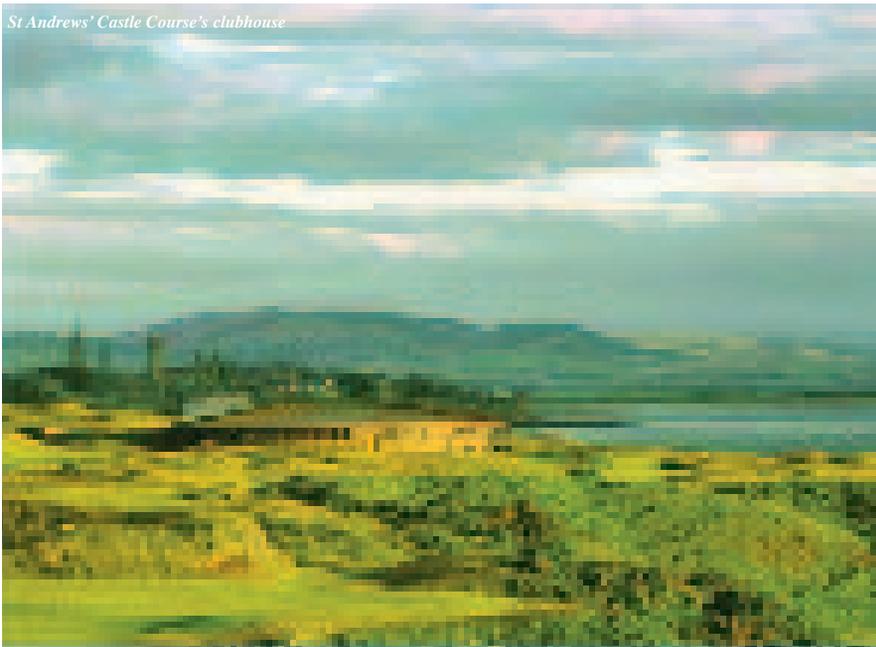


# The Castle that is king

St Andrews Links, which last year received an eco-label, is finding that its Castle Course venue is leading the way in terms of environmental management. Key to this has been the installation of ground source heat pumps to warm the clubhouse, writes **Nigel Harte**

St Andrews' Castle Course's clubhouse



**ONE OF THE** reasons why St Andrews Links was last year awarded the Golf Environment Organisation's (GEO) Certified™ eco-label was because the latest (and seventh) course to add to its portfolio, the Castle Course, was magnificently transformed from intensively managed mixed farmland into a new course with an extensive matrix of grassland habitats.

That, in itself, makes the venue an example of best environmental practice, yet it is far from the whole eco-story that the golf club has become.

Away from the course, the clubhouse incorporates renewable geothermal energy as two ground source heat pump units accurately control the heating and cooling needs of the building. The system supplies underfloor heating throughout the

clubhouse and strategically positioned fan coils around the public and staff areas control a stable and comfortable environment for staff and golfers. Moreover, it means the system heats the clubhouse at approximately one quarter of the cost of the other clubhouses at St Andrews.

The system, which means the club is not dependent on traditional gas from a conventional boiler system to heat the clubhouse, was installed during the construction of the clubhouse in 2007 and involves an underground heat-collecting loop.

The pipes in the ground loop system contain a mixture of water and glycol (to prevent freezing), which is pumped around underground, collecting free, renewable heat energy into the ground pipe fluid. This fluid then enters one

side of the heat pump and exchanges its heat into a low-temperature refrigerant fluid circulating inside the heat pump, causing the refrigerant to boil and become a gas. Heat energy is transferred into the refrigerant inside the heat pump. The refrigerant gas then enters a compressor, and, as the gas is compressed, its temperature rises dramatically in order to heat the clubhouse. After giving up its heat energy, the refrigerant pressure is reduced through a throttle valve and it becomes a low-temperature liquid again, before circulating back through the evaporator side in a continuous loop.

The two pump units are both connected to six indoor units of equipment, which includes a heat pump boiler each.

"The requirement for providing simultaneous heating and cooling to the building in a highly efficient manner enhanced the suitability of installing a watercooled ground source heat recovery system," explained Martin Fahey, sustainable solutions manager for Mitsubishi Electric, manufacturer of the heat pump system, which Specialist Mechanical Services installed.

"Ground source watercooled heat pump units and heat pump boiler units were installed in the plant room which faces the service yard. Background heating to the building is supplied via an underfloor heating system fed by the boiler units with main heating and cooling via various ducted, wall mounted and cassette indoor units installed. Initially for the ground works, slinky coils were considered, however this was difficult to install as one metre below the ground was solid rock. It was decided therefore that a borehole array was to be installed with 10 bores each 150 metres deep providing the heating and cooling to the building."

Following the installation, power and temperature data was logged 24 hours a day, seven days a week for several months in 2009 using remote monitoring interfaces. St Andrews



*Above left: The two arrows point to the heat pump boiler units while the arrow on the right is aimed at the watercooler unit. Right: The arrow points towards the ground source water cooled heat pump unit*

Links was therefore able to calculate a monthly coefficient of performance (COP) for the entire system.

"From six months of analysis it was clear that the ground source systems installed at this site were highly efficient and more than capable of dealing with the building's heating and cooling requirements in an environmentally friendly way," added Martin Fahey.

"From efficiencies derived from the data monitored, logged and analysed it was clear that system efficiency is maximised when heat recovery takes place during months when there was a mixed demand for heating and cooling, that is during May and September. However, even when heat recovery was not occurring the ground source system was still able to produce a very high system COP.

"Based on the system COP data for each month we can calculate an average system COP over the six months of 5.34 which demonstrates a highly efficient system being used to its full potential in this difficult application of large window area and a harsh outdoor environment.

"The ground source system installed showed running costs over the six months of £2,618 and carbon dioxide emissions over the same period of 11,256kg. In comparison, a chiller / boiler combination that would be required to satisfy the heating and cooling demands of the building over the six months would produce running costs of £5,356 and carbon dioxide emissions of 24,110kg. This equates to a 51 per cent reduction in running costs of the ground source system compared to the chiller / boiler combination as well as a 53 per cent decrease in carbon dioxide emissions. Taking this a step

further the cost to heat and cool the building over the six month period using the installed ground source system was £2.38 per metre squared."

Specialist Mechanical Services was shortlisted for an *H&V News* award in the 'Renewables Project of the Year' category for the work, particularly as the ventilation systems required for fresh air intake and exhaust air use heat recovery technology that recover over 80 per cent of the heat in the exhaust air with a running current of only two amps.

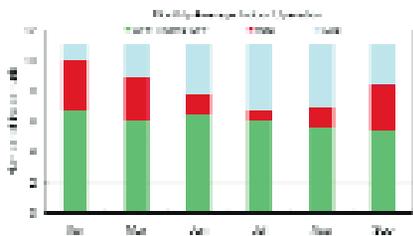
"Renewables technology has become the most important factor for buyers and specifiers in today's economic climate where ongoing running and maintenance costs are equally as important to businesses as the initial capital costs of a building project," said the firm's Graeme Fox. "Heat pump systems are a sustainable heating technology and many qualify for government grants in the UK as well as enhanced capital allowances for business users."

In addition to the heating and cooling system, light sensors have been used as much as practical in non-public areas with energy saving light bulbs installed throughout the building. Solar lighting has been used on the entrance road to guide people at dusk or as they arrive in the morning. There is also a lot of natural lighting in the maintenance facility to the mess room as well as the main machinery storage area which greatly assists when working on equipment. All windows in both the clubhouse and the maintenance building are double glazed.

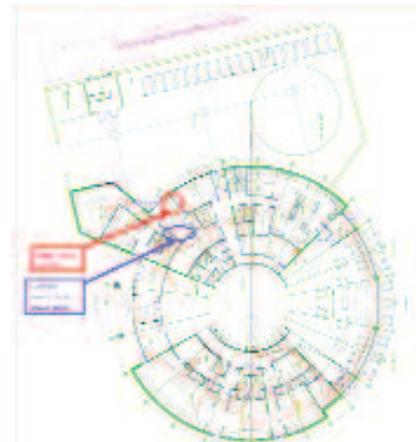
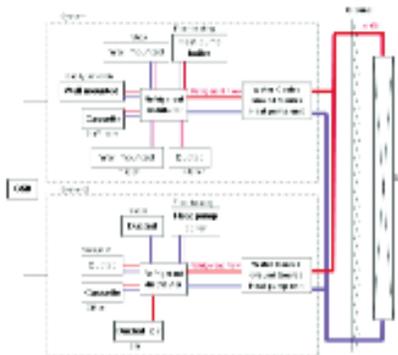
Furthermore, a borehole to a local aquifer, which is treated with an acid / urea complex, is used to irrigate the

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Above left: Data showing how the system heats and cools the clubhouse over a six-month period. Centre: A diagram showing how the two units at the Castle Course operate. Right: A floorplan of the clubhouse



course, although more than half of the site requires no irrigation due to the establishment of natural grassland habitats. A recycled wash-down water system is utilised to clean machinery and copper-rich water from the clubhouse roof is used to spray-off moss on hard surfaces.

Elsewhere, an ecological management plan has led to the creation of small-scale dune-like landforms across the course, which sees low inputs of irrigation and nutrients.

“The pivotal measure, however, was the decision to install two ground

source geothermal heat pumps, utilising the adjacent open areas at the practice range to site ground loops and boreholes,” said Mike Wood, an environmental scientist who worked with the GEO to award the trust with the certified eco-label.

“These drive a comprehensive heating / cooling system balancing background space and water heating demand with airconditioning load. The Castle Course has undoubtedly had to resolve some very significant sustainability challenges in its progression from the development to the management phase. Attention to

detail from concept to completion have contributed greatly to the success of this transition.

“St Andrews Links will remain relevant not only as a powerful symbol of tradition and heritage – but as a standard bearer for 21st century good practice in golf management.

“The trust’s management team has undoubtedly shown the required commitment, organisational skills and resources to continue to improve.”

**GCM**

## Reducing a club’s carbon footprint – an interview with Paul Keeling

Getting clubs to think ‘green’ is close to Paul Keeling’s, club services manager for England Golf, heart. From the early days of the ‘Golf Course Environment Advisory Service’, England Golf has campaigned to both promote the environmental work that clubs do and to advise committees on improving their credentials.

“An important message is that it is not just about water and pesticides, but business sustainability too,” he said.

The Greener Golf website at [www.EnglandGolf.org/grenergolf](http://www.EnglandGolf.org/grenergolf) helps clubs to develop an environmental policy and assess their current performance, as well as showing areas for improvement and providing interactive tools to help make changes. “Golf will have to prove its environmental credentials in the future – in Holland they have environmental police and I could easily see the UK following,” he added.

“We have carried out case studies with clubs using the ‘Carbon Calculator’ tool and monitored improvements made. The point is that it is not just nice to be green, but it can also save money, so is very relevant for clubs now.

“There are so many simple and cheap actions that clubs can take to reduce their carbon footprint. You wouldn’t leave your television on standby overnight at home, so why not use the same practices at home and switch the bar tills and so on off as well?”

Other services include recommended suppliers of low energy appliances and discounts on purchases, plus a payback calculator to work out the benefits of new investments.

A new focus on renewables has seen 20 clubs surveyed under a scheme funded by England Golf, the GCMA and The R&A to establish their suitability to utilise renewable energy sources.



“It is independent advice, without bias to manufacturers or installers. There’s no pressure to take the advice, but some clubs are already considering renewables. If there is sufficient uptake, England Golf could look at buying, using economies of scale to assist a group of clubs,” he said.

England Golf’s base at the National Golf Centre is also considering renewables and would provide an excellent testbed. “We often trial new systems or procedures here; for example we may go for ISO environmental accreditation so that we can advise clubs on the process in future,” he said.

**WORDS BY JANE CARLEY**