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Next Generation case study: Plymouth Energy Community – developing affordable net zero homes through the use of an Esco
December 2020

About Plymouth Energy Community:

Plymouth Energy Community (PEC) is a charity and social enterprise with a co-operative ethos.
We have a vision to empower our community to create a fair, affordable, low-carbon energy system with local people at its heart.

PEC has ambitious plans to develop an innovative community energy project that offers affordable housing, energy and transport as a combined service for people-centred sustainable living. PEC will develop 38 affordable net zero homes and, in partnership with 7 other community led developments, totalling 139 homes, will define how a community-owned energy company could package heat, power and transport services in a manner that could be integrated more widely into new developments.

Key points for Community Energy groups:

PEC is exploring potential opportunities for the community energy sector to work in partnership with developers such as Community Land Trusts to deliver low cost zero carbon affordable homes. They are looking at whether the use of a community owned Energy Service Company (ESCo) can make this approach financially viable. Through this project, business models are being explored involving:

- Integration of PV and storage technology.
- Communal heat solutions utilising biomass or heat pumps.
- Electric car club and charging infrastructure with vehicle-to-grid functionality.
- A micro grid.
- Potentially a new affordable rental model encompassing comfort (heat and power) and transport charges (EV car club) into a single package.

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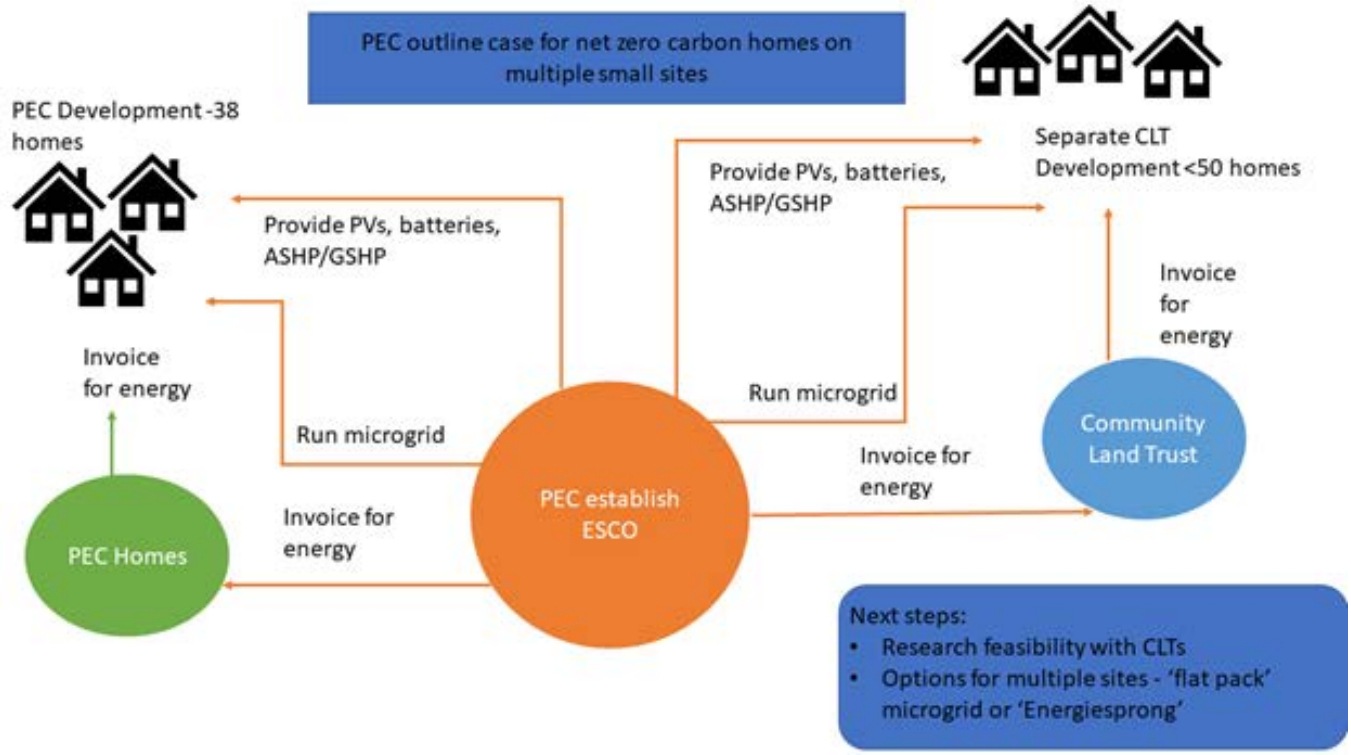
Conclusions to date on the scope and limitations of these models are described in the learning section below.

Overview of the project:

PEC is currently exploring an outline case for developing net zero homes on multiple small sites. This is shown further in the diagram below.



Our learning so far:

The outline case

Through modelling work conducted during the R&D phase, we have established that the outline case for an ESCO within the PEC Homes development is based on supplying heat through an air or ground source heat pump, a microgrid, and providing electricity through PV, possibly with inclusion of a battery. This demonstrates this investment could be viable and could save capex costs for the housing developer, while providing lower energy bills to occupants than a market default option. We think that a model where a community energy organisation such as PEC supplies heat and power to the housing provider to bill on is the best model for community energy, but this needs further exploring with the existing CLTs. This ESCO business model has the potential to create ongoing revenue from zero carbon infrastructure by removing some of the capex costs associated with reaching these standards and the ongoing maintenance cost of maintaining this technology.

Improving the model

A key challenge to making this approach work is the high capital costs of heat pumps. PEC have investigated a number of potential improvements to this model including sharing a heat pump and thermal store between multiple properties and fitting solar thermal or PVT in addition to PV. Both the addition of solar thermal and sharing of heat pumps improve the business case.

Other options such as MVHR with integrated air-air heat pumps are also being assessed. Work to include some of the elements identified above and to analyse alternative technologies such as heat stores and large batteries, alongside discussions with the developers around what 'avoided costs' can be brought into the plan will be needed.

Uncertainties

One of the areas of uncertainties remaining is the relationship between energy standards, capital cost and affordability of bills for tenants. On one level this is important to making the business case stack up. On another level, it depends on whether a CLT wishes to prioritise high energy standards, or low bills for residents. There are implications around a tenant's right to choose their energy supplier and questions of how this may be enacted were the tariff not to be competitive. Another area that needs further exploration is the legal and financial relationships between the ESCO provider, the housing provider (or housing manager) and the customer.

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Finally, the increased complexity of the business models requires reliable data to project dynamic energy use in the homes to establish an accurate assessment of onsite usage and the potential advantages of load shifting.

Developing a solution that can work on multiple sites

There are significant barriers to making a microgrid work on a development of fewer than 50 houses. This is because of the costs of a legal entity (a 'special purpose vehicle' or SPV) that is needed to run a microgrid based ESCO. To address this issue, PEC have explored a number of approaches, but their preferred option is to establish an SPV that supplies multiple sites.

In a 'flat pack microgrid' approach, a near identical set of technology, legal agreements, cost model and management software is developed that can be flexed for the number of homes (within the limits of the supply connection size) but fundamentally all connects together the same way and works well (if not optimally) for every site.

Another option PEC are exploring is to collaborate with a housing developer to procure homes and energy system together, with a guaranteed energy performance. This is a variation of the Energiesprong approach and PEC Homes is currently seeking to build the first Energiesprong new build homes in England. This approach brings the benefits of combining the use of communal heating and microgrids and is sparking much interest from local authorities, Homes England and Innovate UK.

What we're doing next:

Currently we are preparing financial and technical modelling for the scheme. This will be a combination of some technology options analysis and basic heat demand modelling alongside sourcing and applying relevant in-use electricity usage data to establish a dynamic model for electricity usage, generation, export, import and the potential for storage/load shifting.

If you want to know more:

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