

Poultry Litter Disposal

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Introduction

- Biosystems Engineering in UCD
- Bioresources Research Centre (Energy / Food / Environment)
 - Sustainable energies
 - Feedstock evaluation
 - Conversion technologies
 - Environmental impact
 - Research team
 - 22 post docs
 - 50 post grads – mainly PhD
 - 45 taught masters

Background

- Nutrient value of poultry litter:
 - N circa **11** kg/t at 50% availability and P at 6 kg/t
- Nutrient loss associated with agricultural practices has contributed directly or indirectly to the eutrophication of surface waters in Ireland and internationally.
- EPA reports show that water quality in Ireland is improving; (2008, 2009).
- Environmental concerns have assumed greater importance and new laws and directives, designed to improve water quality have been put in place.

Use as fertiliser and OM addition

- Poultry litter results in concentration of N & P due to importation of these nutrients in feed
- Transported off site to end user
 - Bulky material (density c. 0.5-0.6 t/m³)
- Need EPA agreement
- Need NMP for the proposed end user
- Storage?? On poultry farm v on end users site
 - EPA approval – hygiene issues – composting?

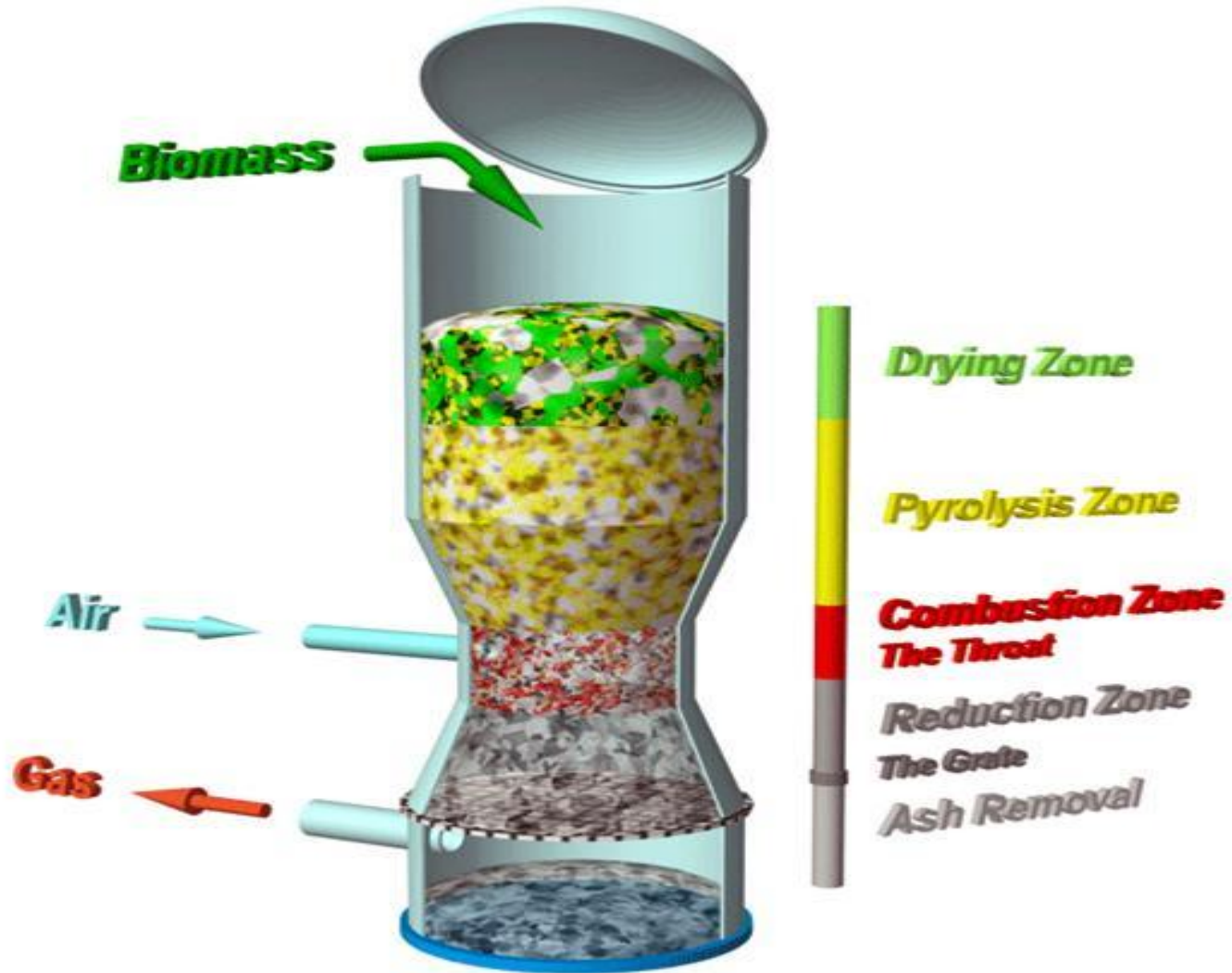
Thermal utilisation

- One disposal method is to produce energy from poultry litter by direct combustion.
- Energy Power Resources Limited is currently operating three large scale power stations in UK that utilise poultry litter as the primary biomass.
 - Thetford – 38.5MW chain grate (second plant planned on wood biomass)
 - Eye 12.7 MW moving grate
 - Westfield 9.8 MW BFB
- Poultry litter provides the heat to produce steam for the steam turbine through combustion.
- By-product ash is rich in nutrition and is used as a high-quality fertilizer.



Gasification

- Another process, gasification of poultry litter for power, heat, transportation fuels, and fertilizer production
- Gasification is a thermochemical process that converts the complex hydrocarbons in the biomass into synthesis gas, a mixture consisting primarily of hydrogen, carbon monoxide, and lesser amounts of carbon dioxide and methane.
- Syngas can be directly fired into a gas turbine combined cycle system for power generation or used in chemical synthesis for production of Fischer-Tropsch fuels, hydrogen, or valuable chemicals such as olefins



Pyrolysis of litter

- Virginia Tech in the US is working with poultry growers to test technology that would convert poultry litter to three value-added byproducts – pyrodiesel (bio-oil), producer gas, and fertilizer.
- The pyrolysis unit heats the litter until it vaporizes. The vapor is then condensed to produce the bio-oil, and a slow release fertilizer is recovered from the reactor.
- The gas can then be used to operate the pyrolysis unit, making it a self-sufficient system.
- The bio-oil is used to heat the poultry production houses



Centralised versus local use

- Majority of them are large scale – depending on large volumes of supply
- Complex technologies to operate unless at significant scale
- Licensing and planning requirements
- Transport issues and storage may still be issues
- Lack of uses for the heat when centralised
- Requires multiple skill sets if localised.

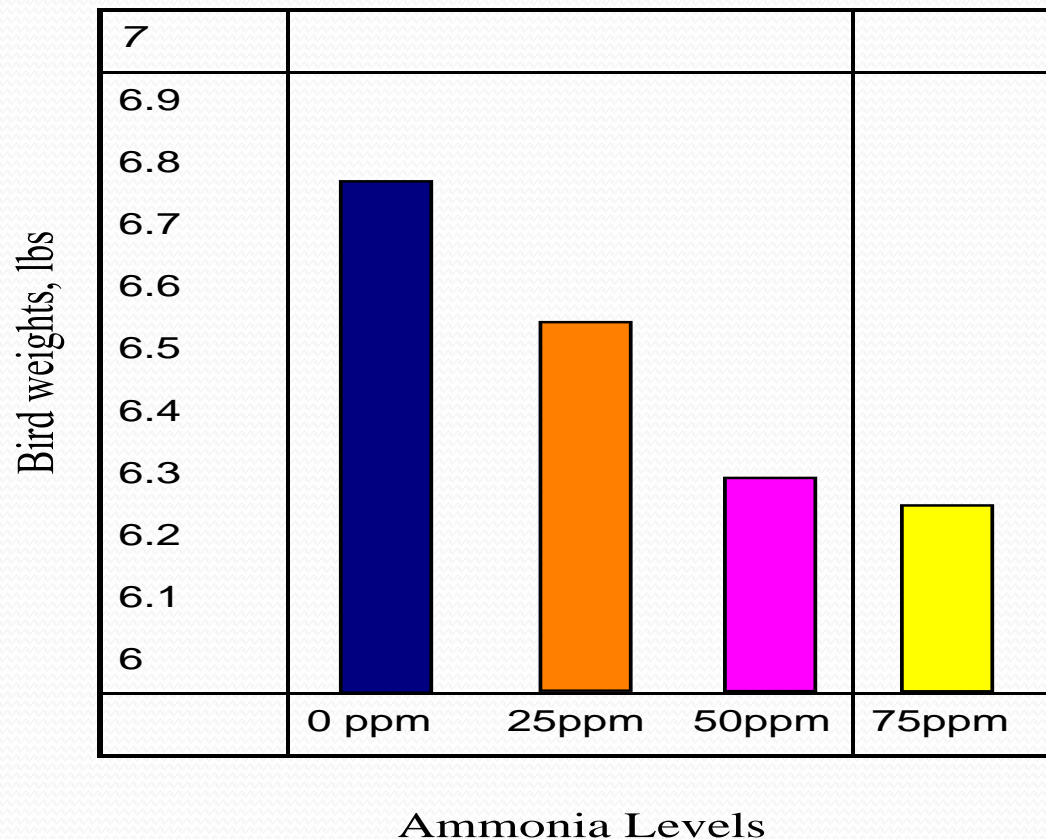
UCD / UL research

- Initial project developed in 1998
- To develop small scale fluidised bed combustion units – funded by EPA
- Demonstration on Limerick poultry farm
- Subsequent development of BHSL to further develop these
- Second project with DAF to look at further developments

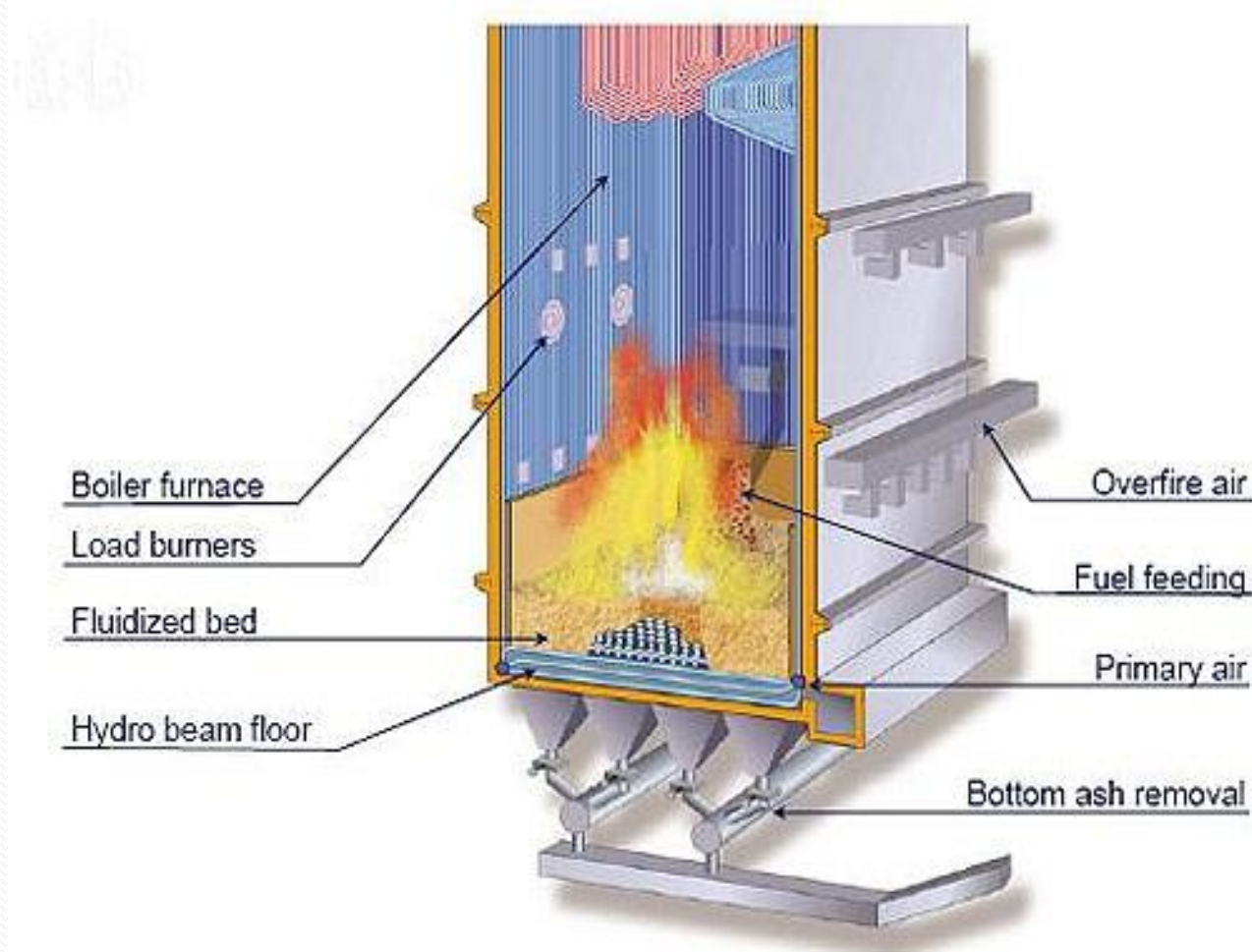
Current research

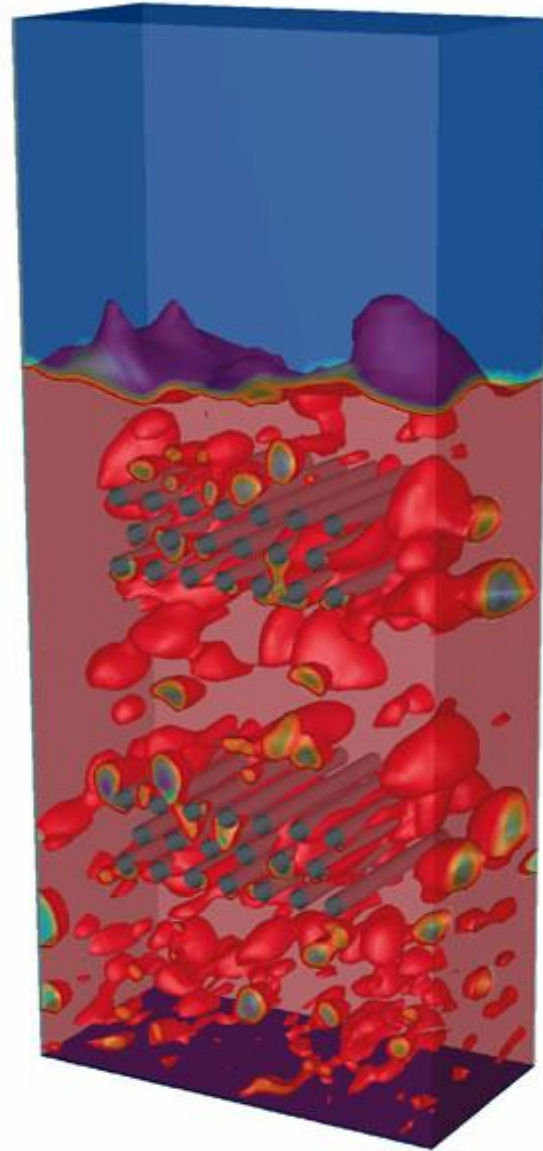
- Concept was for local utilisation with litter being used to heat the poultry houses.
- Poultry litter combusted in bubbling fluidised bed reactor
- Indirect heating of poultry houses i.e. air to air or air to water heat exchanger
- Allow for optimum ventilation rates to improve bird welfare
- Remove the need for gas heating – adding moisture to the house thus increasing the need for ventilation.

The effect of ammonia at various levels on bird weights after a seven week cycle.

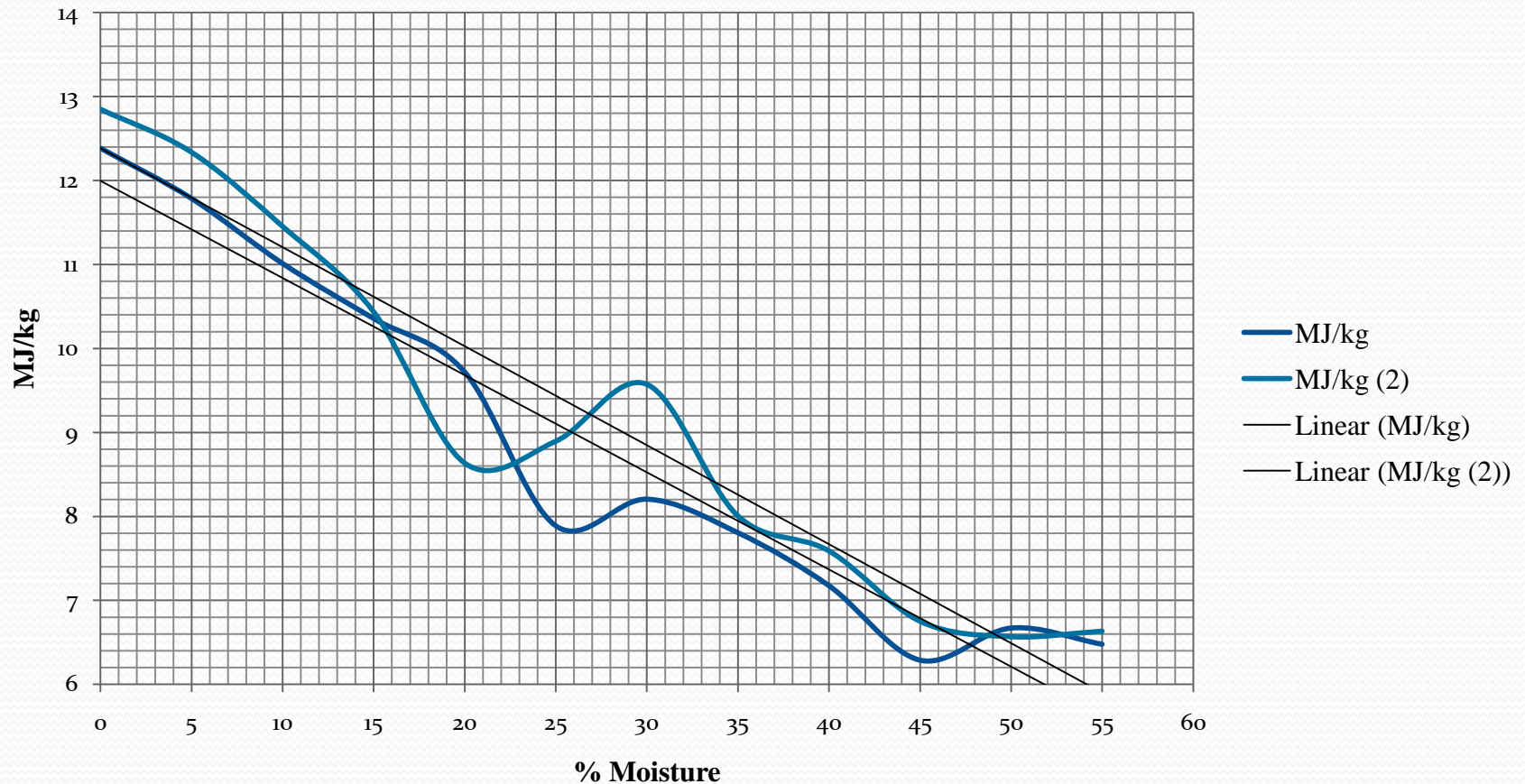


Bubbling fluidised bed reactors

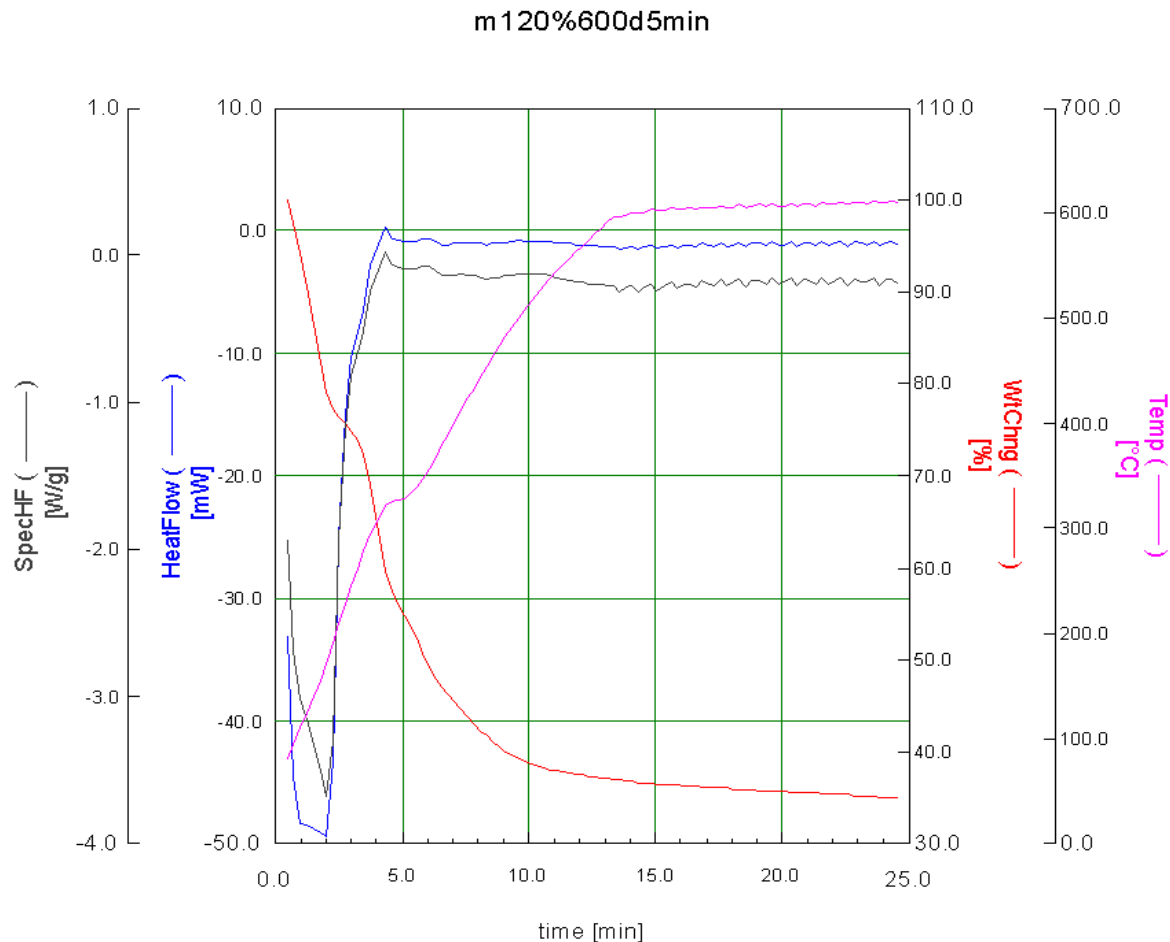




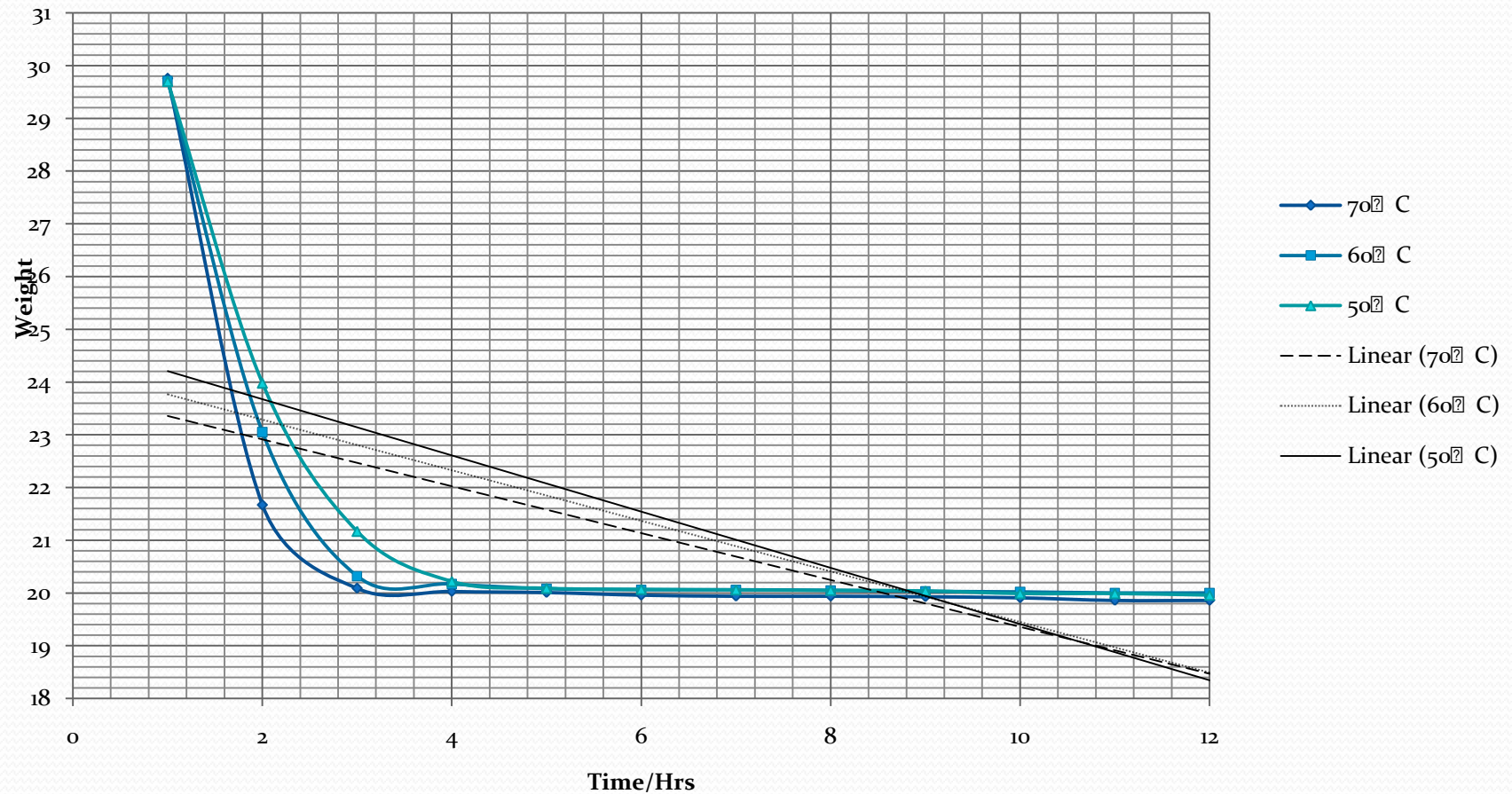
Moisture effect on energy



Poultry litter thermal performance



Drying effect



Storage and hygiene issues

- Most pathogens that affect chickens grow most effectively at a certain temperature and humidity.
- In the case of chickens this is in the range of their body temperature which is circa 41°C. If the temperature goes up just a few degrees the pathogens growth will be inhibited and if it goes up by 15-20 degrees the microorganisms will be killed (Macklin 2008).
- Therefore if storing the drying and moisture control of the litter is critical.

Project objectives

- Use of poultry litter for indirect heating of the houses
 - Maintain / improve bird welfare
 - Deal with disposal of litter issues
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- On Farm storage has significant hygiene issues
 - Proposed use of excess heat from poultry litter

Conclusions

- Local utilisation of the material offers a logical solution
- Planning issues – FBCs exempted under certain conditions
- EPA licensing v permitting – site specific
- Collective utilisation may be possible – specifically for the drying of the litter.
- Ability to substitute for fossil fuel is critical hence quality of litter important and management.