



THWING & OCTON PARISH COUNCIL RENEWABLE ENERGY FEASIBILITY STUDY

SUMMARISED REPORT

Provided by: Luiza Potter Haussen, Senior Consultant

Oliver Cowburn, Consultant

Reviewed by: Helen Troup, Principal Consultant

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EXECUTIVE SUMMARY

Avieco was commissioned by Thwing and Octon Parish Council to conduct a renewable energy feasibility study for the parish.

This Project is supported by the BEIS funded Rural Community Energy Fund (RCEF) which is managed by the North East Yorkshire and Humber Energy Hub and administered by Tees Valley Combined Authority.

This summary document accompanies our final RCEF report, and is designed for use by the residents of Thwing and Octon, to enable them to take action on decarbonisation.

We propose that the recommended renewable energy systems should be owned and operated by the residents within the parish. It is important to note that this method of governance will require active participation of relevant parties, principally during procurement, installation and commissioning of equipment. The Parish Council should support residents as necessary and act as a knowledge hub for engaged residents of Thwing and Octon.

The results of the renewable energy feasibility study provide evidence of the difficulties of decarbonising for rural off-gas grid communities like Thwing and Octon and that more support is needed. We hope that this report can be used to engage policy makers, funders, and others for further support.

Our priority heating recommendations are:

- Individual air source heat pumps (ASHP) and ground source heat pumps (GSHP) – for residents, heat pump type will depend on whether they have available land to install GSHP heat collectors and/or personal preference
- Biomass boiler systems for farms during peak heating demand periods

Our priority power recommendations are:

- Individual rooftop solar PV systems

Our priority street lighting recommendations are:

- 13 solar powered LED smart street lights



OVERVIEW

Thwing and Octon Parish Council has identified an opportunity to explore renewable energy systems in the parish to benefit residents. The Parish Council was successfully awarded a Rural Community Energy Fund (RCEF) grant for the purposes of a feasibility study. Avieco has assisted the Parish Council with specialist support to assess the potential for renewable energy schemes within the parish and identify which schemes to progress.

The results of the renewable energy feasibility study show that at this time building-level individual heat and power solutions are the most viable options for the parish's residents. Some community-scale options were found to be technically viable but not financially viable, which provides a strong case for more funding support for off-gas grid communities in the UK. However, solar power street lights provide a moderate financial case and will benefit the community.

Below we outline our key technology recommendations, with decision trees, FAQs and a glossary to help you make an informed decision on how to decarbonise your energy.

RENEWABLE ELECTRICITY OPTIONS FOR YOU

Solar photovoltaics (solar PV)	<ul style="list-style-type: none"> • Solar photovoltaic (PV) panels capture energy from sunlight and convert it to electricity. Panels can be mounted on building rooftops or installed as stand-alone ground-mounted systems.
Small-scale wind	<ul style="list-style-type: none"> • Wind turbines capture energy from the movement of air, and convert it to electricity. They should be placed at height and away from obstructions for best results.
Solar PV powered street lights	<ul style="list-style-type: none"> • Standalone solar PV powered LED lights are not connected to the electricity network and instead generate their electricity from solar PV panels located on top of the unit.

	Solar PV	Small-scale wind	Street lights
Recommended size (kW)	2	0.75	13 no.
Approx. lifetime (years)	30	20	25
Capital costs (£)	£2,800	£1,700	£22,700
Payback period (years)	12	18	27
Carbon savings per year (tCO₂e)	0.5	0.2	0.6

Existing grants / incentives for solar PV and small-scale wind
 Currently, there are no available financial incentives for power generation technologies.



RENEWABLE HEAT OPTIONS FOR YOU

Air source heat pump (ASHP)

• ASHPs work like fridges in reverse, they absorb heat from the outside air and use electricity to raise the temperature for heating your home.

Ground source heat pump (GSHP)

• GSHPs work like fridges in reverse, however, they absorb heat from the ground and use electricity to raise the temperature for heating your home.

Biomass boilers for peak demand (farms)

• Biomass boilers burn fuels such as wood or crops, converting them into heat. Best suited for users with ample access to the above fuels and can be used to meet peak demand.

Note: all figures here depend on the size of your property	ASHP	GSHP	Biomass boiler
Recommended size (kW)	4 - 12	4 - 12	4 - 16
Approx. lifetime (years)	20	20 (ground loop up to 60)	20
Capital costs (£)	£2,000 – 6,000	£3,500 – 10,500	£3,500 – 6,500
Payback period (years)	1 - 2 (with RHI)	1 – 3 (with RHI)	13 – 9.47
Carbon savings per year (tCO ₂ e)	2 - 7	3 - 9	1 - 3

Existing grants / incentives for ASHP and GSHP

Green Homes Grant: <https://greenhomesgrant.campaign.gov.uk/>

- Covers up to two-thirds of the capital costs for low carbon heat improvements to domestic properties – including heat pumps or biomass boilers – and energy efficiency measures like insulation
- Vouchers are provided up to a limit of £5,000 to homeowners (for low-income households, 100% of the costs are covered up to £10,000)
- Must use TrustMark registered MCS (Microgeneration Certification Scheme) certified installers

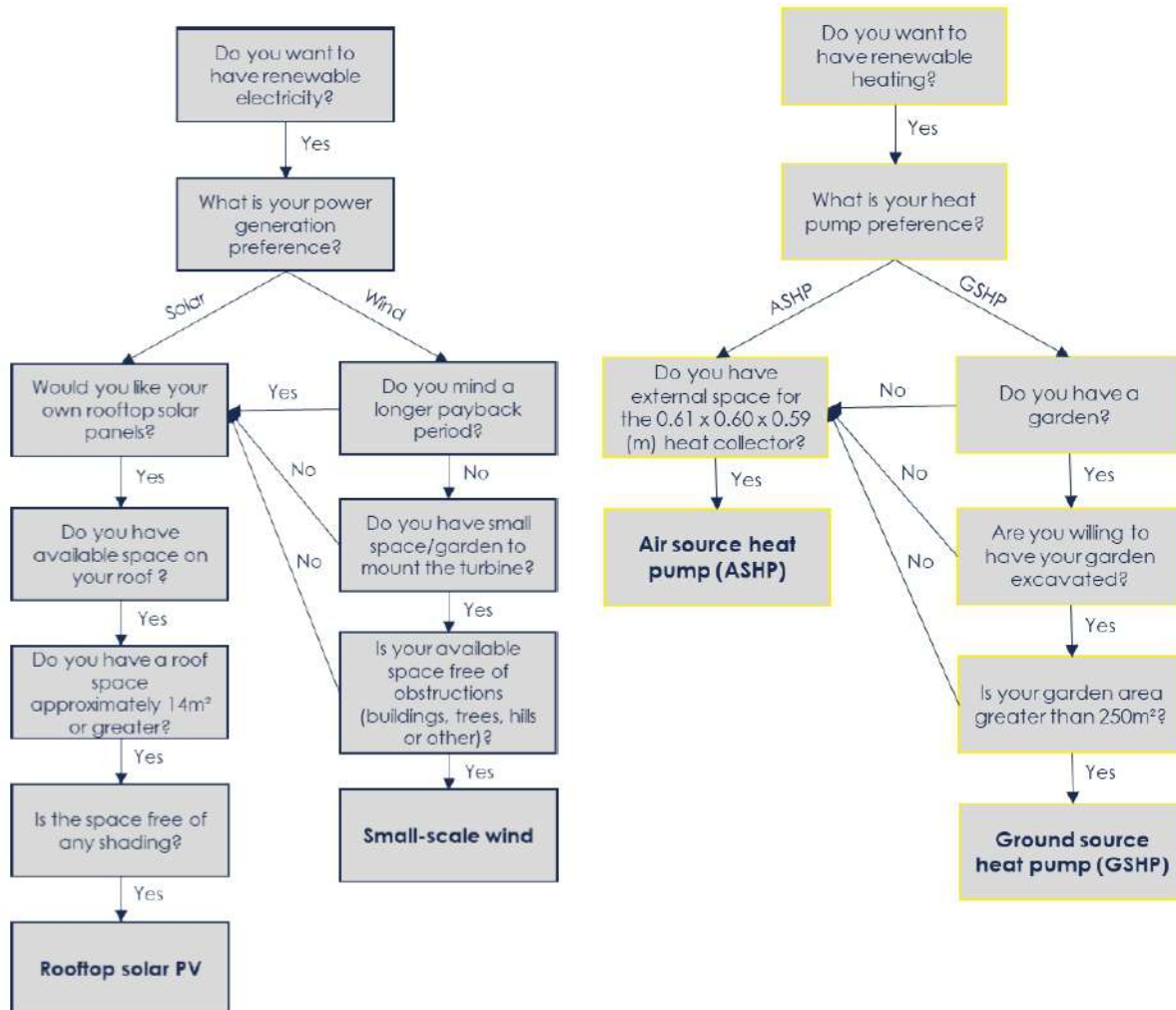
Renewable Heat Incentive (RHI): <https://www.ofgem.gov.uk/environmental-programmes/domestic-rhi/applicants>

- The government will provide £ per kWh of heat produced – for ASHP 2.79 p/kWh and for GSHP 9.68 p/kWh for the first 1,314 hours in a given year and 2.89 p/kWh thereafter (2020 figures)
- Application deadline for domestic users is 31 March 2022
- You will need to commission the system and register before this deadline, or secure a tariff guarantee before then, which requires planning permission and financial close
- To be able to apply you must have a Microgeneration Certification Scheme (MCS) Certificate for your installation and a domestic Energy Performance Certificate (EPC) for the property

Both incentives can be claimed together, you must apply for the Green Homes Grant first and then notify Ofgem when applying for the RHI. The vouchers must be redeemed and works completed by 31st March 2022.



UNSURE WHERE TO START? TRY OUR QUESTIONNAIRE



FAQ

GENERAL

What is renewable energy? An energy source which exists naturally is theoretically inexhaustible (or replenishable) and doesn't originate from fossil fuels. Renewable energy produces little to no carbon emissions or air pollution making it a cleaner energy source. Some example sources include sun, wind and waterpower.

Why is this important and what's in it for me? Renewable energy can reduce the environmental impact of your home or business, it is an infinite energy source and it is an economy booster, creating local jobs and revenue streams. It will bring energy independence, reduced energy bills, less local pollution and often requires less maintenance than other energy technologies.

TECHNICAL QUESTIONS

Will solar panels work in the shade? Solar panels do work in the shade and on cloudy days, albeit their power output will be reduced due to their decreased exposure to sunlight. A supplier will ensure that solar panel placement, design and roof orientation are optimised to reduce shading.



How much roof space is needed? This depends on the amount of electricity you wish to provide with solar panels. For example, to provide approximately 50% of an average household's annual electricity requirements, a 2 kWp system will be required which will cover a rooftop area of approximately 14 m². A supplier will be able to provide bespoke system sizes.

What types of roof can panels be mounted on and will I need to re-roof to install solar PV? Solar panels can be installed on many roof types – it is important to assess the condition and age of a roof before installation, a solar PV supplier will do this for free. Other aspects to consider are pitch, shape, size, orientation and shading, however, none of these should prevent your ability to install solar panels.

How will solar powered street lights work at night? Solar powered street lights have built-in batteries allowing them to store the electricity generated in the day, and disperse it at night. Also, the lights are LED and therefore produce brighter light, but they have smart sensors and so they dim when not in use (reducing light pollution) and brighten when pedestrians or cars pass to ensure safety at night.

Aren't heat pumps noisy? When operating, heat pumps make a noise during operation. A standard domestic ASHP will produce around ~40-50 dB, which is similar to a refrigerator or light rain. The latest models claim to be closer to ~30 dB, the level of noise in a quiet library.

Do heat pumps work when it is freezing outside? Yes, modern systems have been specifically designed for our low temperatures and can continue working at high efficiencies down to -10°C and will continue to work at temperatures of -20°C, so you can rely on a warm and cosy home even when there is snow on the ground.

Do I have to change my central/internal heating system? Heat pumps do need central heating system. If you have an existing central heating system (e.g. for heating oil boiler systems), heat pumps are compatible with your system, however, in some cases new radiators with larger surface areas (or underfloor heating, depending on preference) will need to be installed to ensure comfort. An installer will need to survey your existing systems to provide the best possible solution for each household.

How long will the recommended technologies take to install? In general, most will take approximately 1-2 days to install but expect additional time for excavating and laying of heat collectors for a ground source heat pump, or to make any changes inside your home (e.g. new central heating systems).

Do I need planning permission for any of these technologies? Our recommended technologies do not require planning permission, unless your property is listed. However, being listed does not mean you cannot install one on your property, it just means that listed building consent and planning permission will have to be acquired. For more details on technology specific planning permission, see the link below.

https://www.planningportal.co.uk/info/200130/common_projects/75/home_energy_generation

MAINTENANCE

How much maintenance do the recommended technologies require? All the recommended renewable energy technologies have lower maintenance requirements compared to a wet fossil fuel system and are therefore often cheaper. Installation typically require an annual check which can be done by the owner, an engineer or the installer. Your supplier should provide you with exact maintenance details your system requires and detail on how to optimise performance.

MONEY

How much is this going to cost me? The recommended systems have a range of prices and actual cost will depend on your site and how much you consume. As a rough approximation, typical domestic single household systems range from £1,000-6,000. The table below shows some indicative



capital costs and payback periods for the recommended technologies. Please note that actual prices will vary depending on supplier and model.

	Heat			Power	
	ASHP	GSHP	Non-domestic Biomass (peak)	Solar PV	Small wind
Size (kW)	7	6	8	2	0.75
% household energy supplied	100	100	25	47	16
Estimated capital costs* (£)	£3,550	£5,250	£4,525	£2,800	£1,685
Estimated payback period	2 years (with RHI)	3 years (with RHI)	12 years	13 years	18 years

* available grants are not considered within the estimated capital costs

How am I going to pay for this? There are a number of Government backed incentives and grants available to homeowners who wish to install low carbon heating technologies, and any equipment needed to use these technologies (e.g. new central heating systems, replacing radiators). The Green Homes Grant provides vouchers worth two-thirds of your low carbon heating project costs, up to a limit of £5,000. Additionally, you can earn income through government incentives for first 7 years of operation (the Renewable Heat Incentive). Both schemes will close on 31st March 2022. More details and instructions on how to apply can be found here:

<https://greenhomesgrant.campaign.gov.uk/>

<https://www.ofgem.gov.uk/environmental-programmes/domestic-rhi>

Currently, there are no available financial incentives for power technologies such as solar PV or wind.

NEXT STEPS

- Talk to the Parish Council about this report and its recommendations
- Decide on which technologies to progress – use the questionnaire above and FAQs for more information
- Seek MCS registered providers (we recommend a minimum of 3 quotes to ensure best service and value for money) <https://www.simpleenergyadvice.org.uk/installer-search>
- If you are interested in a heating technology for your property, check your eligibility for a Green Homes Grant and apply for the vouchers
- Apply for the Renewable Heat Incentive (RHI) and notify Ofgem of the Green Homes Grant voucher
- Commence works with preferred supplier and start saving money and carbon



GLOSSARY OF TERMS

ASHP –	air source heat pump: a renewable heat technology that uses electricity to absorb heat from the outside air and uses it for ambient and water heating
Baseload –	minimum level of heat or electricity demand for a property
BEIS –	Department for Business, Energy and Industrial Strategy: a central government department responsible for energy policies
DNO –	Distribution Network Operator: a company licensed to distribute electricity in the UK. These companies own and operate the system of cables and towers that bring electricity from the national transmission network to homes and businesses
GHG –	Green Homes Grant: voucher scheme, which opened in September 2020, in which homeowners and landlords can apply for vouchers of up to £5,000 towards the cost of installing energy efficient and low-carbon heating improvements in their homes
GSHP –	ground source heat pump: a renewable heat technology that uses electricity to absorb heat from the ground using underground piping and uses it for ambient and water heating
ha –	hectares: area equivalent to 100 square meters
HAWT –	horizontal axis wind turbine: type of wind turbine where the main rotor shaft is set transverse to the wind while the main components are located at the base of the turbine
HDD –	heating degree day: a measurement designed to quantify the demand for energy needed to heat a building
IRR –	internal rate of return: a method of calculating an investment's rate of return. Can be used as a definition criterion to decide if a project is worth investing
kWh –	kilowatt-hour: unit of energy consumption
kWp –	kilowatt-peak: nameplate rating of Solar PV modules
LED –	light emitting diode: a modern highly efficient type of lamp
LPG –	liquefied petroleum gas: type of heating fuel
m/s –	meters per second
magl –	meters above ground level
mbgl –	meters below ground level
MCS –	Microgeneration Certification Scheme: an internationally recognised quality assurance scheme supported by BEIS. MCS certifies both products and installation companies to help ensure that Microgeneration products are installed to a high standard.
MWh –	megawatt-hour: unit of energy consumption – equivalent to 1,000 kWh
NPV –	net present value: accounts for the time value of money. Can be used as a definition criterion to decide if a project is worth investing
Peak –	period where energy is used at a significantly higher rate than average supply level. Peak demand fluctuations may occur on daily, monthly, seasonal and yearly cycles.



- PPA – power purchase agreement: a private contract between two parties, one which generates electricity and one which is looking to purchase electricity
- RCEF – Rural Community Energy Fund: a funding scheme to support rural communities across England wanting to set up renewable energy projects in their area
- RHI – Renewable Heat incentive: Government subsidy that provides financial incentives to owners of domestic properties who install renewable heating technologies such as ground source heat pumps and solar thermal on their premises
- ROI – return on investment: ratio between net profit and cost of investment
- Solar PV – Solar photovoltaics: technology that generates electricity from the sun light
- SPB – simple payback (measured in years): time required to recoup the funds expended in an investment, or to reach the break-even point
- SPF – seasonal performance factor: factor used to measure the efficiency of heat pumps
- tCO_{2e} – tonnes of carbon dioxide equivalent: units used to determine the amount of greenhouse gases emitted to the atmosphere.