Kent County Council

AGENDA

SELECT COMMITTEE - RENEWABLE ENERGY

Wednesday, 21st April, 2010, at 1.30 pm
Wantsum Room, Sessions House,
County Hall, Maidstone

Ask for: **Christine Singh/Sue Frampton**
Telephone **(01622) 694334 or 694993**

Tea/Coffee will be available before the start of the meeting in the meeting room

Membership

Mr K A Ferrin, MBE (Chairman), Mr C Hibberd, Mr D A Hirst, Mr R E King, Mr T Prater, Mrs P A V Stockell, Mrs E M Tweed and Mr C P Smith.

UNRESTRICTED ITEMS

(During these items the meeting is likely to be open to the public)

Item No

1. Minutes of the meeting held on 14 April 2010 (to follow) (Pages 1 - 36)

2. Briefing material and suggested themes and questions for today's session (Pages 37 - 52)

3. Interview with Sue Barton, Strategic Projects and Business Development Manager, Kent County Council

4. Interview with Dan Gillert, Commercial Manager, Living Fuels

5. Interview with Rob Asquith, Director of Land and Planning, New Earth Solutions

EXEMPT ITEMS

(At the time of preparing the agenda there were no exempt items. During any such items which may arise the meeting is likely NOT to be open to the public)

Peter Sass
Head of Democratic Services and Local Leadership
(01622) 694002

Tuesday, 13 April 2010

KENT COUNTY COUNCIL

SELECT COMMITTEE - RENEWABLE ENERGY

MINUTES of a meeting of the Select Committee - Renewable Energy held in the Bewl Room, Sessions House, County Hall Maidstone on Wednesday, 14 April 2010.

PRESENT: Mr K A Ferrin, MBE (Chairman), Mr C Hibberd, Mr R E King, Mr T Prater, Mrs P A V Stockell and Mrs E M Tweed

IN ATTENDANCE: Mr P Binnie (Head Of Operations), Mr A Morgan (Energy Management), Mrs R Spore (Head of PPP/PFI), Mr J Thorp (Group Managing Director, Thameswey Ltd) and Mrs C A Singh (Democratic Services Officer)

UNRESTRICTED ITEMS

8. Minutes of the Meeting held on 31 March 2010

(Item 1)

RESOLVED that the Minutes of the meeting held on Wednesday, 31 March were agreed.

9. Presentation by Andy Morgan, Energy Manager, Peter Binnie, Head of Property Operations and Rebecca Spore, Head Of Ppp/pfi*

(Item 2)

(1) Mr Binnie gave a brief account of the renewable technologies being introduced at Oakwood House, Maidstone (Oakwood House has 40 en-suite bedrooms) and gave an outline of the ideas for an Energy Centre at Oakwood Park Campus, Maidstone. (Further details are attached to the minutes as Appendix 1).

(2) He advised that heating for the new bedroom block at Oakwood House was supplied by electricity and the grid limits for the site had been reached. As there was to be an extension to increase the number of bedrooms there was an opportunity to use renewable sources of energy at the site. Consultants were appointed and the option agreed for the site, due to the available land, was a ground source heat pump which would provide 60% of the annual heating load plus solar panels producing 15% of the energy required for hot water for the 40 bedrooms. This project is now complete and will shortly be appraised.

(3) Mr Binnie added that this project led to the idea of an energy centre to serve the whole Oakwood Park Campus with the cluster of buildings consisting of schools, colleges and universities. This was very much at the embryonic stage, although sources of potential funding had been identified.

(4) Mr Morgan referred to an aerial map of the Oakwood Campus advising that there were; 2 Universities, 3 Secondary Schools and 2 Primary Schools which were all publically owned. They all used mainly gas boilers and electricity from the main grid. (Further details relating to the proposal are attached to these minutes as Appendix 2.)

(5) The total energy bill for Oakwood Park Campus was estimated (based on ground area of sites only) at £ ¾ m, which represents a significant amount of CO_2 emissions from the site.

(6) An energy centre at the site could be of benefit both financially and in terms of reducing in the CO^2 footprint. Barriers would include the diverse ownership of the buildings; the majority would have to be on board for proposal to be viable. A major factor would be tying in with the Building Schools for the Future (BSF) and Academy development. New schools must be 60% lower in carbon output than Building Regulations stipulate.

(7) Of the 3 secondary schools on the site; Astor of Hever was to be an Academy; regarding St Simons Stock there was a concern about finance; and Oakwood Park Boys Grammar School was to be rebuilt, with timing phased later in the BSF programme (2016/2017) if plans were on track.

(8) There had not yet been any discussions with the College but Mr Morgan was aware there were plans for the College's redevelopment which had run into financial difficulties.

(9) The Select committee were advised that there was a recently established Stakeholder Group which was starting to collaborate looking at ideas for the whole campus.

(10) The Chairman suggested that the universities and colleges would be feeling the pinch with the current cuts in funding and Mr Binnie advised that the University of Creative Arts had considered vacating the site but would now be staying for at least 8 years.

(11) Mrs Tweed enquired why the University had such a large bill and was advised that the energy costs were estimated on the basis of floor area and this was a large establishment. Mr Ferrin added that the building was high and there were a number of kilns which may add to the energy requirements.

(12) In response to a question by Mr Hibberd, Mr Morgan advised that he had not been in touch yet with anyone else who had built a CHP plant. A number of universities had done this as each campus comprised separate units and facilities. Economically there was the issue of term times and the need for the energy supplier to stay in business throughout the year. There was also experience of hospitals using CHP. Mr Binnie advised that he had worked for a university in the past which had a ring main with an energy centre and excess energy would be sold back to the grid, earning an income when the site was not being used. It was acknowledge that this would depend on the Grid wishing to take the energy.

(13) In response to a question about the idea for an energy centre, officers concurred that there were no firm plans but they were in favour of a gas CHP system or a biomass boiler for heat provision, but a lot more analysis was needed.

(14) The Chairman remarked about gas not being a renewable source and there was a discussion regarding whether the two could be combined. Mr Morgan advised that

they could but it would depend on the balance of costs and benefits as well as the needs of the site.

(15) The Chairman sought some clarity as to how realistic the project would be in the current political climate with a general election in May and questions about the future of the BSF programme. It was felt that the Academies programme would survive but acknowledged that secondary schools were suffering financial difficulties and some were almost bankrupt. The cost-saving aspects of the scheme could make it more attractive to schools as if, for example, new schools were built they would not need to build a boiler house or have the concerns regarding boiler maintenance.

(16) In response to a question by Mrs Tweed on whether the existing schools could have ground source heat pumps, Mr Morgan explained that work was being undertaken to look at systems for existing building stock. All the buildings on the Oakwood Park Campus were in need of attention all were interlinked, which meant that any problem with one meant a knock on effect which needed to be addressed. There needed to be efficiencies even if BSF did not progress.

(17) Mr King suggested that with an annual energy bill of £¾m for the Oakwood Campus there was a basis to do something to improve efficiency. He questioned how the capital investment would be reached and how this would be written off over 30 years. Mr Morgan advised that the Low Carbon Buildings Trust had not been interested in the Oakwood House scheme but in principle would offer support to a larger scheme for Oakwood Park.

(18) Mrs Stockell felt that this was an excellent place to start and that it was the right time to carry out such a project. She said that she would give her support to commissioning consultants and suggested that this could be a flagship energy centre. Mrs Stockell felt assured that Maidstone Borough council would also give its support and said that the schools and universities on the site were full and doing well on this popular estate.

(19) Mr Prater felt that the site had a number benefits such as a large area to make it suitable for ground source heat pumps. He asked about the capital cost and payback for the work at Oakwood House and Mr Binnie advised that the cost of the ground source pump and solar thermal system was £150,000. The ground source pump would pay back over 8 years and it was closer to 15 years for the solar panels but these were by way of trialling a new system.

(20) Mr Prater suggested that when the consultants were appointed to look at the project for Oakwood Park Campus, they should be initially steered to looking at renewable options since if gas was used, this would not be a renewable option. There were ground source heat pumps, photovoltaics, solar thermal and biomass which could be used to ensure the project was a flagship project. Consultants would need a steer on this since if we said ‘the cheapest’ they may opt for something that would not enable a renewable flagship project.

(21) The Chairman asked when the school boilers would need renewing and Mr Binnie indicated that most needed replacing now.

(22) The Chairman was concerned about the viability of the project given the number of different bodies involved and the timescales, as the Academy was due to open on

the site in 2011. Rebecca Spore advised that the Academy would open in January 2011 in the same buildings and the new building would start in summer 2012, and finish in 2014. It was under the feasibility and active design part of batch 2 procurement. Mr Ferrin indicated that there was a window between now and summer 2012 and Rebecca Spore agreed that if the Academy was to benefit we would need to scope and be ready before the detailed design of the Academy.

(23) Mr Hibberd urged that we find other ways to generate electricity apart from with steam turbines since there would be great pressure on all public bodies to do so and he therefore felt that the committee should at least sanction a feasibility study.

(24) Mrs Stockell commented about extended schools and the fact that as a result, energy cot would go up and up. Mr King agreed and suggested we 'think outside the box' looking at ways to use surplus energy and heat.

(25) The majority of Members agreed that the officers should go ahead and appoint consultants to conduct a feasibility study, while at the same time gauging the stakeholders' support for the project as the deadline for instigating the project was tight.

(26) Mr Binnie indicated that there was a potential cost of £50,000 for a full feasibility study and that the question of surplus energy had been discussed. With support from the Carbon Trust the cost could be a lot less; it remained for the right specialist to be found.

(27) The Chairman asked a question about grid connections at the site Mr Binnie advised that the grid was at maximum capacity. The only thing which had prevented them acting before was the need for support and the fact that the issue was cross directorate.

(28) A discussion took place about the size and energy needs of the buildings on site and that those rebuilt were likely to be more compact and have lower energy needs.

(29) The Chairman suggested that officers submit a report direct to the Cabinet Member, stating that the Select Committee were supportive of further investigation of the proposal, rather than via their individual Directorates, as a matter of urgency.

(26) RESOLVED that the Chairman and Select Committee Members thanked Mr Binnie, Mrs Spore and Mr Morgan for attending the meeting and that a progress report be submitted to the Select Committee at a future meeting.

10. Presentation by John Thorp, Group Managing Director, Thameswey Ltd
(Item 3)

(1) The Chairman welcomed Mr Thorp to the meeting and asked him to begin his presentation. It was agreed that Members would ask him questions throughout rather than waiting till the end.

(2) Thameswey Limited was an energy and environmental services company, wholly owed by Woking Borough Council and was the only one of its kind in the country. It was established in 1999. Thameswey Limited acts as a partner to Woking Borough Council to invest in combined heat and power plant (energy stations), to sell

heat and power in an environmentally friendly way, with a view to improving the environment within the Borough. In May 2000, Thameswey Limited invested in its joint venture company, Thameswey Energy Limited, to finance the first energy station in Woking Town Centre.

(3) Mr Thorp began his presentation, which is attached to these Minutes as Appendix 3. He explained that he was a marine biologist so was familiar with Climate Change issues, but did not have an engineering background. If engineering-related questions arose he could refer to experts in his organisation.

(4) Mr Thorp advised that since 1990 there had been the following achievements:

a. Corporate

- Energy Consumption Savings (2008) -31%
- CO_2 emission reductions (2008) -29%
- Sustainable Energy CHP Self Generation (2008) +41%
- Renewable Energy Self Generation (2008) +2%

b. Borough Wide

- Energy efficiency of residential property (up to 2008) +35%
- C02 emission reductions (2008) -21%
- Number of households assisted with energy
- conservation grants (1996 – 2008) 5,072

(5) At one time Woking had 9% of the UK's installed photovoltaic panels but in the last 2 years BP had replaced them due to a fault. Mr Thorp envisaged that in due course the 2% renewable energy figure would rise considerably.

(6) Across the Borough, energy profits were reinvested. None of the money went into general revenue; it was boundaried and spent collaboratively by the Borough Council and the Company on sustainable activities.

(7) The three aims were; Reduction of CO^2 equivalent emissions, adaptation to climate change and promotion of sustainable development.

(8) Mr Thorp outlined how Woking work with developers (who often want to reduce their costs by locating outside of central London) so that both parties achieve their aims. He used the example of developers wishing to build apartments often as high rises close to the station and the way that the company can integrate these with the carbon reduction aspirations of the Council by working with developers as early as possible. In this way they are able to forecast what developers are likely to want in the next 25 years.

(9) Furthermore, they are well aware that developers do not want a lingering association, or to monitor sustainability so Thameswey offer ESCo services enabling developers to complete their project, earn their fee and leave.

(10) This process is facilitated by C-Plan (leaflet attached as Appendix 4) which is an interactive online workflow process for developers and planners and avoids the sometimes adversarial nature of the relationship between those two groups.

(11) Discussing the core town centre CHP plant, Mr Thorp advised that this is at the side of a multi storey car park, taking up 6 parking spaces on 3 floors. It runs on natural gas from the gas grid and provides electricity and distributed heating to buildings in the central business district on a private wire network. The company also moves its power across the EDF network, paying them distribution use of system charges (DUOS)

(12) A fuel cell adds back up heat and electricity for the swimming pool and leisure centre. All buildings can operate in island mode. If the grid goes down, the location is still self sufficient in electricity and heat. CHP recovers heat as well as generating electricity providing efficiencies of up to 90% instead of the central power stations/national grid system which could be as little as 25% efficiency at the point of use.

(13) Photovoltaic cells have been placed on social housing roofs and Members were also advised of the solar canopy erected above Albion Square stretching from the railway station entrance to Albion House in Woking. The canopy is equipped with photovoltaic cells to collect solar energy to light the canopy which provides a covered social space and link between the station and the central business area. The canopy is approximately 34 metres in length and 22.5 metres in width. The glazed roof includes over 35,000 photovoltaic cells, laminated in 272 glass panels having a peak electrical output of 81 kW. The PV cells cost £437,000 to install, offset by a grant from the Energy Saving Trust of £370,000 and the net cost will pay back in 7 years. The energy generated is in excess of that required to light the canopy, and any surplus energy is exported to other council sites and the EDF grid.

(14) Mr Hibberd commented on the non-availability of such grants today, which is the case. However Mr Thorp indicated that with the Feed-in Tariff now in place, those people installing PV panels would get an amount based on installed capacity and export of electricity.

(15) Mrs Tweed commented on the large redevelopment in Ashford where there were huge opportunities for the town and Mr Thorp agreed that where there is development we should think about sustainability and how to incorporate renewables.

(16) Mr Thorp went on to explain how Thameswey had acquired ESCS in order to secure himself and his staff to provide management and support for Thameswey.

(17) Mr Ferrin asked about the relationship with social housing stock and this was purely on an energy supply basis. (deleted)

(18) Woking's arrangements are unique in that they are vertically integrated and Mr Thorp pointed out that 451 other local authorities had not followed their lead.

(19) Mr Thorp advised that it was essential to have a business plan for sustainability. His company was looking at a return of 8% overall for projects over 30 years and this was 12-12.5% outside Worthing over 30 years. Work described in Milton Keynes should return a net 23.5% over 30 years. Mr Thorp added that in addition Thameswey borrow money from Woking Borough Council who borrow from the Public Works Board at 5.5%. Woking Borough Council makes a profit of £750,000 per year on the money Thameswey borrow from them for entrepreneurial, non statutory services.

(20) The economics of an ESCo are in the generating, distribution and retail markets of energy. The economics do not work when selling wholesale to the Grid. Thameswey have an Exemption Licence C Class from Ofgem, have metering and billing services and carry out their own customer relations work.

(21) In response to a question from Mr Ferrin about whether Thamewey actively market their services, Mr Thorp indicated that regarding domestic energy this was usually tied in to the normal network. The in-house call centre sells electricity to private householders and businesses.

(22) In response to a question from Mr Prater regarding the Feed-in Tariff, Mr Thorp indicated this was only in relation to renewables and so did not apply to the gas CHP. He further stated that he felt there was a problem with the Renewable Heat Incentive (RHI) since district heat networks were not well developed therefore renewable heat networks were not well developed. He believed the process should have begun with a heat incentive, then a sustainable heat incentive, then a renewable heat incentive. It is currently envisaged that companies using fossil fuel will pay a levy on their fuels to support RHI and he therefore opposes the RHI levy.

(23) Mr Thorp explained how his company was enabled to be competitive by having a 30 year business plan as they could offer electricity prices 5% below that offered by a dual fuel basket of five major suppliers (measured on a quarterly basis). He stated that Thameswey do not exclude third party suppliers since they were always able to undercut them by charging suppliers to move their power across the private wires.

(24) Regarding heat supplies, Thameswey was the only supplier and Mr Thorp explained that apartments have a heat exchanger. There was no gas supply since Thameswey use, but do not supply gas. The price charged for heat was based on the most energy efficient gas boiler on the market thus ensuring this would always be competitive.

(25) In response to a question from Mrs Tweed, Mr Thorp described the CHP concept, saying that due to the collection of waste heat, there was always a heat supply and users had independent control of heating and hot water in their apartments.

(26) In response to a question from Mr King about heat distribution pipes Mr Thorp referred to a slide showing heat pipes in Milton Keynes, saying that there was almost no noise, vibration or heat from the well insulated energy station. The building is ‘hemmed in’ and hidden within the city centre. CHP in Woking blends into the townscape however there has been an issue where residents have several times called the Fire Brigade thinking a car in the multi storey car park is on fire (due to the steam). Main heat distribution pipes have a diameter of 450mm and they are placed in a 2m x 2m trench. With thick insulation, heat loss is less than 0.1degree Celsius per kilometre. Thameswey pump heat at a variable flow but at constant temperature. Closer to where the heat is required pipes go down in size and are in a trench measuring 0.5m x 0.5m. In placing the underground pipes Mr Thorp recalled instances where there was a necessity to dig in to roads as it was not known where services were on the central reservation.

(27) Mr Thorp told Members about a development of key worker houses in Woking Borough where there was an equity scheme, all of which were built to Code 5 or 6, all with PV panels and insulation with polystyrene, concrete and polystyrene layers inside the brick outer layer. These homes cost 50% more than Code 4 (current Building Regulations) but will be sustainable over a very long period. They allow for the retrofitting of lifts should these be required by residents as they get older. Appliances are A* rated; electricity is by private wire; (deleted)

(28) In response to a question from the Chairman, Mr Thorp indicated that in Milton Keynes to lay the piping for the district heating system cost £1000 per metre and that the furthest points from the central core were at 400m distance. If a system was needed for, say a group of 50 houses, plus offices and a hotel 500m to 1km away they would put in a small CHP close to where it was needed. He indicated that it was always necessary to be able to sell to the heat. Heat production/sale limits constrain the supply of the electricity as it is required to make the margins on production and sale.

(29) To provide services on a district basis Thameswey had carried out spatial analysis on Woking to see where the energy stations were needed. S106 could be used to connect to the existing area network. Developers are happy to pay the cost that would be incurred to install boilers, to Thameswey to enable them to fund a supply to them. It could be cost neutral to developers.

(30) In response to a question from Mr Prater, Mr Thorp explained that the company get the retail margin over a long period, but up-front would have negative cash flow and hence were always pre-investors. An added advantage to developers is they have no cabling to put in. Thameswey get the heat free of charge so the retail margin on it is high and despite the high capital investment, costs can be recovered.

(31) Mr Ferrin posed a question about what was being gained in terms of CO_2 output and whether CHP was in fact a good deal for the environment, in response to which Mr Thorp indicated that CHP compared favourably with electricity from the grid due to their being no losses in transmission. He also used the example that in a toaster 16% of the energy from the grid reaches the toaster to brown the toast since the system is inherently inefficient, whereas in a CHP supplied area 85% does so. Carbon figures fro the two are:

i. CO_2 per MW electricity from the grid 550g
ii. CO_2 per MW from CHP 250g

(32) Mr Hibberd added comment about the efficiency of grid electricity being 35% whereas burning gas in a CCGT (combined cycle gas turbine) electricity had around 65% efficiency.

(33) Responding to a question from the Chairman about equipment supply (Woking's CHP uses converted marine diesel plant), it was stated that there had been no problems obtaining the plant from Austria and in addition, that there was a huge market for CHP anywhere but England. In Denmark for example, there were circumstances to encourage CHP such as no new housing being built with electric space heating and district heating beings used instead of retrospective gas grid connection for anywhere with no gas grid.

(34) The Chairman asked whether there was a minimum size for CHP and there was not; there were domestic-size micro CHP systems. In summer when the heat is not required it has to be switched off or wasted so for the most economic system there should be a 24 hour heat load. (CHP can also be used for cooling and this too is the case at Woking, with piped cold, piped heat and electric wires sitting alongside in the same trench.)

(35) The preferred type of development for CHP would be a mixed development with housing, light industry and it is also ideal for swimming pools. Without a balanced heat load a development is not suited to CHP and more suited to district heating boilers and grid power. Maidstone prison, in close proximity to Sessions and Invicta House was another example given of an ideal scenario for an economic CHP system. Schools, however, were not ideal but would be if next to a housing development to generate a balanced heat load.

(36) There followed a discussion about gas and Mr Thorp indicated that in Germany 6% is generated anaerobically (biogas) but he felt it would take some time for the UK to reach this level of renewable gas injected into the grid.

(37) Regarding biomass, Mr Thorp said considerations were the Clean Air scenario, fuel storage, delivery and maintenance; it therefore not being suited to a confined space. He was aware of problems with fuel supply and management organisations not responding to these problems. He had looked at adding biomass to the system at Milton Keynes but had concluded that it would operate only for 3 hours per year in a back up situation.

(38) Mr Ferrin indicated that CHP was about energy efficiency rather than being a renewable energy solution and that a basic understanding of the economics was needed. Mr Thorp responded with information in relation to the Milton Keynes Project which served 1000 apartments and 300 commercial properties with 6MW installed capacity in an energy station and infrastructure network costing £23million. Eventually the system will have (deleted) two energy stations (a £40 million investment will be required to provide that level of activity). For Thameswey the project will reach break even by 2016, the money having been obtained through shares or commercial paper. It will turn into a long term investment for the remainder of the business plan, becoming cash positive in 2018. Billing turnover will be around £800,000 per quarter. However the development has stalled and no new buildings are currently coming on stream but Thameswey have accounted for substantial capital expenditure, and Mr Thorp added that over a 30 year business plan, two recessions could be expected.

(39) In response to a question about customer choice Mr Thorp indicated that the private wire was connected to the National Grid for synchronisation and if the CHP engines ‘go down’ customers would experience a seamless service.

(40) A further discussion took place about why a developer would choose CHP and the reason for this was the price neutrality, and the sustainability achieved by the reduced CO_2 emissions.

(41) A question was asked regarding whether Woking had made it a planning condition that CHP be used and this was not possible. However Woking can make a particular CO_2 profile a condition of development (which can be met by using CHP).

(42) The Chairman asked whether, as an independent company, there was a market in purely commercial terms and Mr Thorp responded with the example of Utilicom which operated as a fully commercial business, supplying Southampton and Birmingham without subsidy from the councils concerned.

(43) In response to a question about the money borrowed from Woking, Mr Thorp indicated that Woking was one of the most heavily indebted councils in Surrey and there was some nervousness regarding the long term business plan i.e. a 30 year business plan which councillors believe is difficult to explain to the electorate. However, Mr Thorp believed that debt is good for an entrepreneurial council.

(44) The Chairman was very impressed by the model and recommended that Mr Harlock from KCC should speak to Mr Thorp, who pointed out that the credit for the model should go to Ray Morgan, now the Chief Executive of Woking Borough Council and the then leader of the Council, Mr Jim Armitage who started the idea in 1990.

(45) Mr Thorp indicated, regarding providing advice to Local Authorities, that a first meeting would be free and then on a commercial consultancy basis.

(46) Considering the situation of Kent and the vast development taking place, Mr Thorp said that if sites were not on a gas grid it was more viable, but that housing developments alone were not good for CHP.

(47) Mr Hibberd agreed with the Chairman and added that having looked at the possibilities of solar heating in Thanet, this had opened his eyes to other possibilities.

(48) Mr Thorp added that old mine workings could be used as a CHP heat source.

(49) The Chairman spoke of a previous investigation of anaerobic digestion which worked well in relation to a Lille operation to power buses. However currently in Kent we are committed to thermal treatment at an Energy from Waste plant for 25 years. Mr Thorpe indicated that Surrey County Council had investigated these issues and decided to proceed only with a pyrolysis plant.

(50) In Germany anaerobic digestion had been used for some time, with gas injected into the grid. Gas companies were compelled to subsidise a £1.5 million injection facility and had reached 6% of the total. Mr Thorp did not expect UK to reach this proportion for 20 years, in competition with North Sea Gas, and gas from Ukraine, Russia or Libya and believed difficulties would relate to price and not supply since no one utility had enough buying power.

(51) Mr King indicated that it should be borne in mind that municipal waste arisings were considerably less than those arising from the commercial sector, which could provide a great deal of material for anaerobic digestion in response to which the Chairman indicated that commercial waste contained a high proportion of rubble and that Supermarkets such as Sainsbury's had begun to set up anaerobic digestion.

(52) In response to a follow-up question from Mrs Tweed regarding the PV Canopy in Worthing, Mr Thorp indicated that last year it had produced 42,000 kW hours of electricity as compared to its theoretical maximum production of 60,000 KW hours. In

general its performance is 60% of theoretical maximum. Lights on the canopy are powered by the PV and excess power is exported to the Grid (deleted). Grid power is imported to power the canopy lights at night. The net pay back time will be 7 years with net benefits of around £12-13,000 per year.

(53) Members were given a hand-out showing the C-Plan interactive tool (attached as Appendix 5).

(54) The Chairman and Members thanked Mr Thorp for attending the meeting.

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Appendix 1:

Property Group - Oakwood House - Maidstone
Bedroom Block Renewable Energy Case Study

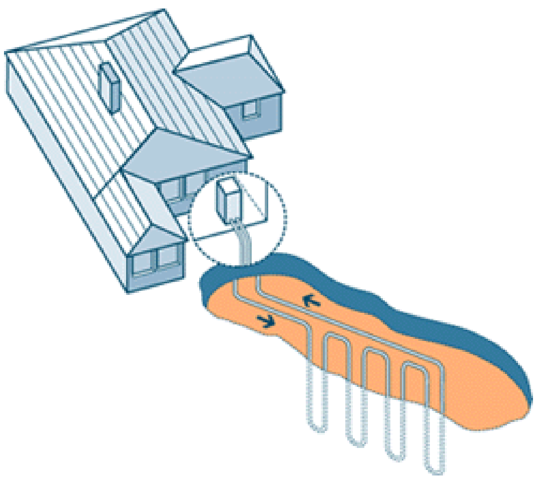
As part of the modernisation of assets programme a project was identified to modernise and refurbish the bedroom accommodation at Oakwood House in Maidstone. The accommodation comprised 36 rooms with en-suite facilities that were dated and particularly inefficient in the use of electrical heating and hot water systems, it was therefore decided to progress with a project for a major overhaul and refurbishment.

A works project was set up and an Architect and Service Engineers were appointed to design 40 new bedrooms to include for 27 standard rooms, 12 superior rooms and a large presidential suite. Due to the original rooms having electrical heating and hot water supplies and the overall site supply being at its limit a top priority for the project team was energy reduction and the incorporation of renewable energies. It was therefore decided to make an application for funds from the Exemplar projects fund in the Environment Highways and Waste (EHW) directorate and funding was granted for us to incorporate ground source and solar heating systems.

Ground Source Heat Pump (GSHP)

Being in its own grounds with extensive garden areas it was decided to utilise a ground source heat pump system for heating. The preferred design option was for a gas fired rather than electrical system because it would run at higher temperature and allow for smaller radiator sizes in the bedrooms. This however precluded us from obtaining a Government grant from the Low Carbon Building Programme because grants at the time were only associated with electrical systems. It was considered that the gas fired system would serve two purposes, the first being that it allowed for smaller radiators where space was at a premium in the smaller rooms and secondly it allowed us to trial an innovative system.

The design team completed their design with a gas fired system to provide heating for the entire bedroom block and a deep well system was chosen as the most appropriate solution. This has been installed, tested and commissioned and is now in full operation and being monitored.



The system has been designed and installed by Earth Energy Ltd and has an output of 30KW.

Energy Benefits

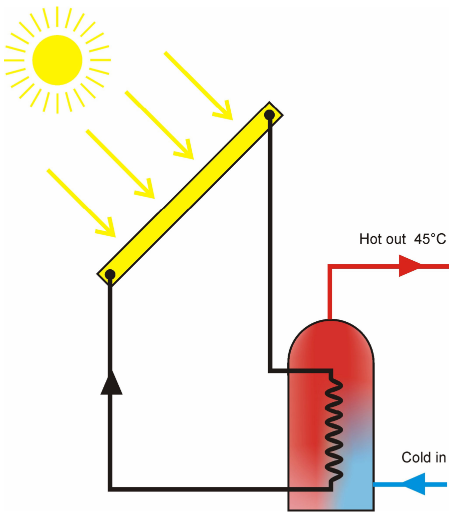
Annual Heating Load	165,830kWh
Net Energy Delivered by GSHP	86,232 (KWh/pa)
Carbon Emissions Reduction	17 (Tonnes/Year)
Carbon Emissions Reduction %	52 % of heating design load
COP of GSHP	2.5
Gross efficiency of Boilers	85%
% of Heating from GSHP	52%

Solar Hot Water

Solar Hot Water is a well proven technology and compared to other renewable technologies is relatively inexpensive and cost effective with low maintenance. Funding for this project was been granted as with the ground source heat system from the Exemplar fund managed by EHW.

At Oakwood House 28m^2 of high efficiency evacuated tube collectors have been located in a south facing position at about 30º to the horizontal on the "inner "roof of the accommodation block. Access is gained through a plant room located on the second floor level giving easy access for maintenance and repair.

The panels are a well developed and robust product and are fully installed, commissioned and in full operation providing hot water to the 40 bedrooms supplemented by a gas fired condensing boiler. The equipment installed on this site is manufactured by MHS boilers Ltd and is part of their Auron package



Energy Benefits

Active area of panels	28 (m2)
Energy output from panels	412 kWh/m2 pa
Annual DHW Load	134,262 KWh
Net Annual Energy produced from panels	11,120 KWh pa
Carbon Emissions Reduction	2.17 (Tonnes/Year)
Carbon Emissions Reduction	8.25 (% of HWS design load)

Appendix 2

Oakwood Park Estate -Potential for an Energy Centre?

The Estate

Parkland Estate built on the grounds of Oakwood House, includes a number of public buildings :-

Establishment	Estimated annual energy spend		Estimated annual CO2 emissions (Tonnes)
Astor of Hever School	£	95,070	523
Oakwood Park Grammar School	£	67,870	373
St Francis Roman Catholic School	£	17,570	97
St Simon Stock primary School	£	91,170	501
Oakwood House	£	75,000	500
Mid Kent college	£	151,104	756
University for the Creative Arts	£	229,356	1147
Total	**£**	**727,140**	**3897**

Oakwood Energy Centre

An Energy Centre on the estate could provide some or all of the buildings on the estate with Electricity and/or Heat. The most likely generation sources could be gas (Combined Heat and Power) or Biomass – or a mixture of the two. Solar and Ground Source Heat pumps should also be considered.

Heat could be circulated through an estate wide hot water Heat Main and electricity via an estate electricity network. Electricity grid connection could be maintained in order to export electricity at times of low load on the estate and to improve supply security.

Other options could be investigated such as including a data-centre on the site to provide lower energy and cost data storage and processing, and possibly making use of the waste heat. Provision of central cooling could also be considered.

Because the estate is still mostly parkland it should be possible to find space for an Energy Centre and excavation to lay heat and electricity mains should be less expensive than in a more urban environment.

Potential Benefits

- Significant CO2 savings
- Lower cost energy to buildings on the estate

- Possible income to KCC through energy sales, Feed in tariffs, Renewable Heat obligation, Renewables Obligation certificates or rent.
- Better energy and price security

Potential Barriers

Although all of the buildings on the estate can be viewed as publically owned responsibility for the buildings is spread amongst a diverse group of organizations. The project would be financially risky unless a good degree of commitment is received from all or most of the relevant organizations which would become either shareholders or customers.

The project would be capital intensive and a long term view on recovering the financial investment would be needed.

Timing may be complex as there is a lack of clarity about when or if Building Schools for the Future will have an impact.

Next Steps

Explore Member interest / support

Seek KCC and Carbon Trust funding to commission consultants to carry out high level feasibility study.

Woking Borough Council

Thameswey Limited

14th April 2010

Achievements and Challenges

John Thorp
Group Managing Director
Thameswey Limited

Acting Locally, Thinking Globally

Savings

Corporate

• Energy Consumption Savings (2008)	-31%
• C02 emission reductions (2008)	-29%
• Sustainable Energy Self Generation (2008)	+41%
• Renewable Energy Self Generation (2008)	+2%

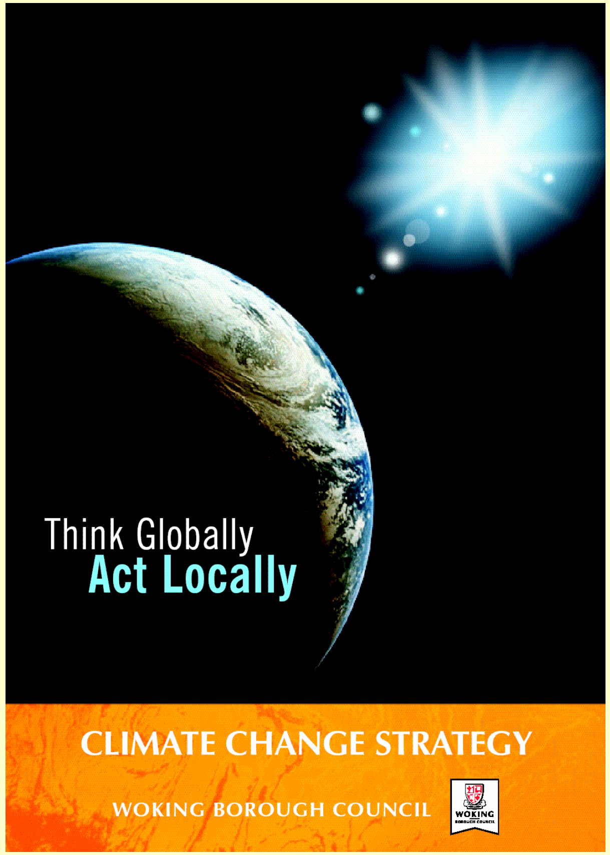
Borough Wide

• Energy efficiency of residential property (up to 2008)	+35%
• C02 emission reductions (2008)	-21%
• Number of households assisted with energy conservation grants (1996 – 2008)	5,072

Climate Change Strategy

Three Overarching Aims

- Reduction of CO_2 equivalent emissions
- Adaptation to climate change
- Promotion of sustainable development



Climate Neutral Development Good Practice Guide

Neutral risk <u>to the climate</u> by not contributing to greenhouse gases and,

Neutral risk <u>from the climate</u> by ensuring development is resilient to changes in climate


I need to submit an energy statement for my development
Developer
I need to check if a development complies with policy
Case Officer
I need to manage receipt of supporting information
Admin manager
PLAN
Carbon Impact Assessment
I need to know the local policies and targets
Architect/
M&E consultant
I need to know the detail of the energy statement
Energy advisor
I need to report on the overall effectiveness of our policies
Policy planner

Town Centre CHP

Gas fired 1.3 MW electrical, 1.6 MW heating; 1.2 MW absorption cooling, island generation

- Thameswey Energy Limited Project
- Private Supply network
- Council Buildings & Car Parks
- Businesses
  - Holiday Inn
  - Big Apple

Thameswey Ltd

Woking Park

-Gas fired CHP 1.1MW electrical,

-Hydrogen Fuel Cell 0.2MW electrical, combined 1.6MW heating, absorption cooling 0.5MW,

-Island generation

- Self sufficient in thermal loads
- Exporter of electrical generation to other TW Energy customers

Thameswey Ltd

Sustainable and Renewable Energy

New build by Council Housing Company of six flats incorporating small scale CHP and Photovoltaic roof tiles in a private wire system

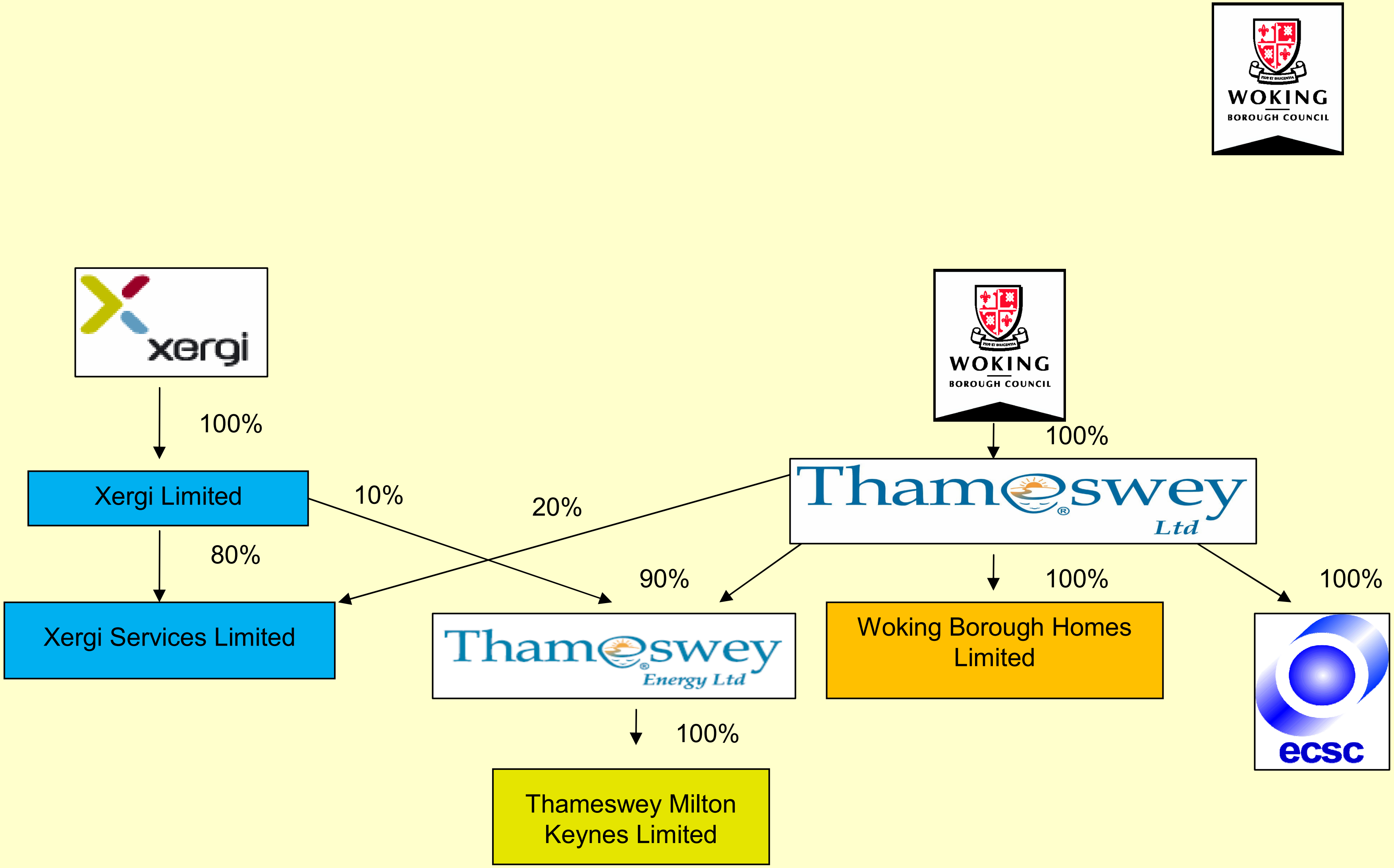
Thameswey® Ltd

Solar Canopy

Woking Borough Council wanted a stunning gateway to the town

35,000 PV cells laminated in 272 glass panels giving peak electrical output of 81kWp

Saves 41 tonnes of carbon dioxide emissions per year


WOKING
BOROUGH COUNCIL
xergi
100%
WOKING
BOROUGH COUNCIL
100%
Xergi Limited
10%
20%
Thameswey
Ltd
80%
90%
100%
100%
Xergi Services Limited
Thameswey
Energy Ltd
Woking Borough Homes Limited
ecsc
100%
Thameswey Milton Keynes Limited

Delivering Energy Generation

Thameswey Energy Ltd

- Twenty to Thirty year project business plans.
- Projects progressed on an internal rate of return of circa 8%.
- Economics rely upon being a generator, distributor and supplier of energy.
- Comparable" charges to businesses and 5% below a basket of major energy company dual fuel tariffs to residential customers.

Milton Keynes Energy Station

Underground pipework

Page 29

Underground pipework

Thameswey Energy Ltd

Efficient Housing

Efficient Housing

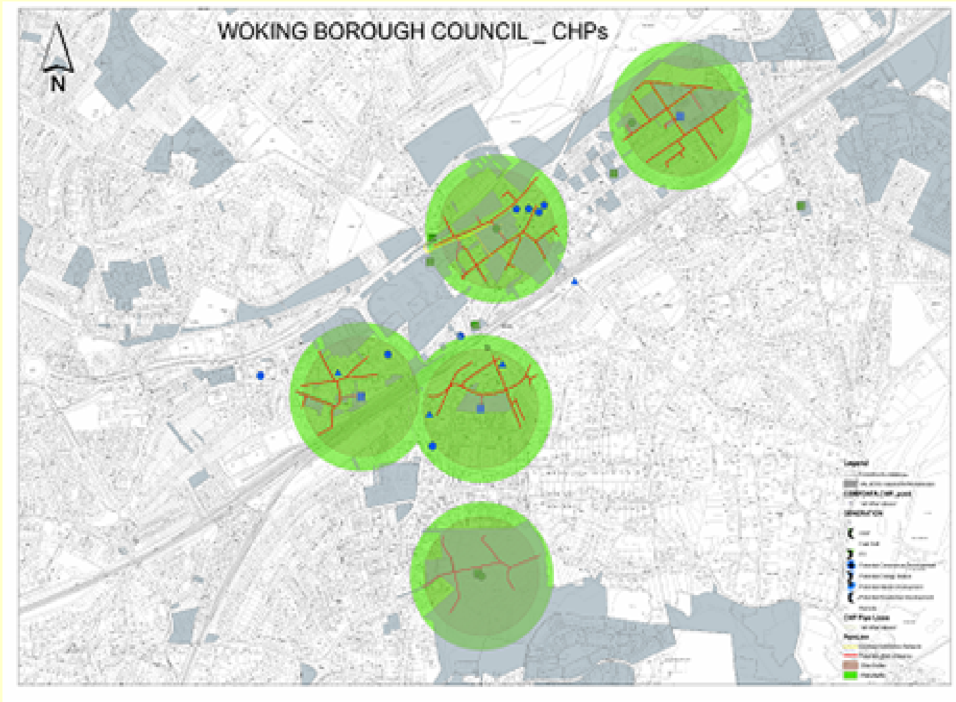
Woking Borough Council
Acting Locally, Thinking Globally

Integrate renewables and CHP wherever possible

Wind turbine feasibility study
1000 Zero carbon homes project

Carbon reduction

Social inclusion and cohesion



Thameswey Ltd

WOKING
BOROUGH COUNCIL

John Thorp MBA MSB CBiol FEI FRSA

john.thorp@ecsc.uk.com

C-PLAN
Carbon Impact Assessment

C-Plan has been developed to enable local planning authorities and developers to achieve fast and effective compliance with sustainable energy planning policies. Configured to meet specific local planning policies, C-Plan uses simple, easy to follow steps to quantify the energy and carbon emissions impact of your development and evaluate renewable/low carbon energy proposals.

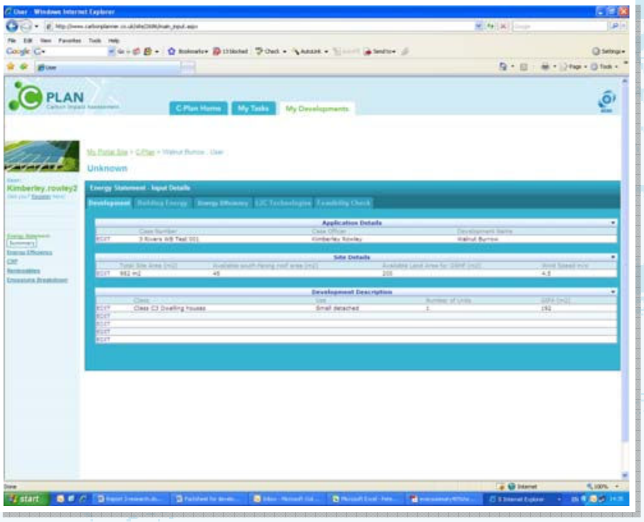
C-Plan: Helping secure low carbon development in Woking Borough Council

Developers of new buildings are increasingly being required, during the early stages of a planning application, to provide information about energy consumption and carbon dioxide emissions of new developments.

Woking Borough Council now requires you to meet specific renewable energy and carbon dioxide targets. Planning applications must show how the proposed development will meet these, which will involve producing an energy statement. The council is encouraging developers to submit their energy statements through C-Plan, which provides a simple and efficient means of checking compliance with the targets.

What is C-Plan?

C-Plan is a web-based collaborative tool, linking together developers and planners. There is no charge for developers to submit their energy statement through C-Plan.



Data input form

How C-Plan can help you

- It provides you with easy-to-follow templates helping you to submit clear, consise information regarding the energy and carbon impact of your proposal.
- It enables you to submit an energy statement electronically to the relevant case officer.
- It keeps track of the status of the approval process of your application, keeping you informed of the decisions that have been reached and whether further information is required from you.

Your energy statement

C-Plan uses the information that you input to generate an energy statement containing all the information needed for the council to assess whether your proposals meet the targets.

It is stored centrally and presented in an easy to understand format which uses traffic lights for key indicators and a range of graphs for carbon emissions impacts.

The Process

If you need to submit an energy statement to Woking Borough Council, and have your energy data available, you will need to complete the following steps:

1) **Go to www.carbonplanner.co.uk and fill in the form on the 'contact us' page.** You will then be provided with a unique password which will enable you to log in to C-Plan via the internet.

2) **Log in and fill in the online questionnaire.** You will be asked for basic details about your development along with the energy efficiency measures and renewable and low carbon energy technologies that you are proposing in order to meet the carbon reduction target.

3) **Submit your energy statement online**. Your development control case officer will receive an email alert and will log in to view the energy statement to assess whether the target has been met.

You will receive an electronic response from the case officer. This will confirm whether the energy statement has been approved or whether further information is required from you.

www.carbonplanner.co.uk

Offline tool

Need help calculating your energy data?

If you do not have information about the energy use and carbon emissions of your development available, ecsc can assist you. We have a highly skilled technical services team who can use C-Plan to calculate your baseline emissions, discuss the appropriate sustainable energy options and produce an energy statement on your behalf. Alternatively our offline tool can help you to evaluate a variety of sustainable energy measures including energy efficiency, combined heat and power and renewable energy.

Contact Mary Rawlinson at mary.rawlinson@ecsc.uk.com or tel. 0207 922 1664. Please note that there is a charge for these services.

How can I find out more?

Go to www.carbonplanner.co.uk or contact Aidan Dunsdon at aidan.dundson@ecsc.uk.com or tel. 0207 922 1667.

ecsc
Energy Centre for Sustainable Communities
Part of the Thameswey Group

Parliamentary Office of Science and Technology

postnote

March 2010 Number 353

RENEWABLE HEATING

Heating accounts for almost 50% of UK energy consumption and associated carbon dioxide emissions. Renewable heating technologies could therefore make a significant contribution towards carbon reduction and renewable energy targets. This POSTnote examines the available resources and technologies for supplying renewable heating and cooling in the UK and the policy options that could support their take up. This briefing does not consider insulation or changes in consumer behaviour that can affect the overall demand for heat.

Background

Heating is required to keep buildings warm, produce hot water, and to supply energy for industrial processes. In total, heating currently accounts for 46% of the UK's energy consumption[1] and 47% of UK carbon dioxide (CO_2) emissions[2]. In 2007, less than 1% of UK heat was generated from renewable sources (Figure 1). Gas boilers are currently the dominant technology for heating and hot water in UK buildings. Industry uses a more diverse mix of fuels for its heat needs, including larger proportions of carbon intensive oil-fired and electric heating.

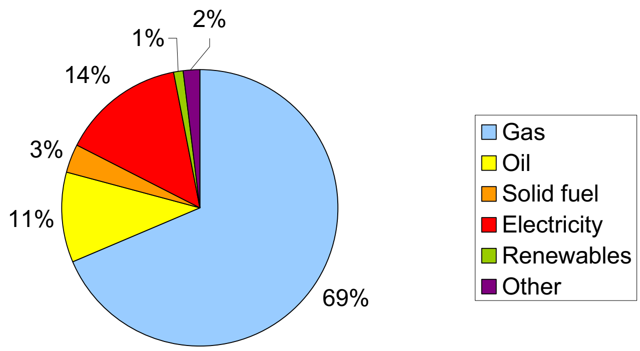


Figure 1 - Fuel mix for UK heat generation in 2007 (ref.1)

Meeting Heat Demand

Unlike electricity, heat cannot be transported efficiently over large distances. As a result, it must be generated close to where it is consumed, at a wide range of temperatures and scales. Some large industrial processes require heat in excess of 400ºC, while buildings are comfortable at 20ºC. Furthermore, the demand for heating in buildings varies widely with the design, age and fabric of the building, as well as with the season and the time of day. Thus, no single heat technology is the best at satisfying all types of heat demand all of the time.

Renewable Heat

Renewable energy is replenished by the Sun or the Earth at least as fast as it is consumed (see POSTnote 164). Renewable heat is defined in the Energy Act 2008 as heat generated from a range of renewable fuels and low-carbon technologies, discussed in more detail below. The UK has adopted an EU target to supply 15% of energy (heat, electricity and transport) from renewables by 2020. To achieve this target, government scenarios suggest that the UK could generate 12% of its heat from renewables.[3] This will require unprecedented growth (sustained at up to 90% per year[3]) in markets for renewable heating technologies. However, in the majority of cases, renewable heating is currently more expensive than fossil-fuel heating alternatives.

Renewable Heat Incentive

The government has proposed a Renewable Heat Incentive (RHI) to come into force in April 2011. This will provide regular payments to the owner of a renewable heating technology to bring costs in line with fossil-fuel heating. It is currently proposed that funds for the RHI will be raised through a tariff placed on fossil fuels used for heating, expected to result in a 14% increase in domestic gas bills by 2020 (equivalent to £104 a year on average), and a 20% increase for industry.[4]

Technologies

Solar Thermal

Solar Thermal (ST) devices collect the Sun's heat energy via solar panels mounted on roofs and use this heat to generate hot water. Even on a cloudy day, there is often enough sunlight falling on a roof to supply a household's hot water demand. In comparison, photovoltaic (PV) solar panels use sunlight to generate electricity.
Solar Thermal devices are widely deployed across Europe, and are currently responsible for the majority of

renewable heating installations in the UK. They can be installed to supplement central heating systems with hot water tanks in existing houses, where they typically supply up to 60% of hot water, but no space heating demand. As a result, the cost of a single unit of heat from ST is high compared with alternative renewable heating technologies (Table 1).

Table 1 Renewable Heating Technology Costs and CO_2 Emissions[5]

Technology	Heat Cost (p/kWh_{th})*	Fuel Emissions ($kgCO_2/kWh_{th}$)
Gas Boiler	6.7 - 16	0.23
Oil Boiler	8.1 - 14	0.32
Electric Heater	19 - 24	0.61†
Air Source Heat Pump	10 - 39	0.20 - 0.22†
Ground Source Heat Pump	10 - 32	0.14 - 0.17†
Biomass Boiler	11 - 24	0.031 ‡
Biomass District Heating	11 - 22	0.036 ‡
Solar Thermal	50 - 74	N/A

***1 kWh_{th} (kilowatt-hours thermal) is the amount of heat energy given off by a 100% efficient 1 kW electric heater left on for an hour. This would supply 5% of an average UK citizen's daily heat consumption.**

† Emissions based on a 2007 electricity grid rolling average.

‡ Emissions relate to processes such as harvesting and transport, not combustion (emissions from which are captured in the growth cycle).

Geothermal

The molten core of the Earth and radioactive decay in the ground generate a substantial quantity of renewable heat. At depths of 5-15 km this is hot enough to be a source of hot water for heating buildings, and steam for industrial processes. Conventional geothermal technologies are mature, but are tightly constrained to suitable ground conditions (for example, the Southampton geothermal district heating scheme[6]). Devon and Cornwall (current trial sites) and the north of England are the most promising locations for more advanced geothermal technologies.

Heat Pumps

As sunlight travels through the atmosphere and falls on the Earth's surface, it warms the air and ground, resulting in a large store of ambient heat energy. However, this heat energy is at low temperatures, usually below that comfortable for homes and workplaces. Heat pumps use electricity to 'pump' this heat to higher temperatures and transfer it into buildings (Box 1). They operate on the same principle as domestic refrigerators, only in this case the outside air or ground is being (slightly) cooled. When run in reverse heat pumps can provide air-conditioning to cool the inside of buildings in summer. There are two main types.

Air Source Heat Pumps

Air Source heat pumps (ASHP) extract heat directly from the outside air and transfer it to water (in a water-based central heating system) or air inside buildings. The efficiency of ASHPs (Box 1) decreases during winter as the outside air becomes colder compared with inside, requiring more pumping. The electricity consumed by ASHPs is therefore seasonal. This requires investment in electricity network capacity – which is often ignored when calculating the cost of a single heat pump (Table 1) - that is utilised for only part of the year.

Box 1 Heat from Electricity

In 2007, 14% of UK heat was generated from electricity (Figure 1). Power stations typically require 2-3 units of fuel to generate 1 unit of high grade energy in the form of electricity. Once transmitted via the power grid, electricity can be converted almost entirely to heat energy in buildings by electric heaters. By comparison, it requires approximately 1.1 units of fuel (gas, oil or coal) to generate 1 unit of heat in buildings directly (in a boiler). Thus, heat generated from fossil-fuelled electric heaters has a larger quantity of fuel embodied within it, and therefore significantly higher CO_2 emissions relative to gas- or oil-fired heating (Table 1).

Heat pumps use a small quantity of electricity to raise heat from the surroundings to higher temperatures. The ratio of heat supplied to electricity consumed is called the Coefficient of Performance (COP). To guarantee reductions in CO_2 emissions in relation to current gas-fired heating (see Table 1), the COPs of heat pumps available in the UK need to improve. From 2020-2050, emissions from heat pumps will decrease as carbon emissions from electricity generation are reduced via the take up of nuclear, renewable fuels, and maybe Carbon Capture and Storage (CCS).

Ground Source Heat Pumps

Ground source heat pumps (GSHP) collect heat by laying pipes under large flat areas (for example, gardens or car-parks). Alternatively, where space is limited, vertical boreholes can be drilled, although this raises costs. The most energy efficient application of GSHPs is in commercial developments, where heat removed during summer (for air conditioning) could be stored underground and pumped back inside in winter.

Biomass Fuels

Renewable biomass fuels include wood from forestry, trimmings from parks and hedgerows, cereal straw from farms and wood pellets made from compressed sawdust (some of which could potentially be imported). In the longer term (2020-2050), dedicated energy crops such as willow, poplar or novel grasses might become available. Biomass fuels can also be produced from waste (Box 2). The government (via the Forestry Commission) has set a target to bring an additional 2 million tonnes of wood-fuel to the market by 2020.[7] This represents 50% of the wood potentially available in English woodlands. Biomass fuels emit no net CO_2 when they are burned, as the same amount of CO_2 is captured as the biomass grows.

Biomass Boilers

Burning biomass in boilers to generate heat, hot water or steam is feasible at a wide range of scales, from the household to industrial level. In the domestic sector, space constraints (for example, truck delivery with narrow driveways) and storage of bulky biomass fuels limit take up. Some estimates suggest biomass heat is feasible in only 2.6% of households.[8] This is compounded by concerns regarding air-quality in towns and cities. Natural gas is a relatively clean fuel, so a shift to biomass heating using current boiler technologies could result in a three-fold increase in particulate emissions (see POSTnote 272).

Biomass boilers have a greater potential in industry, where biomass can provide a renewable source of the high-temperature heat required by many industrial processes. At these larger scales, biomass fuels for combined heat and power generation (CHP, see below) could become more cost effective. In total, it is envisaged that biomass will provide more than 50% of any renewable heat demand.[3] However, estimates of the total quantity (including imports) and cost of available biomass remain uncertain.[3]

Box 2 Energy from Waste

Waste resources that can be used as fuel for renewable heat include sewage (see POSTnote 282), animal manure, food waste, biodegradable fractions of domestic waste and wood recovered from furniture or building deconstruction. Waste resources could potentially supply 8% of UK heat demand.[9]

Technologies

Technologies for the separation of wastes have been developed to satisfy recycling targets. A key innovation is the waste autoclave process which uses steam to separate out the biodegradable fraction of mixed waste. Improved methods for measuring the renewable content of mixed waste, in particular municipal solid waste, are required to allow classification as a renewable fuel.

Waste Policy

In its 2007 Waste Strategy, the government targeted a 45% reduction in household waste not re-used, recycled or composted from 2000 levels by 2009. It also targeted an increase in the recovery of municipal waste from 53% in 2010 to 75% by 2020. EU Waste Directive 2008 allows energy generated from waste to count towards recycling targets only if a highly efficient process is used.

The Waste Infrastructure Delivery Programme (WIDP) was established in England to support local authority investment in residual waste treatment, increasing recycling levels, and energy recovery. However, there is currently no focussed policy to ensure that energy recovery is completed in the most efficient way. Fixed contracts with power generators can lock waste streams into electricity production for 20 to 30 years. Alternative uses, including direct heat generation, might be more energy efficient and emit less CO_2.

Biogas and Biomethane

Biogas (a renewable gas) can be produced from biomass and waste in two ways:

- anaerobic digestion (AD) captures the methane emitted as biomass rots. Biogas from AD is widely deployed in Germany, where it is used for small-scale power generation.
- gasification converts solid fuels into a gas by heating them up in the absence of air. Commercial deployment of gasification is unlikely before 2020.

After AD or gasification, the resulting biogas can be burned in a boiler for heating or to generate electricity. Alternatively, the gas produced can be cleaned to meet the required standards for injection into the national gas grid. This cleaned biogas is nearly identical in composition to natural gas (mostly methane) and is often called biomethane. Calculations suggest that if all UK waste biomass resources (Box 2) were used, biomethane could substitute for 48% of domestic gas consumption.[10] Supplying biomethane as a renewable heating fuel would entail minimal disruption to consumers, as it would use the existing gas infrastructure and could be burned in existing gas boilers. Similarly, renewable bio-oils, produced from waste oil or oil-seed-rape, could be used in existing oil-fired boilers.

District Heating Networks

District Heating (DH) networks connect heat-generating technologies to locations of demand by transporting heat as steam or hot water in pipes. Consumers purchase heat from the network directly (rather than gas or electricity), avoiding the cost of installing and maintaining boilers within their own buildings. However, the piping infrastructure, and connecting buildings to the network, results in significant extra costs (Table 1). DH is widespread in central Europe and Nordic countries, supplying more than 50% of domestic and commercial heat demand in Sweden, Finland and Denmark. Limited UK uptake (DH supplies less than 2% of total UK heat demand[11]) can be attributed to a historical lack of policy support, consumer resistance (although the extent of this is debated), and low domestic gas prices.[12]

Renewable district heating in the UK is currently supplied from geothermal sources, or from boilers burning biomass or waste-derived fuels (Box 2). District heat networks form a flexible infrastructure capable of integrating a range of renewable heating technologies. These can include solar thermal panels and heat pumps as well as waste heat from existing power stations (although this can lead to less efficient power generation). District heat networks can also support Combined Heat and Power (CHP) generation from renewable fuels (for example biomass, waste, or biogas).

Combined Heat and Power

CHP technologies are based on conventional power generation. However, rather than discharging surplus heat (through a cooling tower or into the sea), in a CHP system this wasted heat is used for industrial process heating, or sent to a district heating network. This can increase the overall energy efficiency of the system.

Reducing Emissions

The government has a target to reduce carbon dioxide (CO_2) emissions by 34% by 2020 compared with 1990 levels, increasing to an 80% reduction by 2050. As renewable heat technologies typically have lower CO_2 emissions than conventional heating systems (Table 1), they are supported under a range of policies that aim to reduce CO_2 emissions.

Business and Industry

The EU Emissions Trading System (see POSTnote 354) aims to provide a financial incentive for large industrial users of heat to switch to low-carbon, renewable heating fuels (principally biomass). In the UK, the Carbon Reduction Commitment Energy Efficiency Scheme (CRC) will establish an emissions trading system between large

UK public and private sector organisations. In the short term this is expected to promote the take up of low-cost energy-saving measures, such as insulation. In the longer term (2015-2020) it could also support the adoption of renewable heating technologies.

New Buildings
The Department of Communities and Local Government controls new building developments through the National Planning Policy Statements and the Planning Inspectorate. Compliance with the relevant parts of the building regulations has required carbon dioxide emissions to be controlled since 2006. There is a consensus in the industry that regulations are the most effective driver for the take up of renewable heat in new-build developments.

Zero Carbon Homes
The government has set a target for all new housing developments to be comprised of 'zero carbon homes' by 2016 (a 150% reduction in measured CO_2 compared to 2006). This poses a significant challenge for the design, planning and construction of new homes. CO_2 reductions are allowed to be achieved by exporting renewable heat to other local developments via a district heat network.

Existing Buildings
Of the buildings that will be standing in the UK in 2050, it is estimated that 70% have already been built. Retrofitting existing buildings therefore accounts for a significant fraction of any market for renewable heat. The government's Low Carbon Buildings Programme provides grant support for the purchase of heat pumps and biomass boilers. The Community Energy Saving Programme also supports the installation of renewable heating technologies in low-income households.

Consumer Issues
As proposed, the Renewable Heat Incentive (RHI) will make renewable heating technologies more cost competitive with fossil-fuel alternatives. However, high initial purchase costs (Table 1) could constrain take up unless innovative methods of financing are developed. Proposed methods include:

- establishment of energy service companies ;
- provision of low-interest 'green' loans from banks;
- Pay As You Save (PAYS) schemes;
- billing for heating via council tax.

Energy service companies (ESCOs) may be made up of members from the local authority, energy suppliers, equipment manufacturers, the community, and energy experts. They are capable of raising finance for renewable heating technologies at a lower cost than individual consumers. This business model is particularly applicable to managing renewable district heating or CHP.

Low-interest 'green' loans have also been suggested. These could assist in overcoming the up-front cost barriers to renewable heat. Within PAYS schemes consumers pay the supplier for a renewable heating technology over its lifetime. If repayments are lower than their predicted energy bill savings, then financial and carbon savings can be made from day one. However, it may be the case that current models for the ownership of domestic energy technologies are not sustainable. Ownership of heat pumps or biomass boilers could transfer to local authorities, who would receive RHI payments and then charge residents for heat consumption and the loan of the heating technology.

Fuel Poverty
Any household spending more than 10% of its income on heating is considered to be in fuel poverty. As of December 2009, there are an estimated 6 million such households. It is thought that fuel poverty contributes to an additional 20,000 winter deaths annually. The government is under a statutory duty in England to end fuel poverty in vulnerable households (those in receipt of certain benefit payments[13]) by 2010, and in all households by 2016. Renewable heat could help to alleviate fuel poverty in some cases, for example when replacing expensive electric heating in houses situated off the gas grid (Table 1). However there are fears that a tariff on fossil-fuel heating to support the forthcoming RHI will increase levels of fuel poverty.

Overview
- Government targets to achieve 12% of heat from renewables by 2020 will require rapid and extensive uptake of renewable heating technologies.
- A wide range of technologies is already technically available for the supply of renewable heat, including solar thermal systems, air and ground source heat pumps, biomass boilers, biogas and biomethane production, and renewable district heat and CHP.
- A Renewable Heat Incentive has been proposed which will make renewable heating more cost competitive with fossil-fuel alternatives.
- Renewable heating technologies have high up-front costs and long payback periods. Innovative financing methods are therefore required to support take up.
- Renewable heating could contribute significantly to the government's targets for CO_2 emissions reduction.

Endnotes

1 *Digest of UK Energy Statistics* (DUKES), July 2009
2 *Meeting the Energy Challenge*, HMG White Paper, May 2007
3 *UK Supply Curve for Renewable Heat*, NERA and AEA, July 2009
4 *Renewable Heat Incentive Consultation*, DECC, Feb 2010
5 Technology costs and ranges are calculated from ref.3 and fuel costs from annex to ref.4, CO_2 emissions from fuels are calculated from Defra published figures. Ranges for emissions from heat pumps represent the COPs achieved for various building conditions
6 *Southampton District Energy Scheme*, M Gearty, 2008
7 *A Woodfuel Strategy for England*, Forestry Commission, 2007
8 *Biomass & Bioenergy*, Jablonski et al, July 2008, pp 635-653
9 *UK Biomass Strategy*, DEFRA, DfT and DTI, May 2007
10 *Potential for Renewable Gas in the UK*, National Grid, Jan 2009
11 *Potential and Costs of District Heating*, Pöyry, April 2009
12 Heat; Call for Evidence, BERR, January 2008
13 *A Decent Home: Definition...*, DCLG, June 2006, §6.26

POST is an office of both Houses of Parliament, charged with providing independent and balanced analysis of public policy issues that have a basis in science and technology.
POST is grateful to Dr Alex Dunnett for researching this briefing, to the Grantham Institute for Climate Change for funding his parliamentary fellowship, and to all contributors and reviewers. For further information on this subject, please contact the co-author, Dr Michael H O'Brien, at POST.
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www.parliament.uk/parliamentary_offices/post/pubs2010.cfm

Renewable Energy Select Committee
Topic Sheet - Waste as a source of energy

Introduction

(*A glossary of common terms used in relation to this topic is given at Appendix 1.)*

> *'A shift in perception is required. Waste needs to be recognised as a resource.'*[1]

The Institution of Mechanical Engineers believe waste could provide 20% of UK electricity requirements, making a significant contribution to the future UK energy mix while also helping to achieve targets for renewable heat and transport.

The Energy from Waste (EfW) industry is also capable of rapid development and installed capacity (thermal treatment) could double by 2016.[2] The Waste Strategy for England expects that by 2020 a quarter of municipal waste will be used to generate energy.[3]

KCC's 'Low Carbon Opportunities' identifies gas from landfills, sewage treatment and biodegradable wastes as *renewable* biomass resources which are available across Kent.[4]

The four main techniques used to extract energy from waste are combustion, pyrolysis and gasification which are thermal processes and anaerobic digestion (AD) which is a biological process.

Although energy generation from combustion and biological treatment of waste can both result in 'energy from waste', the term EfW usually refers to treatment by combustion and AD is referred to separately. The incentives offered for these treatments are different and WRG, in their evidence, stress the need to distinguish combustion, for the purpose of generating energy, from incineration, for the purpose of reducing waste volume.

Policy Drivers

The focus of legislation on Energy from Waste (EfW) has tended to be waste treatment, rather than energy production and this has resulted in EfW plants not being treated in the same way as other power stations.[5] It is incentivised mainly through the Landfill Directive which aims to reduce landfill and its environmental impacts (water, air and soil quality, climate change). Waste sent to landfill is subject to landfill tax, currently around £40 per tonne, and this increases by £8 per annum until 2013.

The amount of biodegradable municipal waste sent to landfill must be reduced by 2010 to 75%, by 2013 to 50% and by 2020 to 35% of 1995 levels. The penalties imposed upon Local Authorities under the Landfill Allowances Trading Scheme (LATS) scheme have been largely unworkable but EU Landfill Directive targets for

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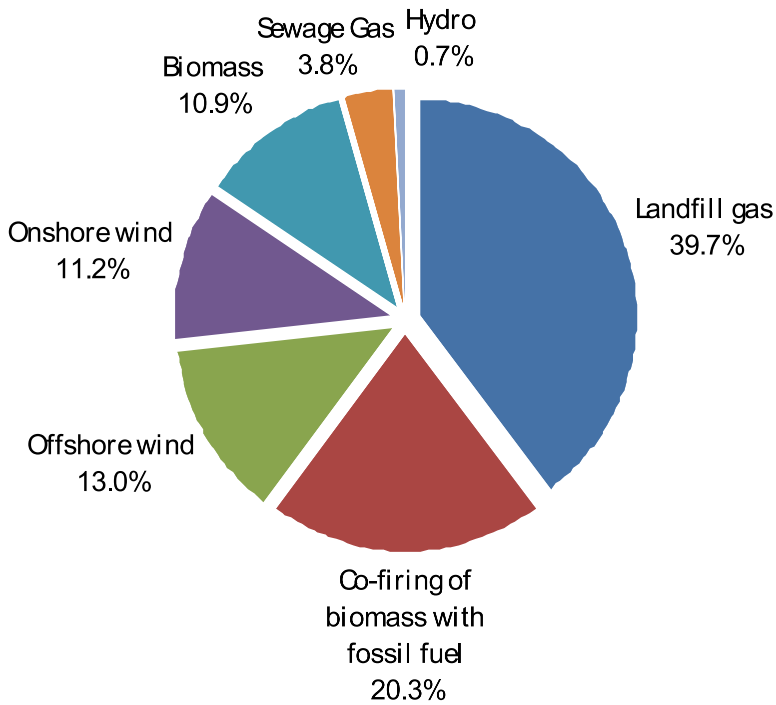
[1] Written evidence – Karl Jansa, Locate in Kent
[2] Written evidence – WRG citing the European EfW Federation
[3] Written evidence – Environment Agency
[4] Along with coppiced wood, sawdust, arboricultural trimmings and energy crops
[5] Institute of Mechanical Engineers Report: Energy from Waste a wasted opportunity?

the UK are likely to be met due to an increase in recycling and a decrease in waste arisings influenced in part by the economic downturn.

EfW (combustion) is currently the cheapest alternative to landfill for non-separated waste. Further government incentives are expected which will serve to make EfW and other alternatives to landfill increasingly attractive.[6]

Energy policy in relation to the generation of renewable electricity has been through the Renewables Obligation (RO) which is in effect until 2037. Although waste that is either biodegradable or combustible can be used to generate energy, only energy from the biodegradable fraction of waste is considered to be 'renewable' and only this fraction (around 65% of municipal solid waste) is eligible for Renewable Obligation Certificates (ROCs), which have up to now been the main mechanism to incentivise renewable energy. A breakdown of ROCs issued in England, shown below in Chart 1 shows that landfill gas and sewage gas together account for 43.5% of ROCs issued.

Chart 1: Breakdown of ROCs issued in England by technology type
Data source: Ofgem Renewables Obligation: Annual Report 2008-9, February 2010



The ROC system has not incentivised EfW. However, a Renewable Heat Incentive (RHI) is to be introduced by the government in April 2011 and is currently being consulted upon.[7] WRG have indicated they will be lobbying for recognition of the contribution that EfW CHP can make to renewable energy targets, so that heat recovery by this means is properly incentivised.

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[6] Written evidence - WRG
[7] A Postnote from the Parliamentary Office of Science and Technology on Renewable Heating is attached.

KCC and Kent districts' responsibilities

KCC is the household waste authority for Kent; the 12 Kent boroughs and districts are the collection authorities and they send their waste (with the exception of green waste in some cases) to KCC for disposal. Together, the 13 councils make up the Kent Waste Partnership (KWP) whose Officer Advisory Group meet every 3 months to take forward the Joint Household Waste Strategy which was adopted in June 2007.

A report commissioned by the KWP on waste management infrastructure in Kent had a number of key findings directly or indirectly relating to energy from waste, in particular:

- In-Vessel Composting (IVC) facilities will be required in North East Kent (Blaise Farm now provides this service) and in North West Kent.
- There is no need for new EfW capacity to treat household waste but disposal capacity should be optimised at Allington
- There is a wide disparity between districts in the amount of household waste recycled and the amount composted.

The waste arisings from Kent households (municipal waste) are about one sixth of the arisings from the business sector.

KCC operates 5 transfer stations *which accept some trade waste (chargeable)* at:

Dunbrik Transfer Station, Sevenoaks
North Farm Transfer Station, Tunbridge Wells
Church Marshes Transfer Station, Sittingbourne
Whitfield Transfer Station, Dover
Hawkinge Transfer Station, Folkestone

KCC is responsible for preparing a new Local Development Framework for minerals and waste in Kent which will replace the Local Plans which have been in place since 1995 (and did not take into account energy from waste).

With regard to planning, where there is local opposition to the development of substantial energy from waste plants this tends to relate to the additional traffic generated[8] and so this aspect is a major consideration when making decisions about siting additional facilities that may be required.

East Kent Joint Waste Project

This project involved waste management officers from Canterbury, Dover, Shepway, Thanet and KCC who have together developed a co-ordinated approach in order to deliver cost savings and efficiencies. A Nominal Optimum Model (NOM), which standardises collection methodology, is part of this process. One of the implications of the project is the reduced energy and fuel usage to be achieved by optimising property requirements and vehicle journeys. Another is the ability of KCC to strategically manage the waste streams within East Kent.

[8] Written evidence – South East Partnership Board

EfW in Kent - WRG - Kent Enviropower

KCC's contract with Kent Enviropower involves the commitment to supply a minimum quantity of the municipal waste collected in Kent to the facility and this quantity equates to just under 40% of the total MSW (c. 800,000 tonnes per annum).

Kent Enviropower at Allington Quarry is one of two EfW facilities in the UK operated by WRG. Allington EfW processes 500,000 tonnes of waste per annum using fluidised bed technology, with an export capacity of 34MW electricity which is sold directly to the grid, offsetting 77,000 tonnes of CO_2 per annum. The plant treats municipal as well as commercial and industrial waste. The EfW plant also powers a materials recovery facility (MCF) which processes up to 65,000 tonnes per annum of recyclables.

The Allington plant currently operates at 25% thermal efficiency, as it does not utilise the heat produced by the EfW process[9]. WRG's other UK plant in Nottingham, which is around one third of the size of Allington, generates 375GW high pressure steam annually which, through 60km of district heating main, supplies a number of major sites with heat including two large shopping centres, the National Ice Arena, Capital One's UK HQ, Nottingham Trent University, The Guildhall plus approximately 5,000 residential customers.

Retrofitting combined heat and power (CHP) is possible and evidence from WRG indicates they would be supportive of such an initiative and are willing to explore the feasibility of developing district heating infrastructure, which could potentially raise the Allington plant's thermal efficiency to 75%. Retrofitting CHP would need the involvement of 'a local third party heat off-taker' and the development of an energy service company (ESCo)-type structure.[10]

Landfill gas as a resource

The methane which would naturally result from the biodegradation of organic waste, unless captured or capped off, escapes into the atmosphere and contributes, to the enhanced greenhouse effect. Although short-lived in the atmosphere (12 years as compared to 100 years for CO_2) methane is 23 times more potent as a greenhouse gas. In any event, Landfill sites in the South East are running out fast and the region may reach its capacity by 2020.

> *'There are six sites in Kent which generate electricity from landfill gas for export into the national electricity grid. The scope for utilising closed Local Authority landfills is limited. There is potential opportunity for small scale generation for on site use at Richborough, Church Marshes and North Farm Landfills'.*[11]

A pilot project to investigate the potential for such generation is about to begin at North Farm Landfill.

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[9] DEFRA administers the government's Waste Infrastructure Development (WID) Programme for England which oversees the allocation of Private Finance Initiative (PFI) credits to assist local authorities in building new waste plants. Allington was commissioned prior to the injection of this funding and it should be noted that the primary aim at the time of procurement was waste management rather than energy production, for which it was an early example in the UK.

[10] Written evidence - WRG

[11] Written evidence – Environment Agency

Anaerobic Digestion

Anaerobic Digestion (AD) involves the breakdown of biodegradable waste by microbial activity in the absence of oxygen to produce biogas or methane (CH_4). The technology is well advanced and guidelines were issued by DECC in December 2009 for the injection of purified biogas into the gas grid.[12]

The technology is supported by the Environment Agency provided there is careful balancing of the recovered value and the environmental impact. Food and agricultural wastes (manure and slurry) are most suited to AD and, when collected separately, the treatment of food waste by this process is more effective than other treatment methods, in both energy and carbon reduction terms[13].

It should be noted that AD requires homogenous waste such as that derived from the sewage industry and that if more varied sources of waste are used it is likely that a pre-treatment would be required. There is also an end product of dried sewage sludge and the bad smells associated with the process mean that careful siting of facilities is required.

> *"The NFU has a vision for 1,000 on-farm AD plants by 2020 and we firmly believe AD can add value to the agricultural sector, while demonstrating how farmers can provide part of the solution to the problem of climate change."*[14]

The National Farmers Union commented in their evidence to the select committee on the complexity of regulations affecting farmers wishing to undertake small scale energy generation from waste, even where no third party inputs are involved. A portal to assist farmers, local governments and commercial organisations understand the planning, environmental and funding issues in relation to AD can be found at: http://www.biogas-info.co.uk/.

The extent of regulations can be seen from checklists which are available to enable farmers to check compliance with waste regulations and these can be found at: http://farmwasteen.netregs.gov.uk/libraries/document/745.pdf

In addition to the option of injecting of biogas into the gas grid, methane produced from AD can be utilised onsite by:

- burning it to generate electricity
- purifying and bottling it as vehicle fuel

Alternatively, it can be piped a short distance and used as a combustible fuel.[15]

[12] To access this guidance please click on: Biomethane into the gas network - a guide for producers
[13] DEFRA Waste Strategy Factsheet: Energy from Waste and Anaerobic Digestion
[14] NFU Press Release
[15] Written evidence – Hadlow College

Solid Oxide Fuel Cells

Fuel cells are electrochemical devices (analogous to batteries) that can convert chemical energy into electricity and heat at lower temperatures, and therefore more efficiently than combustion-based technologies in a continuous process, provided fuel and air are present. A range of electrolytes are used, of which solid oxide is one. Virtually no NOx and no SOx are produced in the process.

Fuel cells require substances that are easily oxidised as fuel. Solid oxide fuel cells can use a range of fuels including methane (CH_4), propane (C_3H_8) and carbon monoxide (CO).

At the cathode, ions oxidise hydrogen to water (H_2O) and carbon monoxide (CO) to carbon dioxide (CO_2) releasing electrons which, if connected to a circuit flow as direct current.

Plant require for the process would include an air blower and fuel compressor and other items such a heat exchanger. Commercially, cells would be connected together in a stack. The heat from exhaust gases can also be utilised.

Separation of food waste

Currently two of the 12 Kent districts and boroughs have separate collections for food waste (Tunbridge Wells and Tonbridge & Malling) which is taken to KCC's Blaise Farm Composting Facility which opened on 1 September 2008.

Evidence received from New Earth Solutions, who operate Blaise Farm In-Vessel composting facility, highlights that waste treatment operations may also provide opportunities to reduce the overall carbon impact of the processing by exploring ways to generate renewable fuel for use on site. (Blaise Farm is off-grid and currently uses diesel to run equipment).

Pyrolysis is under investigation at their facility in Poole as a method of powering generators, with excess electricity available to the grid (which in the case of the Kent facility would require extension of the transmission and/or distribution network). Also under investigation is the possibility of incorporating heat capture technology to benefit local heat-users, turning waste processing plants into CHP stations which can serve local businesses and community if located appropriately.

Further information about Blaise Farm can be found at:

http://www.deandyball.co.uk/user/files/Projects_Gallery/Civil_Engineering/Waste/Blaise_Farm/Blaise_Farm.pdf

A SEEDA funded Biofuels project[16], which ended in 2009 established the concept of a Bio-Material Handling Station where bio-material can be processed into usable liquid, sold and biogas fuels. Three potential Kent sites were identified, including one which could gather and process farm waste. One of the criteria was that materials should be available within the local area (less than 50 mile radius) and fuels should

[16] University of Greenwich – written evidence

be used within that area. The University of Greenwich are also working with ReMade SE to compare composting and anaerobic digestion of food wastes to obtain biogas.

Other types of energy from waste:

Waste wood

- In its written evidence to the select committee the Forestry Commission indicate that waste wood, such as low quality woodchips from tree surgery, site clearance and the waste stream are being used elsewhere in the South East for energy generation with prices less than £25 per tonne.

- Countrystyle Group have applied to KCC for planning permission to build a £7 million plant to generate electricity from waste wood. The wood is shredded and processed in a boiler which drives a turbine, producing enough electricity to power 6,300 homes. The plant would divert 30,000 tonnes of waste wood per annum from landfill.

- Creative Environmental Networks carried out a study for Hampshire in 2008 to compare the demand and supply of woodfuel from forestry, sawmill, tree surgery and clean waste wood, forecasting to 2026 to allow for new development and develop a strategy to develop the industry, maximise market growth and bring benefits to the county. Could a similar piece of work be of benefit to Kent?

LF100 biofuel from waste oil

- On 20th April 2010 a new 150kW combined heat and power plant will be ‘unveiled’ at Port of Dover. The CHP plant will be partly fuelled by waste cooking oil collected by Kent residents – 18 tonnes has been collected over a period of 14 months and the collection target for the next year is 36 tonnes.

Witnesses

Sue Barton – KCC Strategic Projects & Business Development Manager (strategic overview of energy from waste in Kent.

Dan Gillert – Living Fuels (Port of Dover waste oil scheme)

Rob Asquith - Director of Land & Planning, New Earth Solutions (Blaise Farm)

Suggested themes/questions for invited speakers are given in Appendix 2.

Appendix 1:

Glossary of terms used in this paper

AD	Anaerobic Digestion
BMW	Biogenic fraction of municipal waste
CHP	Combined heat and power
DECC	Department of Energy and Climate Change
EfW	Energy from waste (usually refers to combustion methods)
ESCO	Energy Services Company
IVC	In-Vessel Composting
KWP	Kent Waste Partnership
LATS	Landfill Allowances Trading Scheme
NOx	Reactive gases containing nitrogen and oxygen (Nitrogen Oxides)
RHI	Renewable Heat Incentive
RO	Renewables Obligation
SOx	Sulphur Oxides

Appendix 2

Suggested themes/questions for invited speakers (21st April 2010)

Questions (Sue Barton)

1. Could you tell us about national and local targets in relation to waste recycling and landfill. Are there conflicts between these targets, and those in relation to climate change and the recovery of energy from waste. How well is Kent currently performing in comparison to other authorities and what are the issues?

2. What are the key strategic and local planning issues in relation to the increased generation of renewable energy at waste processing sites in Kent, and in relation to the siting of additional plants.

3. Could you tell us about the landfill sites in Kent that currently export electricity to the grid? The Environment Agency identified three potential Local Authority sites with the potential for small scale generation (for on site use) at Richborough, Church Marshes and North Farm Landfills. Could you tell us about plans to develop these or any other such sites?

4. What are the implications of bringing 'in house' the operation of Church Marshes transfer station and waste recycling centre, with respect to targets and aims in relation to recycling and recovering energy from waste of different types? Are there plans to bring other transfer stations in-house?

5. What mix of technologies to derive energy from waste, is the optimum for Kent?

6. What do you believe should be incorporated in the Waste Development Framework, in relation to the generation of energy from waste?

7. Kent is well served by an experienced waste management team with a body of market knowledge – it is also well served by a similarly well experienced energy management team. How can these two areas of expertise come together to ensure that both KCC and Kent residents and businesses gain most from opportunities provided by various options for energy recovery from waste?

Questions (Dan Gillert – Commercial Manager, Living Fuels - Port of Dover CHP

Dan Gillert – Biographical Information

Daniel Gillert, joined Living Fuels (part of the Waste Recycling Group) from the Waste & Recycling Sector, having previously worked for Lafarge Aggregates Ltd and Sulo MGB Ltd in various commercial roles. Dan has responsibility for the securing of Used Cooking Oil and subsequent production of the proprietary fuel, LF100. Dan is married with 2 children. His interested include Golf and Running, and he will complete his second London Marathon this Spring.

1. Could you tell us about your company and about the in the Port of Dover Waste cooking oil scheme which was launched yesterday?

2. What were the drivers for the scheme and what incentives will apply to it?

3. What incentives are there for organisations and individuals to recycle used oil?

4. Please could you tell us of any advantages waste cooking oil has over other biofuels?

5. Can you tell us about the waste oil collection in Kent and elsewhere and how (and where) it is processed into LF100?

6. How much electricity can be generated from processed cooking oil and what proportion of the energy needs of Port of Dover will the CHP plant provide?

7. Can you indicate the amount of fossil fuel use/carbon that will be offset by the scheme?

8. What is the potential waste oil resource in Kent and how much energy generation it could contribute in the county?

9. Is the fuel suitable for transport use and is there sufficient available to have an impact in this sector?

10. Speaking more generally about renewable energy, can you comment on the potential for developing renewable energy in Kent and give us your views on the role of the public sector in this?

Questions (Rob Asquith - Director of Land & Planning, New Earth Solutions, Blaise Farm)

Biography

Robert Asquith has been Land and Planning Director at New Earth Solutions Group since April 2009. Previously he headed Land and Planning at Waste Recycling Group before which he was a planning consultant for sixteen years, latterly as a Director at Terence O'Rourke Ltd. Robert has worked on over ten major Energy from Waste projects as well as windfarms and has provided renewable energy policy advice for central and local government. His move to New Earth reflects the emergence of new technologies as serious players in the waste and renewable energy sectors.

1. Could you please tell us about your company and its operations, under contract with KCC, at Blaise Farm in Tonbridge and Malling District?

2. Could you explain about the current reliance on diesel at the facility and about some of the options you are exploring to reducing this reliance?

3. Could you tell us about grid connection issues in relation to the site?

4. Could you tell us something about the potential at Blaise Farm and any other sites in Kent, for utilising the heat generated in the composting process?

5. What are the challenges to be faced in terms of planning, in maximising the opportunities for generation of renewable energy and reducing the carbon footprint of such waste facilities?

6. In your experience, what are the best options available to secure funding for renewable energy and carbon reduction schemes and would any particular incentives apply to the technology?

7. Do you have any other observations about the potential for obtaining energy from waste in Kent, or about particular renewable technologies that may have an application in Kent?

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