

SOLAR PV (SOLAR PANELS)

Introduction

Solar photovoltaic (PV) cells work on the principle that energy in the sun is converted to electricity. PV cells are used to convert solar radiation into direct current (DC) electricity. This DC electricity is then inverted to alternating current (AC) electricity for use in buildings or export to the grid. When light shines on the PV cell, an electric field is

created across the silicon conducting layers, which causes electricity to flow.

Cabling is required to connect the generated electricity to the grid. A generation meter is used to monitor the total electricity output from the panels and where appropriate, an export meter measures electricity exported to the national grid.



VAT can be claimed back on the purchase of a solar PV system.

VAT (flat rate farmers)

Since January 1, 2012 a flat rate farmer can claim back the VAT incurred on the purchase of a solar PV system, which is designed to be used mainly or solely in his or her farming business. The PV system must be named on Triple E Product Register. This Register is the

public database maintained by the Sustainable Energy Authority of Ireland (SEAI) containing a list of products which comply with the energy efficiency criteria of that Authority. It can be accessed at the SEAI website: www.seai.ie. The claim is made through the Revenue Commissioners VAT 58 form.

Solar PV siting



Angle and orientation of the array is important.

The energy available from the sun is measured in kilowatt hours per square metre per year ($\text{kWh/m}^2/\text{year}$). The angle and orientation of the solar array is very important. Generally a photovoltaic installation requires a large southerly facing roof or field space. Panels are either pre-constructed encapsulated glass/plastic or in some cases may take the form of roof tiles or semi-transparent PV glazing units. There are some costly systems which can track the sun over the course of a day throughout the year. A traditional roof up to a pitch angle of 35° is best for PV output. Trees, chimneys and other buildings should be avoided to minimise any shading effect.

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PV installers need to be on the Department of Agriculture, Food and the Marine (DAFM) approved list.

TAMS support

If eligible, the Targeted Agricultural Modernisation Scheme (TAMS) provides a 40% grant on a solar PV investment, while young qualified farmers can get up to 60% in grant aid. PV installers need to be on the Department of Agriculture, Food and the Marine (DAFM) approved list. TAMS support is now available to support up to

11kW solar PV on dairy, beef, tillage and sheep farms. This complements the 40% support already available to the pig and poultry sector through the Pig and Poultry Investment Scheme 40%, which is not limited to 11kW. Farmers should check their insurances to ensure that they have cover for such work. They should insist on seeing datasheets of the technology being installed, and get written confirmation of place of manufacture and warranties with

Planning permission

The installation of solar panels:

- on agricultural structures, or within the curtilage of an agricultural holding; or
- on or within the curtilage of a house, or any buildings within the curtilage of the house;
- are considered exempted development subject to the conditions set out in Schedule 2, Part 3, Class 18(c) of the Planning and Development Regulations (2001).

Ground mounted solar (exemption conditions):

- ▶ the array shall not exceed 25m²; and,
- ▶ the height of the free-standing solar array shall not exceed two metres.

Roof mounted (exemption conditions):

- ▶ shall not exceed 50m² or 50% of the total roof area, whichever is the lesser; and,
- ▶ the solar panels shall be a minimum of 50cm from the edge of the wall or roof on which they are mounted.

Note that buildings subject to conservation status and all larger ground-mounted installations require planning permission. If there is any doubt it is advisable to contact the local planning officer before any expense is incurred.

exclusions. Another key issue is business reputation and robustness, as some installer companies sail close to the edge financially. Farmers need to pay deposits to companies which are solid and going to be around for the long term. Farmers need assurances that purchased panels are warranted against ammonia erosion, especially on pig and poultry units. See the TAMS section of the DAFM website for full terms and conditions.



If you are generating more energy than you are using and your PV system is connected to the grid, the balance will be exported but you will not receive payment at present, although this is expected to change.

Financial returns

Once you have bought your solar PV panels, the maintenance and operating costs are small. The panels and inverters will require cleaning approximately every 10 years. Panel output should be expected to fall at a rate of 1% per year. The financial return is mainly tied up with the value and amount of energy generated.

The main part of this is derived from the Renewable Energy Feed-in Tariff, which would pay a set amount of money per kWh of electrical energy generated. The Republic of Ireland does not have any feed-in tariff for solar PV at present. A feed-in tariff would normally be paid by a registered electricity company of your choice and would be determined at the time of application, according to the technology and the size of

installation you have. In some countries you can receive a feed-in tariff regardless of whether you export or use the electricity yourself. These tariffs are generally linked to inflation for periods of 15-20 years. If, as in most cases, your solar PV panels operate in parallel with your mains supply, they help to displace the energy you would normally have bought from the grid. For example, if your electricity need at a particular time is 20kW and your PV system was producing 5kW, your net import from the grid would be 15kW. Each unit of electricity you displace from your imported requirement effectively saves you on the imported price of that unit. If you buy your energy at 18 cents (c) per kWh and you displace 10,000kWh you save €1,800. If you are generating more energy than you are using and your PV system is connected

to the grid, the balance will be exported but you will not receive payment at present, although this is expected to change.

For larger systems where you want to be paid for exporting electricity then metering will be required. Together with an export meter you will require a Power Purchase Agreement (PPA). PPAs are set by contract between you the generator and an electrical supply company.

It is worth noting that displacing your own energy use is worth more to you than exporting. Therefore, solar energy systems work best if you have a daily energy use to balance your generation so that you can consume the energy you generate. Feed-in tariffs will be needed to give adequate paybacks. There are some tax advantages with accelerated capital allowance reliefs.

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Grid connections

For systems up to 16 amps (A) per phase (that's 3.68kW single phase and 11.04kW three phase), you need no prior permission to connect from the electricity distribution network operator – ESB Networks. They operate an “inform and fit” policy, i.e., you fill in form NC6 (single page) – email or post to ESB Networks and fit after 20 days of having not received any objection.

The commissioning of the system must comply with EN50438 and can be viewed at: https://www.esbnetworks.ie/docs/default-source/publications/conditions-governing-connection-and-operation-of-micro-generation-policy.pdf?sfvrsn=ad5c33f0_8.

For larger systems (over 26A/16A), a pre-approval is required but only if the system is exporting to the grid. The context here is that if you do not export, i.e., auto generator, you use NC6; if you do export then it is the NC5 form which must be submitted. You can make an application to ESB Networks for a budget estimate when considering larger installations.



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You can make an application, and if it is a modification for an exporting auto producer, you can get a quote from them. It costs

about €1,200 to ask them how much. The contact for ESB Networks is dsogenerators@esb.ie or call 1850 372 757.

Solar PV performance

Solar PV is generally not stored. Houses or businesses that store electricity during the day time, ideally peaking in the summer months (e.g., ventilation of intensive pig or poultry livestock sheds) are best suited to solar PV output. Approximately three-quarters of the energy will be produced from April to September.

A large domestic dwelling with an unshaded south-facing roof of approximately 30m² could install 4kW of PV panels. Located in

Carlow and set at the optimum angle to the sun (35°), it would generate around 3,300kWh of electricity (roughly equivalent to the amount of electricity consumed by a small household) throughout the year. A medium-sized array on a farm roof-top (50kW) would require 350-400m² of roof space. Installed on a south-facing slope, this could generate 41,500kWh of electricity. Alternatively, a 50kW system could be ground mounted on metal frames, requiring approximately a third of one acre of land (0.1ha). The advantage of this is that this system could be aligned due south and

angled at 35° to obtain optimal performance. The disadvantage is that planning would be required, which adds further time and cost to the project. Ground-mounted projects may also require security fencing and this may be a condition of getting insurance cover. In a typical solar park, each megawatt (MW) of a solar PV array would comprise approximately 4,000 panels spread over four to five acres (1.5–2ha) and should generate 850-950,000kWh of electricity per annum, depending on the geographical location.

Further information

For further information please contact Barry Caslin, Teagasc, Rural Economy Development Programme at:
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The following resources are also helpful:

- 🌐 www.irishsolarenergy.org
- 🌐 www.solarpv.ie
- 🌐 www.seai.ie
- 🌐 www.cru.ie

This fact sheet was produced by Barry Caslin, Teagasc, Rural Economy Development Programme.

www.teagasc.ie/ruraldev

