Rochdale Apartments Communal Heating System

Gas Innovation Fund

Final Report

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Contents

Introduction

Kaizen Energy specialise in the operation of district / communal heating systems. Currently we operate 80+ energy centres supplying heat and hot water to ~15,000 customers across Ireland.

In August 2020 we successfully applied for funding from Gas Networks Ireland (GNI), via the Gas Innovation Fund, for the installation of a Gas Absorption Heat Pump (GAHP). The installation was completed in November 2021.

The scope of this report is to evaluate and comment on the project outcomes vs initial objectives set out with the funding application.

Project Overview

Rochdale Apartments in Dun Laoghaire, Co. Dublin consists of 143 apartments connected to a local heat network that is supplied with heat via gas fired boilers and combined heat & power (CHP). We felt there was an opportunity to retrofit a gas absorption heat pump into the system in order to achieve a reduction in operating costs and carbon emissions while improving system efficiency and reliability. In summary the following works were undertaken:

- Installation of new flow and return header inclusive of mechanical separator. This was needed to allow for a variable flow design and accommodate injection of GAHP connections
- Installation of new boiler shunt pumps to accommodate new variable flow setup
- Existing network optimised to reduce system reduce temperatures and flow
- Construction of new room to house GAHP
- Installation of new GAHP inclusive of gas supply, associated ductwork, flue and ammonia sensors
- Upgrade of BMS controls to allow for monitoring of GAHP
- Installation of heat, gas and electrical meters to monitor GAHP performance. All connected back to MBUS logger within plantroom

Project Objectives

We expected the project to deliver an annual carbon reduction of 34% or 71 tCO_2 by improving the distribution efficiency of the heat network and reducing overall heat demand. The GAHP are a more efficient heat generator than the current gas fired boilers. The design intention was to match the base heating load of the system with the GAHP + existing CHP capacity to offset boiler input where possible.

The calculated assumptions / savings were as follows:

- 71.4MWh (10%) reduction in the annual development heat demand
- 20% improvement in system efficiency (HCV) from 77% to 97%
- 71tCO_2 (34%) reduction in the annual development carbon emissions
- €6.1k (21%) reduction in the annual development gas and electricity costs

Summary of Outcomes

We have attached a detailed analysis of the metered data and performance benchmarks. In summary the project resulted in:

- 94.5MWh (14%) reduction in the annual development heat demand
- 13% improvement in system efficiency (HCV)
- 67tCO_2 (33%) reduction in the annual development carbon emissions
- €17.3k (19%) reduction in the annual development gas and electricity costs

Note:

- *Gas priced spiked in 2022 in line with wholesale utilities. This resulted in a lower apartment heat demand due to cost which supports the additional reduction in overall heat demand.*
- *Adjusted baseline costs were far higher as a result of increased gas costs which has supported the additional annual saving in gas and electricity costs.*

Technical Challenges Encountered

As far as we are aware this is the first retrofit of a GAHP into a communal heating system in Ireland. We hope this project can be replicated by others and would highlight the following challenges encountered:

1. The refrigerant used within the GAHP is ammonia. There are strict guidelines around the use of ammonia as a refrigerant. We engaged a H&S consultant (Ayrton group) who provided us with the relevant guidelines in the handling of ammonia based refrigerant systems (Safe Management of Ammonia Refrigerant Systems – copy attached). The consultant also made a number of specific recommendations:
    - The GAHP could not be installed in the same room as any other gas appliance. As a result, we needed to construct a fire rated room to separate the GAHP from the existing gas plant.
    - Additional M&E services were required including a stand-alone ammonia sensor, lighting etc. All the newly installed services in the room needed to be blast proof.
    - Specific ammonia related signage + H&S equipment needed to be installed locally
2. The heat pump contains a fan that will run during operation. Given the physical size of the unit and the fan within the impact of noise pollution on the local residents needed to be considered. Initially it was proposed to the OMC that the heat pump be installed outside the development in a landscaped area. This would have involved the installation of a new concrete plinth and fencing. Although this would have negated the issue of noise the suggestion was turned down by the OMC due to the visual impact of the proposed installation. As an alternative solution the existing plantroom had a large ventilation opening which made it very suitable with little or no impact to the exterior of the building. Locating the heat pump outside may have led to an increase in project costs due to the inclusion of civil, landscaping works and increased pipe runs.
3. As the heat pump was located inside the plantroom we needed to tie into the existing flue system which was in place for the boilers and CHP's. It would be a very difficult task to retrofit a new flue internally within the building. If the unit was to be located externally then this would not be a problem.

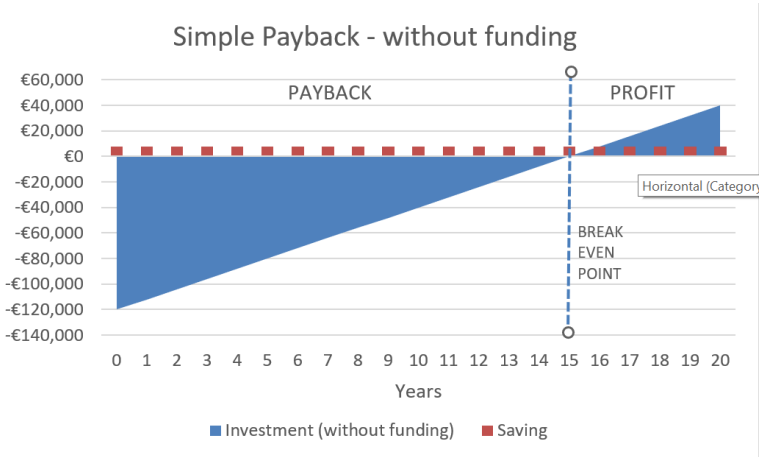
Is the Project Replicable?

The GAHP technology is particularly suitable to communal heating systems as it is capable of supplying the desired, 60-70 degree, flow temperature without negatively impacting on efficiency or COP (Coefficient of Performance) which is a ratio used to indicate the performance a HVAC system. Given its suitability there is no reason why this technology cannot be introduced into any new or existing communal heating system.

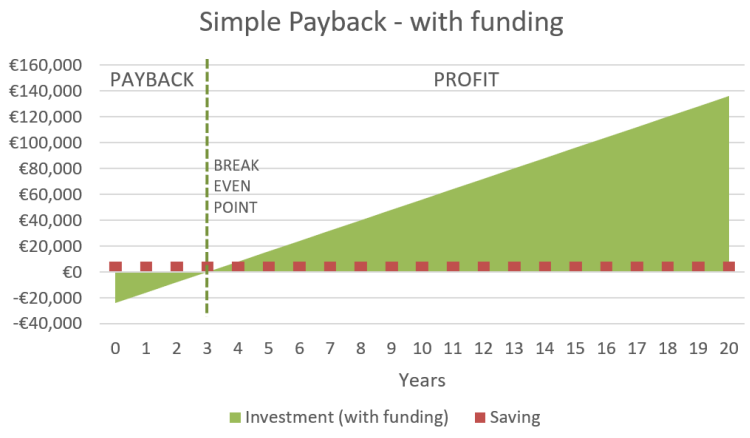
The original estimated payback on the project was 15 years. With GNI funding the payback reduced to 3 years. Current performance would suggest that the original payback period was accurate however this will fluctuate with the cost of input utilities.

In our experience a project payback needs to be a maximum of 6 years but ideally under 4 years to get any real traction with the client. Generally, our clients will fall under two categories (1) Owners Management Companies (OMC) or (2) Institutional landlords working in the Private Rental Sector (PRS). In our option an OMC will be fully focused on the payback with regards to decisions around deploying any capital. PRS clients may have additional considerations such as compliance with taxonomy or Environmental, Social and Governance (ESG) which may assist a project being funded.

It is unlikely that an OMC would have any appetite to fund a project in line with the original payback of 15 years.



In order to try and replicate the project or incentivise the installation of GAHP installations then the appropriate grant assistance will need to be factored in.



Project Photos

Plantroom Ventilation opening

GAHP in situ

GAHP installed

New modified header arrangement – mid installation

New header fully installed + insulated