greenspace scotland

transforming urban spaces into people places

ParkPower: An introduction




January 2020

www.parkpower.org.uk #ParkPower

Public greenspace near Livingston

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1.1 What is ParkPower?

ParkPower is a multi-phase programme run by greenspace scotland to investigate the potential for hosting green energy infrastructure within parks and greenspaces in Scotland. To some extent this has been happening for decades but there is considerable scope to do more.

The Nesta Rethinking Parks report (2013) highlights that public parks have considerable potential to increase their diversity of uses and facilities which have been under-utilised in many places for decades. It suggests *"exploring new uses and activities may include parks resources being used to generate energy (e.g. water, solar or wind power)."*

The ParkPower concept is based on securing capital funding to improve park assets and install green energy infrastructure. This will enable parks to minimise their ongoing energy costs and maximise their revenue generation, over the longer term.

ParkPower can be applied to a specific site, to a group of sites (e.g. within a town) or to a large portfolio of sites.

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Phase 1 of the programme focused on a single site (Saughton Park in Edinburgh) to investigate specific opportunities and progress them to implementation.

Phase 2 used a strategic, data-driven, 'opportunity mapping' approach to sift large portfolios of greenspaces at local authority and national scale to identify the most promising sites for different technologies. At the time of writing [January 2020] we are completing Phase 2 to categorise all greenspaces across Scotland.

Phase 3 has started to investigate the feasibility of 5 highly promising public parks, starting initially with a technical options appraisal. Future phases may involve taking one or more of the 5 sites further through the project development process, together with progressing other sites that offer strong potential.

1.2 Why do we need ParkPower?

Greenspaces play a key role as our natural health service, our children's outdoor classrooms and our cities' green lungs. But, for the majority of parks and greenspaces owned by local authorities, they are a non-statutory responsibility and, as such, face an uncertain future as continued budget cuts make consideration of alternative business models and revenue streams a necessity.

ParkPower opportunities can directly address this challenge:

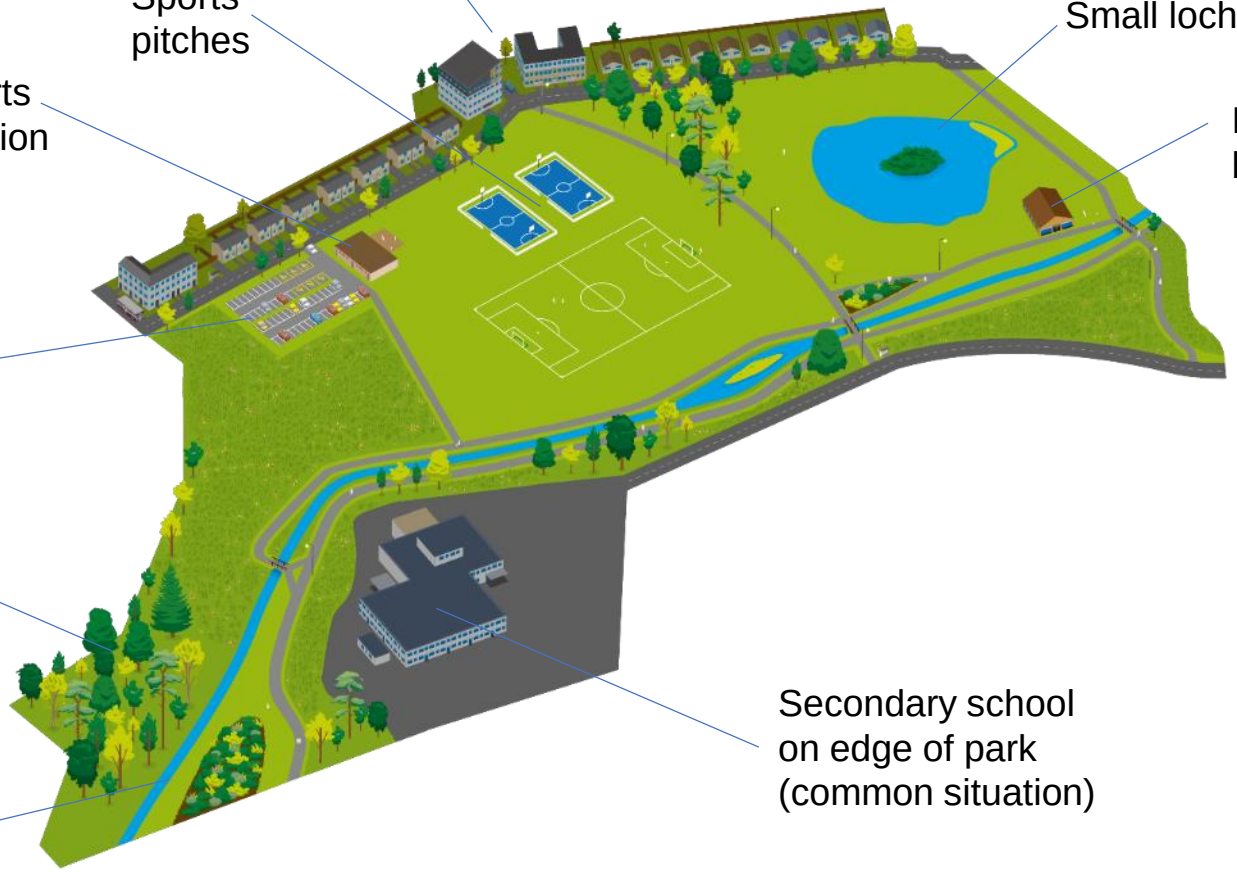
- New, long-term income streams can be generated (although, as government subsidies diminish, they are becoming much less lucrative than they were 5 years ago).
- Long-term financial savings can be made by reducing annual greenspace running costs.
- Their value as vital public assets is enhanced making them less vulnerable to other forms of development.
- They can play a key role in climate change mitigation through supporting the decarbonisation and decentralisation of our energy systems.

ParkPower places our greenspaces in the front-line in advancing our national ambitions to become a net zero carbon society. Perhaps in future we will think of greenspaces as sites that support key grid infrastructure, as locations for charging our electric vehicles, even as our community power stations?

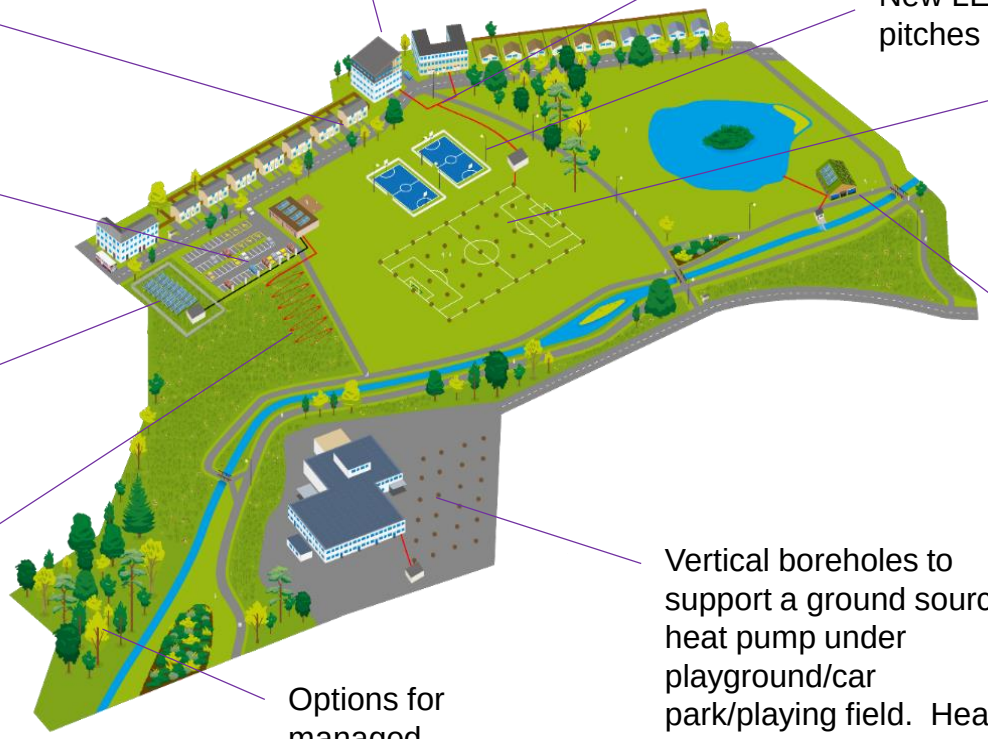
The optimal business model for each green energy projects is context specific. It may be led by greenspace landowners, in most cases local authorities or other public bodies, working alongside communities. With continued encouragement for community empowerment and asset transfers, these opportunities could be adopted by community groups, although there are limited greenspaces examples to date (see Community Guide).

Greenspaces are usually sensitive sites, often treasured by local communities, and development of any kind needs to be carefully considered in relation to potential impact.

1.3 Typical park BEFORE ParkPower



1.4 Typical park AFTER ParkPower



Solar PV and solar thermal panels on roof of sports pavilion

Public buildings undergone energy efficiency retrofitting then connected to a District Heat Network

District heat network transporting heat to public buildings

New LED floodlights for pitches

Vertical boreholes supporting ground source heat pump supplying heat to cluster of buildings on edge of park

New EV charging potentially with solar PV canopies

Refurbished, energy efficient café and community space with solar PV roof, micro-hydro scheme, and heat from a water source heat pump into the loch

Ground-mounted solar PV panels feed power into battery supporting EV charging.

Vertical boreholes to support a ground source heat pump under playground/car park/playing field. Heat used to heat (and cool) high school buildings.

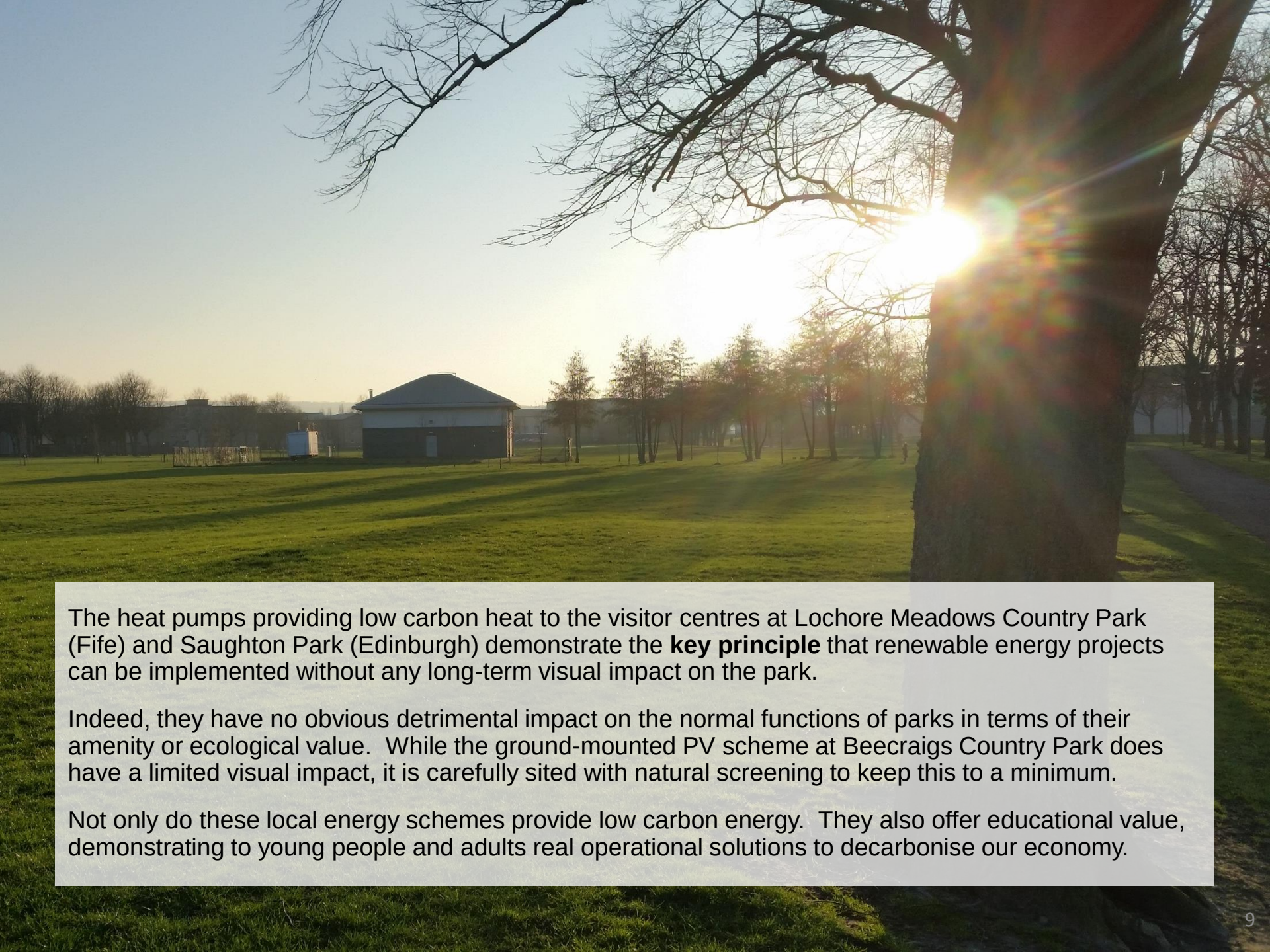
Horizontal ground source heat pump with heat supplied to sports pavilion.

Options for managed timber to sell as biofuel

Note: The model shows multiple project examples to highlight potential opportunities. It is unlikely that any single greenspace would be able to host them all

Beecraigs Country Park, West Lothian: ground-mounted solar PV array feeding power to their visitors centre

Lochore Meadows Country Park, Fife: Water Source Heat Pump providing low carbon heat to their visitors centre



The heat pumps providing low carbon heat to the visitor centres at Lochore Meadows Country Park (Fife) and Saughton Park (Edinburgh) demonstrate the **key principle** that renewable energy projects can be implemented without any long-term visual impact on the park.

Indeed, they have no obvious detrimental impact on the normal functions of parks in terms of their amenity or ecological value. While the ground-mounted PV scheme at Beecraigs Country Park does have a limited visual impact, it is carefully sited with natural screening to keep this to a minimum.

Not only do these local energy schemes provide low carbon energy. They also offer educational value, demonstrating to young people and adults real operational solutions to decarbonise our economy.

Section 2: Developing ParkPower

2.1 Historical background

2.2 Today's greenspaces

2.3 ParkPower: Phase 1

2.4 ParkPower: Phase 2

2.5 ParkPower: Phase 3

2.1 Historical background

There are centuries old links between energy and our present day parks and greenspaces – a significant number are located along rivers and burns where water power was used for milling grain. These sites were often in steep sided valleys and glens, prone to flooding, and were never extensively developed. Many have become our green networks.

Through the 19th and 20th centuries, greenspace sites were linked with Scotland's history of mineral extraction, particularly coal mining. These ex-industrial sites were 'reclaimed', often in the 1970s, turning them into parks with a strong focus on providing amenity and recreation.

Remains of Millig Mill in Hermitage Park, Helensburgh

Remains of Mill, The Glen, North Berwick

Pithead, Loch Ore Country Park

2.2 Today's greenspaces

Hosting energy infrastructure in our public greenspaces has been happening for decades – and this is only the visible evidence. There's more underground in terms of pipes and cables. Many ParkPower opportunities offer solutions that are less visually intrusive than these examples.

Developing the role of greenspace in climate change mitigation and adaptation

Scoping report



greenspace scotland
July 2011

In 2011, greenspace scotland embarked on an extended research project to explore how to manage greenspaces for climate resilience.

From this project came examples of where greenspaces were being used for green energy projects and the concept of ParkPower was born.

2.3 ParkPower: Phase 1

ParkPower started by exploring green energy opportunities in Saughton Park, Edinburgh, as part of a major park-wide refurbishment project. Subsequent project stages led to installation of solutions.

Ground Source Heat Pumps (GSHPs) using vertical and horizontal collectors now heat greenhouses and café, while a micro-hydro scheme offsets additional electricity usage (see case study).

2.4 ParkPower: Phase 2

Rethinking Parks

COMMUNITY FUND HERITAGE FUND nesta

Phase 2 was supported by funding from the Rethinking Parks programme to research the opportunity for green energy in greenspaces across Scotland.

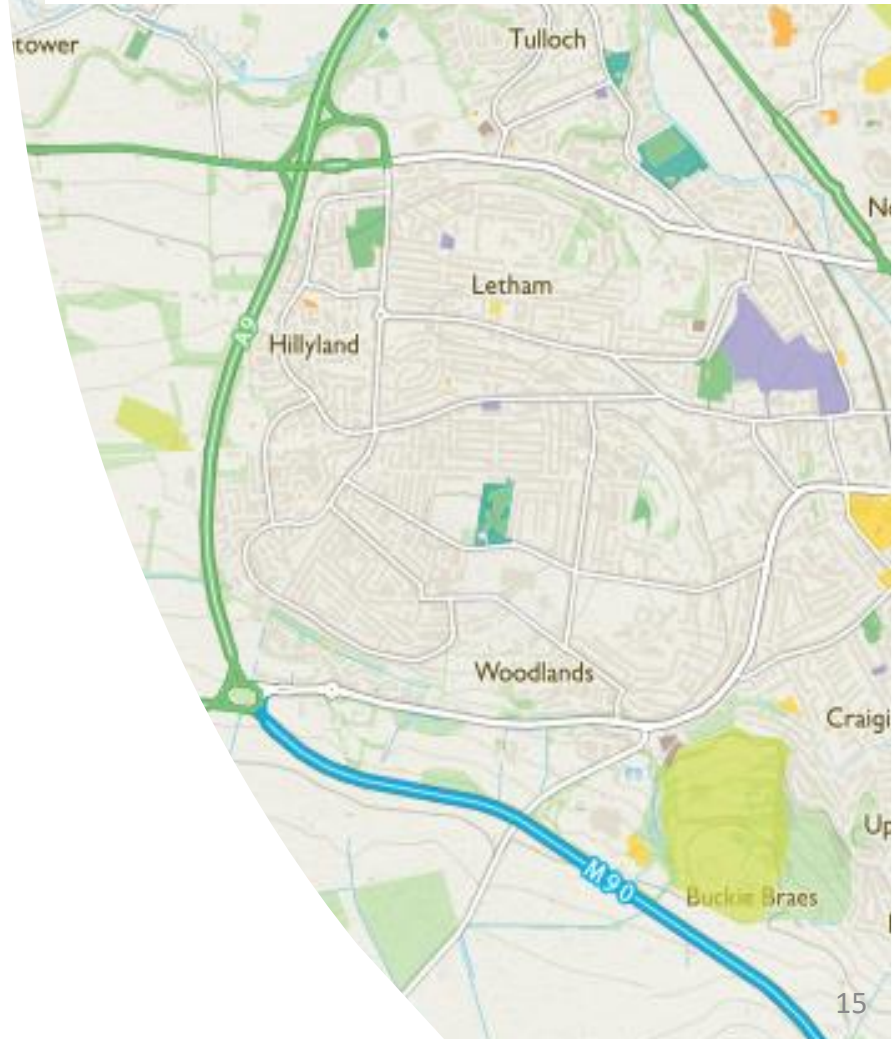
A strategic, data-driven, ‘opportunity mapping’ approach was used to sift large portfolios of greenspaces at local authority and national scale to support the short-listing of promising sites.

A **methodology** was developed using Scotland-wide GIS datasets, including the Ordnance Survey Greenspace dataset and Scotland’s Heat Map, to rate 3500 greenspaces according to their potential viability for a range of green energy solutions.

This provides a more objective approach for a portfolio owner, highlighting both short-term opportunities and those that could make a contribution to our low carbon energy transformation over the next 25 years.

An online map dashboard tool has been developed to support this short-listing process.

See http://www.parkpower.org.uk



2.5 ParkPower: Phase 3

In October 2019, funding was secured from the Local Energy Scotland CARES fund, together with match contributions from project partners, to undertake feasibility studies for 5 sites in Falkirk and North Lanarkshire.

Outputs will include an assessment of potential risks and constraints, together with an options appraisal of potential technology solutions at each of the sites.

Where solutions appear viable, we will develop an outline business case indicating whether sites should be progressed to full business case analysis.

This project is due to deliver in March 2020.

Section 3: Energy technology solutions for greenspaces

3.1 Why are greenspaces suited to energy projects?

3.2 Green energy technology options considered

3.3 Technology mix

3.4 Most promising technology solutions

3.1 Why are greenspaces suited to energy projects?

Greenspaces have been aptly described as "*islands of energy opportunity within a sea of energy demand*". They have been utilised for hosting energy infrastructure for decades. Why do they offer such potential in the future?

Our low carbon energy transformation, particularly for heat, requires substantial localisation of energy services and installation of new infrastructure to meet future demands – urban space will be in demand.

Cumulatively, for a typical city or town, greenspace covers a significant area (often up to 50%) and is spatially distributed across a settlement to be accessible to most neighbourhoods.

Many greenspaces have large open areas, without constraints of buildings and trees, and they are surrounded by urban development with high demand for heat and electricity.

Development underground is often less complex than in 'grey space' and significantly cheaper due to 'soft dig'. Legal arrangements are often simpler due to single ownership.

Greenspaces have a clear spatial correlation with high energy anchor points like leisure centres, schools, high-rise residential flats and campus-like building clusters (hospitals, higher education etc).

Greenspaces may be suited to new EV charging facilities by being sited near high traffic routes, in dense residential areas with minimal off-street parking, or near high daytime worker populations – and they may have car parks.

Greenspaces are often supported by local community groups who are looking for sustainable income streams to develop business plans that can justify public asset transfers.

Energy infrastructure can add value to greenspace assets, affording them additional protection against other forms of less desirable development without detrimental impacts on their existing functions.

Over recent years, as a non-statutory service, greenspace maintenance has been seen as a budgetary liability and now faces severe financial strain – councils are actively looking to diversify the role of greenspaces to create new revenue streams and potential for long-term savings.

3.2 Green energy technology options considered

Opportunity	Sun	Wind	Water	Wood	Ground	Air
Electricity	Solar PV	Wind Turbine	Hydro Turbine			
Heat	Solar thermal		Heat pump	Biomass boiler	Heat pump	Heat pump
Move and store	Battery store	Battery store	Battery store		Heat store	
					Heat distribution	
					Electricity distribution	

Technologies have been selected which can utilise the existing natural assets of greenspaces without having a significant detrimental impact on their current functions. It is acknowledged, for example, only a small proportion of sites would be considered suitable for a wind turbine.

3.3 Technology mix

Electricity

- Solar PV rooftop
- Solar PV ground mount
- Solar PV EV canopies
- Hydro Turbines
- Wind Turbines
- Battery storage
- Management & distribution (cables, substations etc.)
- EV charging infrastructure

Heat

- Solar thermal rooftop
- Solar thermal ground mount
- Ground source heat pumps (H+V)
- Water source heat pumps
- Air source heat pumps
- Biomass boilers
- Combined Heat & Power (CHP)
- Heat storage
- Management & distribution (pipes, infrastructure)
- Biomass crop production

OUT OF SCOPE: Geothermal, flooded mine workings, energy from waste (EfW), waste water treatment, hydrogen production and distribution, Anaerobic Digestion (AD), Advanced Conversion Technologies, Landfill Gas, Sewage Sludge Digestion, Hot Dry Rocks, Wave, Tidal, Offshore wind

3.4 Most promising technology solutions

Technology Solutions	Small scale	Large scale
Energy efficiency measures – new build / retrofitting	✓	✓
Heat pumps (+ solar thermal panels)	✓	✓
District Heat Networks	✓	✓
EV charging (+ solar PV canopies + battery storage)	✓	✓
Roof-mounted solar PV	✓	✓
Heat and power from waste water / sewage treatment		✓
Heat from flooded mine workings		✓
Heat storage in enclosed water bodies		✓

In the longer-term, other options may become viable especially if energy prices rise and/or new government incentives are introduced and/or project capital costs fall.

Section 4: Designing green energy solutions

4.1 Design models considered

4.2 The ‘Island’ Model

4.3 The ‘Generator’ Model

4.4 The ‘Host’ Model

4.5 Examples of solutions by design model

4.6 Business model options

4.1 Design models considered

We have identified 3 main design models when considering how green energy opportunities in greenspaces could be progressed:

1. *Looking inwards*: "The Island Model"
   For greenspaces that have a medium to high energy demand inside their boundary, usually from buildings and other services, a project can aim to provide a low carbon energy alternative solution leading to the ambition of a "Low Carbon Park".

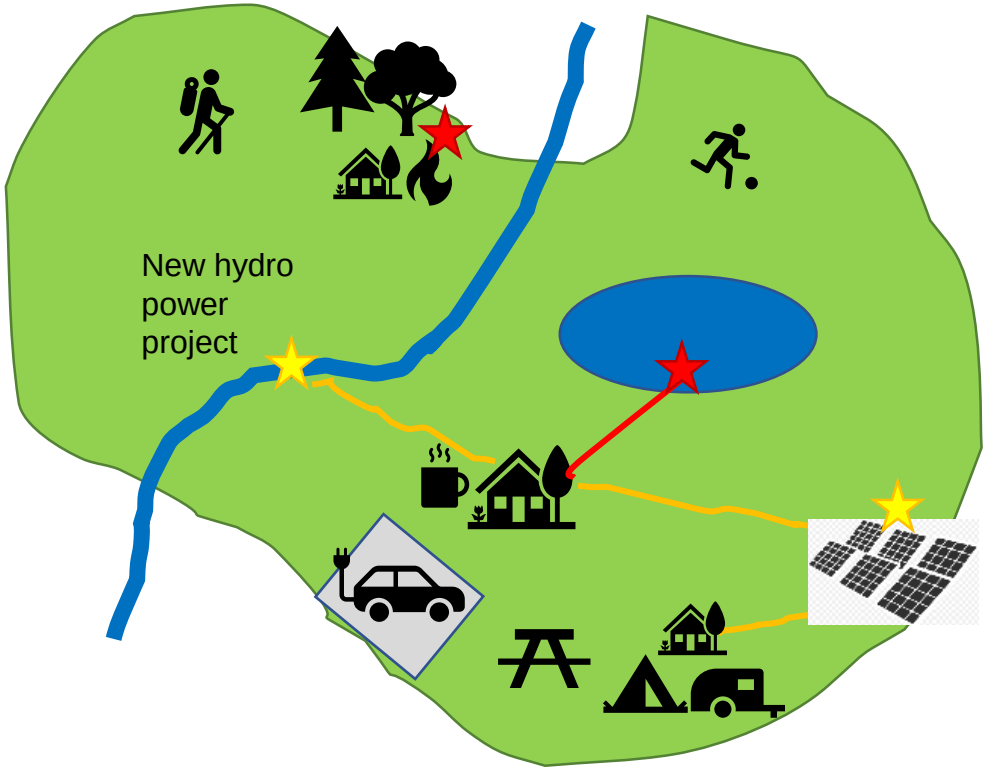
2. *Looking outwards*: "The Generator Model"
   For greenspaces that have the potential to supply larger energy loads, if they have significant energy demand within proximity of their boundary, they can generate energy inside the greenspace, then transport it and sell it to customers outside.

3. *Looking across*: "The Host Model"
   For greenspaces that are suitably located, there are opportunities to host energy infrastructure to enable wider solutions within the locality to be delivered. This is typical for cable and pipe routing where greenspace is used as a low cost route to connect energy supply with demand. Many parks have already adopted this model to support a range of energy-related infrastructure. However, this often goes unnoticed, perhaps because the benefits are not obvious and the infrastructure is a common sight so largely over-looked.

All three models could be progressed for a single site within the same development phase producing a hybrid model. It is more common for an Island approach to be progressed as the first phase of a ParkPower project, as has been the case at Saughton Park in Edinburgh. There is then potential over time to move to the Generator model in a subsequent phase.

4.2 Island Model

The area shaded green is the park or greenspace. It has a river running through the site, a loch, 3 main operational buildings and a car park. Heat pipes are in red and electricity cables in yellow – both would be buried. The site could be relatively small or large – larger sites are likely to offer more project opportunities.



= *Sites where green electricity generated*

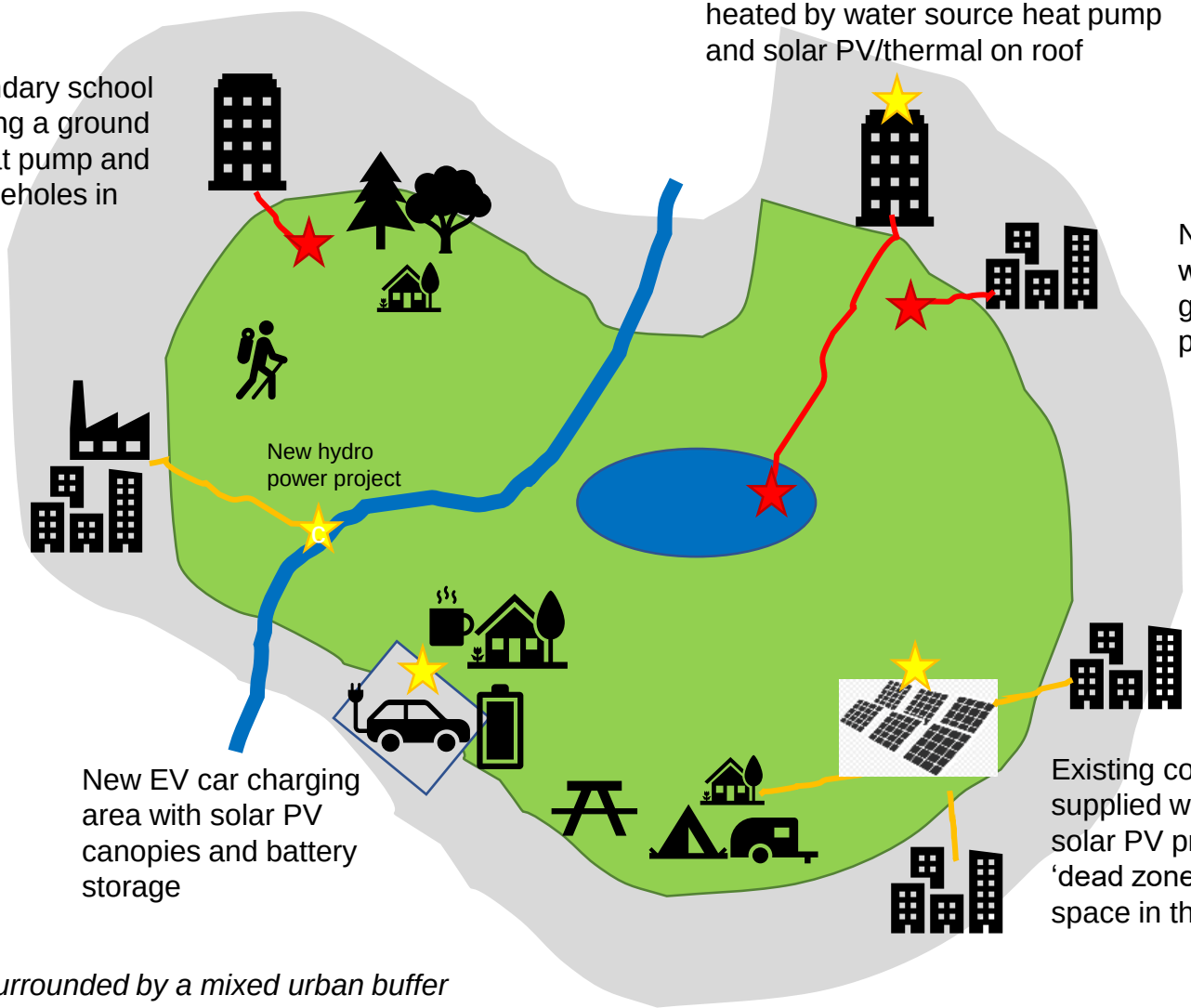
= *Sites where green heat generated*

The project could be simple and undertaken as a single phase to deliver heat using a water source heat pump between the loch and the visitor centre/café.

Optional subsequent phases could include:

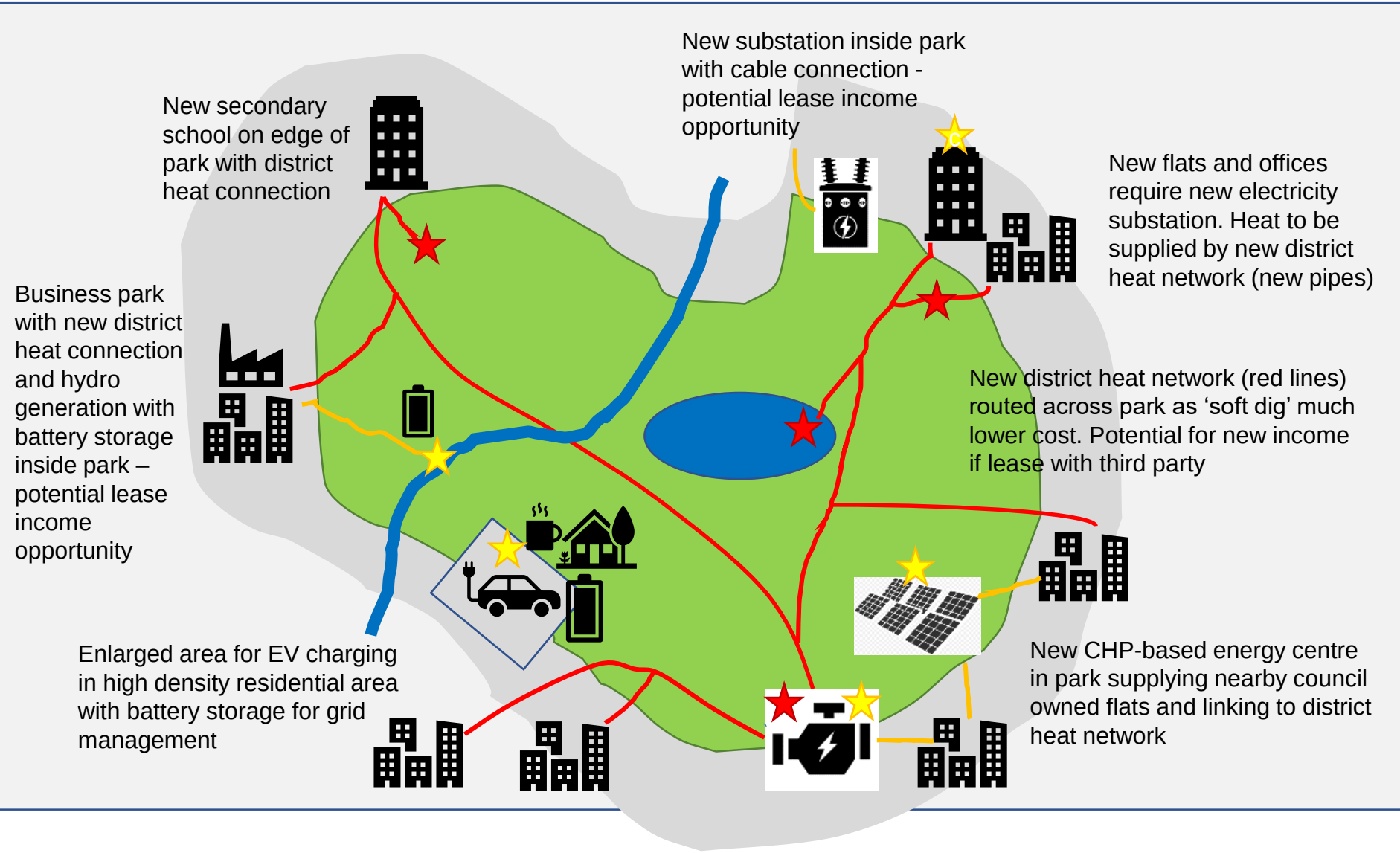
1. Ground-mounted solar PV array to supply electricity to the visitor centre and caravan site
2. Hydro project to supply power to the café and offset electricity demand of heat pump
3. New EV chargers in the car park
4. Biomass boiler for a remote building using sustainably managed local timber.

4.3 Generator Model



The park is surrounded by a mixed urban buffer zone (grey). Heat pipes are in red and electricity cables in yellow – both would be buried.

4.4 Host Model



4.5 Examples of solutions by design model

Solutions	Island	Generator	Host
Park operational buildings – heat, hot water and electricity demand	✓		
EV and bike charging	✓		✓
Supporting events with energy supply	✓		
Horticulture and grounds maintenance demands	✓		
Supply energy demand nearby		✓	✓
Space for own infrastructure (e.g. heat pump and pipes)			✓
Space for 3rd party infrastructure (e.g. District Heat Network, Energy Centre)			✓

Photos: EV charging and Energy Centre at Caird Park, Dundee

4.6 Business model options for public bodies to develop energy projects

1. Public body self-develops, self-owns, self-manages the solution.
2. Public body contracts a third party (usually commercial) to develop a solution; public body then ‘leases’ solution paying for it over extended period.
3. Public body contracts a third party (usually commercial contractor but could be a public or third sector body) to design, develop and operate a solution.
4. Public body partners with one or more commercial, public or third sector bodies to design, develop and operate a solution.
5. Public body offers the right to use land to a commercial, public or third sector body through a lease arrangement, in return for a long-term income.
6. Hybrid versions of the above mixing and matching different elements.

The risk-reward balance obviously varies depending on the option.

5. Online Resources

- ParkPower manual for public sector
- ParkPower guide for communities
- Case studies
- Exemplar sites (Scotland, UK, International)
- Greenspace energy survey template
- Opportunity mapping:
  technical methodology report

Available at www.parkpower.org.uk

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ParkPower Case Study:

Lochore Meadows Country Park, Fife Council

From coal mining to renewable energy: how a new visitors centre and water source heat pump is helping to save money at Lochore Meadows Country Park in Fife.

Lochore Meadows is a 1,200 acre country park in eastern Fife, about 15km north east of Dunfermline. The eastern edge of the park abuts the fringes of two villages, Lochore and Crosshill. One third of the park's area is actually water, Loch Ore. In the 14th Century an island on the loch was chosen for the site of Lochore Castle although its watery defences would only last a few hundred years. In 1795 the loch was drained to increase the acreage of productive farmland on the estate.

Looking out today over the tranquil loch and parklands, it's hard to believe this was once the heartland of Fife's coalfields. By 1904 seven pits had been excavated within the area occupied by the Country Park today. The closure of the last active colliery, the Mary Pit, in 1966 left a scarred and derelict landscape. Reclamation work started in the 1970s and included flooding a large area to re-create Lochore. In 1976 Lochore Meadows was designated as a country park. Today, it is well-used, attracting over 800,000 visitors in 2018, to enjoy a range of water and land-based activities.

Water source heat pump solution extends into the loch - marked by buoys, ignored by swans!

In 2017, a park redevelopment project included a new visitor centre, designed to high standards of energy efficiency. Its location, within 100 metres of the lochside, enabled engineers to utilise the heat stored in the water of the loch to design an efficient renewable heating system for the centre based on a water source heat pump.

The heat pump is a closed loop system delivering hot water at lower temperatures suitable for buildings with high thermal efficiency and, ideally, underfloor heating pipes. Pipes were buried in a trench between the centre and the lochside and they extend approximately 10m into the loch at a depth of 3m.

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With grateful thanks to support from:

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