Harnessing renewable energy in parks

Rethinking Parks

COMMUNITY FUND HERITAGE FUND nesta

Introduction

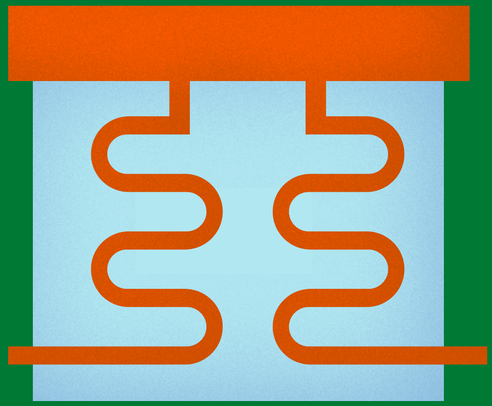
Public parks and greenspaces play an important role in people's lives. They are much loved assets, valued for many reasons, but due to demand placed on local authorities' budgets to support statutory services such as social care, non-statutory services like parks are facing budget cuts and are at risk of decline.

This means that there is a critical need to rethink how we resource and utilise greenspaces to help secure and support them in the future.

Renewable energy production in parks is an under-explored area that could help these spaces be financially sustainable by creating new sources of income and reducing operating costs.

The appeal and benefit of renewable energy for parks goes beyond energy production, and can become an important signifier for local parks and their communities to be actively involved in practical experimentation that aims for solutions to climate change and wider sustainability challenges.

The development of renewable energy projects, however, is challenging due to reduced public subsidies and a general lack of understanding of how these projects would work. To improve this, we need more investment, policy support and an effective methodology for identifying suitable locations for renewable energy generation.

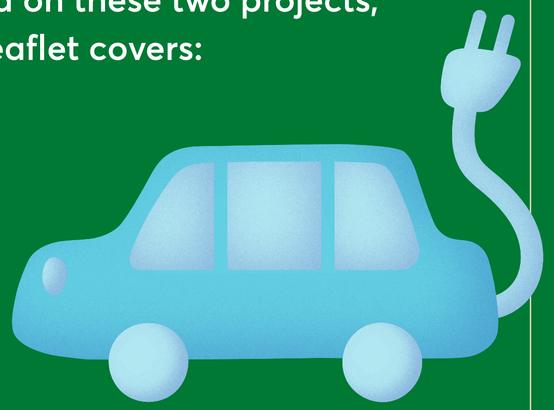


In this leaflet

In this leaflet, we will draw on the experience of greenspace scotland and Powering Parks. These two pilot projects, backed by the Rethinking Parks programme, explored the potential of public parks to become a widely-used source of renewable energy, through better available data and an analysis of possible business models.

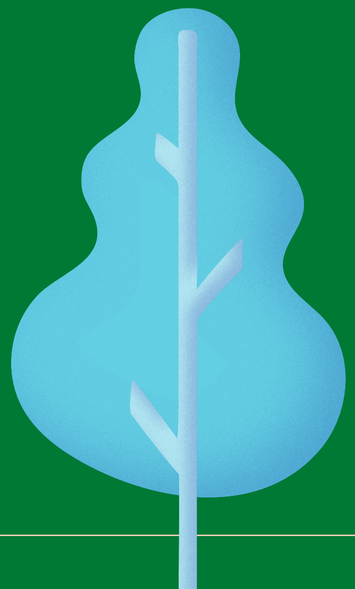
This leaflet outlines the results from the pilot projects, some of the challenges they faced, what they learned, and helpful tips.

Based on these two projects, the leaflet covers:



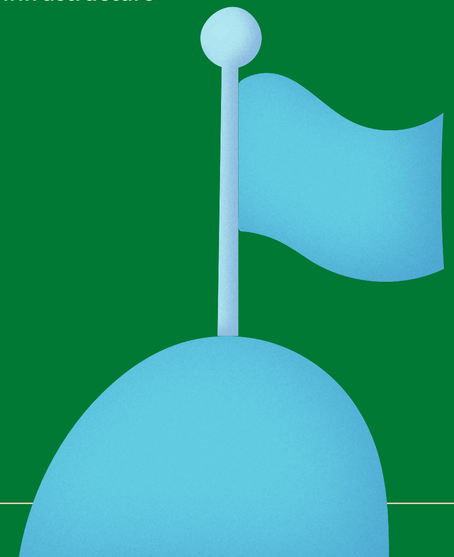
The green technology that each project explored

How would it work?



Their calculation of low carbon energy generation efficiency compared to fossil fuels

The methodologies they developed to identify best sites for renewable energy infrastructure



Why generate energy in public greenspaces?

Moving towards decarbonising our energy system

Greenspaces and parks can be prime spaces for green energy infrastructure for two primary reasons:

Their resources

Most greenspaces are optimal because of their land, water, and wind resources, which can generate different forms of energy.

Their location

Many greenspaces and parks are in close proximity to other public spaces with high heat and electricity demands (e.g. leisure centres and schools), which can make them ideal candidates for hosting local energy systems.

"A key challenge in meeting the UK's net zero carbon ambition is decarbonising our energy system. Our projects show the huge green energy potential waiting to be unlocked from our parks and greenspaces."

Julie Procter from greenspace scotland

For public services, communities and groups involved in climate activism or supporting their local greenspace, the attractions of low carbon energy-related projects include:

- Providing a tangible reason for taking control over a greenspace with a clear community focus.
- Potential to generate a long-term income stream to sustain ongoing investment in other areas of greenspace management.
- Reducing annual energy bills for parks, making their business model sustainable and ensuring long-term protection against significant energy price rises in future.
- Helping to deliver carbon reductions for the community.
- Leading the way in the community by demonstrating how to move away from traditional fossil fuel-based energy systems, and encouraging others to follow suit.

"Parks are unique in their ability to cultivate a space where all sections of society mix. So it's incredibly exciting to be able to demonstrate their role in creating climate solutions. We've shown how previously untapped heat, stored in the ground below lawns and playing fields and replenished by nature, provides a huge part of the solution for low-carbon heat for our buildings – made possible through the wonder of heat pumps"

Neil Jones from Possible

Powering Parks: heat pumps in Hackney

Powering Parks is a project led by Possible, a charity tackling the climate crisis, in partnership with Hackney Council and Scene, a social enterprise working on renewable energy.

The project investigated whether by tapping into the hidden low-carbon heat resource in greenspaces, two problems could be addressed simultaneously: cutting carbon emissions, and supplementing park revenues.

In particular, the project aimed to demonstrate the feasibility of using heat pumps in a Hackney park by supplying nearby buildings with this energy.

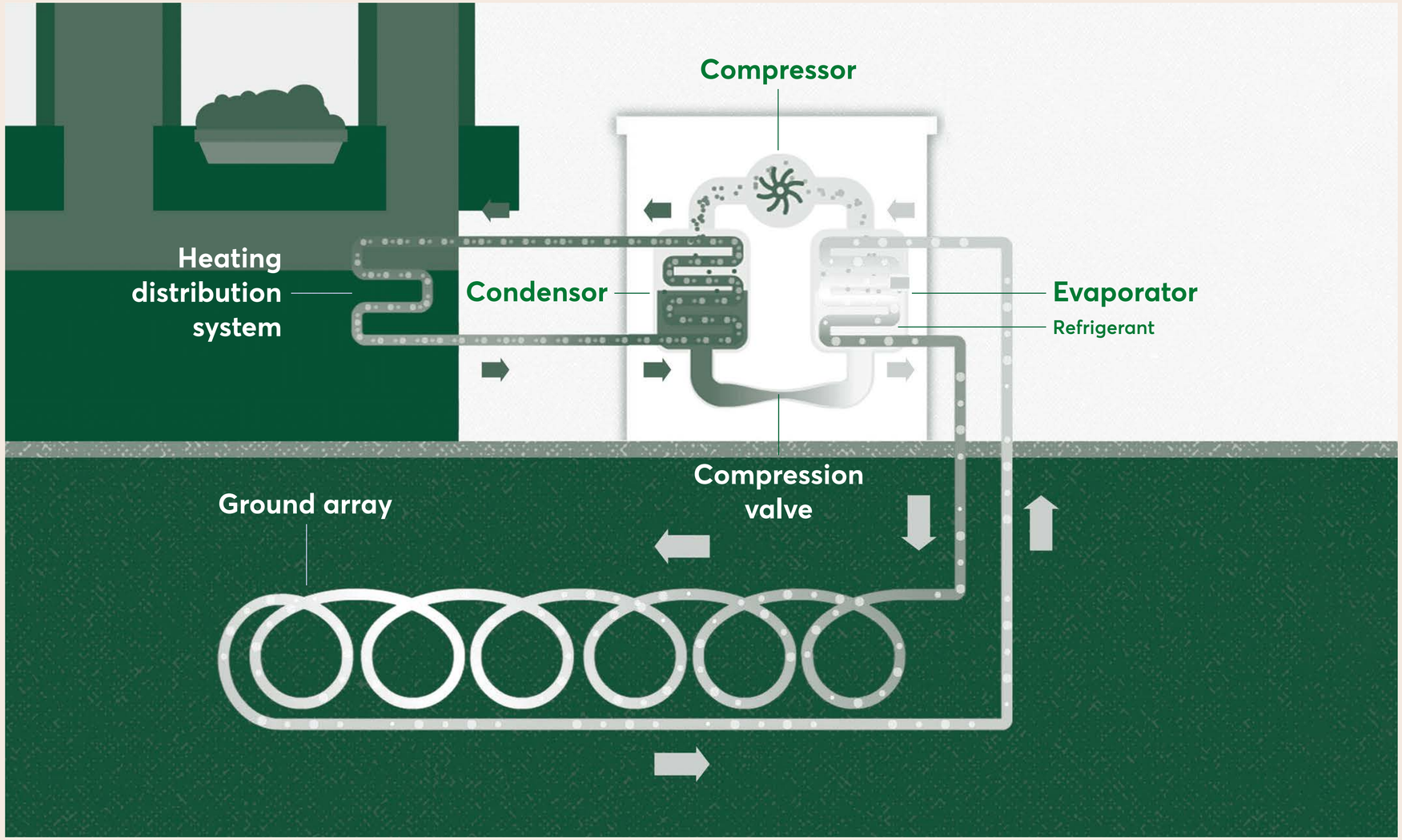
Following discussions with Hackney Council and a 'Heatseekers Quest', i.e. an engagement exercise with members of the local community using thermal imaging cameras and ground thermometers to raise awareness on the potential of park heat, the historic Abney Park Cemetery was selected over 50 public greenspaces in the borough. From 2022, it will host a heat pump in the entrance area that will provide heat and hot water to the nearby café and classroom.

Local residents testing the technology at the 'Heatseekers Quest' in Hackney

How do heat pumps work?
A heat pump is a device designed to gather ambient heat, concentrate it and pump it into buildings. By controlling the pressure in different parts of the circuit, a heat pump can turn liquid into gas or gas into liquid – warming or cooling the environment by using air or water.

Ground source heat pumps use pipes buried in the ground to collect heat and can be either vertical or horizontal. Heat is absorbed from the ground through coiled loops in metre-deep trenches (horizontal) or boreholes that are tens or hundreds of metres below ground (vertical).

Climate change charity, Possible have created a short video to show how this works.



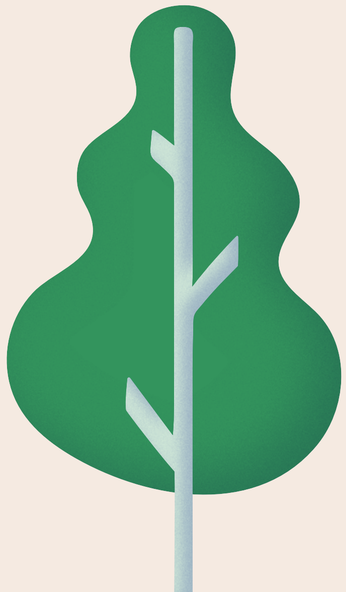
How would it work?

The heat pump location is an important factor in determining how effective it will be.

Although perfect conditions are quite difficult to achieve, locations next to buildings with large heat demand, good accessibility and away from trees, protected buried archaeology and other pipework are a good place to start.

Most buildings are already heat pump-compatible or can be made compatible without excessively intrusive work. In poorly insulated buildings, it is common to invest in basic energy efficiency measures when the heat pump is installed. Additional measures can add upfront cost to a project but typically pay for themselves in the long run and can often be subsidised with government incentives.

The project found that disruption to park users can be minimised and costs can be reduced by installing pumps at the same time as other improvement works, like upgrading drainage for sports fields – or, in the case of Abney Park Cemetery, through a major National Lottery-funded restoration project.



The additional money, from either saving on energy or from generating income by selling heat, can be put towards other expenses such as additional gardeners, refurbishing sporting facilities and playgrounds.

Based on what they learned in Hackney, the team have developed a toolkit * to help other parks authorities identify and evaluate opportunities. The toolkit also outlines the basic technical, economic and practical steps required to implement a ground source heat pump project.

"If we're going to get the 19 million heat pumps the Committee on Climate Change say are required, then we need to get everyone on board. Few people currently know about heat pumps. Parks, and the visitor centres, leisure centres and schools around them are the perfect places to show people the technology working in practice and engage with them meaningfully on the challenges facing us to decarbonise heat."

Neil Jones from Possible

*Available from October 2020

Efficiency

By developing a replicable model for tapping into heat stored in the ground or bodies of water within parks, Powering Parks aims to not only reduce carbon, but also increase revenue. While heat pumps alone will not result in net-zero carbon emissions, they could be one of the most effective and low-cost technological solutions for decarbonising heat in urban areas.

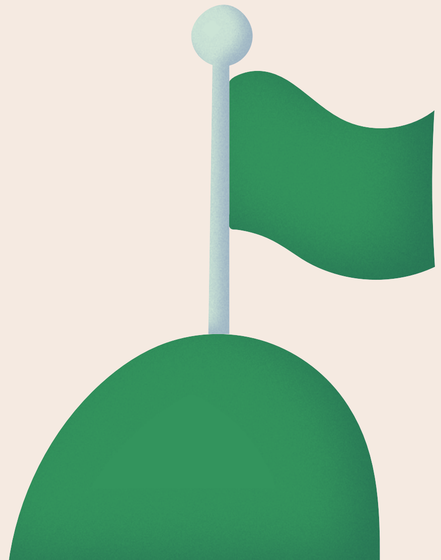
Scene's research showed that the amount of heat that could potentially be supplied from parks, playing fields and other greenspaces across Great Britain totals around 30GW. This is the equivalent of heating 5 million homes via the installation of heat pumps located in parks and green spaces. If 100 per cent of this potential was utilised, carbon emissions could be reduced by 8 million tonnes annually (equivalent to 2% of UK's domestic emissions).

Location

There are a number of factors that will affect a site's suitability for installing heat pumps.

Scene developed a methodology to analyse the available data on greenspaces and highlight sites that could be suitable for heat pumps in Great Britain. This included using survey and GIS data to identify available areas by region. This data was then combined with a temperature data model derived from a combination of datasets and academic literature which was used to calculate the ground source heat potential by country, region and local authority. Results are published in this Powering Parks report.

Interested in knowing more?
This toolkit will take you through a ten point process for identifying greenspaces best suited for installing this technology.



greenspace scotland: Mapping green energy

greenspace scotland, a charity based in Scotland, conducted research exploring the potential for public greenspaces to support green energy services. It also looked at how these services could help deliver income, long-term savings and support the Scottish Government's ambition to transition to a net-zero economy by 2045.

The research brought many interested people and partners together to build a group of local authorities to co-design and use prototyping methods to create a GIS online ParkPower dashboard. This publicly available tool allows users to view and filter approximately 3,500 greenspace sites across Scotland according to their potential suitability for a range of green energy generation technologies. A technology guide is also available to explore each of the technologies in more detail.

They reviewed a wide number of technologies including:

Heat

- Ground Source Heat Pumps (GSHP)
  - Vertical collector (Borehole)
  - Horizontal collector ('Slinky')
- Biomass boilers
- Solar thermal panels
- District Heat Networks (DHNs)
- Heat from sewers, waste water treatment works, and flooded mine workings
- Water (WSHPs) and Air (ASHPs) Source Heat Pumps

Thermal storage

- Gas Fired Combined Heat and Power (CHP)

Electricity

- Wind turbines
- Solar PV (ground & roof)
- Hydro turbines

Electric vehicle charging
Including with solar PV and battery storage

Energy transmission and distribution networks

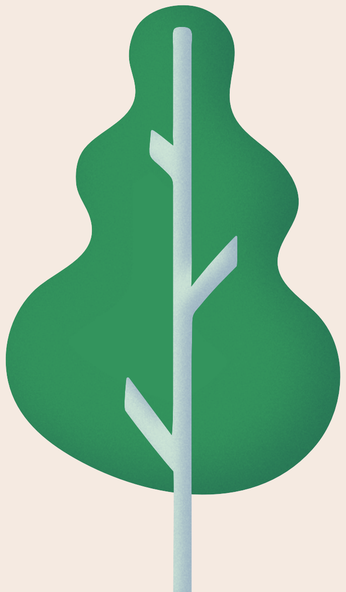
Battery storage

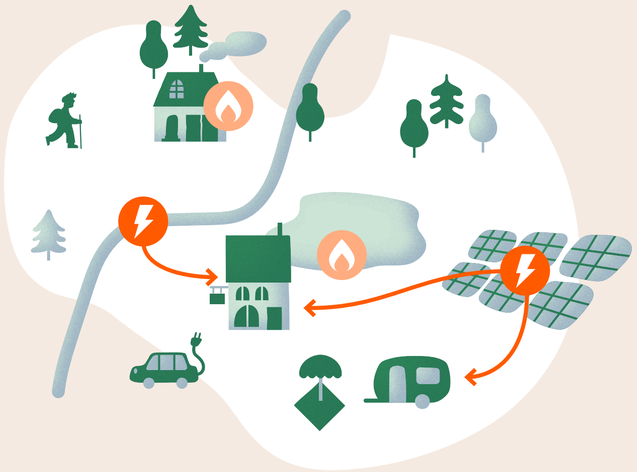
How would it work?

The ParkPower dashboard is intended to help Scottish local authorities, their partners and those interested in using greenspace infrastucture for green energy. They can then apply their local knowledge to the results, and use the information found in the dashboard to support their decision-making criteria on potential project opportunities.

greenspace scotland, in an attempt to understand the green energy potential and develop a strategic approach to its production in public parks and greenspaces, have developed three possible models (see illustrations on page 15).

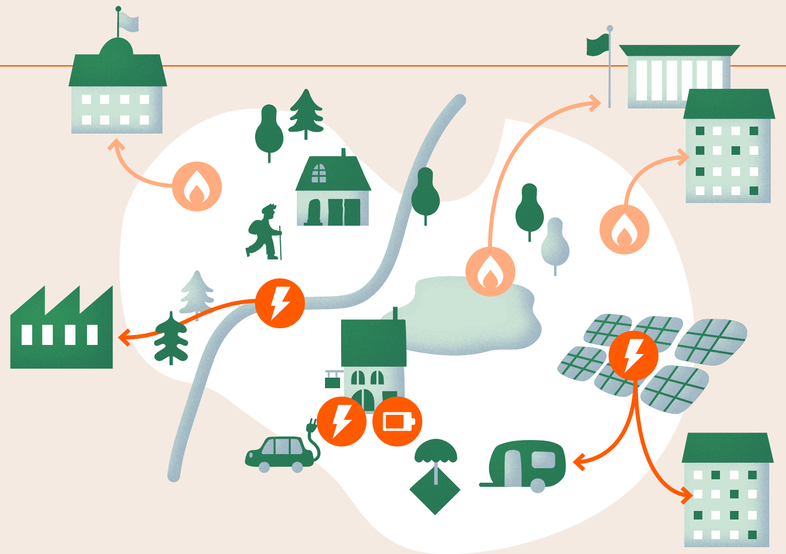
These are not mutually exclusive: all three models could be progressed in a single site within the same development phase, producing a hybrid model. More information can be found in this Implementation Models document.





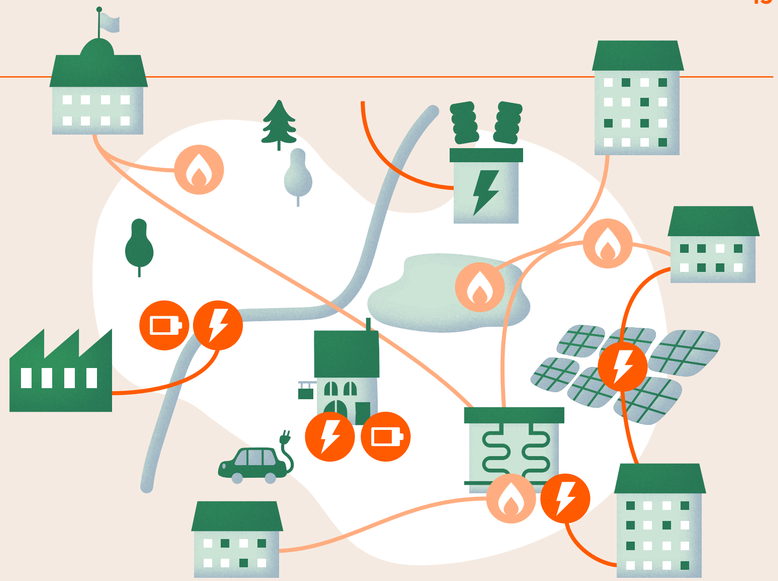
The island model

This is an internal focused approach where energy infrastructure (such as pipes, cables, energy stores and centres, electric vehicle chargers) is hosted inside the greenspace. The aim is to generate and deliver energy services to the park, benefitting the owner and/or manager of the greenspace.



The generator model

This is an external focused approach where project infrastructure is hosted inside the greenspace but the aim is to provide energy services to customers outside the greenspace. The benefits are felt by customers, the energy service provider and the wider community.



The host model

This is an enabler approach where parcels of land are utilised for energy storage, charging or transportation. A third party installs the infrastructure that will provide energy services both to the park and to customers outside. Benefits are likely to accrue to the infrastructure owner and greenspace owner through selling or leasing parcels of greenspace land (sub-surface included).

Efficiency

While Scotland is rated across Europe as the second best performer for renewable electricity, it has the worst record for use of low carbon heat, and heat accounts for 54 per cent of domestic emissions. Currently Scotland can only supply about six per cent of its heat demand from renewable sources (e.g. biomass), despite the Scottish Government's target to reach 11 per cent by 2020.

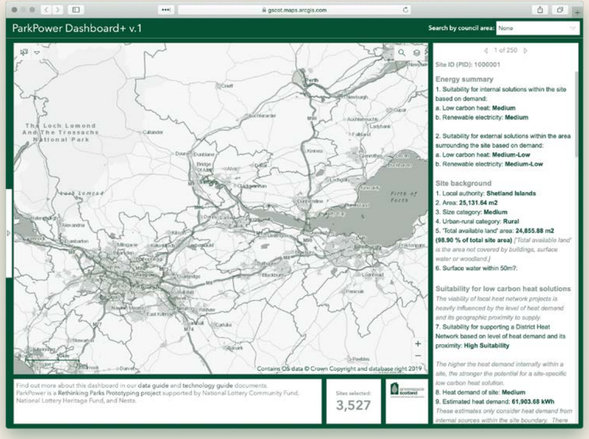
greenspace scotland calculated the scale of opportunity and the most suitable location for energy generating technologies within greenspaces. They estimated that ground collectors located within greenspaces across Scotland could supply 4,600GWh of heat annually (5.5 per cent of the current total non-electrical heat demand). This would result in a reduction of 580,000 tonnes of carbon each year – that's approximately 1.4 per cent of Scotland's total emissions based on 2017 usage. Significant additional capacity could also be added from water source and air source heat pumps located in greenspaces.

Location

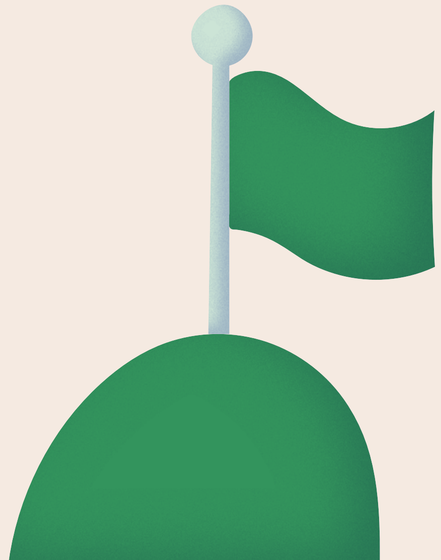
greenspace scotland created a replicable methodology to strategically analyse greenspace assets to highlight sites that could be suitable for low or zero carbon technology deployment. Using the Ordnance Survey Open Greenspace database, they calculated the total area of each greenspace site. They did this by subtracting the area covered by existing buildings, woodland and watercourses and an assumed 20 per cent of the remaining available area, for which technical, physical, political and cultural restrictions would, on average, constrain energy-related development.

More information on the methodology is available in the methodology report.

The areas featured in the ParkPower dashboard were selected using this methodology and can be filtered using pre-defined criteria to investigate different technologies and their energy production potential.



A screenshot from the ParkPower online dashboard



Tips and tools

Where to start?

A strategic approach to mapping, using and managing local assets should play a key role in the response to the climate crisis. Since low-carbon energy generation projects mostly depend on opportunities (e.g. grant funding) it can be easier to include renewable development within an existing project budget rather than approaching it separately.

There are two possible approaches to pitching this type of project to local authorities:

- Look across the entire local authority portfolio and strategically consider how to implement the technology according to the demand for energy.
- Adopt a more experimental approach by individually selecting different sites for prototyping.

The experience of Powering Parks and greenspace scotland suggests that, given the limited amount of resources usually available for these kinds of projects, local authorities will most probably choose the second option. Considering the potential of greenspaces to supply and support low carbon energy, infrastructure is a key component of an area-based energy masterplan. They therefore recommend undertaking a strategic level assessment to identify the potential of all greenspaces as well as the top ranked opportunities across each council portfolio. A data-driven approach can help, but needs to be complemented with the contextual knowledge of park managers and staff.

What is needed?

A long-term vision and policy support

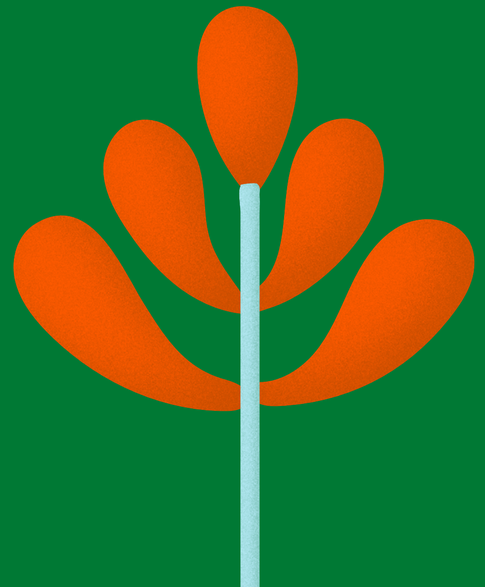
Green energy alternatives, like heat pumps, are typically competing with other low-cost energy technologies, such as gas boilers. Subsidies and RHIs (Renewable Heat Incentives) can help level the playing field between the two, but in many places ground and water source heat pumps struggle to outperform gas boilers in short-term financial calculations.

What is really needed is a culture change and a more long-term vision.

These projects can be difficult for local authorities to fund because they can take about 8–10 years for financial returns. Organisations should consider the wider advantages as well as the social cost of carbon emissions and air pollution, along with the intangible benefits from protecting and improving greenspaces. The technology exists and can offer returns on investment.

Time and expertise

Although toolkits and guides can help pave the way for others, providing data tools to local authorities is not enough. For successful project implementation you will need credible, external experts, a pool of skilled people working on the project and a willingness to experiment.



Practical tools

- greenspace scotland's report on how much heat could be generated and carbon saved through harnessing the power of Scotland's parks. Their ParkPower dashboard allows users to view and filter approximately 3,500 greenspace sites across Scotland according to their potential suitability for a range of green energy generation technologies.
- Powering Parks report on how much heat the parks in your area could provide. The Powering Parks toolkit, which will be published in October 2020 is a useful resource to get started. Through a ten point process it will help you identify greenspaces best suited for installing this technology.
  If you're surprised by how much potential your local parks have to help tackle the climate crisis and power buildings, then you can tell your local council representative.
- Looking for funding? Why not take a look at The National Lottery Community Fund's Climate Action Fund.

Rethinking Parks is funded by The National Lottery Community Fund, The National Lottery Heritage Fund and Nesta. It supports innovative ways of managing and financing the UK's public parks to make sure they are sustainable and are run more impactfully for their local communities.