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FEASIBILITY REPORT

Kent Downs AONB Wood-fuel Pathfinder

BIOMASS HEATING FOR SCHOOLS

Report on technical and financial feasibility of biomass heating for rural school clusters

EXECUTIVE SUMMARY

Kent County Council

KENT DOWNS Area of Outstanding Natural Beauty

Forestry Commission

"Investing in your future"
Crossborder cooperation programme 2007-2013 Part-financed by the European Union (European Regional Development Fund)

Executive Summary

Kent Downs Area of Outstanding Natural Beauty (AONB) has partnered with Kent County Council (KCC) and the Forestry Commission (FC) to support the continued deployment of biomass heating in schools with the aim of stimulating demand for locally produced biomass fuels, reducing CO_2 emissions, supporting local job creation and realising woodland management benefits.

To date biomass heating systems have been installed in seven schools in Kent, generally on larger sites ranging from 150 kW to 660 kW. The new the Renewable Heat Incentive (RHI) provides a potentially powerful mechanism to support the installation of biomass heating in schools, particularly those in rural areas where most schools are dependent on oil and LPG.

Econergy, a biomass heating specialist (and part of British Gas), were engaged study the practical application and financial viability, in the context of the RHI, of installing biomass heating solutions for primary schools in Kent by looking in detail at twenty sites in five clusters across the County.

Based upon our understanding of the client requirements a set of design principals has been developed to define the practical approach to biomass implementation at KCC schools with key principals including:

- Specification of equipment and detailing system design to maximise efficiency and reliability and minimise emissions; high quality automatic boilers, *always* installed with buffer vessels.
- Sizing biomass systems to meet 100% of the site heating load, but also retaining standby capacity, at least initially, to ensure security of heat supply while biomass systems and local support infrastructure “bed in”.
- Where practical and economically viable wood chip systems should be preferred to maximise local benefits.
- Any disruption to the operation of the school or to local residents must be kept to an absolute minimum both during installation and during operation, particularly with respect to fuel delivery and chimney emissions.
- With these principals in mind a detailed study was made of each of the shortlisted sites, including:
- Initial contract via a remote survey to gather data on the existing heating system, site operation and so on which was then combined with data already provided by KCC.
- A site visit to survey each school focussing in particular on the practical considerations including space for biomass plant, access for fuel deliveries and so on.
- Assessment of heating demand and likely load profile based on a whole building heat loss calculation for each site, analysis of historic oil use and consideration of current boiler plant capacity.
- Selection of an appropriate combination of biomass boiler and thermal store for each site based upon estimated heating load and practical considerations, principally; space, access and availability of three phase power required for wood chip solutions.

Following completion of the site surveys and examination of the data a set of biomass heating product solutions where defined for the range of sites based upon the design principals outlined above, the boiler outputs required and practical constraints observed on site.

The proposed product solution is based upon a range of pre-fabricated self-contained biomass energy centres including biomass boiler, buffer vessel / thermal store and ancillary plant as well as an integral wood fuel store and appropriate wood fuel reception system, with boiler outputs ranging from 38 kW to 199 kW and for both wood chip and wood pellet fuels.

For sites where space and access allow and where three phase power is available (essential for the fuel reception system) a fast auger woodchip reception system is proposed to accept tipped deliveries and load the integral fuel store. For wood pellet sites the standard blown delivery from bulk wood pellet tanker is assumed.

In each case the proposed location of the biomass energy centre has been identified and provisional runs for underground heat mains to existing plant rooms detailed and measured. At each existing plant room a suitable interface including heat exchanger, modulating flow control, heat exchanger and local controls integration (with automatic standby boiler enabled) has been specified to connect to the existing system(s).

For every site where a biomass solution could be practically achieved a complete cost for the installed system has been developed and the expected annual quantity of heat supplied used to estimate fuel costs and RHI income and for each a simple business case has been assembled to calculate the simple payback period (capital investment by savings plus RHI) providing an straightforward measure of financial viability.

The key findings with respect to the biomass solution proposed for each school ranked by simple payback period may be summarised as follows:

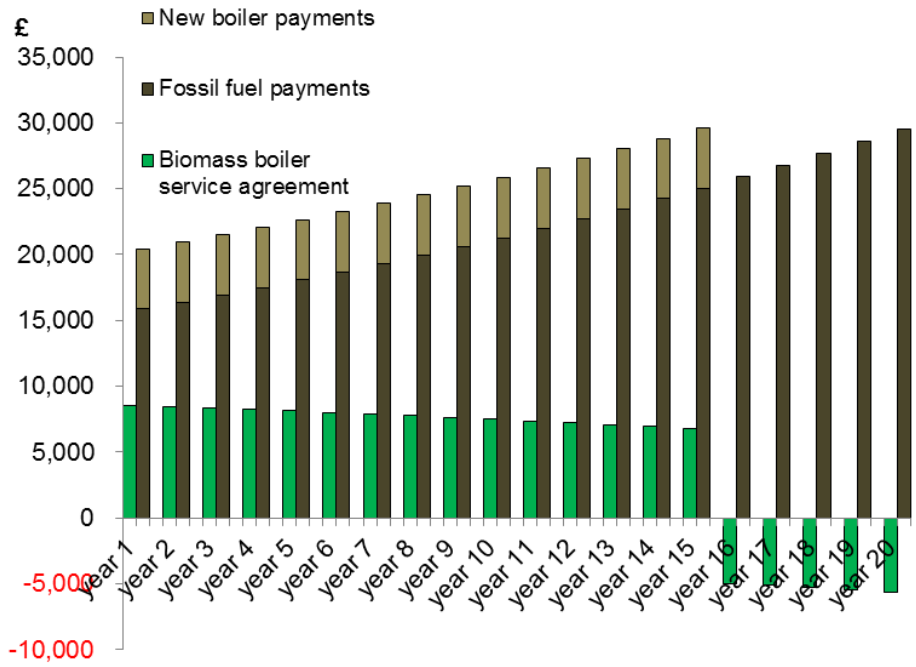
School Name	Payback (yrs)	Fuel type	Recommended biomass boiler size	Expected biomass utilisation level	Total installed cost	£ per kW installed
EIS Shepway	4.6 years	Wood Chip	199	15%	£161,300	£811
Swattenden	5 years	Wood Chip	199	17%	£183,500	£922
Sellindge	5.3 years	Pellet	100	20%	£101,100	£1,011
Lamberhurst	7.9 years	Pellet	100	13%	£106,077	£1,061
West Kent Health Needs Education Service	8.1 years	Wood Chip	100	13%	£120,427	£1,204
West Kingsdown	8.1 years	Wood Chip	150	11%	£164,000	£1,093
Cobham	8.2 years	Pellet	100	15%	£128,400	£1,284
Brabourne	9 years	Pellet	60	14%	£98,800	£1,647
Sevenoaks Weald	10.5 years	Pellet	60	19%	£110,500	£1,842
Challock	10.8 years	Wood Chip	80	12%	£118,777	£1,485
Lyminge	11.4 years	Wood Chip	80	12%	£123,077	£1,538
Crockham Hill	11.6 years	Pellet	80	11%	£113,000	£1,413
Petham	13.2 years	Pellet	80	10%	£106,277	£1,328
Stowting	14.6 years	Pellet	48	16%	£109,184	£2,275
Bodsham	15 years	Pellet	60	12%	£106,500	£1,775
Goudhurst and Kilndown	15.5 years	Pellet	80	8%	£104,877	£1,311
Trottiscliffe	22 years	Pellet	38	10%	£89,200	£2,347
Borden	N/A	Pellet	38	13%	£97,800	£2,574
Shoreham	N/A	Pellet	60	13%	£110,795	£1,847
Seal St Lawrence Cof E	N/A	Pellet	38	7%	£0	£0

From these results a set of key findings has been derived:

- Of the 20 sites surveyed a biomass heating solution was practically achievable for 17, (i.e. 85%) with 16 paying back within the expected 20 lifetime of the installation and thus, in theory at least viable.
- Of these 16 sites where a biomass system might be viable, six (four schools, two others) are suitable for wood chip fuel while the other 10 would need to operate on wood pellet.
- The cost per kW installed for the viable sites ranges from £811/kW up to £2,275/kW.
- The total installed cost for biomass installation for the 16 viable sites ranges from £98,000 to £183,500, the total for all 16 sites (14 schools plus two others) being £1.96 million.
- For the 14 viable primary school sites (ignoring the two non-school sites), excluding the smallest and largest school sites to analyse the 12 more “average” sites;
    - the boiler size range was between 60 and 100 kW;
    - the average installed cost per site was £111,500;
    - the average simple payback period was 10.5 years; and
    - three were suitable for wood chip while nine would need to use wood pellet.

To further establish the viability of the biomass heating solutions proposed for the schools various approaches to funding have been considered and an example of a long term financed energy services funding model tested on a cross section of four sites; chip and pellet with long and short paybacks.

In each case the lifetime cash flow for the financed installation has been developed as per the example below for *Sellindge School, a proposed 100 kW pellet system with 20% utilisation, 100% financed.*



Based upon this study, conclusions have been developed which might reasonably be applied to a wider sample of schools and other similar sites, including:

- By delivering a larger group of projects together in partnership with a selected supply partner(s), or perhaps in a series of phases, the cost and challenges of delivery may be much reduced. In particular we'd expect savings to the cost of; design and feasibility, communication with the schools and stakeholders (e.g. events), processing of planning, buildings regulations and so on, overall supervision of installation on site and so on.

- Existing school boiler rooms will rarely be suitable for the installation of biomass boilers and in the great majority of cases a pre-fabricated biomass energy centre with integral fuel sore is likely to be the most appropriate solution.

- Biomass solutions must include appropriately sized, high quality boiler plant including automatic grate and heat exchanger cleaning and lambda modulating control, and which should *always* be installed with a suitable buffer / accumulator tank and appropriately sited with a properly designed chimney system to ensure reliable, efficient operation and low emissions.

- While existing boilers should be retained to provide emergency standby capacity where possible it is not likely to be cost effective to provide new oil boilers for standby only for primary schools and as such a "biomass only" approach is recommended, with oil boilers being retained in the early years but not replaced when life expired.

- Achieving a higher density of installations in the region will yield benefits in terms of reduced fuel costs (wood pellet in particular), reduced maintenance costs and improved maintenance cover, making subsequent phases of biomass installations easier and more cost effective form the start.

- While biomass heating will not be appropriate for all primary schools it is likely to be possible and feasible for the great majority, this study suggest 85%, of off gas grid sites, and is likely to be suitable for some schools on the gas grid in later phases of deployment.

- The majority of primary schools will require systems of 60 to 100 kW at an average capital cost of about £111.5k and with an average simple payback of 10.5 years.

- Biomass heating for schools may be procured via a suitable financed energy services arrangement provided that a long loan term (15 years) is available and a balanced approach is taken to long term risk sharing (fuel tariff etc).

- In the context of the RHI the installation of biomass heating systems therefore is very much a viable proposition for a large proportion of off-gas grid primary schools and other public buildings and can deliver both running cost savings and substantial CO2 emissions reduction.

We therefore recommend that KCC implement a relatively rapid programme to roll out biomass heating across its estate, perhaps entailing:

- Pilot implementation by installing biomass heating for a set of four of the sites included in this study representing a range of scales and technology solutions (i.e. wood chip, pellet, small and larger) by end 2012 to refine the technical, commercial and regulator / stakeholder approach solution for a large scale roll out and provide sample sites to support the roll out.

- At the same time it would be worth reviewing KCC's entire property portfolio so that prime biomass heating sites with the most rapid paybacks are identified as soon as possible. As part of this process plans for a mass roll out programme, including securing sign offs and selection of an appropriate procurement mechanism, should be initiated to ensure that KCC is in a better position to benefit from the RHI and reduced running costs.

- Complete mass roll out of biomass at KCC sites, in phases from late 2012, complete by April 2014.