

From: [Ellis, Cathal](#)
To: [Hughes, Seamus](#)
Cc: [Wightman, Stuart](#)
Subject: Heat requirements within the Northern Ireland Poultry sector
Date: 17 July 2015 10:28:14
Attachments: [Environmental Control in Poultry \(Broiler\) units. C.Ellis July 2015 2.docx](#)
Importance: High

Seamus,

Please find attached document regarding heat requirements within the N I poultry sector. I have provided an explanation of why the production of broilers needs the levels of heat suggested and some costings associated with conversion to biomass. Examples are provided but the nature of the sector (age and type of poultry house, size of house, type of boiler and fuel type and quality can all affect the amount of heat required. I am aware that you will be holding a number of meetings over the coming weeks to discuss with industry and I am happy for you to disclose this information. Also happy to discuss the document with you if there is anything you need clarification on.

Kind regards

Cathal

Cathal Ellis
Renewable Energy Technologist
CAFRE
Greenmount Campus
Antrim
BT41 4PU
028 94426793

63793 (network)

Personal information redacted
by the RHI Inquiry

(mobile)



Wood chip quality workshop

Tuesday 8th September 2015, 1.30pm – 5.30pm

Environment and Renewable Energy Centre
AFBI, Hillsborough

DARD
Department of Agriculture
and Rural Development
www.dard.gov.uk

cafre
College of Agriculture,
Food & Rural Enterprise

afbi
Agri-Food and
Biosciences Institute

Environmental Control in Poultry (Broiler) units.

Raising broiler chickens is big business in Northern Ireland. Energy costs for heating broiler houses from around 32°C for young birds, lowering to 23°C by about the fifth week are considerable and can have major impact on gross margins. Houses have traditionally been heated using LPG air blown heaters and canopy brooder systems.

Conversion to a biomass heating system can provide a cost effective, low carbon alternative to gas. Because biomass heating contributes no moisture, the chicken litter is kept drier, reducing ammonia levels, boosting growth and improving bird welfare. With biomass fuel being slightly more expensive than fossil fuels, kW for kW, installing a biomass heating system can significantly improve the welfare of the birds, but it is not economically viable without being subsidised.

Costs associated with conversion to biomass vs. LPG

Example 1 Wood Pellets

Cost per kWh of heat produced

| | | |
|---|---|------------------|
| Pellets | £179 per Tonne @ 4300kWh per Tonne (Assuming 4800kW/T @ 90% efficiency)* | 4.16p |
| Increased requirement in electricity usage for pumps and fans @ 12p/kWh | | 0.30p |
| Boiler servicing cost | | 0.25p |
| Remedial repairs | | 0.10p |
| Total | | 4.81p/kWh |

This does not include cost of capital and interest repayment, depreciation and additional labour – (approximately an additional 2p to 3p/kWh).

For comparison, LPG currently costs around 25p/l @ 6.6kWh/l **3.79p/kWh**

***NOTE! Not all boilers will run at 90% efficiency. Potentially boilers may run between 80% and 92% efficiency based on age, service schedules and design of system. Assuming 4800kW/T @ 80% efficiency heat produced would cost 4.49p per kWh.**

Example 2 Wood Chip

Cost per kWh of heat produced

| | | |
|---|--|------------------|
| Wood Chip | £120 per Tonne @3150 kWh per Tonne@ 30% moisture content (Assuming 3500 kW/T @ 90% efficiency)* | 3.81p |
| Increased requirement in electricity usage for pumps and fans @ 12p/kWh | | 0.30p |
| Boiler servicing cost | | 0.30p |
| Remedial repairs | | 0.10p |
| Total | | 4.51p/kWh |

This does not include cost of capital and interest repayment, depreciation and additional labour – (approximately an additional 2.5p to 3.5p/kWh).

For comparison, LPG currently costs around 25p/l @ 6.6kWh/l

3.79p/kWh

***NOTE! Not all boilers will run at 90% efficiency. Potentially boilers can run between 80% and 92% efficiency based on age, service schedules, design of system and fuel quality/moisture content. Cost of heat produced assuming 3500kW/T @ 80% efficiency and 30% moisture content would cost 4.28p per kWh. Variation in moisture content can significantly change the heat produced and cost per kWh.**

Need for Heat!

Genetics and nutritional improvements in broiler production have been extremely important to the efficiency of poultry meat production. The full potential of broilers cannot be reached unless the proper environment is maintained in the broiler house.

Maintaining proper temperature to promote growth is key to efficient broiler production. Thus, heating a broiler house is extremely important in terms of performance, economic standpoint and the welfare of the birds. Chicks are not able to completely maintain their body temperature until approximately 14 days of age. During this time, it is crucial that floor temperature be maintained around 30 degrees C with minimum variation.

Ventilation is necessary to deliver fresh air and remove excess heat, moisture and noxious gases from the broiler house. Ventilation systems are usually of two types, natural airflow and mechanical air movement (fans).

The Welfare of Farmed Animals Regulations (Northern Ireland) 2012 states that:

Schedule 1, paragraph 13 – Air circulation, dust levels, **temperature**, relative air humidity and gas concentrations shall be kept within limits which are not harmful to the animals.

Schedule 1, paragraph 20 – Where the health and well-being of the animals is dependent on an artificial ventilation system –

- a. Provision shall be made for an appropriate back-up system to guarantee sufficient air renewal to preserve the health and well-being of the animals in the event of a failure of the system; and
- b. An alarm system shall be provided to give warning of any failure of the system.

Schedule 5, paragraph 5 – Ventilation shall be sufficient to avoid overheating and, where necessary in combination with **heating systems**, to **remove excess moisture**.

This is of importance when considering the environmental conditions within the broiler house and the difference in management between using a gas based heating system and a system utilising biomass.

Biomass will result in a drier atmosphere with relative humidity (RH) dropping below 40%. This provides the birds with a better start making them less prone to respiratory disorders. It does however require a higher degree of management to prevent dehydration in the first 24hrs. At a lower RH e.g. <35%, performance may be adversely affected and action may need to be taken to increase RH. As the chick grows the ideal RH should be <60%, with a high RH (above 70%) causing wet litter and associated welfare problems. As the broilers increase in weight, RH levels are controlled using ventilation and **heating systems**. With traditional LPG systems it has been almost impossible to achieve RH of <70% in the poultry sheds, which in turn can lead to CO₂ build up in the sheds of >3000ppm and ammonia levels of up to 20ppm. With the biomass systems installed CO₂ can be controlled at approximately 1000ppm and ammonia at 1 or 0ppm, making it a much-improved environment for the broiler and for the farmer.

According to Dr. Malcolm Mitchell from the Scottish Agricultural College, the temperature experienced by the birds is dependent on dry bulb temperature and RH. Birds lose heat to the environment by evaporation of moisture from the respiratory tract and through the skin. The higher the RH the less evaporation loss occurs, increasing the birds' apparent temperature at a particular dry bulb temperature. **Low RH will decrease apparent temperature so at low RH the dry bulb temperature will need to be increased.**

What effect does Biomass heating have on the RH in a broiler house?

Most farms have found a reduction in RH to 35% – 40% when using biomass-heating systems. The dry heat produced means less ventilation is needed to remove gases and water vapour, and is generally beneficial to bird health, reducing the incidence of hock burn, pododermatitis, breast blister, respiratory infections and possibly campylobacter. For day-old chicks, the ideal dry bulb temperature at 60% RH is 30.8 deg. C. However, at 40% RH the dry bulb temperature would need to be 36 deg. C. Therefore, to achieve the ideal temperature, additional energy will be required when using a biomass system.

Energy Requirement for heating

A standard 240 x 60ft, 27,000 bird broiler house (without renewable energy installed) in Great Britain, consumes on average 40,000 litres of LPG per year. (Article in Poultry World July 2015 by Paul Spackman - Simple steps to improve shed energy efficiency). This is equivalent to 264,000kWh of heat. (40,000 x 6.6kW =264,000). A typical broiler house in Northern Ireland will use up to 42,000 litres of LPG per year. This is equivalent to 277,200 kWh of heat. This can be explained by the difference in average temperatures between GB and Northern Ireland, NI being 2-3 degrees lower than GB (Met Office)

As explained above additional heat is required when using biomass for the heating of the houses.

A typical house in Northern Ireland will use 365,500kWh of biomass heat per year. (Around 30% more than LPG due to lower RH and an additional 5 deg. C. required). However, this can range between 360,000kWh and 388,000kWh of biomass heat per year depending on the size, insulation, age and type of house.

Without this level of input, there are a number of potential issues:

Wet litter

Respiratory Infections (potential could also affect farmer)

Pododermatitis or foot burn

Hock burn

Breast blister

Potentially this can result in poor performance, loss of sales to processor, increased penalties from the factory and potential loss of single farm payments.

Cathal Ellis

CAFRE, Greenmount Campus, Antrim (028 9442 6793)

16th July 2015