INTERSEASONAL HEAT TRANSFER

The efficient use of energy in buildings is becoming more and more important. ICAX is an independent company structured to provide turnkey heating and cooling to buildings based on Interseasonal Heat Transfer

The big problem with renewable energy up to now has been its unreliability, with neither solar nor wind providing an uninterrupted supply. And since the energy couldn't be stored for long periods during times of plenty, this meant conventional power generators had to be available as backup. With gas and oil being finite, something has to be done to heat buildings in a sustainable manner and ICAX has an interesting solution with its interseasonal heat transfer system.

"It's a mechanism for capturing surplus heat in the summer, storing it in the ground in thermal banks and releasing it in winter to heat buildings without burning fossil fuels," explains Director Edward Thompson. "It can also capture cold in the winter, store that in the ground and release it to buildings in summer to provide cooling in a way that uses less electricity and issues fewer carbon emissions than conventional air conditioning."

What it's effectively doing is augmenting the operation of ground source heat pumps by increasing the amount of heat in the ground for when it's needed for winter heating. Conversely, temperatures

fall during the winter as stored heat is removed and these lower temperatures can be used for summer cooling. By doing this, ICAX overcomes the normal problem when using ground source heat pumps of having a Coefficient of Performance (COP) less than the widely quoted 4. This figure is based on standard test data which do not reflect conditions on site throughout the heating season. A modern heat pump can achieve a COP of 4 in autumn conditions when a delivery temperature of 40°C is being provided from a below ground temperature of 10°C.

The latter temperature falls as winter progresses and heat is extracted from the ground, often resulting in an actual COP of only 2.6 over the heating season. The ICAX solution raises the ground temperature above the normal 10°C by collecting solar energy in the summer and storing it thermal banks. The ground source heat pump typically starts the winter with a temperature of 25°C, resulting in the COP being virtually doubled.

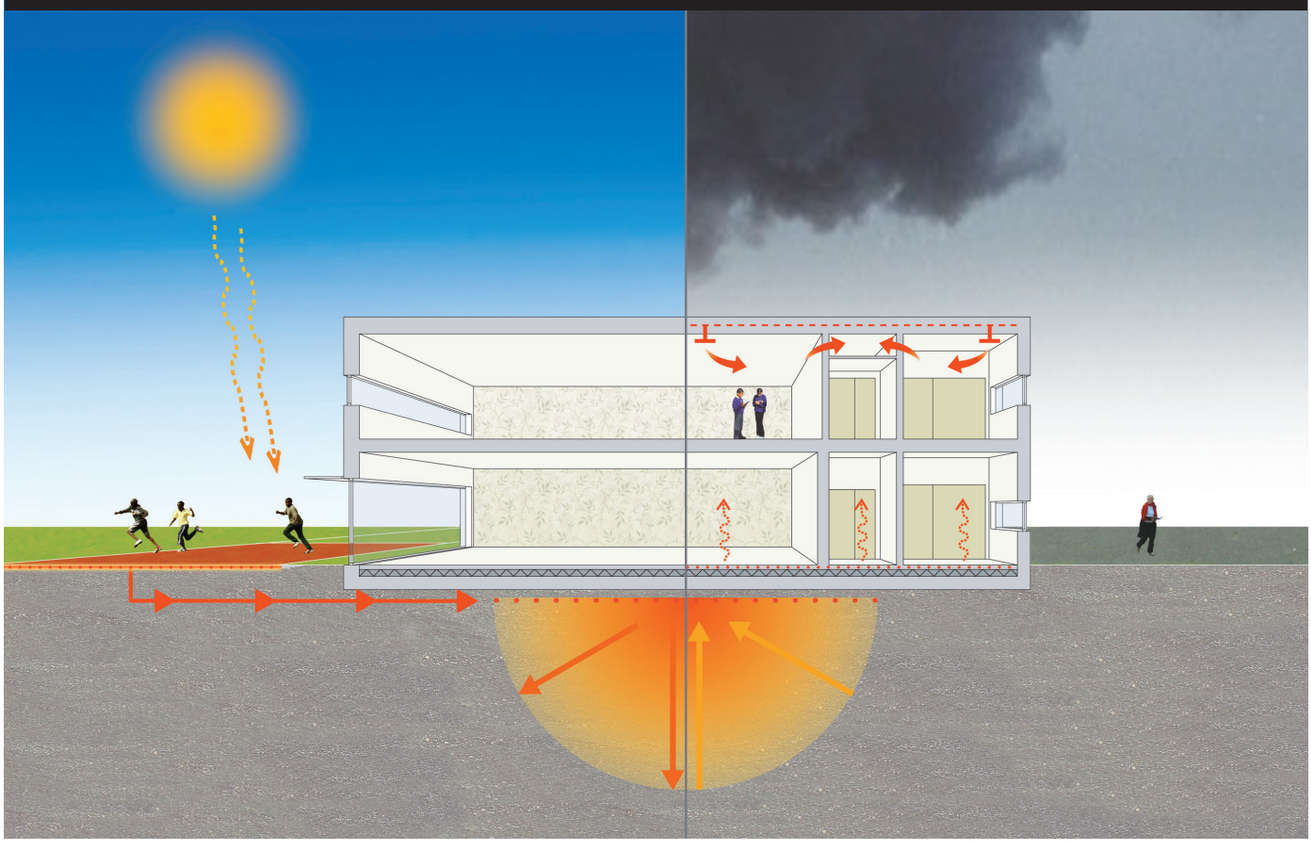
The perceived problem is often the unpredictable nature of the British weather, although Edward insists this isn't an issue: "It's about thermal balance because almost every building in the UK receives enough heat in summer to be a reasonable temperature on average over the year. They all need some heating in winter and some get too hot in summer. But you can provide it all without back-up — people grossly underestimate the power that radiates from the sun."

GOOD DESIGN AND THERMAL BALANCE

Critical to the success of an installation is good design, which involves understanding the architecture of the building, thermal loads, heat loads, cooling loads and heat source in order to achieve the best balance. The aim may be to provide 70% of the peak load through ground source energy, which will provide heat for almost every day of the year with a gas boiler or similar to fill the gap. However, if the intention is to provide everything with ground source energy, ICAX can certainly do that.

Handling everything without backup means having a thermal bank and collection system that are the right size, which requires a detailed thermal modelling exercise. For a conventional ground source heating system, this means providing more boreholes, which can be very expensive. The solution, says Edward, is much more economical: "The ICAX alternative is to charge a smaller number of boreholes with heat in summer so that you don't need more boreholes in the winter. They start with more warmth, which is a more efficient way of doing it. That's why we provide a more efficient system in terms of using less electricity but also one

Interseasonal Heat Transfer works by capturing heat energy from the sun via a collection pipe network just beneath the surface of black tarmac roads (or car parks or school playgrounds). It then stores the energy in computer-controlled thermal banks in the ground under the foundation of buildings, and releases it to heat the buildings in winter via heat pumps linked to underfloor heating



that is cheaper to build. We follow the fundamental principles of heat capture in summer, heat storage over autumn and heat delivery in winter."

To achieve peak efficiency, the system generally interacts with a building management system and captures heat in summer in different ways. A recent ICAX installation at the Wellington Civic Centre for Telford & Wrekin Council illustrates how versatile the system can be. "The pitched roof incorporates an integral solar collector," explains Edward. "Heat is collected in the summer by the ICAX Skid, which incorporates a very sophisticated control mechanism. The main source of heating is the Solex solar roof, which provides hot water, heats the swimming pool and generates space heating. The space heating is delivered by various methods (underfloor heating, fan coil units) and the ICAX Skid controls the movement of energy from the solar roof. If it's not needed for other purposes, it is stored in the ground to recharge the thermal bank.

"The ICAX Skid has a triple source heat pump which identifies the optimum heating source. In winter when the sun's not shining, that's going to be in the ground, while in summer it's going to take heat from the roof. In spring and autumn, there's an interesting balance because the air may have a higher temperature than the thermal bank but if the sun is shining there might be a reasonable amount of heat off the solar roof. So there's a constant control mechanism to determine the best heat source and the ICAX Skid takes heat from the most economical place, thus producing a very high COP."

"THE PRICE OF GAS ROSE 20% LAST YEAR. THE LONG TERM TREND IS DEFINITELY UP AND THERE'S GOING TO BE INCREASES ABOVE INFLATION IN OIL AND GAS FOR MOST OF THE NEXT 20-30 YEARS. FOR AN OWNER OF A BUILDING, IT MAKES PERFECT SENSE TO USE INTERSEASONAL HEAT TRANSFER."

EDWARD THOMPSON DIRECTOR

ICAX works with and gets strong support from major suppliers, including Rehau who provide PEX piping for the borehole arrays and Mitsubishi who provide heat pumps and fan coil units. The ICAX Skid, which incorporates Mitsubishi equipment, is fabricated and tested offsite to enable efficient dovetailing into the main contractor's timelines.

It is a sophisticated system that is most suited to larger buildings, such as schools, hospitals and offices, which gain the most benefits. However, there are potential problems with main contractors who are always looking to save on capital investment. Interseasonal Heat Transfer involves a higher capital cost than conventional heating although it yields clear savings in the long term, as well as substantial savings in carbon emissions. The situation isn't helped by the government's renewable heat incentive, which provides no incentive at all for building contractors.

One of the company's biggest challenges is getting the message across so that main contractors and building owners know the benefits of the system. Nevertheless, the tide is running in favour of ICAX simply because fossil fuels are a finite resource, which is reflected in the price. Edward says: "The price of gas rose 20% last year. The long term trend is definitely up and there's going to be increases above inflation in oil and gas for most of the next 20-30 years. For an owner of a building, it makes perfect sense to use Interseasonal Heat Transfer."

www.icax.co.uk
Tel: 020 7253 2240