Thermal Equalisation De-Stratification Units (TEDS)

By

Fernando Ferreira Project Manager Scolexia Project Management

Project Manager
Scolexia Pty Ltd.
Project Management Division
8/19 Norwood Crescent
Moonee Ponds VIC 3039
Ph. +61 (0) 3 9326 0106
Fax. +61 (0) 3 9372 7576
Mob.+61 (0) 488 677 431
e-mail. fferreira@scolexia.com.au
www.scolexiaprojects.com.au

Key Outcomes Summary

The TEDS solution has proven to decrease the amount of gas required to heat a poultry shed, thus providing ongoing cost savings in terms of gas consumption and environment livability.

Operational & Environmental Savings

A significant reduction in the running costs was recorded for the gas consumption of up to 40%. Additional perceived benefits to the operational aspect were observed:

- A significant reduction in the mortality.
- Feed consumption was reduced while on average the birds in the treated sheds had superior weight gain throughout the cycles.
- An additional benefit to the operational aspect is the reduction in CO_2 levels at the bird level.

Running Cost

One of the most exciting aspects of the TEDS is its ability to offer significant savings with negligible running costs. The TEDS units tested operate at low wattage between 11 and 15 watts, or 110 to 150 watts for a shed with 10 operational units.

It must be stressed that only 21 types of fans were tested and represent only a small fraction of fan types and units out in the market. Other units in the current market may perform as well. A range of fans were tested from ceiling fans to existing poultry house stirring fans and current de-stratification units.

Selection Criteria of TEDS

- an ability to operate smoothly in the harshest conditions of the poultry shed environment.
- easy to install and operate
- cost of units and installation cost
- economic benefits and health benefits directly associated with the use of the TEDS units.

1. Introduction

Stratification is a term used to describe the difference in air temperature between the floor and roof of an enclosed structure. De-stratification is achieved by efficiently balancing these temperatures from floor to roof.

This project aimed to implement a de-stratification solution in poultry sheds to capture and recycle heat from the roof, sending it back to the floor level. This required the installation of commercially available and specifically designed de-stratification units in poultry sheds during entire growing cycles.

Science dictates that hot air rises.

In the case of poultry growing sheds, this is costly in a shed being heated using gas heaters; first the roof is heated followed by the main cavity of the building and infrastructure and finally the floor is heated. As the birds are grown on the floor most of the heat is wasted on heating every other part of the building.

Through the implementation of a TEDS solution, “cleaner” hot air in the roof is forced down to the floor continually. In this manner, the cleaner (e.g. less CO_2), hotter air in the roof is recovered and forced down very gently at low speed and low volumes of air, to where it can provide use for the birds, the floor without creating a chill factor on the birds. Significant amounts of wasted hot air is recovered from the roof and recycled.

2. Project Aims

The project aimed to determine whether the following benefits make this technology a cost effective commercial investment.

- Determine the shift in temperature at the floor and at the roof to enforce 'Thermal Equalisation'
- Determine whether the change in Thermal Equalisation is able to reduce gas consumption in the heating of the shed and any equivalent savings in carbon emissions and quantify this potential saving.
- Monitor the effect of the de-stratification on the birds throughout the growing period in terms of morbidity, feed consumption, growth rates and air quality at the bird level.

3. Trial Methodology

(a) Two poultry sheds were selected in the same location with the same dimensions and construct, housing the same number of birds (i.e. identical sheds). One was the control facility and the other implemented the strategic TEDS solution.

(b) The TEDS solution was trialed across two growing periods in different seasonal conditions in:

i. Poultry test sheds (Scolexia Animal Research Facility)
ii. Poultry Rearing sheds (commercial farm)

(c) Any notable difference in the running of the sheds were recorded including percentage gas consumption, temperature at bird level and apex of the shed, feed consumption, bird weights, mortalities and CO_2 levels.

(d) Shed cross-over testing was implemented to ensure that results were not due to any potential differences in shed conditions.

Measurements

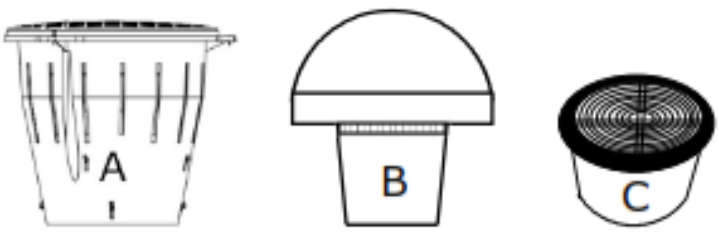
The following categories of measurements were applied:

1) Air temperature in the roof, body and floor of the sheds using temperature data loggers. The ambient air temperature was recorded daily during the experiment timeframe;
2) Landis & Gyr Gas meters (detail of supplier) were attached to the shed inlets measuring the amount of gas consumed in each shed;
3) Average feed consumption per bird during the trial;
4) Average weight gain per bird over the trial period;
5) Actual mortalities during the trial;
6) Air quality in the form of CO_2 levels at bird strata
7) A general observation on bird spread

As this evaluation was conducted in a commercially operated shed environmental changes are to be expected and are unavoidable. However, to try and mitigate this as much as possible data has been logged across several distinct growing periods to highlight any anomalies.

4. Results

Three of the commercially available units tested (Excluding current poultry de-stratification systems), were identified having good results and ticking all the boxes as per the selection criteria.



These three - A, B and C - commercially available fans outperformed all of the other fans tested with all three having a significant reduction in the gas consumption.

Additional perceived benefits to the operational aspect were observed:

- A significant reduction in the mortality.
- Feed consumption reduction was recorded, all while the birds on average outperformed the control and other sheds in regards to weight gain throughout the cycle.
- An additional benefit to the operational aspect is a significant reduction in CO_2 levels at the bird living strata, was recorded in the test sheds in relation to the control sheds.

KEY ATRIBUTES

Coverage Diameter The units tested are designed to cover a *10 – 14m* diameter circle from a roof apex height of 4.3m

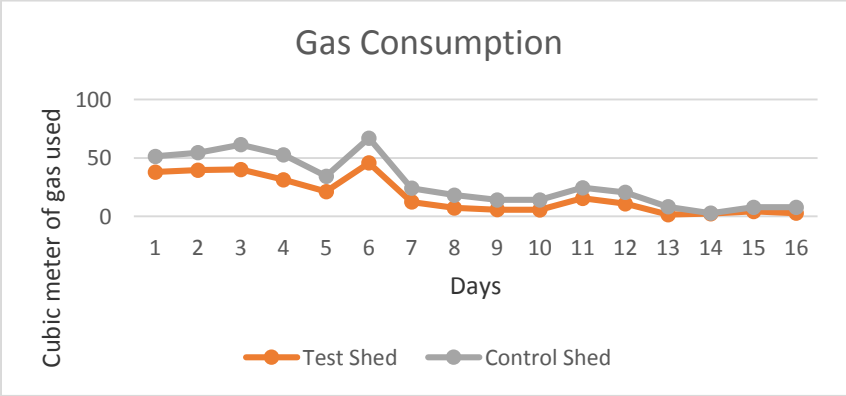
Minimal running costs The units tested had low wattage motors (comparable to a single light bulb) between 8 and 15 watts / motor.

CFM The tested units offer an air volume velocity of between 119 L and 310 L

Minimal Noise The units tested operates at *15dBA*

GAS CONSUMPTION

The following graph gives an indication of the results attained during the test periods.



Gas Consumption

Considering that the two sheds are identical and thermally rated, there is a significant reduction in the consumption of gas in the Test Shed when compared with the Control Shed.

TEMPRATURE

The data shows that the environment temperature at bird height was stable and effective while the TEDS were operational. For the start of each cycle the shed temperature was set at 32ºC in order to receive the day old chicks. As the birds grew, the heat in the room was slowly reduced down to 22^0C from the starting temperature of 32^0C. The trial demonstrated that the required temperatures were met at bird height even during cold spell conditions.

TEDS operates in a unique manner as they force air down **vertically** and at a low air velocity (which does not affect the birds and does not dissipate the heat, unlike similar products on the market which force the air in a horizontal motion with a large amount of air flow that create a chilling effect and moves the heat away from the chicks on the floor. When internal circulation fans are directed downward it causes a large amount of air flow over the birds with removal of heat being their primary function.

A concern was the potential for creating cold spots throughout the shed which would affect the birds' health, forcing them closer to the walls away from the fans located at the center of the sheds. A key indicator to the success of the TEDS in a poultry shed environment was noted with the birds brooding directly under the flow of the air.

Temperature & Analysis: Trial Period 23/12/10 - 14/01/11

ON – OFF Cycles Tables

The de-stratification fans were set to operate in **ON-OFF Cycles**: (see the table below)

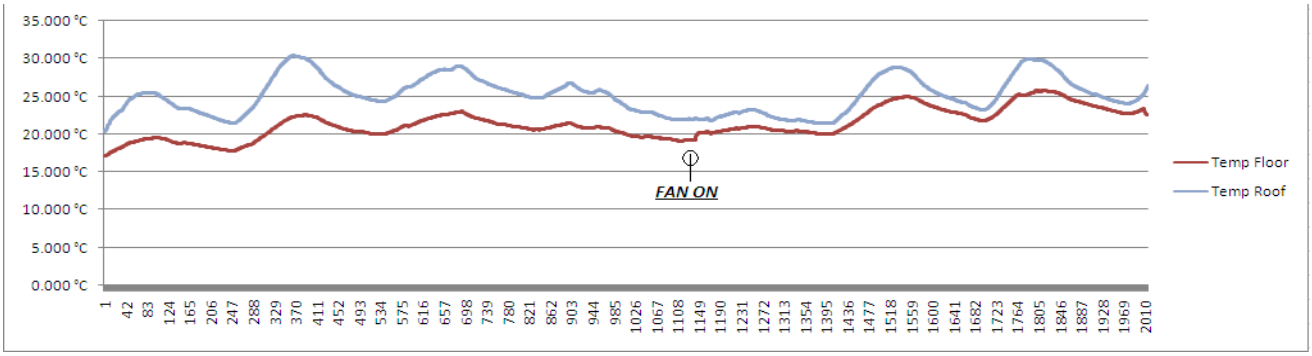
Trial - Three Cycles: (summary of all treated sheds)

Temp °C

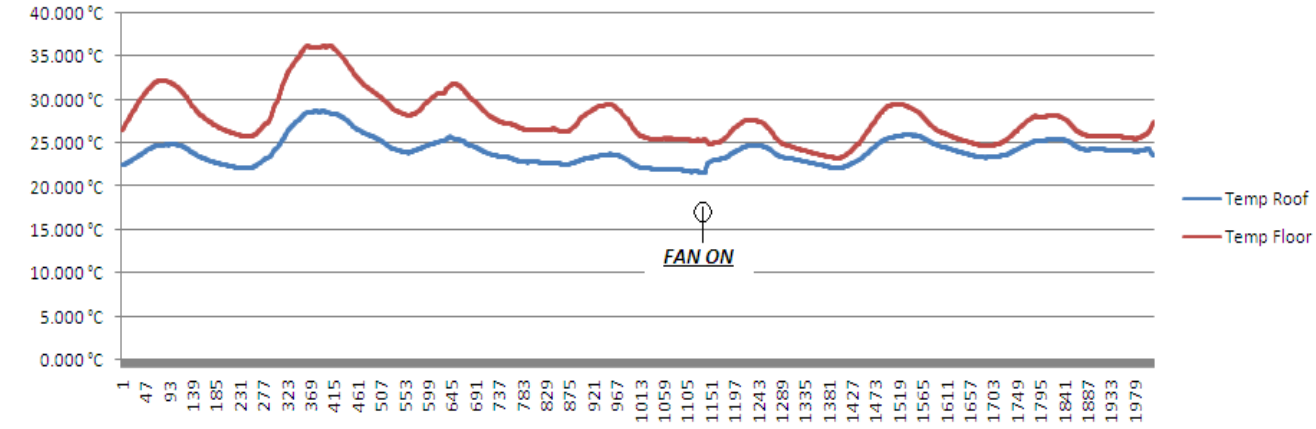
		Cycle 1			Cycle 2			Cycle 3		
		Roof	Floor	Change	Roof	Floor	Change	Roof	Floor	Change
FAN OFF	Min	20.374	17.125	2.726	25.335	21.603	3.452	27.529	23.662	3.156
	Avg	25.28	20.325	4.958	29.163	24.071	5.092	30.125	25.385	4.74
	Max	30.458	22.98	8.213	36.282	28.713	7.855	35.222	28.189	7.944
FAN ON	Min	21.442	19.246	1.368	23.251	21.714	1.131	27.72	24.517	1.752
	Avg	24.939	22.601	2.338	26.194	24.111	2.083	29.14	27.021	2.119
	Max	29.927	25.771	4.724	29.513	25.934	3.809	30.472	28.02	3.861

Note the three cycles of on/off operation of the fans covered the first 16 days of brooding.

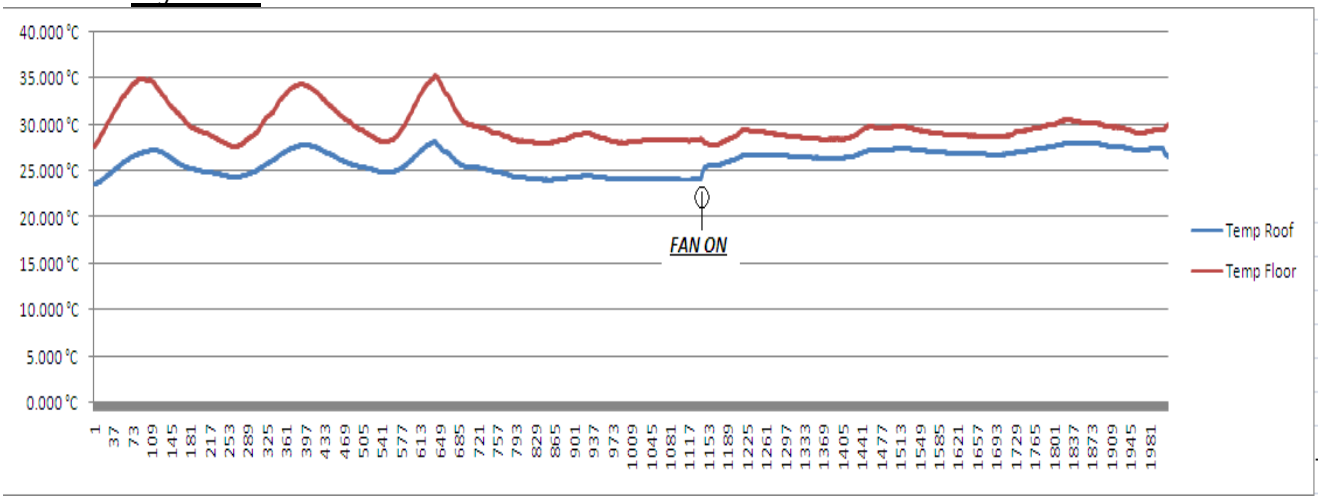
Cycle 1:



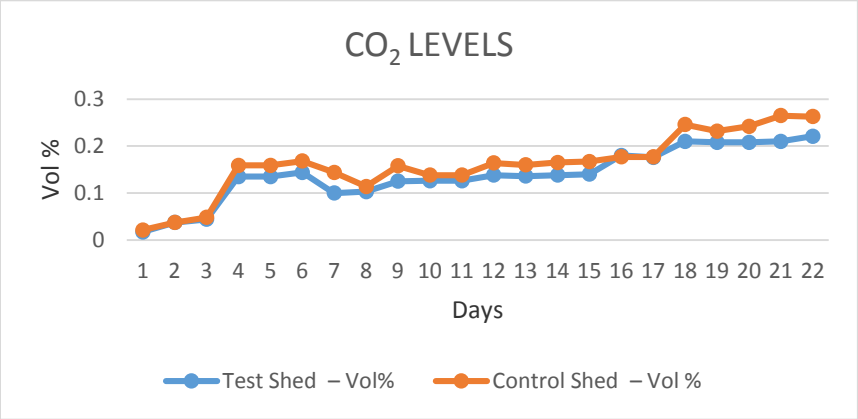
Cycle 2:



Cycle 3:



CO_2 MONOTORING



CO_2 LEVELS

The test shed average over 22 days was 0.139 vol% or 1390ppm at bird level
The control shed average over 22 days was 0.161 vol% or 1610ppm at bird level

FEED CONSUMPTION AND WEIGHT GAIN

The feed consumption reduction was reduced, while weight gain was increased in the birds in the treated sheds. This was an unforeseen outcome and more testing needs to be undertaken to verify this.

MORTALITIES

A further unforseen benefit was a significant reduction in the mortality rate in the test shed compared to the control shed. Once again, more testing needs to be performed to verify this result.

5. Conclusion

De-Stratification in Poultry sheds during brooding periods led to significant savings in gas consumption, a more even temperature throughout the sheds and a re-distribution of heat from the roof to the bird level in the shed. During and after brooding a further air quality benefit was identified and tested with a reduction in CO_2 levels at the bird level in the shed. Also during and after brooding additional perceived benefits were observed in reduced mortality, reduction in feed consumption with added weight gain of the birds. Of the units tested the three models (A, B and C) provided the greatest savings in gas consumption. Other products similar in nature are commercially available but may not maximise potential efficiencies.
Testing is ongoing.