Hall Barn Estate

Report of the technical training in England

Summary

The project is very suitable for practical implementation because on the one hand the infrastructure already exists (boiler house, wood chips storage) and the other hand the wood raw material is cheap available. The installation of a wood chip boiler as a replacement for the existing gas and oil plants would mean for this object that there is a significant reduction in fossil fuel use. The annual use of 445 MWh of energy from fossil fuel gas could be replaced by approximately 800 - 900 loose m³ of wood chips (soft wood). For our experience it would be the best to realize the project in a single phase. The investment costs are more favourable for the realization of the entire project and the boiler plant will be better utilized (higher overall efficiency of the system). As the heating costs are cheaper in your own wood than with oil, the realization brings in one step also economic benefits.

Project description

Hall Barn Estate is a rural estate in Buckinghamshire with its own wood fuel resource, comprising a large house and a range of other buildings. A 250 kW biomass boiler has been proposed for Hall Barn House and other buildings on Hall Barn Estate, connected via a district heating system and using wood fuel from the surrounding estate or alternatively purchased from local supplier/ aggregator. The biomass fuel requirements would be around 90 tonnes @ 30% moisture content per year for heat supply to Hall Barn House, up to a maximum of 142 tonnes per year for heat supply to all connected buildings on the estate.

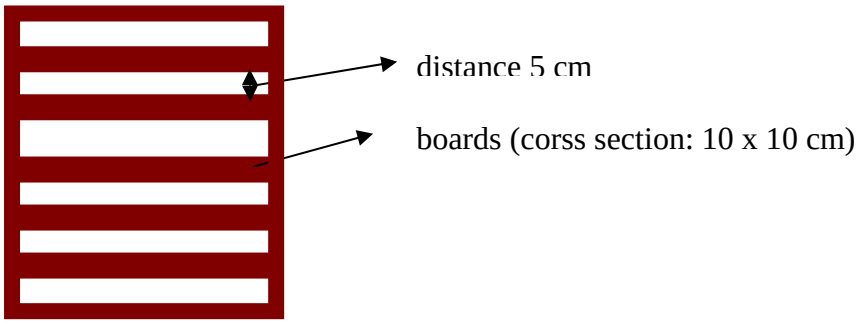
A woodchip boiler of between 200 and 250kW capacity would be suitable to supply heat as hot water linking into existing building systems, split in phases as Hall Barn House (phase 1), West Flat and Clockhouse Flat (phase 1 extension) and the Workshop/ Office building and Stable Cottages (phase 2). The purchase of heat from Hall Barn Estate to the other, rented buildings (offices and houses) on the estate could be administered by an ESCo type organisation.

Question for the location?

- **Fuel storage and chipping arrangements**

The existing hall is ideal as wood chips storage. In winter, bevel, round wood should over the summer on a dry, well ventilated storage bin be pre-dried. The pre-dried timber is then, if possible, chopped directly into the fuel storage. It would be possible to create after the fuel storage a timber storage area. It is important to ensure that between the fuel storage and the timber storage area about 6 m distances are elapsed (manipulation area for the hackers). The fuel storage must have a correspondingly large opening. It is recommended that the field-based contracting company (hackers) can lead to a conversation in this regard. Tend the achievements should not be too small because the hackers hack and its performance will increase. An annual demand of 800 until 900 loose m^3 is roughly equivalent to a round wood demand of 320 until 360 sqm round timber, i.e. the storage bin has roughly the dimensions of 18 x 5 x 4 meters. The fuel storage should be well ventilated so that there is no meld growth in wood chips; this means that the contained residual moisture in the wood chips flows upward must be able to escape. This condition is given, when the existing glass windows are replaced with wooden grid.

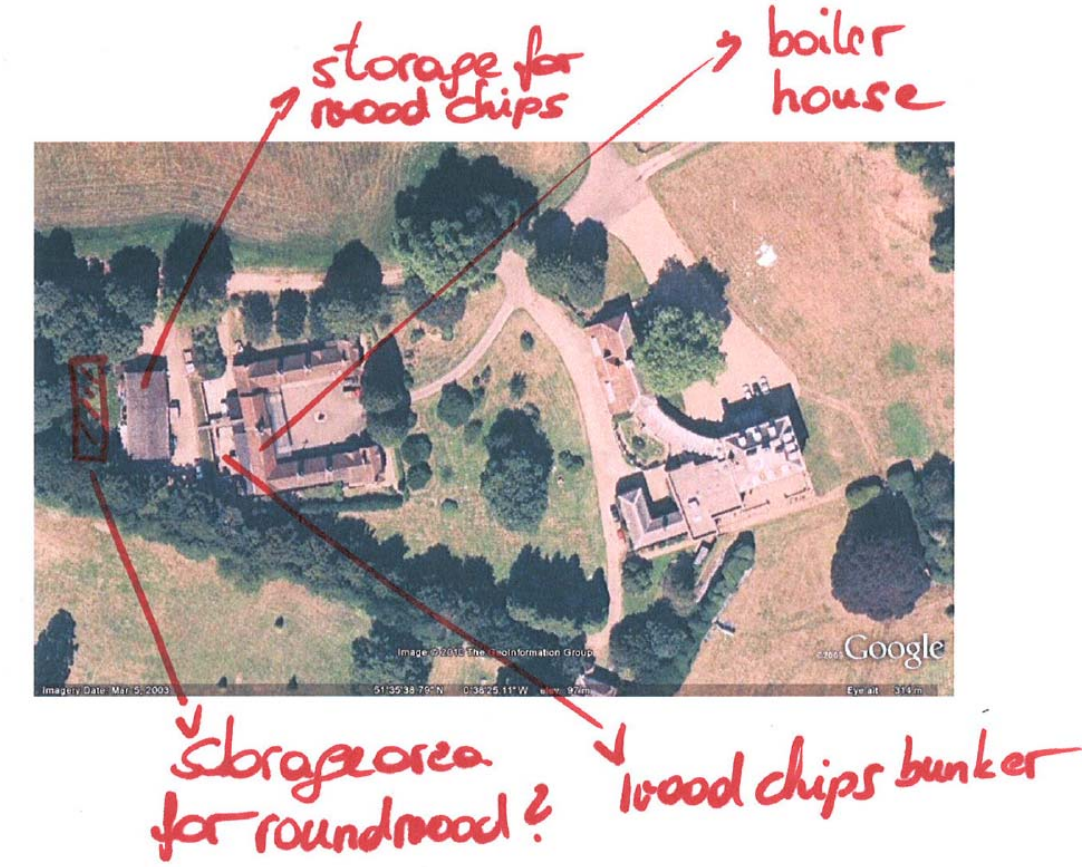
Fig. 1: Wooden grid



By draught, the moisture is removed. The existing sliding door remains and also ensures that no rain and no snow can get into the wood chips. The wood chips should be dried down in about a water content of 25 - 35% before it is burned.

Fig. 2: Existing fuel storage

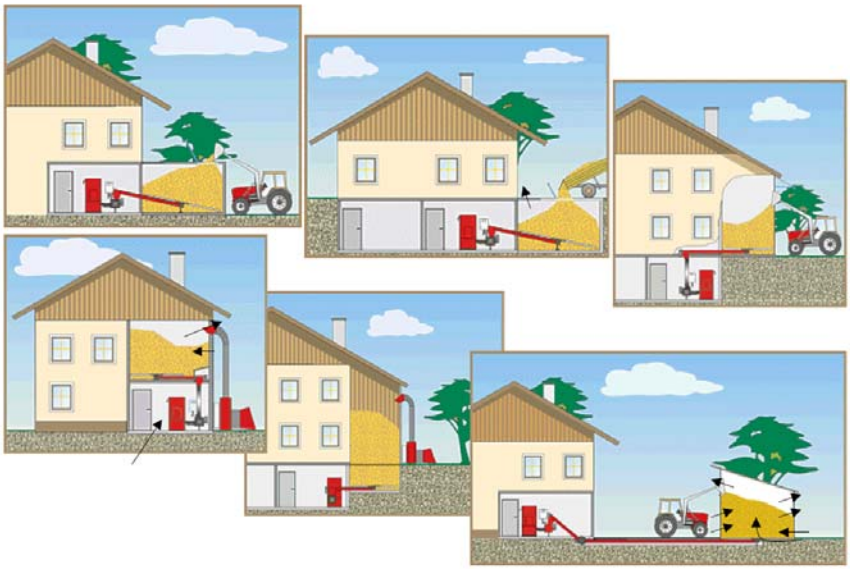
Fig. 3: Ariel view of Hall Barn Estate



The wood chips bunker is then filled by a tractor. Therefore the distance from the woodchips storage to the wood chips bunker is relatively low, the manipulations costs are negligible.

Fig. 4: Wood chips bunker

Fig. 5: Different possibilities to create a wood chip bunker



You could consider if you will integrate the heating system into the wood chips storage (next room). With this option, you would spare the filling of the bunker and you could fuel directly from the fuel storage (wood chips distribution).

- **Installation of a wood chip boiler**

The annual heating energy amount is around 445 MWh per year. The performance of the boiler would therefore lie in the range of 300 kW. For the fuel supply there are approximately 800 - 900 loose m³ needed per year.

There is the possibility of a 300 kW boiler or 2 x 150 kW to install boiler.

To optimize utilization of the boiler, the installation of 2 x 150 kW would recommend instead of 1 x 300 kW, but this increases the investment costs. The maximum heat output of the boiler (full load) is only to some, a few days per year required; the remaining days of the boiler is running at part load. In contrast to the 150 kW boiler, a 300 kW boiler is available in an industrial version (depends on the manufacturer), which can also be lesser quality fuels burn easily (boiler is running more robust). The decision for a particular boiler should also be made on the basis of the available fuel range.

In this case we would recommend a 1 x 300 kW boiler with an appropriate buffer (5,000 - 10,000 litres).

The reasons for this:

- less space
- lower investment costs
- lower maintenance costs

Fig. 6: Thermal output over the year

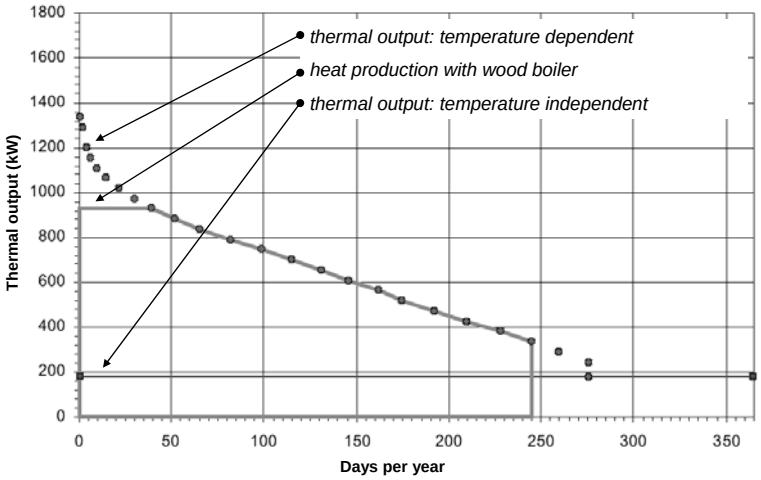
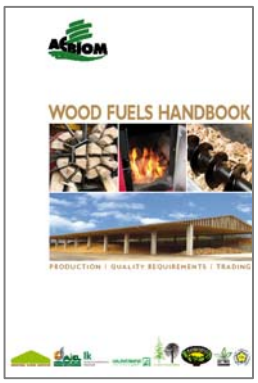


Fig. 7: Annual heat demand (TV-Energy)

Building	Boiler fuel	No of boilers	Boiler total kW	Boiler, year installed	Estimated seasonal efficiency	Annual fuel consumption (litres)	Annual fuel consumption (kWh)	Annual heat demand (kWh)	Project phase	CO_2 emissions (tonnes/yr)
Hall Barn	heating oil	2	340	1950s	60%	40,000	440,000	264,000	Phase 1	116.6
Clockhouse Flat	heating oil	1	37	2008	85%	7,617	78,455	66,687	Phase 1 extension	20.8
West Flat	LPG	1	47	1996	75%	5,000	37,400	28,050	Phase 1 extension	8.8
1 Stable Cottage	heating oil	1	30	estimate 2000	80%	1,574	16,212	12,970	Phase 2	4.3
2 Stable Cottage	heating oil	1	30	estimate 2000	80%	1,704	17,551	14,041	Phase 2	4.7
Workshop/ Office	heating oil	1	70	2009	85%	6,523	67,187	57,109	Phase 2	24.1

– **Fuel Quality**

Information about quality requirements and reference standards are available in the WOOD FUELS HANDBOOK (download under: **www.biomasstradecentres.eu).**



Quality requirements for:

2x 150 kW plant: water content up to 35%, max. size pieces G50 mm (ÖNROM, G50=cross-section of the wood chip is > 5 cm²), homogeneous fuel is advantageous

300 kW plant: water content up to 40%, size pieces > G50 mm (depends on the manufacturer)

– **Back-up System**

Today's biomass heating systems generally have a low error rate. Nevertheless, it may lead, as with any other fossil fuel heating system malfunctions. Most accidents are due to insufficient fuel quality (e.g. contaminants such as stones and iron, non-homogeneous fuel size). In the selection of the heating system is to ensure that the boiler or boiler manufacturer seller, if possible, can offer a 24-hour service. A good service should be a top priority in the selection of the boiler manufacturer. *There are the following options for a back-up system:*

1) In variant 2 x 150 kW you have a boiler automatically as a reserve, provided that the fuel supply is disconnected (2 space host systems).

2) For a short time (3 - 5 h), the buffer offset a loss.

3) It is possible to implement the existing gas and oil heating systems into the system.

– **District heating gird**

The decisions whether iron or plastic pipes are a question of price. The transfer takes place in a double tube. A plastic tube is limited due to the fact of pressure and temperature (manufacturer). At high pressures and temperatures the lifetime of the network decreases. The district heating network should not be dimensioned in any case too large, it increases the pump electricity costs, increase the heat losses and capital costs are greater.

- **Back up memory**

For practical experience, a buffer is recommended by at least 5,000 litres. The memory should be small in any case, bigger would be good. The tank is used to cover peak times (morning panel) and short-term reserve at the failure of the heating system.

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Impressions of Hall Barn Estate

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