proportion used in-home*
SECTION 4: MONITORING AND EVALUATION ➢ How and why to measure the impact of your project	This helps determine: *a) Electrical output* *b) Proportion used in-home*

The final section summarises the report:

SECTION 5: SUMMARY AND PROJECT CHECKLIST
- A brief summary and checklist to read before commencing a PV project

1. BACKGROUND INFORMATION

This section gives background information which would be relevant for any staff involved in developing a PV project, and reviews the financial savings that may be expected from PV based on our research findings.

What is PV?

PV stands for 'photovoltaics' and this refers to solar panels that generate electricity. Solar PV panels convert sunlight into electricity. Electricity generated by the PV either goes (a) into the national grid or (b) into the building where it is installed. PV therefore can reduce residents' electricity bills and, because it is a clean energy source, reduces CO_2 emissions.

How do tenants benefit from PV?

Electricity from the PV panel will only be used in the home if there is immediate demand for electricity (i.e. an electrical appliance is on) when the PV panel is generating. Because PV uses sunlight to create electricity, this will be during the daytime. Currently, electricity produced by the PV system cannot be stored. Therefore, if there is no or less demand for electricity than produced by PV, some or all of the electricity will go (i.e. be 'exported') to the national grid.

Electricity generated from the PV system is free to use for the household. Any electricity that the household imports from the national grid will be charged at the normal rate (around 14.5p/kWh for a standard rate tariff). Thus, the householder would be best to use as much of the PV-generated electricity as possible and reduce their reliance on the national grid.

Solar panels generate electricity whenever it is light, but will generate more on sunny days and less when it is cloudy. They produce most during the summer months. Tenants should use more of their electricity during daylight hours, and less when it's dark, to reduce their reliance on the grid.

An unintended consequence of installing PV could be increased electricity bills if households do not fully understand how systems work. For example, some may assume that the system will provide all their electricity free and go on to increase overall electricity consumption. In other cases, households who significantly increase daytime electrical demand (e.g. using several appliances simultaneously), may exceed the PV's electrical output, even on sunny days. For this reason, it is important to put electrical appliances on during the daytime – but not all at once. Further, if they previously used many of their electrical appliances at night on a cheaper electricity tariff (e.g. using a washing machine at night on an Economy 7 tariff), they could see a rise in their electricity bills as they would now be drawing some of this additional daytime electricity from the national grid (on a more expensive tariff).

Why install solar PV?

When the FITs scheme was first introduced (see Box 1), many social landlords installed PV primarily to benefit from a high rate of FITs which generated an attractive income stream. These projects also enabled landlords to reduce tenants' fuel bills, help alleviate fuel poverty, improve housing stock and assist in meeting energy efficiency standards. When the FITs rate initially reduced, many social landlords abandoned their projects; however, organisations are increasingly re-assessing PV as a means to reduce tenants' fuel bills. Pros and cons of installing PV are outlined below.

Reasons why PV may be worth considering:

- Average savings of £90/year (see overleaf for more information) – comparable to savings from measures such as solar hot water;
- Reduces tenants' electricity bills, an area on which few other energy efficiency measures impact. Energy efficiency measures are usually focused on reducing heating usage[2];
- Social housing tenants tend to have high daytime occupancy rates which means they are well-suited to PV;
- Can substantially increase SAP ratings which means it can help to meet energy efficiency standards;
- It is easy to predict output;
- Relatively easy to install and the installation is non-disruptive to tenants;
- May be particularly beneficial where other measures (such as loft and cavity wall insulation have been installed);
- Minimal maintenance; panels last at least 20 years (perhaps 30 years) and in that time are likely only to need an inverter[3] replacement after ten years, and an annual cleaning programme.

Disadvantages and problems with PV:

- Costs to purchase and install are relatively high, especially if scaffolding is required;
- May be restricted in some areas or on buildings due to planning and listed building consent requirements;
- Where roofs are in multi-ownership (e.g. roofs on blocks of flats), getting agreement from other properties might be difficult;
- May be considered unfair in blocks of flats as only top floor tenants will (generally) benefit.

[2] Our research shows that electricity usage in social housing homes can be relatively high compared to heating bills.
[3] Which converts DC electricity produced by the panels into AC

Box 1: Feed-in Tariff (FITs)

FITs provide payments to homes, businesses and organisations with an installed electricity technology under 50 MW, such as PV. FITs consist of two payments:

1. Generation tariff: a payment for every unit (kWh) of electricity generated from the technology;
2. Export tariff: a payment for every unit of electricity exported to the national grid (for domestic PV systems it is usually assumed that this is 50% of all generated electricity).

At the end of 2013, the generation tariff for PV systems of 4kW or less was 14.9p per kWh and the export tariff was 4.6p per kWh. The amount received for each of these tariffs is set at the installation date. Ofgem (which regulates FITs) considers whether to reduce the generation tariff rate every three months. Once installed, the owner of that technology is guaranteed that rate for 20 years.

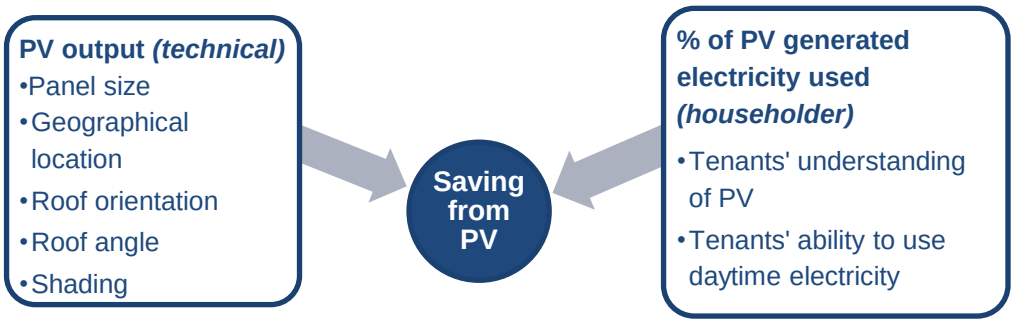
Social landlords may chose to invest in PV themselves, in which case they receive the FITs. Alternatively, under a 'rent-a-roof' scheme, a third party purchases and owns the panels, simply renting the roof from the social landlord. In this situation, the third party receives all or the majority of the FITs.

The FITs rate has significantly reduced from when it was first introduced in 2010 (43.3p/kWh for systems less than 4kW) but this reduction has been matched by a substantial reduction in the upfront costs of PV. The FITs scheme means that PV installations have shorter payback periods), which often means they can be financially viable. For example, modelling of some housing in Edinburgh in mid-2013 as part of our research, found that the upfront cost of PV panels would be paid back by the FITs in 11 – 13 years.

Bill savings from PV

As explained in Section 1, there are two over-arching factors that determine the savings tenants realise from PV, as shown in Figure 2. Firstly, the electrical output of the PV system is influenced by a number of technical factors such as size, orientation and shading. Secondly, the proportion of this that is used in-home which is influenced by the tenants understanding of how to adapt behaviour and their ability to do so.

Figure 2: Determinants of bill savings from PV



Our research measured bill savings in 42 households with PV. This found:

- average savings of £38 per year per kWp[4];
- the sample had an average system size of 2.4 kWp, which equated to a total annual saving of £90;

These savings are less than often predicted by other sources. This is because many sources (including installers) assume that households use half of the electricity generated from the PV whereas householders in our research used around a third. This was likely in part to be due to a widespread lack of tenant understanding about how to get the most from PV, despite their landlords having provided some guidance to the tenants[5].

From these findings, we would recommend:

- Ensuring clear advice to tenants about how to get the most out of PV (Section 3) so that they can maximise the amount used.
- Being cautious in the estimated savings figure provided to tenants. Our results suggest tenants are more likely to use a third of the electricity generated, not the 50% figure usually quoted. Tenants who follow the advice, however, have the potential to save more.

The results also showed that savings varied significantly between households. Some tenants' bills went up after PV installation, which may have been due to misunderstandings about how to get the most out of the system (see Section 3). Conversely, other bills reduced by a larger amount than was possible from PV alone; although it was not clear why this was, it may have been that PV provided a positive 'prompt' to tenants to start reducing overall energy consumption.

Based on our findings, the expected savings from different sized systems are shown in Table 1.

Table 1: Typical savings from PV systems, based on Changeworks' research[6]

Size of PV system	1.5 kWp	2 kWp	2.5 kWp	3 kWp	3.5 kWp	4 kWp
Expected annual saving	£57	£76	£95	£114	£133	£152

[4] kWp refers to the size of the panel
[5] Guidance provided by the social landlords. Changeworks provided their leaflet at a later stage.
[6] Based on 2012 average electricity price of 14.5p/kWh. Source: DECC (September 2013): Quarterly Energy Prices

2. SELECTING PROPERTIES AND TENANTS FOR PV

This section provides information on how to design a scheme for maximum benefit to tenants.

Why is this important?

As shown in Figure 2, the savings arising from PV depend on a number of technical and user factors. Identifying the properties and tenants best suited for PV, ensures a better likelihood of high savings being achieved.

Selecting properties

Table 2 shows the factors that influence the electrical output of PV systems. All of these factors can be taken into consideration when designing a scheme to identify the most suitable properties.

Table 2: Factors influencing electrical output of PV systems

Factor	Explanation
System size	Larger systems will generate more electricity.
Location	Solar radiation across the UK varies; solar panels in the south west will receive most solar radiation and therefore produce more electricity (see Figure 3).
Orientation	Panels facing south will produce the most electricity.
Angle	Panels on roofs that are at a 30 – 40 degree angle will receive the most sunlight and therefore produce most electricity.
Shading	If the panel is in shade (e.g. from a tree or chimney), this reduces the amount of electricity generated. Even a small amount of shading can have a significant impact.

A desktop analysis (e.g. using maps, plans or satellite images available via online mapping websites) will identify suitable roofs. A more detailed site survey by an installer will then be required to gather greater detail and consider other factors such as roof accessibility.

Using this data, installers can predict the electrical output of PV systems. Our research (which involved 44 PV systems across three social landlords[7]) showed that installers' predictions of output were, on average, accurate: predicted output for 86% of households were within 20% of the original predictions. However, a handful of PV systems had performed a lot worse or better than predicted, and this highlights the importance of monitoring and evaluation to identify any problems (Section 4).

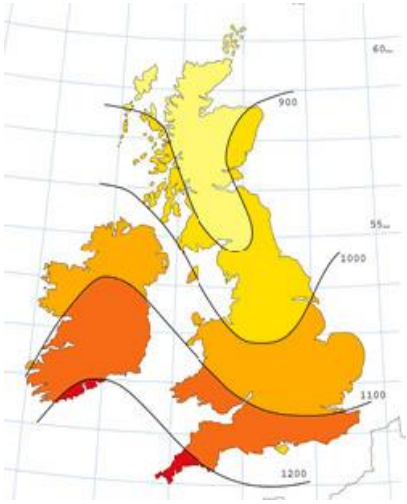


Figure 3: UK map showing average solar radiation for panel on 30° angle per year. Radiation is highest in areas shaded dark red, reducing to the lowest amount of radiation in areas shaded pale yellow. Taken from www.solar-trade.org.uk

[7] This sample is lower than cited previously because expected values had been only been supplied for 44 households.

When selecting properties, it is also important to consider your overall project aims and objectives. For example, if the aim is to reduce the energy bills of tenants who currently have the highest bills (e.g. off-gas homes or those with low energy efficiency ratings), this would automatically reduce your selection.

Selecting tenants

As shown in Figure 2, tenants who have the ability to use daytime electricity will benefit most from PV (because this is when the free electricity is produced by PV systems). Therefore identifying tenants with a high daytime occupancy would maximise their chances of high savings from PV. Table 3 suggests two approaches to carry this out. Whether these approaches are feasible or practical largely depends on the social landlord and their stock.

Table 3: Approaches to identify most suitable tenants for PV

Approach	When to use this method	Disadvantages
1) Collecting (or using existing data) on household daytime occupancy levels or tenants' occupation status to identify most suitable tenants. For example, surveying tenants for this data.	• May be suitable if choosing between different renewable technologies for specific properties (such as heat pumps or PV) where considering tenant characteristics is crucial. • Particularly where tenant turnover rates are low.	• Can be difficult to obtain this data from tenants (i.e. may be unwilling to divulge information). • Turnover of properties likely to occur multiple times during PV's lifetime, so the approach may be only successful temporarily. • May be deemed unfair to provide PV only to certain properties, unless a wider retrofit strategy in place and communicated to tenants.
2) Targeting PV at estates or complexes with high daytime occupancy	• Where blocks or estates of housing are easily identifiable e.g. sheltered housing blocks or areas with high proportions of retired residents.	• May not apply to some social landlords.

3. TENANT GUIDANCE AND SUPPORT

This section provides a best-practice approach to providing guidance and support to tenants so they can maximise the benefits they realise from installed PV systems. It provides advice that should be given to tenants and information on common problems and solutions.

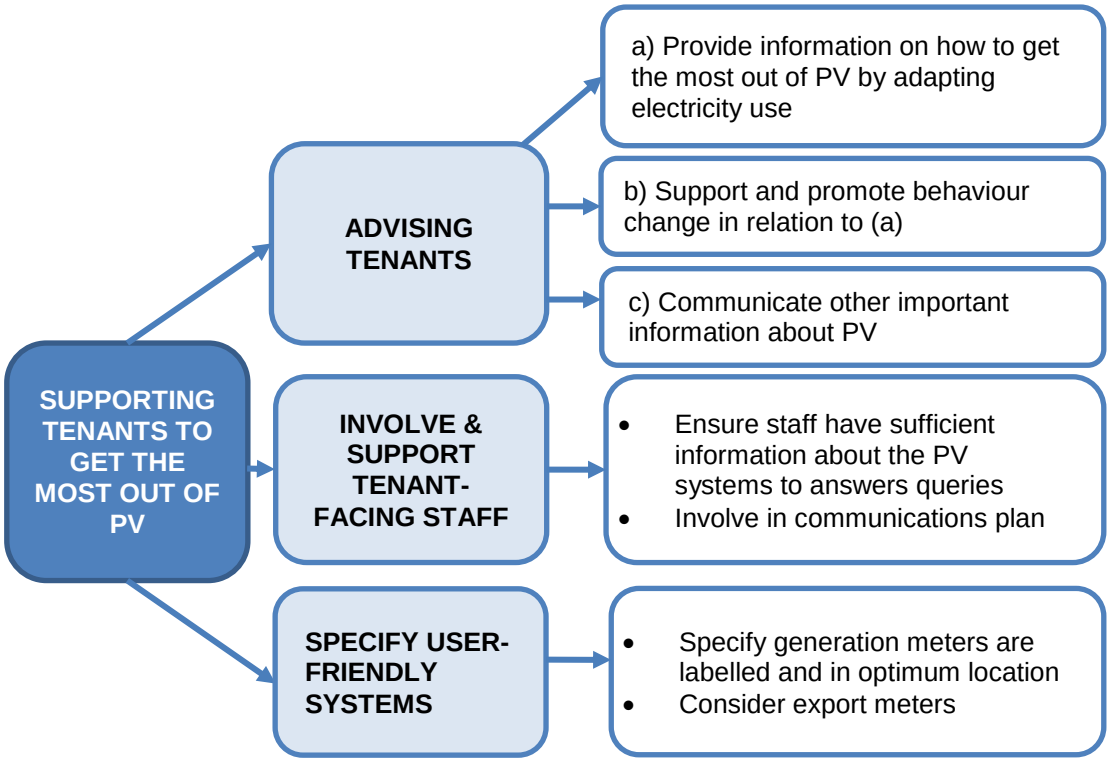
Why is this important?

Our research found that many social housing tenants with PV lacked a basic understanding of the system. For example, 60% did not know they needed to use electricity during the daytime in order to realise good savings from PV. All of these tenants had received guidance of some kind from their landlord but much of this had not been effective in getting the message across to tenants; some had been left confused by over-complicated advice. Unfortunately this means that many tenants were not getting the expected saving from their panel: in a number of households, bills had even gone up. Thus, PV should not be promoted as a 'fit and forget' technology. To achieve the potential energy savings, **tenants need to be actively engaged with their PV system and proactive about changing their behaviour.**

How to support tenants

To get the most out of their system, tenants need to be provided with sufficient information in an effective manner. Additional activities will be required to support behaviour change, but these needn't be time consuming. Involving tenant-facing staff (e.g. tenant liaison officers or energy advisors) is also critical. An overview of recommended support activities is shown in Figure 4 and expanded on throughout this section.

Figure 4: Suggested approach to supporting tenants maximise savings from PV



Advising tenants

a) How to get the most out of PV

The priority for communication with tenants should be ensuring they know how to adapt their electricity use to get the most from PV; the information they need is shown in Box 2.

As part of our research project, an easy-to-understand leaflet for tenants was created for this purpose: *Getting the most from your solar panels*[8]. After being given to social housing tenants with PV as part of the research, the majority of tenants surveyed found the leaflet useful and as a result, two-thirds changed their electricity use.

This leaflet can be used by other social landlords free of charge. It is available electronically as a download or a printable version (for professional printing) and can be obtained free of charge by emailing consultancy@changeworks.org.uk. For a small fee, the leaflet can also be tailored to your organisation.

Recommendations for providing this leaflet (or other similar information):

- Communicate to tenants about the scheme early on in the project;
- Provide the leaflet (or other written information) at the time of installation. Avoid overloading tenants with too much information particularly technical information or jargon;
- If resources allow, provide tenants with the opportunity to discuss the solar panels with a staff member; some people prefer verbal advice to a written leaflet. Also, ensure tenants do not have any misunderstandings at the start of a project. This is beneficial to you in the long-term. Verbal advice could involve:
    - A short home-visit around the time of installation;
    - A follow-up phonecall after the leaflet has been received to ensure it has been read and understood;
    - Appointments at your office for those that request it;
    - Open events;
    - Tying in to any existing energy advice service offered by you.

Box 2: How tenants can maximise benefits from PV

1) Using appliances during the daytime (when possible);

- As explained in Section 1, PV produces electricity from sunlight so tenants need to use electricity in the day time, when it is light.
    - e.g. do the ironing or washing during the day, cook a main meal during the day or charge electrical items during the day.
- PV produces most electricity when it's sunny but still produces some on cloudy days. It will produce most during the summer compared to winter.

2) Only using one major appliance at a time;

- The output of PV, even on a very bright day, is unlikely to be enough

[8] Full weblink: http://consultancy.changeworks.org.uk/Changeworks%20Solar%20Guide.pdf

electricity to power more than one large electrical item (such as a washing machine or dishwasher).
- It's very important that tenants are aware of this – if they use appliances during the daytime, but put them on simultaneously, they might even see their bills go up.
- Warning: don't actively advise tenants to put appliances, such as washing machines, on a timer to enable them to come on when they are out of the house or asleep. The fire service recommends against this due to fire risk.

b) Encouraging behaviour change

Whilst providing information to tenants on how to change their behaviour in relation to electricity use is very important; in reality, people often need more than this to change their behaviour, especially on a long-term basis. Behaviour is influenced by many other factors; in this case, for example, it is influenced by tenants' daily schedules, habits, relevance and perspectives on PV. For example, if they don't like PV, they are less likely to engage with the system and read the leaflet. Some suggestions on supporting behaviour change are:

- Insert reminders about using electricity in the daytime into communications such as tenant newsletters. People need reminding about the advice as they may forget. This is also important for new tenants moving into properties with PV systems. Timing communications for the start of summer, when PV starts to produce most electricity, is particularly appropriate.
- Use case studies of tenants to reinforce positive messages and normalise best practice in PV use e.g. a short item in a newsletter with a photo of a resident, giving examples of how they have changed their behaviour to adapt to PV and what savings they have made (measured savings, if possible).
- A significant barrier will apply to those people not at home during the day. Communications can acknowledge this fact but provide positive examples of how people in this situation have made changes to the way they use electricity and still made savings e.g. using the washing machine during the day at weekends.
- Ensure that all tenant-facing staff, installers and electricians have seen the advice you are providing. This ensures the message tenants receive is consistent.
- There may be other networks or communication channels to get positive messages across e.g. tenant representatives, community groups and social media.

c) Communicating other key information

As well as information on how to change behaviour, it is also important to provide other key information about PV:

- Why you are installing the PV; so it is transparent why they are getting solar panels and who is benefiting. For example, some tenants in our research were negative about the systems because they thought the landlord had installed PV only for their own benefit;
- Information about the installation e.g. key dates;

- Contact details for more information;
- Maintenance requirements (i.e. what they can expect to happen);
- The actual savings tenants are realising, if you have this data (see Section 4 on monitoring and evaluation). Our research suggests that many tenants don't know, but would like to know, what they're saving.
- Tenants' expectations of savings will vary. Be careful not to promise high savings – these might not be achieved. Remember, savings may also be masked by electricity price increases.
- You may notice that some tenants are experiencing problems (see Box 3). Explaining what and why this has happened through mass communications may prevent other tenants experiencing the same issue.

Installing PV may also be an opportunity for tenants to assess their electricity use at home and consider how they could reduce it e.g. switching appliances off or reducing use of a tumble drier. Your communications might want to include information on how to do this.

Involving and supporting tenant-facing staff

It is essential that staff who are in regular contact with tenants (such as tenant liaison officers) are involved in the PV project so that:

- They can provide advice to tenants;
- They can confidently answer tenant questions and queries;
- Communications to tenants are developed with input from these staff who will have expertise in this area and can draw on existing communication tools and routes.

Tenant-facing staff will need information on PV so they understand:

- Some basics of how PV works;
- How tenants can make the most from PV;
- Typical savings from PV and why this may vary between households;
- How to deal with any problems that may arise.

Sections 1 and 3 of this guide will provide most of this information; Box 3 provides information on common problems. Tenant-facing staff should then be involved in planning and implementing communications to tenants.

Box 3: Common PV problems faced by tenants and their solutions

- Common misunderstandings are that PV can 'store electricity' or 'reduce gas heating bills'. Neither of these is true. A simple explanation of how PV works (Section 1 or the tenant leaflet) can help show this.

- Some tenants mistakenly think that PV will provide all their electricity needs. Even if a tenant manages to use all the electricity that the PV system produced (which is very unlikely) they would still need to buy some electricity from the national grid – for example, electricity in the evening. Unfortunately this misunderstanding can lead some tenants to *increase* the amount of electricity they use in the belief that it will all be free. Advise tenants not to

increase how much electricity they use overall – just to use more in the day instead of the evening.

- Some tenants will not notice savings from PV. This may be:

  1) If they have started to use more electricity (as above).

  2) If electricity prices per unit (kWh) have increased since the panels were installed (which is likely). So even if the amount of electricity they get from the grid has reduced, the price increases may have offset this. Explain to tenants that their bills would be even higher if they did not have solar panels. You might want to monitor their bills to see whether this is the case (see Section 4).

  3) If they pay by direct debit as energy companies do not normally adjust monthly payments immediately after changes in consumption. The situation may be more complicated if the tenant has built up debt or credit on their account as the monthly payments may be adjusted to account for this. Advise tenants to contact their energy supplier as soon as possible to ensure their payment amount is accurate. Monitoring their bills (Section 4) can also help with this.

- Some tenants might expect their bills to stay the same every year after the PV installation (i.e. realise an initial reduction in the year after the installation and then for bills to stay constant thereafter). Unfortunately, even if their energy consumption stays the same, electricity prices are increasing and therefore their bills will continue to rise.

- Generation meters (which show how much electricity the PV panel has produced since installation) can sometimes confuse tenants if not explained properly. For example, some tenants in our research thought that the green light on the panel lit up when the panel was working; in fact, it was indicating connection to the remote monitoring system (to record readings, required for FITs). Whilst generation meters can be useful to tenants to indicate how much electricity has been generated, they need to be labelled and explained clearly (see overleaf).

- Some electricity meters can start to run backwards when PV systems are fitted (i.e. the electricity reading will reverse). This is an error as this meter should only record the electricity consumed by the household from the national grid. However, households may believe it is accurate. Advise tenants to contact their electricity supplier as soon as possible if this happens as they can replace the meter. If the supplier is not made aware of this, they may issue a bill based on an estimated reading which may over-estimate how much electricity the tenant has used.

- Some tenants in our research (particularly those living in Scotland) did not believe solar panels would produce enough electricity to be worthwhile installing. As shown in Figure 4, locations in the south will generate more electricity – but locations in the north still receive sufficient sunlight.

Specifying user-friendly systems

PV systems are too often designed without the user in mind and provide minimal feedback to the householder; this is particularly the case in social housing where the social landlord will be monitoring the generation of PV systems, but the tenant may not be able to access or understand such information. When specifying PV systems, steps can be taken to provide greater feedback to tenants, helping to improve their understanding of the system. By doing so, it's very possible tenants are more likely to engage with the system. This can be achieved by the following:

- **Generation meter:** this measures the electrical output of a PV system and therefore indicates when the PV system is generating, and how much it has generated over a given time (if readings are recorded by tenants). Our research indicates that the meters are often not explained to tenants and sometimes installed out of view (e.g. in a loft), which means the tenants have no way to benefit from this information. In some cases, a lack of explanation can lead to a misunderstanding about what the meter is displaying (see Box 3). Whilst not all tenants are likely to be interested in looking at the generation meter, our research indicated that some tenants who understood the meter were checking it. We would therefore recommend that landlords specify to installers that the generation meter is in an accessible location and that it is labelled so it can be understood (or supplementary information provided).

- **Online readings:** readings from the generation meter will be collected by the energy supplier for collecting FITs, usually remotely. As part of this, some energy suppliers can provide online access to tenants to view electricity generation levels from their system over time. As with the above, it would enable tenants to gain a greater understanding of the system and could also help tenants to see that their system is working to a satisfactory level. Our research indicated that if tenants were not noticing a bill saving, they may believe their panel is faulty, and have no information (aside from contacting their landlord) to verify that it is working.

- **Export meters:** these indicate how much of the PV-generated electricity is exported to the grid. Using export meter readings together with generation meter readings (which show overall generation), allows the amount of PV-generated electricity used in-home and therefore the savings from PV to be calculated. Without export meters, there is no way to accurately assess this. Installing export meters is therefore recommended to provide greater feedback to tenants and for monitoring and evaluation purposes (see Section 4).

  Because export meters are not normally installed in domestic settings, the cost of installing them is largely unknown but anecdotal evidence suggests it may range between £50 and £400 (depending on your energy supplier) with possible additional ongoing maintenance costs[9]. The Energy Saving Trust states that it

[9] http://www.yougen.co.uk/blog-entry/1659/Energy+companies+confuse+customers+over+export+meters+for+feed-in+tariff+/ - accessed February 2014

must be the energy supplier who fits the export meter, rather than the PV installer[10].

Fitting an export meter would also mean that the export tariff is accurately calculated, which in many cases would mean the landlord would receive more from the export tariff. However, since the export tariff is reasonably low (currently around 5p/kWh compared to the generation tariff at 15p/kWh), this extra income would not be significant.

[10] http://www.energysavingtrust.org.uk/Generating-energy/Choosing-a-renewable-technology/Solar-panels-PV/Measuring-the-electricity-you-export accessed February 2014

4. MONITORING AND EVALUATION

Monitoring and evaluation of microgeneration schemes in social housing is often a neglected aspect of projects, yet it is the only way for you to know what impact your project has had. This section provides some guidance on how to monitor a PV project.

Why is this important?

Our research highlighted that most social landlords with PV schemes did not know what benefit their tenants were actually getting. Whilst installers generally assume tenants will use half of the electricity generated from PV, our research found this was more likely to be a third. This meant that the savings tenants get from PV were being over-estimated.

Monitoring and evaluation can also:

- inform future decision-making;
- identify problems with the systems (for example, meters going backwards, solar panels not generating);
- let you know what has happened in situations where tenants have reported increased electricity bills;
- be a positive way of engaging tenants and informing them of their savings.

What to monitor and evaluate

There are two aspects of a PV scheme that need monitoring and evaluating:

1) Performance of the PV system	2) Tenant fuel bill savings
• **What?** Measure amount of electricity generated • **Why?** Are the panels performing as expected? Are there any problems with the system? • **How?** Look at the generation data from systems (i.e. kWh produced each quarter). This information is already collected for FITs. • **Note:** Output of PV systems will vary from year to year based on the sunlight that year but there could be other issues affecting performance such as shading.	• **What?** How much have tenants saved on their bills • **Why?** To work out whether tenants are getting any benefit from the PV systems. • **How?** Two options: export meters or measuring fuel bill savings. See Table 4.

How to monitor how much electricity tenants have used and how much they have saved on their bills

There are two ways you can calculate what savings tenants have made from PV:

1) Export meters
2) Using electricity consumption data

Details of these two approaches are outlined in Table 4. Export meters are not normally installed into domestic PV systems because the cost of installing them is

expected to be greater than the benefit received through receiving a higher export tariff income. Our research therefore had to use the second approach – measuring differences in electricity bills pre and post PV installation. However, we would strongly recommend that social landlords consider installing export meters for the purposes of monitoring and evaluation: by comparing how much electricity is generated by the panel (the generation meter) and how much is exported (the export meter), it is known how much electricity is consumed in the household. This is the only accurate and reliable method to calculate how much PV-generated electricity households are using. In contrast, our research required the collection of historic energy consumption data; a very-time consuming approach that does not provide accurate results. Thus installing export meters could be more cost-effective than the staff time to collect energy data.

Table 4: Approaches to calculating reductions in fuel bills post PV installation

Approach	Using an export meter *(best practice)*	Using electricity consumption data
How it works	• Export meters measure how much of the PV-generated electricity is exported to the national grid. Since it is known how much overall electricity the PV panel has produced, the amount consumed by the household can be calculated.	• Comparing electricity consumption in households before and after the PV installation provides ***an indication of savings only***.
How to carry this out	• Subtract the amount of electricity exported to the grid (known from the export meter) from the amount of electricity generated by the panel (from the generation meter – this is read for FITs). This will tell you how much has been used in-home. • Note that domestic PV installations do not normally have an export meter fitted; the FITs scheme assumes 50% of electricity is exported.	• You need to collect at least a year's worth of electricity data from before and after the PV installation. • This can be collected by meter readings, from tenants' bills or contacting energy companies (see Table 5).
Cost	Export meters are estimated to cost between £50 and £400 per property. However, this cost may be reduced for large projects if fitted at installation.	No upfront costs but staff time to gather energy data is likely to be considerable. Using export meters may be a more cost-effective approach.
Accuracy of calculations	100%: Results accurately show how much has been used by the tenant.	***Results are not accurate***. The flaw with this methodology is that other factors will affect electricity consumption during this time; for example, new electrical appliances bought or changes in occupancy. As a result savings from PV are not directly measured.

Collecting energy consumption data

You will need to collect energy consumption data if:

- You decide to use the second approach (consumption data);
- You decide to use the export meter approach and you want to know what proportion of tenants' bills have been saved as a result of the PV installation (in which case you require historical data).

There are multiple ways you can collect this data, as outlined in Table 5. None of the methods are ideal, and it may be worth considering how the methods could be combined. Based on our experience, we would recommend:

- On the day of PV installation, ask the installer to take a meter reading, since this will be a time efficient way to collect data.
- Ask tenants to supply previous household bills or meter readings if they have them; this could be combined with a visit from a housing officer to explain how the PV system works. If tenants cannot provide the data, contact energy suppliers.
- Ask tenants to provide a meter reading around a year after the PV system was installed. This again could be combined with a follow-up visit from housing officers.

The methods used will obviously depend upon the resources available to the social landlord, and we appreciate these can be limited.

Calculating energy consumption

Issues to consider:

- Ideally, you would want energy consumption data for at least a year before and a year after the PV installation. This is because electricity demand will change from month to month (in winter it is slightly higher), and the output of the PV system is much higher in the summer months. A shorter monitoring period is possible, but the results will be less accurate.
- Guidance on reading electricity meters can be found on the Citizen's Advice website. Calculating electricity usage is very straightforward using meter readings – subtracting the earlier reading from the later reading will show how much electricity the household has consumed over this period (in kWh).

Table 5: Approaches to gathering energy consumption data *(gathering this is not necessary with the installation of export meters, unless historic data is desired)*

Approach	1) Collect meter readings	2) Tenants' energy bills	3) Gathering meter readings or consumption data via an energy supplier
How it works	• Get meter readings by either (a) asking tenants to take readings or (b) getting a member of staff to take readings at tenants' homes. • Installers could also take a reading the day of installation.	• Ask tenants to supply past energy bills to you (or even meter readings, if they have them). • Tenants could bring information into your office or a member of staff could collect bills from tenants' homes.	• Energy suppliers can provide you with consumption data for tenants, if tenants sign a mandate form[11] allowing you to access account information on their behalf.
Pros	• You have control of when meter readings are collected (in contrast to relying on energy bills which are often based on estimated readings or the data is not held for the exact dates you require). • It may be a positive way to engage tenants with the project.	• Reasonably quick and simple.	• Can access all data held on that account – all known meter readings.
Cons	• Tenants may be unwilling or unable to take a meter reading. Providing guidance on how to read meters would help with this. • It is time-consuming for staff to collect readings; however, this could be combined with visits to provide advice about the panels. • Cannot access historic consumption this way.	• Tenants often do not keep them or may be unwilling to share bills. • Bills are often based on estimated meter readings, which cannot be used for the purposes of monitoring.	• Contacting energy suppliers can be very time-consuming and as not all companies will be used to receiving these requests, there can be a delay in receiving information. • Bills are often based on estimated meter readings, which cannot be used for the purposes of monitoring.
When to use this method	• This is a good method to use if you only need a small number of readings (e.g. on the day of install and another a year after installation).	• To gather historic energy consumption.	• To gather historic energy consumption; however, you may want to use method (1) first.

[11] This will need to state: tenant name, tenant address, phone number, DOB, electricity account number, statement allowing you access to their account.

5. SUMMARY & CHECKLIST

Summary

This guide has provided best-practice guidance to social landlords to ensure PV projects optimise the bill savings tenants realise. Our research highlighted that tenants often use less of the PV-generated electricity than installers and other sources would predict. Therefore, it is essential that landlords put in place a plan to optimise this. This includes identifying the most suitable properties and tenants, providing tenant advice and support, and carrying out monitoring.

Checklist

Before you proceed with PV, have you:

- ☐ **Considered where PV would best be installed?**
  - ☐ Identified suitable properties?
  - ☐ Identified, if possible, tenants who would benefit most from PV?

- ☐ **Developed an effective communication plan to tenants?**
  - ☐ Involved tenant-facing staff with developing the plan?
  - ☐ Ensured tenant-facing staff have an understanding of PV and can deal with queries?
  - ☐ Sourced written information to help tenants maximise the benefits from PV (such as the Changeworks leaflet)?
  - ☐ Written supporting communication material which provides other key information about the PV scheme?
  - ☐ Planned other activities to promote and encourage behaviour change?

- ☐ **Specified appropriate meters are installed?**
  - ☐ Specified that generation meters are located in an accessible location for tenants and labelled?
  - ☐ Enquired about online monitoring systems for tenants?
  - ☐ Specified the installation of export meters, if possible?

- ☐ **Developed a monitoring and evaluation plan?**
  - ☐ Specified the installation of export meters *or* set up a system to monitor electricity meters?
  - ☐ Ensured that, if required, meter readings are collected at the time of installation?