

# 21st-century renewable energy from the Irish Sea for a centuries-old mansion

- › BUILDING | PLAS NEWYDD, ANGLESEY, WALES
- › CLIENT | THE NATIONAL TRUST
- › INSTALLED EQUIPMENT | FOUR WPF 66 GROUND SOURCE HEAT PUMPS



**STIEBEL ELTRON**

# Cutting-edge technology meets nature and heritage conservation



## Plas Newydd



- › Grade I listed building with elements dating back to the 16th century
- › Located in an Area of Outstanding Natural Beauty
- › Close proximity to a Special Area of Conservation
- › Heated floor area of approx. 5000 m<sup>2</sup>
- › Heat pump system commissioned in May 2014

### Plas Newydd deserves very special treatment for many reasons

The stately mansion, the ancestral home of the Marquess of Anglesey, and surrounding parkland are listed as a Grade I heritage site and the nearby stables building is listed as Grade II. The grounds are located in a designated Area of Outstanding Natural Beauty and the nearby Menai Strait is a Special Area of Conservation (SAC).

The building has an approximate heated floor area of 5000 m<sup>2</sup> over three levels. Apart from living quarters, the remainder of the building has museum accredited status and is used for display purposes and National Trust offices. Up to now, it was heated by means of two oil-fired boilers, located in the stables building some 120 metres to the north of the house. Heat was transferred to the wet radiator system from the boiler house via two pairs of underground pipes.

An innovative marine-source heat pump system was installed using STIEBEL ELTRON technology. The award-winning solution, the UK's largest marine-source heat pump system to date, keeps the historical monument and its contents free of moisture on a year-round basis, reduces CO<sub>2</sub> emissions and cuts down estimated annual heating costs by around £40,000.

**Award-winning energy excellence** | The Plas Newydd heat pump project has been recognised as the Commercial Project of the Year by the Energy Efficiency and Renewables Awards 2014. In addition, it has won the Renewables UK Cymru 2014 Award as Outstanding Renewable Energy Project.

# Meticulous planning to protect the environment

## Could you describe your responsibilities in this project?

First of all, I was asked to check technical feasibility – would a heat pump work at all for Plas Newydd? Then I collaborated on the scoping document for the entire project. I also conduct a long-term assessment of the solution and worked with the National Trust people on metering and the application for government funding. Funding through the Renewable Heat Incentive was a necessary precondition for the project to go ahead.

## What made STIEBEL ELTRON a potential partner for this project? Have you cooperated before?

No, this is the first cooperation. Essentially, we began looking at STIEBEL ELTRON because the National Trust wanted a turnkey contractor. That narrowed down the number of potential partners.

## Which challenges have resulted from the height difference and distance between the Menai Strait, the stables building and the mansion? How did you solve them in your specifications?

The height differences led to a number of challenges. Due to the high tidal flow rates and the SAC, putting large arrays of heat exchanger pipes on the seabed was not an option. The same flow rate issues also made it impractical to install a submersible pump, so we decided on a solution to suck the water in. This, however, cannot



“This is a great example of fitting 21st-century technology into a Grade I listed building”

Rob Gwillim, Independent Energy Consultant

be done over a height of 10 metres, so we had to locate the pump house at an intermediate level between the sea and the buildings.

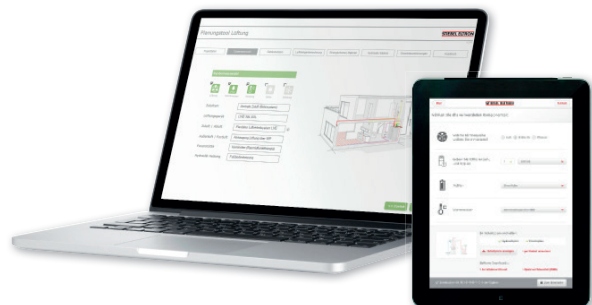
Installing the pump house at a distance from the stables building, where the heat pumps are, loses a bit of efficiency, but that was the only way to realise the project. We could afford the efficiency hitch due to the high average water temperatures in the Menai Strait.

## Planning expertise you can count on

With a team of more than 15 specialists in different disciplines, STIEBEL ELTRON gives you timely and expert support in planning widely diverse projects. From initial assessments to the final calculation of your proposal, we are at your side with quick answers to your questions about our solutions and how to get the best performance out of them.

In the area of systems technology alone, STIEBEL ELTRON carries out approximately 3000 planning projects for customers in Germany and elsewhere annually. Whether in the calculation of heating requirements, development of tailored solutions or individual project support, whether in economic evaluations and feasibility analyses or the development of tendering documents and offers, we provide comprehensive service.

In addition, we offer an extensive portfolio of analysis and planning software solutions including an array of apps to support you in your day-to-day work.





# The UK's biggest marine-source heat pump, built in 12 weeks

## How did the idea of installing a heat pump as a new solution for Plas Newydd come about?

In 2011, the 7th Marquess of Anglesey came across a magazine article that talked about the ground-source heat pump installation at Castle Howard. He ripped out the pages and passed them on to the National Trust with the words "I think this could work here" noted on them.

## What was the reason for the decision to install a heat pump at Plas Newydd in the end?

The main decision drivers were risk reduction, financial benefits and the need to control humidity within the mansion. Just imagine the risk of storing thousands of litres of oil at the shore of the Menai Strait. That, coupled with the prospect of saving an estimated £40,000 a year on operating costs, money we could put into conservation, convinced us.

## How many companies tendered for the project?

Seven companies came in at the end of 2013 to present what they could do and how much it would cost. Two of them ran away and one proposed a ground-source heat pump that included drilling in the garden, which may not be altered. That left four potential partners.

## Why did you choose STIEBEL ELTRON as a partner to realise the project?

We wanted to work with them because I felt that they knew what they are talking about and I appreciated the common-sense approach they presented

to us. We looked at who we could develop a relationship with rather than who was the cheapest, although cost was of course also important.

## How satisfied are you with the project in general?

From the switch-off of the oil heating system it took exactly 12 weeks until the heat pump was running, which is extraordinarily fast. Overall the Trust was surprised how quickly it was delivered – it certainly surprised me. It was easier than most of the projects I've been involved in. Public response has also been great. Our website received 71 million hits on the story and we've seen a huge increase in visitors.



"So far we've spent only £665 instead of £17,500 as we did over the same period last year."

Paul Southall, Heat Specialist for the National Trust Renewable Energy Programme

## Constructing the UK's largest marine-source heat pump system

Meant dealing with an array of unknowns. Aside from the sheer scale of the project, the challenges included working around rising and sinking tides and a long list of precautions required to protect the marine conservation area.

Great care had to be taken to avoid damage to delicate marine habitats. The pump house, located on the beach and partially recessed into the cliff-side, was constructed with a minimum of wet concrete. On-site refuelling of machinery was strictly prohibited due to the risk of spillage.

Another top priority was preservation of the location's natural beauty. The 60 metres of pipes that extend along the seabed out into Menai Strait to suck in seawater are disguised by local rocks. Over time, these will be colonised by marine flora and fauna.

**The innovative technology** | Uses heat exchangers to extract warmth from seawater. The process can be compared to refrigeration technology, which uses chemicals to draw off heat. In this case, the heat produced is captured and used to warm water, which is piped 30 metres up a cliff face to the stables building where the heat pumps are located. The temperature achieved is 55 °C, which is ideal for keeping the mansion's interior temperature constant and preventing the development of moisture. Formerly the National Trust's biggest oil consumer and polluter, Plas Newydd is now one of the cleanest-operating buildings anywhere in the UK.



# Large-scale installation with logistical challenges

## What makes this project unique compared to other large-scale heat pump installations in the UK?

The unique side of it is the fact that it is the largest marine-source heat pump. That led to an array of very special challenges.

## What were the major challenges of the project?

It was more of a logistics challenge than a technical challenge. Kimpton already had considerable experience with historical buildings, including buildings with Grade I and II listings, so the conservation concerns were not new to us.

But working around the tides with water level differences of as much as six or seven metres was very demanding. Moving all the necessary equipment to the shore of the Menai Strait was far more complicated than it would have been without the tidal aspect.

## How large was your project team?

A team of more than 40 people worked on this complex and challenging project, working around the tides, moving equipment and carrying out the installation. The design phase of the project was incredibly demanding and we had to ensure that our calculations met the criteria of the government's Renewable Heat Incentive, which stipulates specific performance requirements.



“The results were better and quicker than we expected.”

Chris Livesley, Business Development Manager, Kimpton Energy Solutions

## To what extent is Kimpton Energy Solutions focused on renewable energy projects?

Renewable solutions are a top priority. We've been installing renewable heating technologies since 1995.

## Has Kimpton worked with STIEBEL ELTRON in the past?

This is in fact the third project we've cooperated on since 2010. We're very happy with the performance of STIEBEL ELTRON technology.

## WPF 66 ground source heat pump

- › Suitable for cascade control for higher output requirements
- › High reliability through robust single compressor design
- › High coefficient of performance
- › Extremely quiet operation
- › Limit of application WQA from -5 °C to +20 °C
- › Heating flow temperature up to +60 °C
- › Integrated heat and electricity meters

## Award-winning project



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