Northern Periphery and Arctic Programme
2014–2020

EUROPEAN UNION
Investing in your future
European Regional Development Fund

Technical Summary

LCC - UHI

Overview

- The project objective is to determine if CHP (and particularly the H-CHP products) can be applicable to the colder parts of Northern Europe
- Domestic energy consumption information has been gathered
- Giuseppe has modelled the use CHP for commercial devices at community level
- We are currently looking at a device for a single home and this is being trialled – trials will continue for 2 months
- Some preliminary results are available

The Typical Older Western Isles Home
Annual Energy

Heat: 32,000 kWh

Electricity: 3,500 kWh

An algorithm has been generated that includes factors such as size, insulation, and occupancy, and accepts wind, solar, rainfall and air temperature data to produce an energy demand file (heat and electricity) to feed the system models.

The Typical Older Western Isles Home
Annual Energy

Option 1: Electric Heating

£4,850

The result is generally fuel poverty (more than 10% of net household income on energy). However this is a good solution in environmental terms as more and more electricity is coming from wind energy.

The Typical Older Western Isles Home
Annual Energy

Option 2: Electric Heating with ASHP

£3,200

This assumes an average COP over the year of 2.5. This is still an expensive solution, but in a modern highly insulated home the total can drop to half or even less.

However modern houses are not the focus of this analysis.

The Typical Older Western Isles Home
Annual Energy

Option 3: Oil

£2,500

This is a cheap solution at the moment but the oil price can fluctuate dramatically. In addition, it is environmentally a poor solution: as well as the intrinsic CO_2 emissions there are significant emissions associated with transportation.

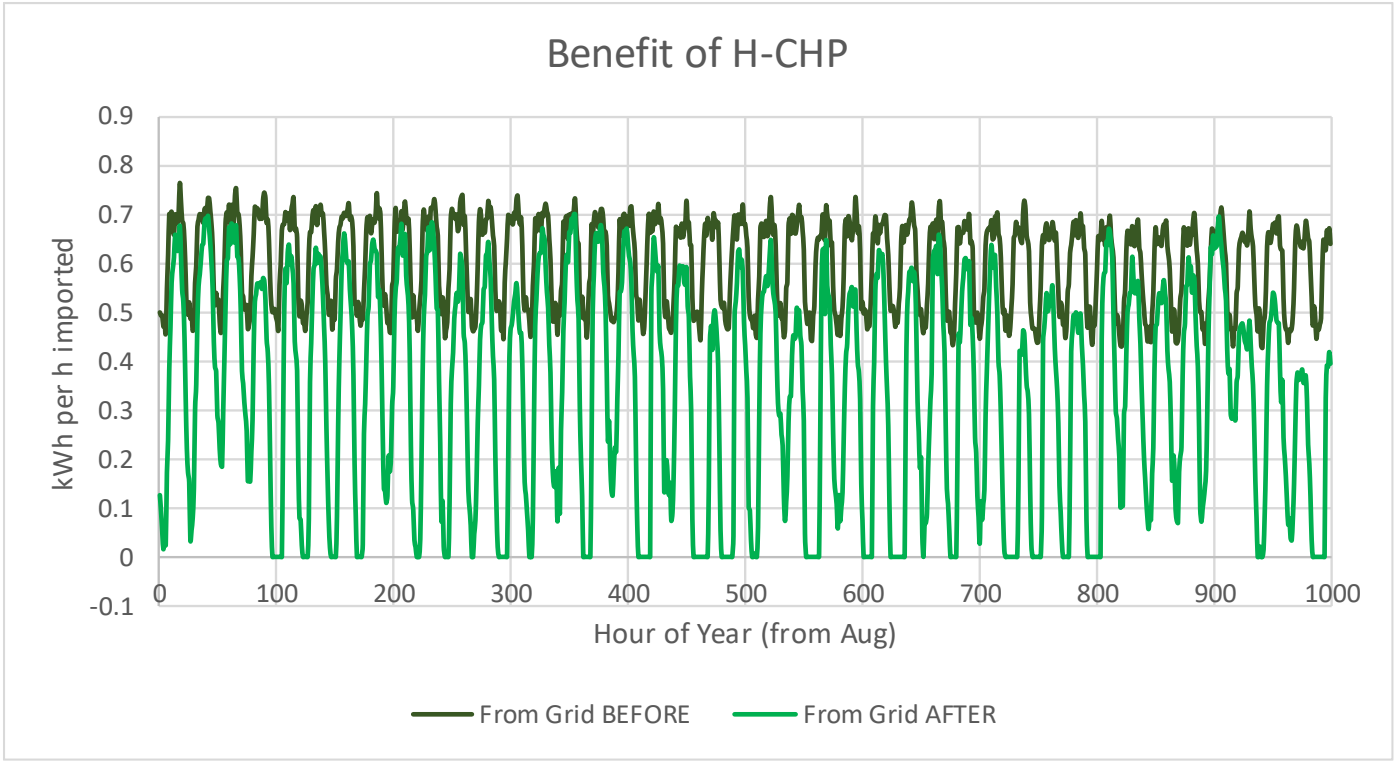
The Typical Older Western Isles Home
Adopting H-CHP

Stirling Engine Model

Assumptions:

1. The CHP system is biomass
2. It will produce 700 W electricity with 7 kW heat (typical of system being tested)
3. RHI available @ 6.97 p /kWh (or £7.00 for 20 kg wood)
4. Excess electricity can be sold to grid
5. 4 kWh battery storage @ 95% efficiency

Storage Usage
Adopting H-CHP

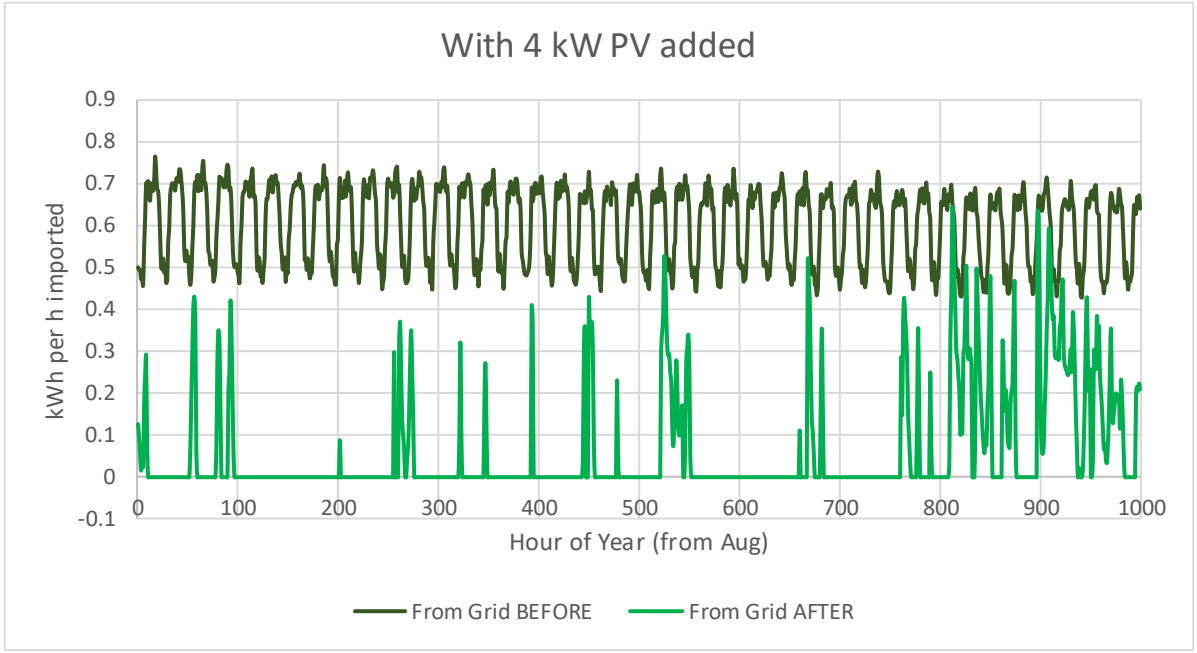


Annual Cost: £375

But this is largely down to the RHI scheme, though electricity costs fall significantly (to half). Very little energy is lost – no advantage in exporting to the grid (£8 income). Battery is essential but 4 kWh sufficient.

Evaluation (1)

CHP has promise and could be part of a balanced energy mix. Adding in solar PV is promising:



The projection is £550 annual profit (and no energy costs).

Evaluation (2)

However it is not without problems:

- Biomass has to be transported to the island (could consider modifying gasifier for peat)
- Boiler has to be loaded and cleaned manually
- The Stirling engine is silent but less efficient that a steam engine
- The capital costs have not been considered – these are high because there is no mass-produced CHP (could investigate the upgrade of a standard biomass boiler to CHP)
- The system is bulky

Summary

We will continue with tests until the end of the year

The models will be updated to reflect new data

The installed system will be available for viewing by interested parties

Measures will be taken to deploy systems in homes on the island

Research will continue to see how CHP can be an effective part of a mix of renewable sources as we progress towards zero-energy homes.

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