

Tall Ship Water Source Heat Pump

Introduction

Built in 1896, the Glenlee is a three masted ship with great historical significance. It is owned and cared for by the Clyde Maritime Trust (CMT). Since 1999, there have been more than 300,000 visitors and users of the ship.

Restoration of the Glenlee began in 1993 and was opened to the public in time for a move in spring 2011 to the Riverside Transport Museum further up the Clyde River in Glasgow. The Clyde Maritime Trust (CMT) were refurbishing the boat, and looked to CARES funding to install an environmentally-friendly system for insulation, heat and ventilation. The CMT were keen to install a water source heat pump which would be visible to visitors as an integral part of the visitor attraction, interpretation and educational work of the CMT on the Glenlee.



Equipment

2 x 40kW NIBE Fighter 1330/40 water source heat pumps with 4 x slim jim collector plates (SLIM JIM Geo Lake Plate Heat Exchangers SJ-10T stainless steel) on floating pontoon.



As the ship was docked on the water and was planning on a move, a water source heat pump system was an excellent match for the heating requirements of the ship, with the main source of heat coming from the River Clyde. The ship is heated via a wet heat distribution system. The heat pumps are linked with the ventilation system to improve their efficiency by recovering heat from the ventilation air. The heat pumps also provide the domestic hot water, with an electric immersion heater providing back-up. A 26 kW electric ELK boiler helps with the peak loads for the heating on the coldest days.

A CARES funded technical study provided the design for a floating pontoon, which supports the heat collector 'slim jims'. The floating pontoon was designed to sit alongside the ship; rising and falling with the tide in the River Clyde and protecting the slim jims from flotsam moving in the River. It is thought

that this is the first time that a water source heat pump in a ship with slim jims on a floating pontoon has been attempted (in the UK at least).

The CMT approached four companies about installing the heating system and slim jims. Only one company was able to offer what the CMT requested. The company that the CMT chose to do the work has successfully installed a water source heat pump with slim jims at another site.

Cost and Grant Funding

Total project cost	£248,577	Rock Wool Insulation donated £68,029 worth of insulation Clyde Marine Trust funds £36,048.25
CARES grant	£144,500	
CARES grant percentage	58 %	

Fuel Bill Savings

It was expected that fuel bill savings would be around £25,400 a year (compared with using electric room heaters). The information gained before the move indicated there would be significant savings from the original all-electric heating – it is

complicated to make an accurate assessment as they could not afford to heat the ship regularly, one of the primary reasons for selecting this was to make constant heating of the ship affordable.

Emission Savings

Estimated kWh savings p.a.	230,651
Annual CO ₂ savings (kg)	99,180
Lifetime CO ₂ savings (kg)	1,983,600

Project Monitoring

There is a bespoke monitoring panel which provides details of the energy saved (in kWh), the equivalent CO₂ saving, and the efficiency factor the system is operating at (this varies with the temperature of the river). Additionally the CMT are installing three additional sensors that will show the temperature of the river, air and ship internal temperature, and intend to have some interpretation information alongside to further explain the heat pump benefits.

Local Impact

This is a novel, high profile project that has provided useful and relevant information, with potential for replication across a number of static maritime applications

The use of the heat pump sits very well with the Tall Ship's ethos and educational messages about the benefits of using "nature's resource". The large number of visitors, from a wide range of interests, are creating invaluable learning, education and awareness raising opportunities. The water source heat pump is a key part of the education and interpretation and enjoys high exposure. As a result of the project, visitor conditions aboard the ship are also much improved.

Lessons Learned

1. Lots of small points regarding supplier performance which could have been improved with better pre-planning of our particular installation challenges.
2. There was some concern over the separation between heat pump supplier and the installer, but this is a common problem with any project like this and is not difficult to overcome.
3. There has been trouble with the monitoring panel since day one and although it operated well to begin with it has failed since. The supplier has been pursued on several occasions but they say the problem lies between the panel supplier and their electrical installers. The Trust has chased this up and hopes to have it operational for the coming heating season.

Frank Brown, trustee of the Clyde Maritime Trust, said:

"The Clyde Maritime Trust is delighted with their new energy efficient water source heat pump heating system. The dramatic improvement in heating efficiency and energy use has enabled the Trust to provide a greatly improved visitor experience aboard our historic vessel "Glenlee". The advice, support and encouragement received from Community Energy Scotland's staff was first class and they should be congratulated for providing enthusiastic and understandable guidance through a complex process".

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