



Report to Services Scrutiny Committee

Subject: Sustainable Energy Systems

Date: 28th November 2006

Author: Chair of the Committee

1.0 Purpose of the Report

- 1.1 To report on the Services Scrutiny Committee's deliberations on 'Sustainability', especially as it relates to Energy Saving & Generation and to make recommendations to Cabinet for further consideration of generating electricity in an environmentally friendly manner at the Civic Centre.

2.0 Background

- 2.1 The report was prompted by concerns over Global Warming and increased generation of so-called 'Greenhouse Gases' by the continued use of fossil fuels.
- 2.2 The committee was comprised of Councillors A. Gillam and C. Pratt (each part Chairs of Committee), and all Members of the Services Scrutiny Committee. A specialist presentation and advice was given by Gareth Ellis (National Energy Centre), and support and technical advice offered by John Evens (Technical Services Manager- Gedling Borough Council), Steve Wiseman (Facilities Manager- Gedling Borough Council).

3.0 Scope of the review

- 3.1 The Committee sought to explore different means of energy procurement and consumption saving measures to identify any possible schemes whereby costs and consumption could be reduced. The scope is attached at Appendix 1.

4.0 Information gathering

- 4.1. The working group gathered information on sustainable energy options this included:
- 4.2 A presentation by Gareth Ellis: Manager, Renewable Energy- The National Energy Foundation 9th May 2006
- 4.3 A presentation by Steve Wiseman: Facilities Manager- Gedling Borough Council 25th July 2006 (Appendix 2)
- 4.4 A report by Gareth Ellis: Manager, Renewable Energy- The National Energy Foundation (Appendix 3)

5.0 Findings

- 5.1 The Committee acknowledge the presentation given by Gareth Ellis. This took the format of a PowerPoint presentation and detailed / illustrated various wind and solar energy options. These included Space Heating- Biomass (wood heating) and Ground Source Heat Pumps (and Air source), Hot water- Solar Thermal, Electricity- Wind and Solar Photo Voltaics. The Committee were made aware of the various costs / benefits of these alternative energy provisions.
- 5.2 The Committee note the presentation given by Steve Wiseman which detailed the various energy and water saving measures used in the Council's buildings. Having discussed the issues raised in some depth with Council officers from Technical Services, (S. Wiseman and J. Evens) it would appear that energy conservation measures have already been implemented quite widely although further energy saving measures can be identified and introduced. However the Committee realise that they lack the knowledge base to progress sustainable energy generation much further without additional input particularly in relation to choosing the most appropriate system and the required structural modifications to the Civic Centre (and other buildings) to install them.
- 5.3 The Committee note the report written for Services Committee by Gareth Ellis. This report details the observations made during a tour of the Civic Centre prior to Gareth's presentation at Services Committee. This tour was arranged so that Gareth could evaluate the Civic Centre campus (including Arnot Hill House) with a view to making some recommendations for viable alternative energy solutions. The Committee have discussed this report which details the potential for implementing Solar Water Heating, Ground Heat Pumps, Photovoltaics and a Wind Turbine.
- 5.4 The Committee recognise that it would be worthwhile to make a bid for funding to support this review and its aims and understands that the Council Executive is interested in supporting the sustainability agenda. Whilst this

Committee realises under the current budget bidding system any such 'environmentally based' application funds would not score highly, it never the less considers that the time is apposite for Gedling Borough Council to investigate the introduction of such systems. The benefits that would accrue include a stable electricity supply at a competitive price for the foreseeable future, the possible gaining of grants from central Government to support the project and the opportunity for Gedling Borough Council to become a leading civic proponent of 'Green electricity'. It would also be hoped that Gedling Borough Council would also be a point of reference for other civic and commercial bodies thinking of introducing similar schemes for their premises.

6. Recommendations

It is recommended that:

- 6.1 it is noted that as a consequence of the investigations carried out by this Committee, proposals were put forward for budget growth at the meeting on 12th September 2006:
- i. To request resources to carry out an environmental audit of the Council.
 - ii. To request resources for consultants to produce proposals for sustainable energy saving measures.
 - iii. To submit a Capital programme bid to implement proposals for sustainable energy saving measures.
 - iv. To request a £5,000 budget for energy saving measures within the Council.
- 6.2 Cabinet considers making a commitment to an on-going programme of energy saving, to reduce greenhouse gases and to the introduction of sustainable energy generation systems wherever they prove cost-effective.

(A further recommendation was agreed at Services Scrutiny Committee on the 28th November 2006):

- 6.2 It is recommended that the Planning Committee consider ways in which planning development policy can be amended to facilitate householder initiatives on sustainable energy production and energy saving schemes including potential fee reduction incentives and to ask the Chair of Planning Committee to report back to this Committee on the outcome.

7.0 Acknowledgement

7.1 The working group wishes to thank everyone who made themselves available to provide information and support this review.



Scope

Scrutiny committee: Services

Working Group: Sustainability

Chair of group: Councillor C. Pratt

Working group members: Services Committee Members

Portfolio holder/s: To be determined

(1) Scope

This review is being undertaken because of the steep rise in energy prices to the Borough. The Borough should be leading the way in energy economy measures in order to be able to demonstrate to its residents that it is conscious of its environmental protection role and to assist its officers to gain knowledge of what is on the market and experience of its effectiveness.

The review will look at all energy requirements, gas, electricity and water, how these are procured, what sustainability measures are in place and how energy consumption is monitored.

The review will explore different means of energy procurement and consumption saving measures to identify any possible schemes whereby costs and consumption can be reduced.

(2) Aims

- i. To understand what options are available for using sustainable sources of energy and the extent to which these are being implemented across the Council.
- ii. To identify possible realistic sustainable energy initiatives which would lead to savings in energy costs and help the council to deliver its Community Leadership value to 'promote sustainability in the wider community'.
- iii. To understand what options are available as energy saving initiatives and the extent to which these are being implemented across the Council.

- iv. To identify possible realistic energy saving initiatives which could be implemented and where necessary to support a capital bid for installation of these

3) Timetable

The review will commence in: *November*

Milestones: *at 21st March committee meeting, Members will decide on its future course*

If scope agreed at meeting on 21st March, the following 3 Committee meetings will have an agenda item to progress this review against the scope.

(4) Information gathering and consultees

The working group has requested the following information:

Council's energy spend

What procurement routes are used for utilities

What sustainable options are available and the pay back periods

What energy saving options are available and the pay back periods

The Council's approach to sustainable energy and energy saving – what are we doing now?

What are the main questions to be asked and of what parties?

D.Grattage – work taking place re HRA stock – presentation November

S.Wiseman – work taking place re council buildings – presentation January

Identify an representative from a relevant organisation whose role is to promote sustainable energy or energy saving, to present to the Committee what alternative solutions might be available; to give advise on practical issues and on pay back rates.

Visits

No visits are anticipated, unless the research identifies a relevant site where significant improvements in energy usage or sustainable sources have been implemented.

(5) How the community will be consulted, informed and involved

It is not anticipated that this review will require any consultation. Any outcomes if appropriate will be reported through Contacts Magazine.

(6) Resources

The working group is supported by:

The Scrutiny Officer

The Building Services Manager

(7) How the effectiveness of the review will be measured

Recommendations from this review will be made to the relevant portfolio holder or directly as a possible budget bid to Cabinet for the 2007/07 budget. This review will be considered to be effective where recommendations made by this Committee have led to:

- i. Any bid for investment prepared on behalf of this committee is included in the Council's 2007/08 budget
- ii. Savings in energy consumption across the Council
- iii. Increased proportion of sustainable sources of energy as part of the overall energy usage
- iv. Any recommendations put for investment have a realistic pay back period, and savings can be measured.
- v. To carry out a case study comparing similar size building with our buildings where there have been energy saving sustainability measures.

Energy and Water Saving Measures in the Council's Public Buildings

For the purposes of this report, Energy and Water saving measures have been divided into 4 categories-

- Good housekeeping and effective control of energy and water using appliances
- Insulation of the building fabric and service pipes etc
- Installation of efficient energy and water using appliances
- Use of alternative fuels/renewable resources and renewable technology

Good Housekeeping and effective controls

No matter how energy efficient an appliance may be, if it isn't suitably controlled then wastage will occur. Control can be as simple as switching, or turning, something off as soon as it is finished with. As well as being a 'no cost' measure, it is often all that is needed when switching off lighting and turning off taps. The difficulty is ensuring that end users of equipment and appliances do actually turn them off after use and best results are achieved in circumstances where a specific person is given responsibility for the task. Over the years the Council has implemented a number of raising staff awareness campaigns through staff news letters and induction courses and Departments have procedures in place for key staff to follow, in respect of checking and switching off regimes in buildings.

However in some instances, where usage patterns are consistent and predictable, or where the correct actions of the users can't be assured, it may be possible to configure automated control of equipment, typically presence and luminance level detection for lighting and press down/timed release taps on wash basins and showers. Press down taps are relatively effective against wastage and are therefore commonplace in the toilets and shower areas in Council buildings, however lighting control is far less extensive and reflects the fact that automated control is not always suitable, or cost effective in many instances. The cost effectiveness of controls is often determined by the relative size of the system and they have therefore not been implemented in the Council's portfolio of smaller buildings. Variable speed drive control is a good example of this. This is a device for regulating the speed of a motor, such as that on a heating pump. Invariably pumps don't need to operate continuously at full speed in order to meet the required work load and only a small drop in motor speed has a significant effect on energy consumption. The greatest savings are attainable for larger pumps, working long hours and a Leisure Centre with a pool has pumps which fit that description.

The most common form of automated control is that used for space and water heating purposes. Controls can vary tremendously in complexity, reflecting also the

complexity of the heating system, but in general terms control involves temperature sensors and timers for on/off sequences. In larger buildings, such as a Leisure Centre, there is more than one heating, or comfort control system operating in the same area, for example pool water heating, air temperature heating, humidity control and fresh air/ventilation. It is important that these systems work in unison and are controlled by a more complex Building Management System (B.M.S). In the offices the heating systems are 'zoned', or separated into North and South facing, to take account of likely variances in comfort levels around a larger building due to the different aspect of rooms. Within the offices and several other larger Council Buildings, the systems are also 'optimised and compensated'. That is to say that the operator programs in the time at which the building is required to reach the set occupancy temperature and the controls determine, through external and internal temperature sensors, the optimum time to switch on the heating system in order to achieve the settings. Compensation is the process of the system regulating the temperature of the water in the radiators, increasing or reducing it accordingly, to minimise overheating. This also provides better control of the boilers, reducing unnecessary firing-up sequences. Once again however good housekeeping measures apply, as the effectiveness of automated controls is determined by the operator inputting, checking and maintaining the correct temperature and time settings.

Finally, under the heading of Good Housekeeping, must be included suitable planned and responsive maintenance regimes. The Council's Property Management Group has looked to ensure that all public buildings have an effective and suitable maintenance programme and collates information on maintenance expenditure and percentage of planned against responsive maintenance, for relevant performance indicators.

Examples of measures undertaken are-

B.M.S controls-	Leisure Centres with pools
Optimised/compensated controls-	Richard Herrod Centre, office buildings and several Community Centres.
Urinal flush control-	Extensively in public buildings, particularly, Leisure Centres, public toilet blocks and changing pavilions.
Variable speed drives-	Arnold Leisure Centre
Lighting controls-	Public Toilets and toilets/changing areas in Leisure Centres.
Timed switch off-	Photocopiers in the offices.

Insulation

This category covers insulation to both the external envelope of a building, as well as insulation to heating pipes and hot water cylinders and swimming pools.

Generally it is recognised that insulating roof voids in pitched roofs and insulating hot water cylinders, hot water distribution pipework and heated swimming pools are the most cost effective energy saving measures in respect of improving insulation. This is due to the relatively easy nature of the work. However insulation of most other main elements of a building is less cost effective, i.e. double glazing, wall and floor insulation, flat roof insulation. Therefore improving insulation in these elements is usually carried out at the same time as the element becomes in need of replacement, or improvement due to condition.

The practicalities of improving, or increasing insulation in building components will also be determined by the type of construction. Improving the thermal qualities of an external wall without a cavity for example, requires either an externally or internally applied insulation layer and this is often impractical and cost prohibitive, involving also significant adjustments to other components to match, such as window openings and roof perimeter details.

Upgrading insulation in the Council's public buildings has therefore largely been determined by opportunity, both in terms of whether building elements have needed to be replaced and also in terms of whether the original construction of the building element lends itself to additional insulation material being incorporated.

Examples of measures undertaken are-

Swimming Pool covers-	Leisure Centres.
Replacement double glazing-	Arnold, Calverton and Carlton Forum Centres, Jubilee House and several Community Centres.
Increased pitched roof insulation-	Arnot Hill House, Civic Centre, and several Community Centres.
Increased flat roof insulation-	Arnold, Redhill, Calverton and Carlton Forum Centres, Jubilee House and sections of Community Centres.

Energy efficient equipment

Within public buildings energy using equipment includes, gas boilers, electric heaters, gas and electric water heaters, heating pumps, air conditioning units, ventilation units and fans, lighting, kitchen/catering/bar appliances, fitness equipment, I.T and general office equipment and numerous systems requiring power sources such as burglar and fire alarms, door entry systems, lifts, CCTV, automatic doors, heating controls,

intercoms, public address and sound systems.

With most significant energy using appliances, advances in technology and tighter regulations have enforced manufacturers to improve the energy efficiency of their products over the years and the Council have therefore generally improved the energy efficiency of equipment as a natural consequence of replacing the item.

As with upgrading insulation in the building elements, upgrading an appliance usually stems from the need to replace the appliance at, or near the end of, its useful life. This is the most cost effective approach, as equipment replacement cannot normally be financially justified, purely on the basis of the potential energy savings. In this respect the Council has for the most part installed upgraded energy using appliances within the public buildings, but as this has taken place over the period of the last 10 years or so, it cannot be said that all the appliances are the most energy efficient by today's standards.

Examples of measures undertaken are-

Replacement boilers-	Arnold, Calverton and Carlton Forum Centres, all Office and Depot buildings and several Community Centres.
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Heat recovery in ventilation units-	Arnold and Carlton Forum Leisure Centres.
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Alternative fuel/water sources

As part of this Scrutiny Committee's exploration into Sustainable Development, work is due to be carried out to investigate the options, implications and costs of increasing the Council's use of renewable sources for public buildings, in particular wind and solar energy. However the Council has made use of alternative fuel and water sources in certain circumstances. As with any other energy and water saving initiative, the practicalities and cost effectiveness of installing the measure has dictated its implementation and limited widespread use in all Council buildings.

Rainwater recovery systems have been installed at the Civic Centre and in the Depot and the surface water drainage system for Arnot Hill House has been modified to re-direct rainwater to supplement the Lake, rather than simply go into the main drains. The principle of collecting rainwater to use within a building is straightforward, but establishing a suitable site requires sufficient space around a building to install an underground collection chamber on the existing surface water drainage system. This then also needs to be conveniently placed to pump recovered water to a cold water storage tank. It also requires the original surface water drainage system to have car park and hard standing drainage separate from the roof drainage, to minimise water contamination. Whilst a recovery

system incorporates filters to bring recovered water almost to drinking standards, health and safety issues (including prevention of Legionella), means that only certain water outlets should be supplied in this way. For example, there was sufficient space behind the Civic Centre to install a collection tank on the rainwater system below ground and this could be connected to an existing water storage tank in the roof, from which the internal plumbing connections could be relatively simply modified to limit the rainwater supply to feed toilet cisterns only. In the Depot practical difficulties of connecting to a 'clean' surface water drainage system were overcome by installing the collection tank above ground and contamination concerns were minimised by choosing to feed the vehicle wash storage tank.

Examples of measures undertaken are-

Combined heat and power unit-

Arnold Leisure Centre.

Rainwater recovery systems-

Arnot Hill House, Depot and Civic Centre.

Visit to Gedling Borough Council to discuss Solar and Wind Energy options

Gareth Ellis, Head of Renewables, The National Energy Foundation 9th May 2006

The objectives of the visit were to:

- Comment on Renewable Energy opportunities in the Council buildings
- Present these opportunities to the council Members focusing on wind and solar

The Council buildings comprise an older building (Edwardian or Victorian) and a newer 1980's building where the main Council offices are located.

Older building

The older building has limitations in terms of energy efficiency as it is protected building making the application of wall insulation and double glazing difficult to implement without visual impacts. Certain renewable energy options may present the best opportunities for reducing carbon emissions. Two options, which could be fitted with little or no visible impact, would be a biomass (wood pellet) boiler and a solar water heating system. The former would fit in or near the existing boiler system with the cycle shed allowing an option for fuel storage. The solar water heating system would fit on the roof near to existing hot water storage. The roof in question is not readily visible from the ground but should provide good exposure to the sun (although shading effects should be checked).

A small wood pellet system with store could start at around £10,000 to £15,000. They are easy to maintain and largely automatic in operation. The optimum size will depend on the size of the existing system and whether a back up fossil fuel boiler is used. Currently however wood pellets are just as expensive as gas. This would not make wood pellet an obvious choice economically and so the option of a wood pellet boiler should perhaps be reviewed when the existing boiler is due for replacement.

A small solar water heating system would cost from around £3,000 to £4,000 (slightly more than a typical domestic system because of the poor access to the roof). Depending on the pattern of use and the cost of gas the simple payback could be around 10 to 20 years. Perhaps an incentive to consider solar is that for a low overall cost it could have an iconic status with cyclists taking showers in the building able to say they are using solar energy.

Newer office building

The distributed nature of the building heating systems does not lend itself to a biomass boiler or heating system. However given that the open plan areas of the building have underfloor heating and there is a lot of green space around the building then ground source heating could be an option. Ground source heat pumps give savings in CO₂ and running cost when compared with gas heating.

They operate most efficiently when coupled to underfloor heating systems. They also can have the option to provide “free” cooling using lower temperatures in the soil over the summer months (as well as the relatively warmer temperatures in the soil in winter months). This latter point could be important for the council chamber, which currently uses air conditioning. It is difficult to estimate the cost of a suitable system to cater for the relevant part for this building. However as an example the NEF offices have a 13 kW heat pump costing £18,000 installed and heating a 430 m² energy efficient building.

The building has an extensive roof space facing south. This lends itself to solar water heating (as in the other building) particularly as there is hot water storage adjacent to some south facing roof. However solar water heating does not take up much space (a typical domestic system only covers 3 or 4 m²). The other opportunity here is Photovoltaics, which can take up large areas of roof. One kW of peak output can take up around 10 m² and will output 800 kWh per annum of electricity. So around 50 m² would give around 4,000 kWh per annum (mainly in the summer months). This could be exported if weekend use of the buildings is low. A 5 kW system covering 50 m² would cost some £25,000 and payback would be in excess of 50 years before grant.

The other option considered was wind energy. The general area is very windy with the national database of windspeeds suggesting that average wind speeds for the local area is in excess of 5.6 m/s at 10 m height and as much as 6.8 m/s at 45 m. The latter would be attractive for a wind farm developer if it were not for the obvious planning constraints locally (nearby housing which ideally needs to be 500 m from large wind turbines). However the office building itself is well sheltered by trees. Also the complex nature of the roof would make it difficult to be sure how to site a wind turbine on the roof without encountering a lot of turbulence.

There is a significant hill adjacent to the council building, which could be ideal for a small to medium sized wind turbine. Something like a 6 kW or 15 kW turbine would still be far enough from houses to not be a noise nuisance (c 70 to 100 m). Assuming a wind speed of say 6 m/s at 15 m hub height then the output of such a machine could be 16,000 kWh (6 kW) to 40,000 kWh (15 kW). For a cost of £22,000 (6 kW) to £45,000 (15 kW) and assuming electricity value of 8 p/kWh then a simple payback of around 14 to 17 years is possible before grant. Note the electricity value will need analysing in detail it could include 3 to 5 p/kWh for ROCs (Renewable Obligation Certificates) as well as the offset value of existing electricity imports or the value of exporting the electricity.

Grants

Whichever option is pursued all the above will qualify for grant under the Low Carbon Building Programme – probably at a rate of 50% within limits for a public building – although details have yet to appear for Community projects on the web site www.lcbp.org.uk.

For more information contact Gareth Ellis on 01908 665555 or gareth.ellis@nef.org.uk