
ENVIRONMENTAL REPORT

Mr. William Davies
Town Farm Poultry Unit
Castle Frome
Ledbury
Herefordshire
HR8 1HH

29.5.16.

Dear Mr. Davies,

Re ENVIRONMENTAL BENEFITS
OF INSTALLING A LARGE CAPACITY 2.5m Clima Unit₂ HEAT
EXCHANGER FOR EACH 49,300 BIRD POULTRY HOUSE

SAVINGS

1. AMMONIA REDUCTION - EA APPROVED 35%
2. ENERGY SAVING - 28,186 LITRES OF LPG = 196,035KWH
3. CARBON REDUCTION - 11.93 TONNES
4. LESS FEED CONSUMED - 11.54 TONNES
5. REDUCTION IN LITTER USE - 14.2 TONNES
6. DUST DISCHARGED TO THE ATMOSPHERE REDUCED BY 44.92%
7. ODOUR REDUCTION estimated at 29.2%

Site Specification

- POULTRY SHEDS of 360' x 66' Housing 49,300 birds

All calculations are compared with traditional Gas Heating

AMMONIA REDUCTION 35%

- 35% agreed reduction with the Environment Agency - APPENDIX 1
- Data gathered over 12month trial at Banham Swannington Farm in Norfolk
- Trial using 1.5m Clima Unit conducted by ADAS, led by emissions expert Steven Smith
- Protocol to trial agreed by Tom Judd Senior Technical Advisor of EA
- Ammonia reduction in 30-60% range - APPENDIX 2
- Ammonia reduction by reducing litter moisture and dust and vapour capture - APPENDIX 3
- Ventilation capacity of 2.5m unit for Town Farm Poultry Unit providing 68.2% of minimum ventilation for 49,300 birds is greater than that of 1.5m unit capacity of 65.1% for 24,000 used during Swannington Banham/ Environment Agency approved trial - APPENDIX 4

CARBON REDUCTION

- 1 litre LPG produces 1.569kg CO₂ (Source: <http://www.aie.org.au/melb/material/resource/fuels.htm>)
- 1kg CO₂ = 0.27kg carbon (Source: <http://www.aie.org.au/melb/material/resource/fuels.htm>)
- Average consumption of gas in UK = 0.15 litres per chick per crop (source: Aviagen Ross 708 bird)
- 49,300 Ross birds will use 7,395 litres of gas for each crop
- Intended use of 7.2 crops per year (Source: Faccenda) gives total gas consumption of 52,244 litres.
- 52,244 litres of Gas burnt will produce 83.54 TONNES OF CO₂
- This gives 22.88 TONNES OF CARBON

Clima Unit₂ average performance reduces gas consumption by 52.9%

EACH 2.5m Clima Unit₂ HEAT EXCHANGER SAVES 28,166.08 LITRES OF LPG AND CARBON EMISSIONS WILL BE REDUCED BY 11.93 TONNES EACH YEAR.

REDUCTION IN FEED CONSUMED

- Trial data on 3 farms has on average increased weight gain of 24gm when compared to controls
- FCR IMPROVED by 1.05%
- i.e FCR 1.63, a 1.9kg bird eats 3.097Kg of feed
- With Clima Unit each bird consumes 32.5gm less food

FOR 49,300 BIRDS
ANNUAL SAVINGS OF 11.54 TONNES OF FEED

REDUCTION IN LITTER USED

Comparable farms in the UK have seen a reduction in top up litter of 58.5% (source: Moy Park: Crownthorpe Farm, Norfolk, and Red Barn Farm, Lincoln. Hook2Sisters : Quarry Farm, Scunthorpe). This equates to a reduction of 0.04kg per bird, per crop

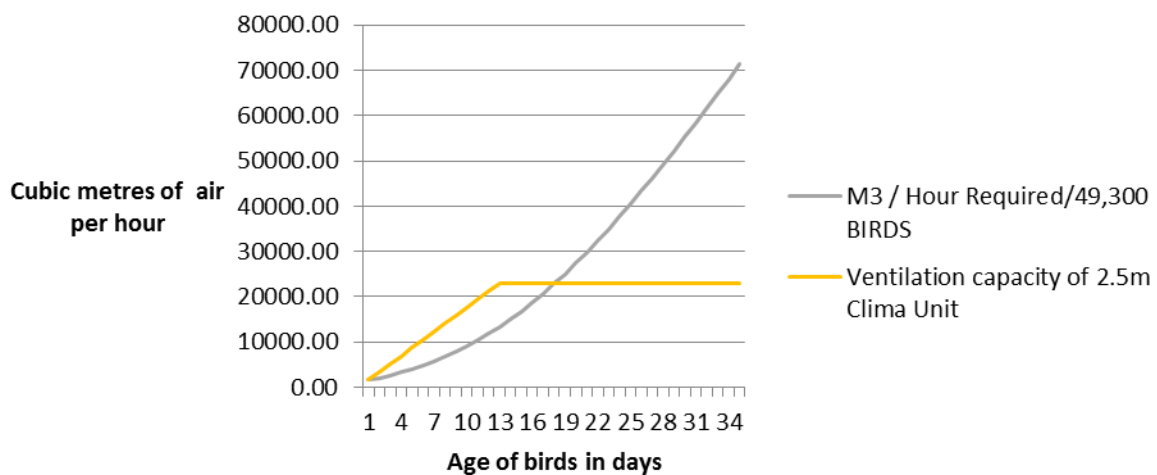
ANNUALLY YOU WILL USE 567.94 LESS BALES OF TOP UP LITTER, WHICH IS 14.2 TONNES.

REDUCTION OF DUST TO THE ATMOSPHERE

- The Clima Unit₂ has the potential of retaining between 46% and 82% (average of 75.9%) of the fine dust that enters the unit (source: Dr. Van Wagenberg. Ersel, Holland 2009)

2.5 m Clima Unit provides 68.2% of minimum ventilation for 49,300 birds

Total minimum ventilation to day 17



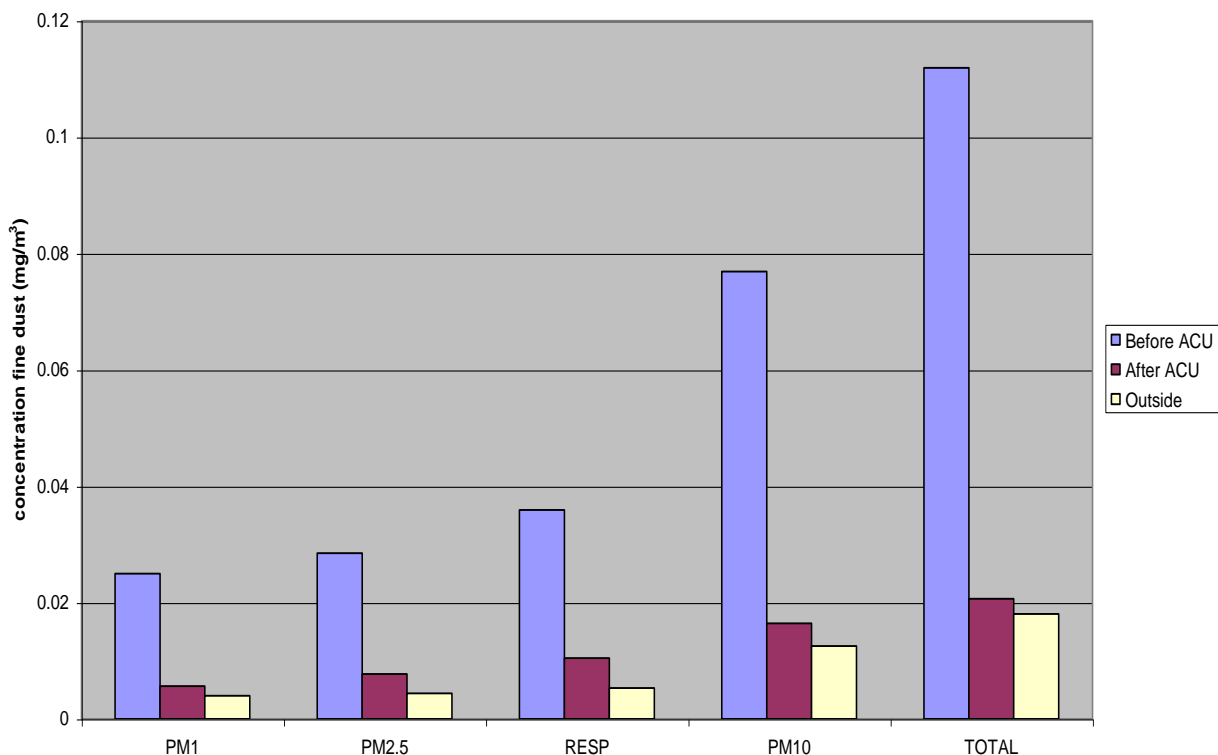
GREY LINE SHOWS BIRDS VENTILATION REQUIREMENTS, YELLOW LINE SHOWS Clima Unit₂ CAPACITY TO VENTILATE THIS POULTRY HOUSE

- This chart shows the ventilation requirement of the 360' x 66' sheds, with 49,300 birds compared to that provided by the Clima Unit₂ which shows this unit could provide all the minimum ventilation to 17 days.
- The 2.5m Clima Unit₂ provides 68.28% of the minimum ventilation during the crop. 100% of the total minimum ventilation to day 17, when approximately 20% of the total fine dust is produced, (Kirychuk 2008) ie the reduction of total dust can be 15.18% in this period.
- During the rest of the crop the Clima Unit₂ can provide 48.99% of the minimum ventilation requirement, when 80% of the dust is produced, ie 39.192% of the dust produced during this period, can pass through the Clima Unit, and 29.7% can be contained there. Total potential dust capture of 44.92%. Obviously in hot weather when extra ventilation is required this would not apply.

POTENTIAL REDUCED DICHARGE OF DUST INTO THE ATMOSPHERE OF UP TO 44.92%

CHART OF RESEARCH SHOWING DUST REDUCTION

fine dust concentration before and after the ACU Broiler breeder House 04-06-09
 Test 3: After flushing, ACU 92% (46 Hz)



EFFECT ON ODOUR

Mr. Nick Sauer head of Odour mitigation at the Environment Agency agrees that heat exchangers catch the odour laden moisture as a condensate and that will significantly reduce odour produced.

**DEFRA SAYS 65% OF *ODOUR* CAN BE CARRIED ON DUST, SO
 BY REDUCING DUST DISCHARGE BY 44.92% *ODOUR* MAY ALSO BE
 REDUCED BY 29.2% though this will be site specific.**

APPENDIX 1

creating a better place



Dr Leon Furlong
Agro Supply UK Ltd
Unit 1 Sussex Court
Thirsk
North Yorkshire
YO7 3TA

Our ref: Heat Exchanger
Your ref:

Date: 9 May 2013

Dear Dr Furlong,

The Environment Agency accepts that heat exchangers used in broiler houses can be expected to produce reductions in ammonia emissions. The extent of the reduction will depend on the equipment used and will be site specific. With appropriate evidence and information with respect to a particular site we will usually agree a 35% reduction.

If you have any questions or require any further information please feel free to contact me.

Yours sincerely

A handwritten signature in black ink that reads "A. J. Holdsworth".

Alison Holdsworth

Agriculture Technical Advisor (Lead for Intensive Farming)
Environment Agency, Kings Meadow Road, Reading RG1 8DQ
Tel 01189 535590 / 0799 064 5344

APPENDIX 2



Heat Exchangers

Supporting statement for Banham Group Limited

February 2012

The Environment Agency has major responsibilities for limiting and adapting to climate change. We will help reduce greenhouse gas emissions through regulating industrial processes, running emissions trading schemes and by advising the Government on where further action is needed.

We regulate large intensive pig and poultry farms through the Environmental Permitting Regulations (EPR). EPR implement the Integrated Pollution and Control (IPPC) Directive in England and Wales. The IPPC regulations employ an integrated approach to control the environmental impacts of large intensive farms by preventing and reducing emissions to air, land and water, ensuring efficient use of raw materials and the conservation of energy.

We have been working with Banham Group Limited since April 2008 in relation to their permit for the Woods End Farm site in Norfolk. The Woods End Farm site borders a Site of Special Scientific Interest and, as a result, the permit includes an ammonia reduction improvement condition requiring them to reduce the levels of ammonia emitted from the poultry sheds.

Banham Group Limited identified an Agro Clima Unit heat exchanger produced by Vencomatic as a possible way of reducing ammonia emissions. The heat exchanger was primarily developed for energy saving in poultry house systems.

Following discussions with the company we agreed to a trial of the technology on one shed at the Woods End Farm site. A heat exchanger was installed on one shed and monitoring carried out at that shed and at a control shed.

Trial results show average savings of ~ 57% for LPG consumption and therefore significant reductions in carbon dioxide emissions from the shed with the heat exchanger. The LPG savings resulted in a considerable cost saving for the company.

Drier incoming air dries the litter in the shed and during the trial this led to reductions in ammonia emissions ranging from 30 - 60%. The results of

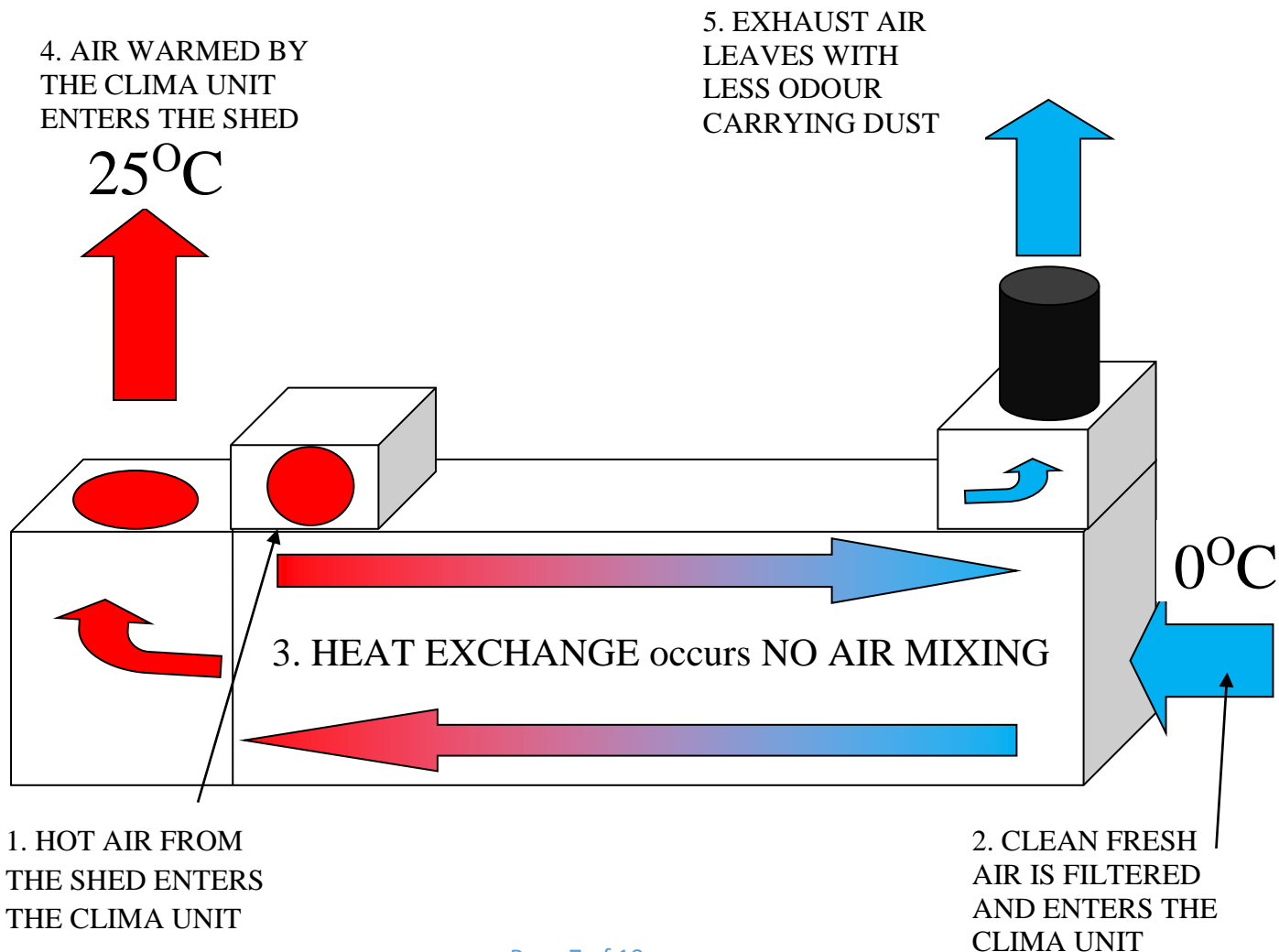
APPENDIX 3

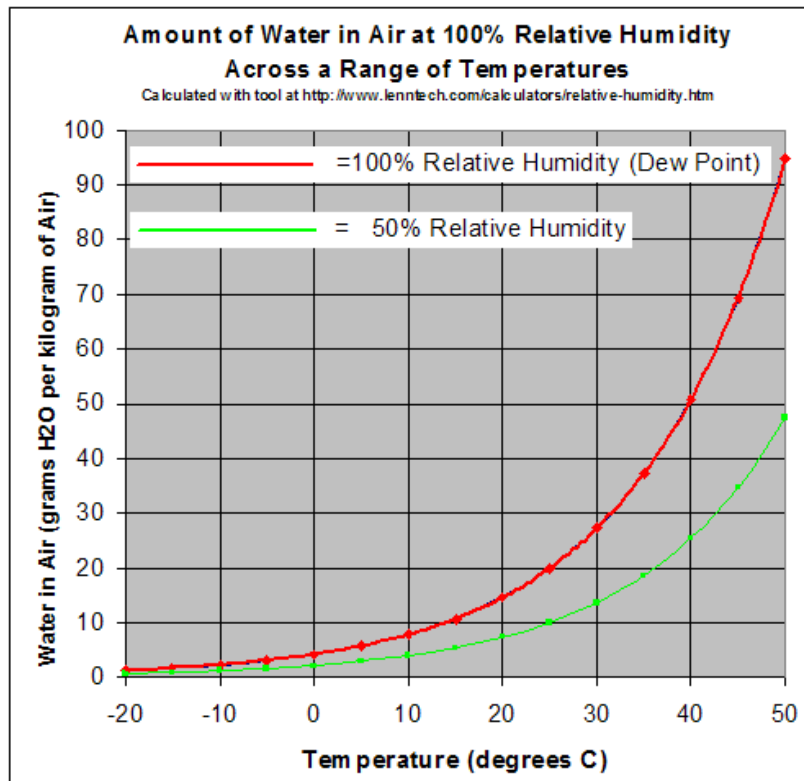
FUNCTION OF THE CLIMA UNIT

1. Reducing moisture in the poultry shed - dry litter produces less ammonia.

The Clima Unit₂ saves 80% of the energy in the hot air that normally is discharged straight into the atmosphere by standard minimum ventilation. By passing the moist heated exhaust gas from the shed over our Clima Unit₂ tubing, the cold incoming air inside the tubes, is preheated, and fuel consumption to heat the shed is PROVEN TO BE REDUCED by typically 52.9%.

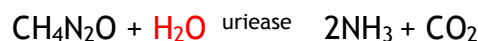
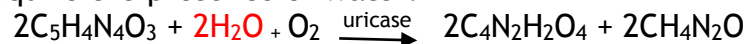
In this example outside air is warmed by the 30°C exhaust air from 0°C to 25°C. The air at 0°C has significantly less ability to hold water vapour only 3.8g/Kg of air. When heated to 25°C air can hold 19.8g water/Kg of air. Thus the pre-warmed air has an ability to absorb moisture when it enters the poultry house, and dry the litter. See chart below.





AMMONIA PRODUCTION

Chickens cannot store the excess amino acids from the high protein in poultry feed. These amino acids are deaminated and the derived nitrogen is mainly excreted as uric acid (80%) ammonia (10%) and urea(5%). Rapid reactions catalysed by uricase and urease found in the litter, produce ammonia (NH₃). All the reactions require the presence of water.



Drying the litter significantly reduces ammonia production.

2. Condensation of the warm humid air from the poultry house.

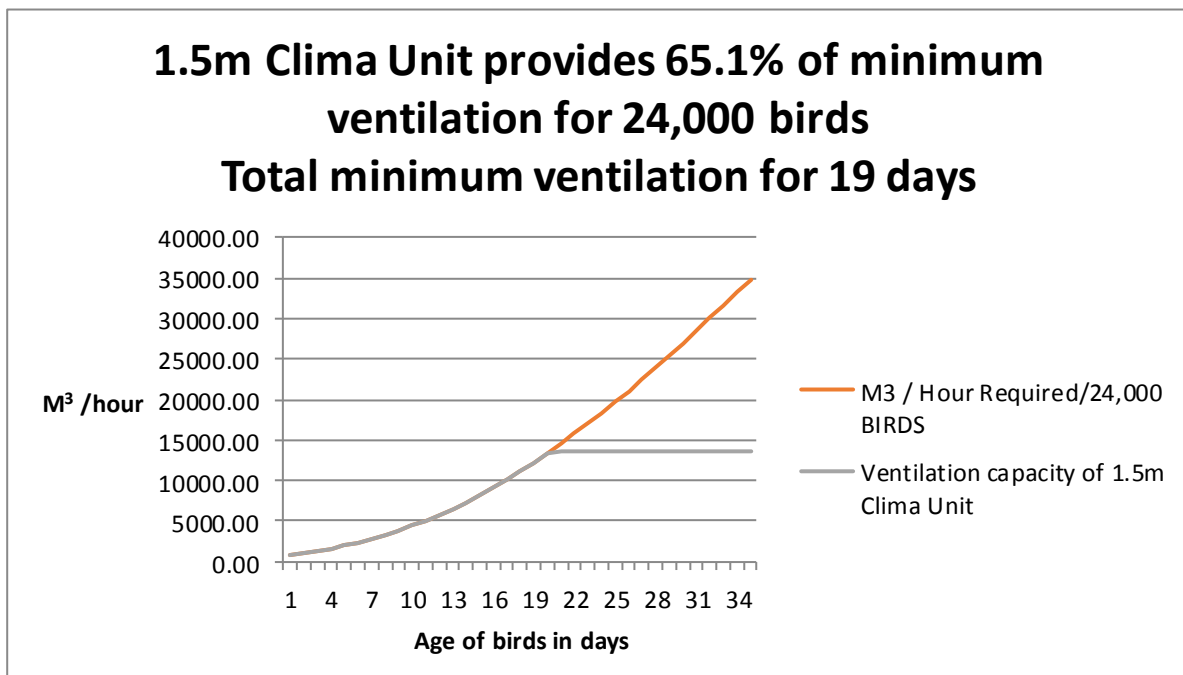
When the humid air leaves the poultry house, with dust and ammonia, it contacts with the cooler heat exchange pipes, and a dew point is reached and water forms. This condensate water contains dust and ammonia. This ammonia collection has been confirmed by sampling at various sites. The effect of this reduction in ammonia release was calculated as part of the Banham/EA study.

APPENDIX 4

COMPARISON OF BIRD NUMBERS AND VENTILATION RATES BETWEEN BANHAM SWANNINGTON FARM AND DAVIES TOWN FARM

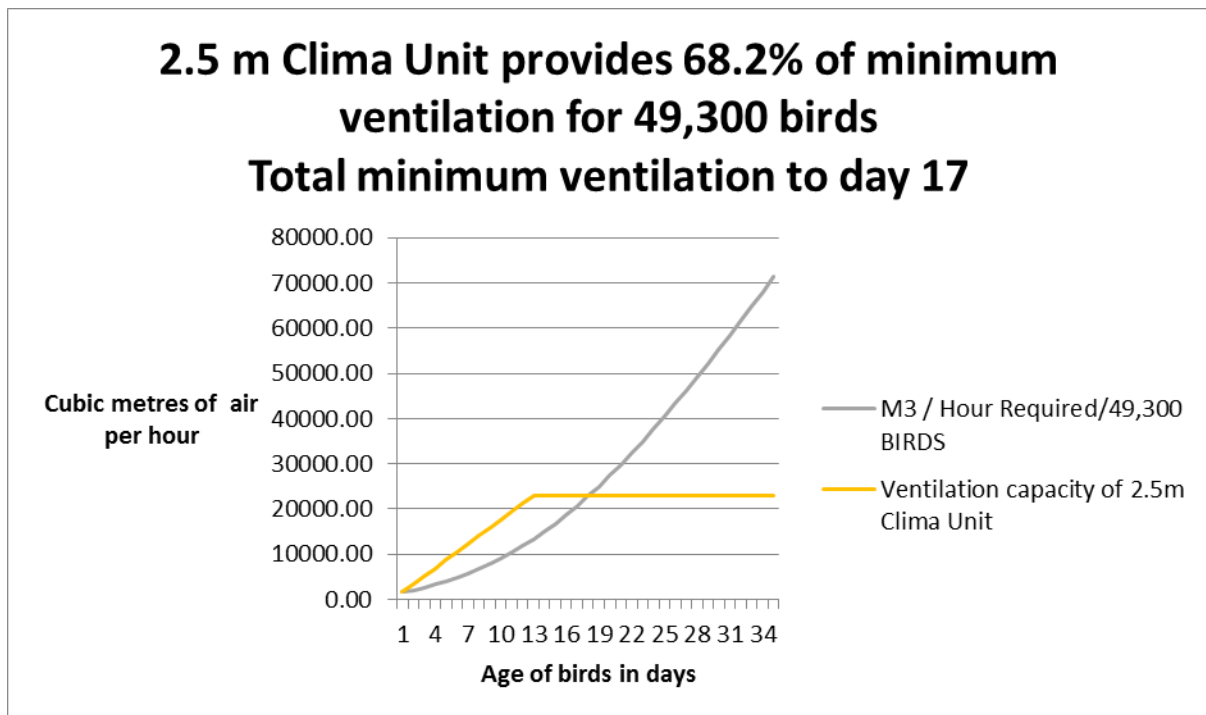
1. SWANNINGTON FARM

- 1.5M Clima Unit - ventilation capacity 13,700 cu.m./hour
- Housing 24,000 birds
- Providing 65.1% of minimum ventilation requirements



2. TOWN HEAD FARM

- 2.5M Clima Unit - ventilation capacity 23,000 cu.m./hour
- Housing 49,300 birds
- Providing 68.2% of minimum ventilation requirements



By utilising the full capacity of the 2.5m Clima Unit earlier in the cycle, extra drying airflow can be introduced and this will further deplete moisture in the litter. Maximum air flow can be reached at day 12 to enhance the performance of the heat exchanger.

The capacity of the heat exchanger is easily changed on the programme in the Navi+ computer which is used to control the machine.