Background

Aberdeen Heat & Power (AH&P) was set up in 2002 by Aberdeen City Council (ACC) as an arms-length, not-for-profit Company, limited by guarantee. ACC had conducted an energy appraisal of its housing stock and concluded that the multi-storey blocks (of which there are 59 in Aberdeen, consisting of 4500 flats, spread across the city) had low energy ratings, and classed as difficult and expensive to heat. A study revealed that many of the residents were living in fuel poverty, could not afford to heat their homes properly with resulting damp, and in some cases, poor health conditions. Many of these high rise blocks had a high tenancy turnover and deemed not to be desirable places in which to live. The aims of the study were to investigate the possibility of affordable heating in terms of capital outlay, affordable heating for tenants, reduction in CO₂ emissions, safe in operation, sustainable energy and affordable for Aberdeen City Council. All high-rise properties were heated with various design and vintage of electric heating systems, and evaluation showed that to achieve the aims of the study that a Combined Heat & Power (CHP) / District Heating (DH) system would be the most cost effective option in the long term. The company was set up and agreements put in place with ACC with the following objectives, which are still very valid today.

Mission – To deliver clean affordable energy

Values – AH&P value providing affordable energy with low environmental impacts that delivers socio-economic benefits to the citizens of Aberdeen

Vision – AH&P will be a committed proactive organisation, and will be a leading example to communities in Scotland and the UK, delivering decentralised sustainable and affordable energy.

What is Combined Heat & Power (CHP)?

Combined Heat & Power (CHP) integrates the production of usable heat and power (electricity) in one single, highly efficient process. This contrasts with conventional methods of generating electricity where a vast amount of heat is simply wasted to atmosphere. Normally CHP is referred to as provision of electricity with a by-product of heat, but in the case where CHP is used with an active District Heating (DH) system, the heat is the primary product to be delivered effectively to customers and the generated electricity and subsequent sale thereof is the economic by-product, which sustains the viability of the scheme. CHP is regarded as fuel neutral, in that a CHP process can be applied to both renewable and fossil fuels. The specific technologies employed and the efficiencies they achieve will vary, but CHP offers the capability to make more efficient and effective use of the primary energy resources. Good quality CHP schemes must deliver primary energy savings, and this legal requirement in enacted in the UK through the CHP Quality Assurance (CHPQA) programme. Cost savings are between 15% and 40% over electricity sourced from the grid and heat generated from on-site boilers. In comparison with conventional forms of energy generation CHP delivers a minimum of 10% savings in CO₂ emissions. CHP has a proven and established supplier base.
What is District Heating (DH)?
District Heating (DH) uses a central plant to supply heat to a number of buildings through a network of piping. Most district heating plants deliver this heat in the form of hot water, (which is subsequently returned to the plant room for re-heating) and Aberdeen Heat & Power is no exception. The hot water is delivered to individual dwellings and public buildings where it passes through radiators and heat exchangers. In domestic dwellings there is virtually no noticeable difference between a building using district heating and one with a conventional central heating system, apart from the absence of a boiler in each dwelling! The boiler is simply replaced by a heat interface unit. (HIU). Maintenance costs are lower with a district heating system when compared to conventional boiler fed heating systems. This is due to there being only one centralised plant to maintain, rather than a large number of boilers situated in many properties.

Relating this technology to Aberdeen Heat and Power (AH&P)
A key aspect of embarking on such a scheme is to have a “Champion” at Local Authority level, and AH&P is fortunate to have had this commitment from Aberdeen City Council (ACC) since the outset. The close cooperation between ACC and AH&P has been very key to the success of the scheme, from agreements, source of funding for projects, access to planning specialists, and support from elected and non-elected officials. In addition, AH&P have employed the services of a design consultant in all projects since 2002. The design consultant has produced feasibility studies on all projects and has effectively mapped out the densely populated and commercialised areas within the city to allow a visionary map to be developed to meet with the vision and values of the Company. This map will assist with future priority decision making. On a technical front this will help determine pipe sizing and design of the critical underground network well into the future – with the aim of digging up the road only once!

Progress so far
Three schemes have been installed to date. The first “pilot” scheme consisted of 4 blocks of flats (280 flats) connected to a small CHP gas-fired engine (with back up boilers). The electrical output is 200kW, within heat output at approx. 300kW in winter. It was recognised that the heat load pattern was very cyclical (summer / winter demand and daily peaks in the morning and evening), which is not conducive for best efficiency operation of the CHP plant. The next project was installed in a secondary school with adjacent 25-metre pool and also nearby multi storey flats, a sheltered housing complex (200 flats total) and a sports pavilion. This scheme is approx. ½ as big again as the original, with 300kW electrical output, and due to the more diverse head load pattern, can run much more efficiently and through the whole year. With the CHP being located directly inside the school there is also the opportunity for a proportion of the generated power to be used directly in the school which provides direct economic benefit to both the school and AH&P.

The third scheme and by far the largest has been installed in successive phases to provide up to 2000kW electrical output, providing heat now to over 1000 domestic dwellings and 6 public buildings. More recently the underground network is being extended to the city centre, with plans to connect a further 4 public buildings before the next heating season (including the City Council Town House). Further plans are in place to connect a 50-metre swimming pool in 2013.
In addition, the council commissioned AH&P to carry out stand-alone gas fired district heating systems on three individual blocks, which could be linked into the wider CHP / DH network at a later date.

The public buildings have been able to demonstrate carbon and cost savings over the conventional heating systems employed previously. As stated, the heat demand profile for the public buildings is vital to continued efficiency of the system.

However it is the domestic properties where the largest benefits are realised

- Reduced levels of fuel poverty. Many people could not afford the electricity cost to heat their home properly.
- Affordable heat and hot water rates. Typically 40-50% saving over the previous electric heating methods.
- Carbon savings up to 40% over the inefficient electrical systems.
- Elimination of damp conditions – the whole block is warm.
- Improved health conditions.
- Happier and more content people.
- Homes that people now want to live in.

These benefits have been borne out through customer satisfaction surveys.

**Funding**

To date, most funding sources for AH&P has been through Aberdeen City Council (ACC). These have included ACC Capital Housing Programme, Community Energy Programme (CEP), Community Energy Savings Programme (CESP), initial loan funding through the Co-op Bank backed as guarantor by ACC, and Scottish Government for extension of the District Heating Network to the City Centre.

**That’s the success story thus far, but where is District Heating going and what needs to be done?**

- We need to remember that heat demand constitutes approximately 50% of the energy used in UK as a whole. It is therefore vital that resources and funding are directed to reducing heat demand and provision of efficient and sustainable heat supply systems.
- This is about reducing carbon by whatever means through zero and low carbon technology. CHP / DH, even fired by gas, provides a reduction in carbon and CO₂ emissions. A typical reduction of 45% CO₂ emission has been calculated by the measures already taken.
- Building the infrastructure for DH is the catalyst to deliver low and zero carbon heat to homes and businesses.
- Once there is sufficient infrastructure in place, the front-end energy source(s) can be by various means – gas, oil (possible, but not likely), biomass, biogasification, Anaerobic Digestion, Geothermal, where practicable, etc. The front end determines the economic viability and environmental credentials of
the scheme, while the network delivers that heat to the domestic and commercial user at an affordable price.

- DH can range from small clusters of dwellings to large city-wide networks supplying domestic and commercial premises. It is important to recognise that’s it’s horses for courses and one solution does not fit all. Design is therefore a key parameter.

- We need some joined up thinking both at design and planning levels, both from public/private sector designers and planning authorities. E.g. a new build designer will be required to adopt carbon saving measures in the design to satisfy planning regulations. With some knowledge of what is available locally from a DH system, a design solution could be reached that could satisfy all requirements without the need to adopt individual measures just to match that particular building. In other words “remove the blinkers” from M+E designers and planners to thinking about District Heating as an option.

- The cost of the infrastructure (the buried heat network) is a major component to progress of a DH system. The Committee remit, terms of reference refers to the “development and finance of the necessary infrastructure”, but this specifically refers to handling of excess electricity generated. It is not only about that. The funding of the infrastructure for DH systems needs to be considered to be able to make progress on delivering what is 50% of required energy to the consumer. This has partly been kicked off, and much appreciated, through a grant from the Scottish Government of £1m to Aberdeen City Council to extend the DH network in Aberdeen. More help will be required in the future.

- Once installed, the heat network is currently subject to rateable value. This is another on-cost to the business which adds pressure on the need to maintain heat costs to consumers, in particular those areas that are in fuel poverty.

- Replacement of electric heating systems within homes with heat from a more efficient CHP/DH source (whether powered from by renewable sources or not!), helps to strengthen the local electric grid infrastructure. (e.g. remove 6-9kW of electric heating from a flat, and 100 flats per building with 10 buildings per area soon adds up to a sizeable relief of the local grid). As the demand for electricity continues to grow this is surely a good thing.

**Summary and the Future**

Aberdeen Heat & Power has come a long way in the past 10 years through hard work, good co-operation and support from ACC, and a will to succeed and develop. District Heating is proven to deliver carbon savings for the environment and affordable heat to consumers. These schemes provide environmental and social benefit, thus “ticking the right boxes” at local and national level.

Going forward, the future looks positive for District Heating systems, subject to some of the above barriers being reduced or eliminated. Future funding of projects for not-for-profit companies like AH&P will depend on continued co-operation and support from local and national government to develop and support district heating schemes.
AH&P Company currently does not have forms of renewable energy within its portfolio. With sizeable networks now installed and operational, we are well placed to consider other forms of primary energy. To consider new technologies (e.g. Geothermal energy), may require feasibility studies and possibly speculative funding in some form, to develop such technologies. We may need financial support to look at these technologies.

AH&P has now a proven and well-respected track record and is well positioned to take advantage of new developments.

Aberdeen Heat and Power
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