Renewable energy for community buildings

Vital Villages

asiantaeth ynni SevernWye energy agency

This booklet was produced by Severn Wye Energy Agency.

Severn Wye is a charity and not-for-profit company, established in 1999 under the European Commission SAVE programme to promote sustainable energy and affordable warmth through partnership, awareness-raising, innovation and strategic action.

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Contents

Introduction

Community buildings are often the hub of village life, but remaining financially viable in these challenging times is always a concern.

For some community buildings, energy is one of the biggest costs they face and this is one of the key things that Vital Villages has sought to tackle.

Our focus is always on recording and monitoring energy consumption first and then working to reduce it, through a range of energy efficiency actions, starting with low-cost and no-cost solutions.

These are covered in a separate booklet: Energy efficiency in community buildings.

It's important to understand your current and future energy needs before spending on renewable energy projects.

For communities, generating their own energy has never been more attractive.

The benefits that energy generation offers, such as predictable costs with more control and good financial returns, are more desirable than ever and this booklet is intended as a brief guide to the most relevant technologies, and their respective benefits.

When we refer to energy generation, we are considering both electricity and heat.

It is easy to overlook the latter, but heat is often the biggest energy consumer and biggest cost to community buildings – especially those with electric heaters.

Key points

When considering a renewable energy installation for your community building, it's worth bearing in mind these steps:

- Ensure you have taken all sensible energy-saving steps first – check out the Severn Wye website for more information: www.severnwye.org.uk/communitybuildings
- Check the latest feed-in tariff (FiT) payment rates for electricity, and the Renewable Heat Incentive (RHI) rates for heat (note that the non-domestic RHI is different to the household version). Visit Ofgem to check: www.ofgem.gov.uk/environmental-programmes
- Always use an MCS-registered installer. Find one here: www.microgenerationcertification.org
- Always get at least three comparable quotes to ensure you are getting a good deal.
- Consider publicity options for the project to raise awareness within your community.
- Calculate your pay-back/cost analysis based on your last three years energy usage.
- Consider the maintenance and management required for each technology and your future plans for the building.

Wood pellet heating for community halls

Many rural community buildings use heating oil or LPG, with a radiator heating system.

For these sites, wood pellet (modern, high-tech wood fuel) makes an ideal replacement option.

Advanced wood-fuelled boilers, running on wood pellets (*below right*), can be just as convenient to run as an oil system.

Advantages

Pellet boilers achieve similar 90% efficiencies as oil and gas boilers, and fuel-handling can be fully automated.

Pellet boilers are fully eligible for government subsidies through the Renewable Heat Incentive, with tiered support levels depending on boiler size.

For community buildings, the first tier, with the highest tariff rate, is generally applicable.

Once the system is in place, maintenance for a pellet boiler is no more of an issue than for an oil system, with an annual service being needed.

Other biomass boilers such as woodchip are available, but these usually aren't suitable for community buildings due to the intermittent demand, as well as the increased maintenance and management they require.

However, they could be an option for large, frequently used community buildings.

Below: wood pellets can be manufactured to a high standard for maximum calorific value

Wood pellet heating for community halls

Disadvantages

More space is required, both for the boiler (which are larger) and for a fuel store (which needs to be close to the boiler).

Access for fuel deliveries is another consideration, but the requirements are similar to oil, as pellets can be blown through a large hose, from a delivery truck up to 30m away from the fuel store.

Typical costs

£15k+ (wide variations depending on boiler type and fuel store; much less for a simple hand-fuelled stove).

RHI support

8.8 p/kWh for wood-fuelled boilers up to 200 kW.

Below: a diagram of a small pellet boiler

Solar photovoltaic panels

Solar photovoltaic (PV) has become a ubiquitous technology in recent years, across all sectors, and it is also popular in community buildings.

Prices have fallen by over 75% since 2008, helped by a huge market growth driven by the feed-in tariffs, which were introduced to the UK in 2010.

Advantages

PV works well on any building with an unshaded, pitched roof facing between south-west and south-east, and can also work well on flat roofs.

It is quick to install, operates entirely without intervention, and requires almost no maintenance, offering a 20-30 year lifetime of clean electricity generation.

Although feed-in tariff rates are much less generous than back in 2010, this reflects the continuing fall in prices for PV.

Simple payback times, therefore, remain favourable, with 7-8 years being typical.

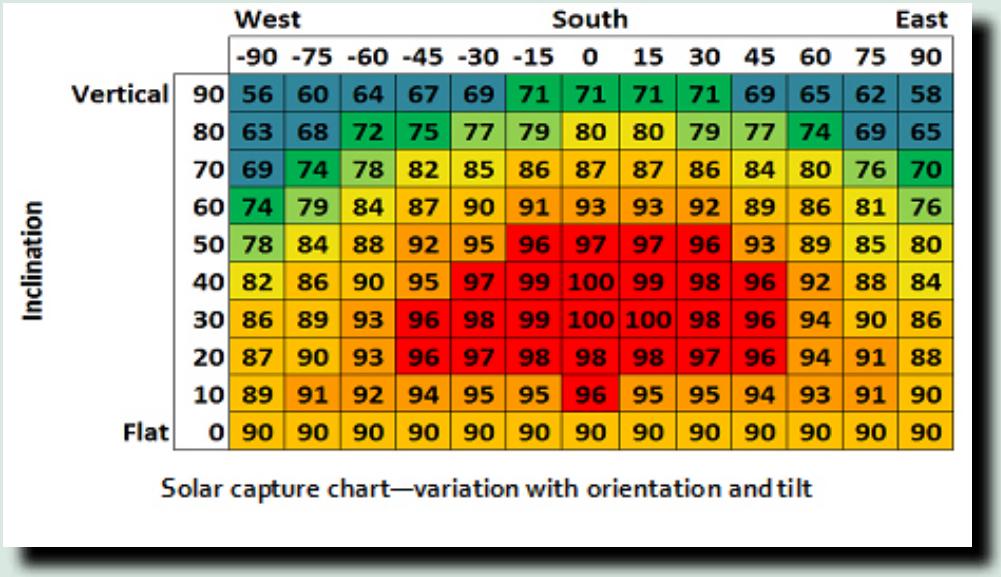
The feed-in tariff revenue is guaranteed for 20 years, making PV a good investment for most suitable sites.

All MSC approved installers will give a free suitability check, quote and payback calculation.

Scenario: 4 kWp PV with FiTs	
Annual generation	3,540
Capital cost	£6,600
FiT revenue	£509
Export revenue	£84
Savings	£265
Net benefit	£858
Simple payback	**7.7 years**

Above right: this table shows in red the optimum orientation and tilt for PV panels in the UK

Solar photovoltaic panels



Inclination		West					South						East	
		-90	-75	-60	-45	-30	-15	0	15	30	45	60	75	90
Vertical	90	56	60	64	67	69	71	71	71	71	69	65	62	58
	80	63	68	72	75	77	79	80	80	79	77	74	69	65
	70	69	74	78	82	85	86	87	87	86	84	80	76	70
	60	74	79	84	87	90	91	93	93	92	89	86	81	76
	50	78	84	88	92	95	96	97	97	96	93	89	85	80
	40	82	86	90	95	97	99	100	99	98	96	92	88	84
	30	86	89	93	96	98	99	100	100	98	96	94	90	86
	20	87	90	93	96	97	98	98	98	97	96	94	91	88
	10	89	91	92	94	95	95	96	95	95	94	93	91	90
Flat	0	90	90	90	90	90	90	90	90	90	90	90	90	90

Solar capture chart—variation with orientation and tilt

Disadvantages

Solar photovoltaic panels are only suitable for some roof spaces.

The roof has to be strong enough to take the weight of the panels and be angled at a suitable tilt and orientation.

Shading on the panel from trees and so forth, reduces their output.

Planning permission for PV is needed on community buildings and can be restricted on listed buildings and in conservation areas.

Typical costs

From £1,300/kWh

FIT support

14.4 p/kWh for small systems, less for larger arrays

Air-to-air heat pumps

Air to air source heat pumps are a simple and easy to install technology that can be a good option when replacing electric radiant heaters in community buildings.

They are in effect air conditioning units set to heat mode so that cool air is drawn from outside, passed through a heat exchanger and warm air is then blown into the room.

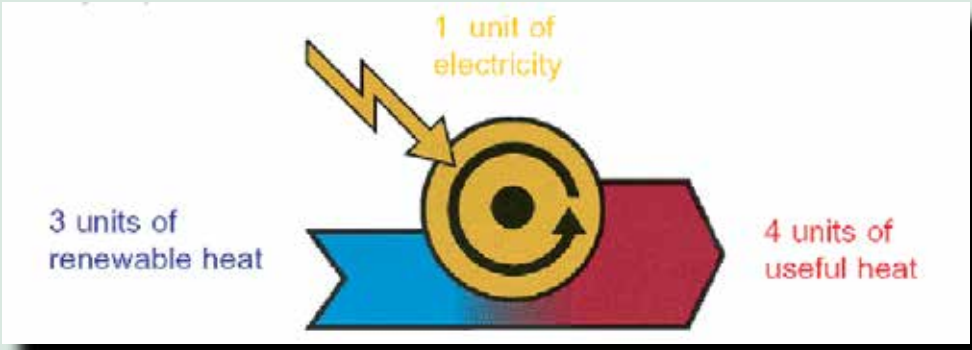
They are easy to install as they do not require a 'wet' radiator system.

They run on electricity, but have a performance ratio (known as C.O.P. – Co-efficiency of Performance) of 2.5-3.5. This means that for every 1 unit of electricity put in you get 2.5-3.5 units of usable heat.

Advantages

As well as improved efficiency one of the main advantages in comparison with electric radiant heaters is that heat pumps can be controlled by sophisticated programmable timers just like a standard heating system.

Many also come with convenient remote controls to allow instant temperature and fan speed adjustment.



Air-to-air heat pumps

Disadvantages

Air to air source heat pumps are not recommended for older properties as they best suit well-insulated buildings with good levels of air-tightness.

The programmers can be difficult to set if a range of timed settings are needed. As part of the installation process the installer should ensure that at least two committee or staff members are familiar with the system.

Air to air source heat pumps are not eligible for government subsidies through the Renewable Heat Incentive.

Payback times would depend on the type of fuel being replaced and the usage.

Overall

The advantages of air-to-air heat pumps mean they may still offer the most cost-effective heating option for new-build or retrofit community building projects.

This is especially true where other options (such as ground source heat pumps) are not technically viable.

Typical costs

£8-10k (for a 20 kW output installation).

RHI support

None.

Below: an external unit of an air-to-air source heat pump

Air-to-water heat pumps

Air-to-water heat pumps are an alternative to air-to-air systems, although they work on the same principle.

Instead of using direct warm air blowers, they require a 'wet' heating distribution system, which can comprise either larger than normal low temperature radiators or underfloor heating.

Advantages

Modern air-to-water heat pumps offer a performance ratio of 2.5-3.0, meaning they are up to 3.0 times as efficient as direct electric heating, thus offering substantial savings.

They can be supplied with sophisticated programmable timers, just like standard central heating controls, and they respond similarly.

Lower flow temperatures are required to maintain efficiency, however; underfloor heating circuits typically run at just 35°C.

They are an excellent choice for new-builds, and are much cheaper to install than ground source heat pumps, since there are no complicated ground works.

They are a low-maintenance and well-proven technology, and can also provide hot water at up to 50°C.

Below: an external unit of an air-to-water source heat pump can be sited away from the building but linked with super-insulated pipes

Air-to-water heat pumps

Disadvantages

Air-to-water heat pumps are not usually the best retrofit system, particularly in older buildings, where high levels of air-tightness are often not possible.

Air-to-water heat pumps are not yet eligible for government subsidies through the Renewable Heat Incentive.

Overall

The advantages of air-to-water heat pumps mean they still offer a proven cost-effective and low maintenance heating option for new-build community building projects, or those that already have a high standard of building fabric performance.

Typical costs

£6-8k (for a single system).

RHI support

None (except domestic), but this may change in the future.

Below: thermal hot water store for the air-to-water source heat pump

Ground source heat pumps

Ground source heat pumps (GSHPs) also work on the vapour compression refrigeration cycle principle, but can typically offer higher efficiencies than air source systems by using year-round low-grade heat from the ground.

They use either shallow trench or deep borehole collectors, and also require a 'wet' heating distribution system, which can comprise either low-temperature radiators or underfloor heating.

Advantages

Modern GSHPs offer a performance ratio of 3.0-4.0, meaning they are up to 4.0 times as efficient as direct electric heating, offering substantial savings.

They use sophisticated programmable timers and thermostats, just like standard heating controls.

Lower flow temperatures are required to maintain efficiency, however underfloor heating circuits can typically run at just 35°C.

Hot water can also be provided, although this reduces overall efficiency.

They are an excellent choice for new-builds, particularly where outside space is available for the collector.

They are always more expensive to install than air source units, due to the ground works; but they are a low-maintenance, well-proven technology – and surprisingly compact (see below).

Ground source heat pumps

GSHPs are fully eligible for government subsidies through the Renewable Heat Incentive.

Combined with their other compelling advantages, this means they are an excellent choice for some new-build community building projects.

Typical costs

£10-12k (but varies greatly depending on ground works).

RHI support

4.9 p/kWh.

Disadvantages

GSHPs are not the best retrofit system, particularly in older buildings.

The heat output is at a low temperature so not ideal for community buildings with elderly or vulnerable residents who need a really warm environment.

Good examples of retrofit GSHPs also exist, usually with underfloor heating though not suitable for everywhere. GSHPs need careful analysis and upgrades to the building fabric to achieve optimal performance.

Opposite page: a heat pump connecting to the thermal store

Below: trench work laid with pipes for a ground source heat pump

Other technologies and considerations

Wind turbines

Small-scale wind turbines make good economic sense on farms, which often benefit from large, open spaces and have high power demand that need to be offset.

They are extremely rare for community buildings and their substantial planning challenges mean we have not covered them in this guide.

If you feel you have a potential exposed site for a community wind turbine, please contact Severn Wye for impartial advice.

Below: 500 kW wind turbine at Great Dunkilns farm, St Briavels

Hydro power

As with wind turbines, it should be borne in mind that hydro is highly site-specific and depends on a resource that is very rarely found at community building sites.

Hydro feasibility assessments are a specialist topic, but there are organisations in the area who can provide expert advice on this.

Check out the Ynni'r Fro programme on the Severn Wye website: www.severnwye.org.uk/ynnirfro

Below: visitors at Hendre Glyn Farm's mini-hydro scheme at Upper Llanover

Other technologies and considerations

Solar hot water

Popular in the domestic sector, this technology is rarely useful on community buildings.

The exception is those that have high summer hot water demand, such as sports centres and football clubs with showering facilities.

Even then, the economics are challenging, since RHI rates are less generous than for other technologies.

Consequently, we generally recommend this technology only for buildings with specific utilisation cases which have a high hot water demand.

The best alternative where there is no central heating boiler would be an instant hot water unit. If the building has PV then a smart diverter can be installed that will divert unused generated electricity to a hot water storage tank, thereby pre-heating the water for radiators or hot water usage.

See the Vital Villages booklet 'Energy effficiency in community buildings' for more information on immersion heaters.

Community energy

This brief guide is about small-scale generation technologies on community buildings.

Community-owned energy is a different consideration, and usually involves the formation of a new group of interested and active citizens to create a new energy generation project, such as a medium-scale wind turbine or hydro scheme, which generates income for the community.

There is much support and experience available in the region—please contact Severn Wye for guidance if you want to find out more.

Further support and advice

Link to Energy

This is a free-to-use online database helping you to find sustainable energy installers and tradespeople in your area.

www.linktoenergy.org.uk

Energy Saving Trust

The Energy Saving Trust offers impartial advice to communities and households on how to reduce carbon emissions, use water more sustainably and save money on energy bills.

www.energysavingtrust.org.uk

Feed-in tariffs

The feed-in tariff scheme is a financial incentive for generation of renewable electricity.

www.gov.uk/feed-in-tariffs

Renewable Heat Incentive

The Renewable Heat Incentive is a direct financial subsidy for generation of renewable heat at all scales, administered by Ofgem.

www.ofgem.gov.uk

Ynni'r Fro

This Welsh Government programme offers support, advice and funding for social enterprises developing renewable energy schemes in Wales.

www.severnwye.org.uk/ynnirfro

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