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SOUTHAMPTON ENERGY SCHEME

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ABSTRACT

The City of Southampton Energy Scheme is the only exploitation of geothermal energy in the United Kingdom. The purpose of the paper is to briefly describe the Southampton geothermal resource and its history, and how a relatively small, limited economical life aquifer has been integrated into a very large and successful heat to power and chilling scheme. Using the Southampton experience, the paper will also explain the role of the City Council in its development, and why local authorities generally should be involved in such schemes and precisely how they may assist in their introduction and development.

INTRODUCTION

Southampton is one of the largest cities in the U.K. and is situated centrally on the south coast of England. It may be known through its reputation as an international port, through its university and colleges, its prominence in English history or simply the port from which the ill-fated ship, the Titanic, sailed.

Southampton aspires to be one of the finest cities in Europe. It wishes to offer a high quality of life to all its people, including the opportunity to live – now, and in the future – in a sustainable way. One vital area in which the Council is leading by example is in the use of energy. It seeks to reduce harmful emissions and greenhouse gases from energy production, conserve precious stocks of fossil fuels and maximise energy efficiency. The City's energy scheme contributes to all these aims at a competitive price for businesses and an affordable price for householders. Furthermore, following the Earth Summits in Rio de Janeiro and Kyoto, local authorities have had responsibility to take action locally to minimise the production and release of greenhouse gases, in response to the problems of global warming. Encouraging and facilitating the development of local schemes using either alternative energy sources, or high efficiency schemes such as Combined Heat & Power, or both, are clear responses to the world-wide calls for local action.

The Council believes that it must not only advocate sustainable development, but demonstrate its commitment.

Southampton's geothermal credentials were first established in the 1980's when the United Kingdom Department of Energy undertook a research and development programme to examine the potential of geothermal aquifers in the United Kingdom.

One such promising area was in the Wessex Basin in Central Southern England (Fig.1). The City Council persuaded the Government to drill a well in the city centre with the aim of using the hot brine to heat major city centre redevelopment. The Government agreed, the well was drilled in 1981 and an aquifer located in Triassic Sherwood Sandstone at a depth of 1730-1800 metres. The aquifer was 70m thick, but only 24m was water-bearing. Following testing and modelling, geologists concluded that although the water temperature was adequate at 76^{o}C, the aquifer was bounded by geological faults, giving it a limited life and ruling out reinjection. The economical life is estimated at 15-20 years, pumping at the rate of 10-15 litres per second.

The Department of Energy was generally disappointed with the whole United Kingdom Research and Development programme and in due course decided to curtail it. However the City Council was very keen to utilise the geothermal resource and teamed up with Utilicom Ltd, a U.K. subsidiary of the French company IDEX, to exploit the well.

At the outset the economics of the proposal were marginal at best. However, there was great enthusiasm from both the City Council and Utilicom to proceed with the project, but it was obvious that if the project was to succeed, it would need considerable co-operation from both parties.

Looking back, it is now clearly apparent that if there was a single factor which contributed to the success of the Southampton scheme it was, without doubt, co-operation. Co-operation between the public and private sector, co-operation between the City Council and its development partner Utilicom, and co-operation with the European Union and the U.K. Department of Energy. In fact the Council's legal agreement with Utilicom is appropriately called the Co-operation Agreement. The contract was a non-adversarial agreement in which the City Council undertook to co-operate with its partner company in establishing an initial scheme and in its subsequent wider development.

For its part, the Council made available very valuable city centre land for the well, wellhead equipment and a sizeable heat station building. It granted licences and wayleaves for laying distribution mains, and assisted with the planning processes. It established a multi-disciplinary project team to assist in development, and made bids to the European Union for financial support in developing the scheme.

Utilicom's obligation was to finance, construct and operate the scheme's initial development, and it had a reciprocal obligation to co-operate with the Council in later, wider development.

Construction of the project commenced in July 1987 (Fig.2) and was very much an act of faith by Utilicom and its parent company. At the time of the initial investment the company had only one customer, the City Council, with whom they had signed a contract. That alone demonstrates the spirit of co-operation on this project and the confidence and faith that the company had in the Council in helping delivering the wider scheme.

Soon after the scheme started, the Council realised that once the heating mains infrastructure went in place, it was possible to link in any other low grade heat. The Council, and Utilicom, therefore decided to initially add a small-scale Combined Heat & Power Generator (CHP), and absorption heat pumps. From those small beginnings the CHP element has grown considerably with the recent installation of the large 5.7MW high efficiency (Wartsila) generator. District chilling was added in 1994 and since then there has been a rapidly growing demand for chilled water for air conditioning.

The list of city centre customers is now extensive and varied, and includes four hotels (Fig.3), the BBC's regional radio and television studios, a food superstore, a large college campus, numerous office complexes, a vast swimming pool development, a major city centre hospital and one of the largest shopping malls in the United Kingdom. In the next three years, it is intended to add photovoltaics, heat and energy from the anaerobic digestion of household waste, and in the longer term it is hoped eventually to link in a new energy from waste incinerator via submarine mains across a major river. The feasibility of tidal power is also being examined in an endeavour to harness Southampton's unique four daily high tides.

Success with this scheme has enabled the City Council to raise its horizons and confidence has been developed to tackle more ambitious and complex projects. On the strength of the city centre scheme, the U.K. Government has recently awarded the Council £5M to help establish its part of a planned £40M Combined Heat & Power scheme for 3,000 dwellings, 10 schools and numerous commercial buildings in the western part of the city, working with General Electric and the existing partners, Utilicom. Without doubt, this further project will mean that the City of Southampton has the largest district energy, heating and chilling scheme in the United Kingdom and the Council has been pleased that the U.K. Government has given the project endorsement as an example of best practice.

Municipalities, and particularly cities, are ideally placed to facilitate the development of geothermal and other integrated energy schemes because:

- At the macro level, as part of their strategic planning processes, local authorities are able to assess potential heat, power and chilling loads and can insist that where such schemes are in existence, they must be used by new developers. At the micro level, having established those strategic plans, the Council is able to require developers to link to the system when they bring forward individual proposals for new buildings.
- They are able to facilitate the harnessing of new and existing heat and power sources for incorporation into integrated schemes and to encourage their development where they do not exist.
- Councils are in a strong position to persuade existing owners and occupiers of buildings to link to such schemes. Another powerful lever is that councils are usually extensive owners of property and dwellings, and through their sale, letting and tenancy agreements they can insist that such schemes are developed, or that owners and tenants link to existing schemes.
- Licences and wayleaves can be granted for laying distribution mains.
- Land can be identified and made available for wellheads and heating/chilling plant buildings.
- Councils are large users of energy and can link their own buildings and service premises to these schemes.
- Forums for partnership working can be established to both assist establishment and development of these projects
- They are pivotal to the dissemination of best practices, both nationally and increasingly internationally, including to developing countries.
- Through membership of national and international "energy" organisations they are able to influence European and national governments, to participate in research, development, and demonstration programmes, and access related financial assistance. (Southampton has membership of the European "Energy Cities" network, is participating in the European Union's Fifth Framework Research and Development Programmes and is a senior member of the U.K. Combined Heat & Power Association.)

CONCLUSION

It is the geothermal element on which the Southampton scheme's reputation and success has been built, and by which it is known. The use of geothermal energy always captures the imagination of the community, visitors and the media.

The opportunity to utilise a wide range of sources of heat and electrical power takes the City Council closer to its vision whereby large parts of the City's domestic and commercial properties will be heated from the district scheme. It is significant that the original initiative and the catalyst was the geothermal resource, but what the Council is continuing to demonstrate is the ability to integrate geothermal and other energy sources into a comprehensive energy scheme.

Local government in its many forms, and particularly in urban areas, has a major role to play in either developing such schemes directly or encouraging and facilitating their development by others. Southampton's acquired knowledge is freely available to any other municipality in the world and the City Council is happy to share its experience with them.

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Figure 1. The principal areas of potential geothermal aquifers in the U.K. and the location of Southampton in the Wessex Basin in the South of England.

Figure 2. The heating mains being laid across one of the busiest junctions in the City Centre.

Figure 3. The De Vere Five Star Grand Harbour Hotel, Southampton is supplied with both heat and chilled water.