Englefield Estate

Report of the technical training in England

Summary

The project is very suitable for practical implementation because the wood raw material is cheap available (management of own woodland). 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 853 MWh of energy from fossil fuel gas could be replaced by approximately 1,400 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

The Englefield Estate has been examined for feasibility to provide heat to Englefield House and other buildings on the estate from a new biomass boiler linked via a district heating system, with the potential to use woodfuel from the surrounding estate or alternatively purchased from local supplier/ aggregator. The advantages of a woodchip-fuelled heat supply system include significantly lower fuel costs, increased long term security of fuel supply, improvements in the management of woodland areas, increased opportunities for local employment and reduced carbon emissions compared to the use of heating oil within conventional boilers and heating systems.

Question for the location?

– **Boiler size**

For a full supply of all existing buildings, a biomass boiler will be needed with a capacity of 500 kW. To cover peak loads and to compensate for light loads, a buffer memory should be used with a minimum volume of 10,000 litres. The annual heat consumption is 853 MWh per year, are required for its production in about 1,400 loose square metres wood chips (soft wood).

In a second variant the existing oil and gas systems might get involved in the heating system. In this case, we would recommend to install a 350 until 400 kW biomass boiler and for the peak load to use the existing oil and gas boilers. According to first calculations of TV Energy a 250 kW boiler was being considered. But in this size, to our knowledge, no industrial boilers are been built. Full load of over 2,000 hours per year could be also a problem for this boiler.

Overall, we would suggest a realisation based on biomass. *The following arguments why to realize that project:*

– Complete substitution of fossil fuels
– Low-cost (free) of existing energy source wood
  The cost for the network, boiler house and storage do not change much with a smaller boiler

Fig. 1: Existing Energy Supplies & Heat Demands (Source: TV-Energy)

Building	Boiler fuel	No of boilers	Boiler (kW)	Year installed	Estimated seasonal efficiency	Annual fuel consumption (litres)	Annual fuel consumption (kWh)	Annual heat demand (kWh)	Notes	CO_2 emissions (tonnes/yr)
Englefield House	heating oil	2	220	1999	85%	46,641	480,402	408,342	phase 1 connection	127.3
Extension to Englefield House	heating oil (default)							22,248	phase 1 conn. (estimated heat demand)	6.9
St. Marks Church	heating oil	1	120	1997	80%	7,733	79,650	63,720	phase 1 connection	21.1
Swimming Pool	heating oil	2	106	2001	85%	4,700	48,410	41,149	phase 1 connection	12.8
Stable Flat	previously LPG boiler	none						15,000	phase 1 conn. (estimated heat demand)	6.3
Stable Cottage	heating oil	1	19	1998	80%	2,288	23,566	18,853	phase 1 connection	6.2
Partridge Gardens	electric	4	48	2004				60,000	phase 2 conn. (estimated heat demand)	25.3
St. Mark's Close	heating oil	1	43	1988	75%	20,097	206,999	155,249	phase 2 connection	54.9
WRB Glasshouse	LPG	1	44	1996	80%	5,210	71,794	57,435	phase 2 connection (LPG in kg)	16.8
Brewhouse	heating oil	1	52	1998	80%	1,350	13,905	11,124	phase 1 connection	3.7

- **Boiler and storage location**

Questions regarding the correct location are always very difficult to answer because many factors play a role, such as wood chips logistic, resident's problems (emissions, noise), timber storage and site distance. The originally planned location in the horse barn is not necessarily a location for the boiler house. The location could cause problems with regard to the wood chips logistic, since on the one hand there is not a suitable access road for trucks and tractors, and there is secondly, the limited space.

After initial rough estimates (assumption!), you can expect a total power of 500 kW, resulting in an annual wood chips demand of about 1,400 loose cubic meters (soft wood). The minimum storage (bunker) should be based on practical experience of 200 loose cubic meters and should require a minimum storage space 50 - 60 m², with a dumping height of 4 meters. With an average load volume (tractor with trailer) 30 m³, you need 45 – 50 delivery per year.

The renovation of the existing building (horse barn) is difficult but not impossible. One problem is that the courtyard is relatively small, and there are also apartments and other stables located. By the high logistical effort a compliance with noise will be expected.

From our perspective, we would recommend a new boiler house to build, unless this can be represented economically. The heating is usually designed on a time horizon of 20-25 years that would bring a non-optimal solution to long-term problems. During the construction of a new boiler house could also expand the storage capacity (bunker).

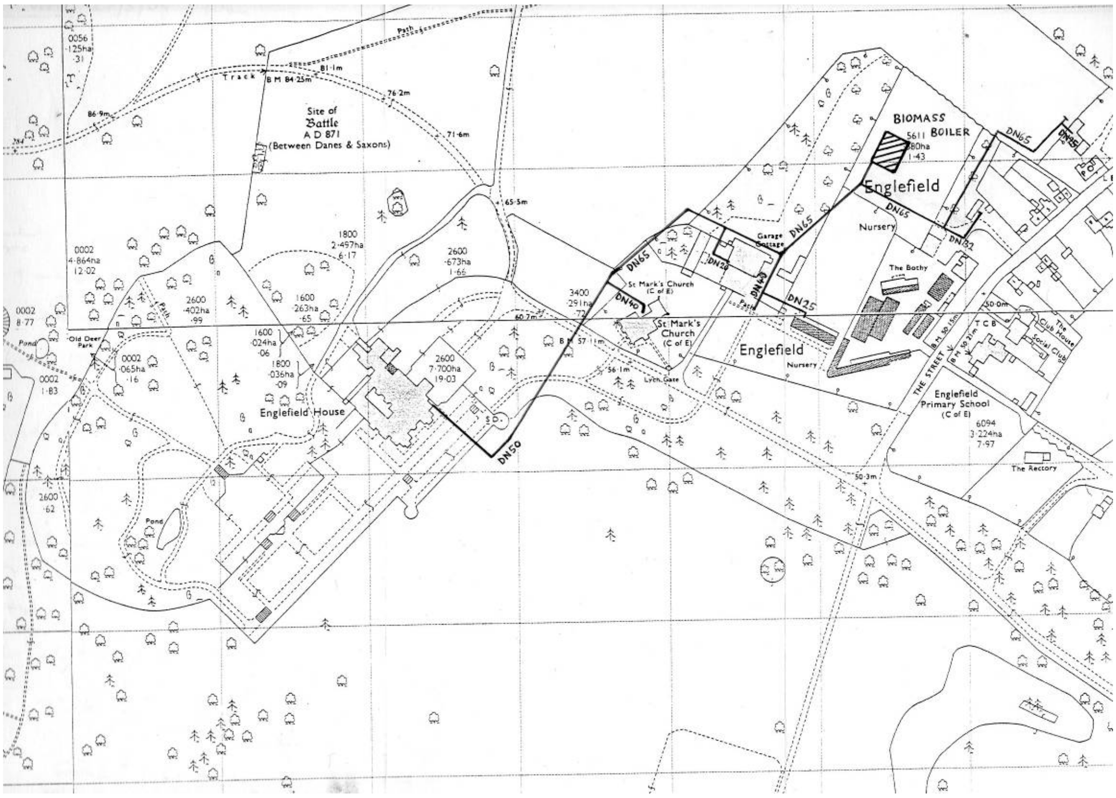
Fig. 2: Proposed site of the heating plant (horse barn)

- **District heating pipes**

Fig. 3 shows, how the heat network could be implemented practically. For a more accurate representation a true to scale plan and the connected power (kW) and heating demand (kWh/a) of each object is necessary.

Primary the thing is to make sure that the ratio of line length and heat capture matches. Too long line length and to less heat losses increases the inefficiency (high power drain) and endanger the economic viability of the project (high construction costs).

Fig. 3: Location of the boiler house & district heating pipe (Source: TV-Energy)



<u>In general, it should be paid to compliance with the following targets:</u>

Heat losses in the netw*ork:* *less than 20 %*

The losses of the heating network should not on average be higher than 20%. The network losses affect the electricity and fuel costs in a sustainable way (life of the plant). Optimized heating plants have a net loss of less than 10%.

Sold heat per network length: > 900 kWh / meter

The connected load per meter path should be more than 900 kWh / m. The shortfall of this value is an important prerequisite for obtaining funding in Austria. In this case the value is a little bit to less but it is in the limit of tolerance.

Connected load per network length: > 0.5 kW / meter

The connected load per meter path allows a first, rapid assessment of the given situation. The value should be higher than 0.5 kW/m.

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Impressions of Englefield Estate

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