AUSTRALIAN POULTRY CRC

FINAL REPORT

Program 3

Project No: 09-7

PROJECT LEADER: Dr Angus Crossan

DATE OF COMPLETION: 4/1/2010

09-07: Determining Egg Production Exposure to the Carbon Pollution Reduction Scheme (CPRS)

© 2010 Australian Poultry CRC Pty Ltd

All rights reserved.

ISBN 978 1 921890 26 0

Determining Egg Production Exposure to the Carbon Pollution Reduction Scheme (CPRS)

Project No. 09-7

The information contained in this publication is intended for general use to assist public knowledge and discussion and to help improve the development of sustainable industries. The information should not be relied upon for the purpose of a particular matter. Specialist and/or appropriate legal advice should be obtained before any action or decision is taken on the basis of any material in this document. The Australian Poultry CRC, the authors or contributors do not assume liability of any kind whatsoever resulting from any person's use or reliance upon the content of this document.

This publication is copyright. However, Australian Poultry CRC encourages wide dissemination of its research, providing the Centre is clearly acknowledged. For any other enquiries concerning reproduction, contact the Communications Officer on phone 02 6773 3767.

Researcher Contact Details

Dr Angus Crossan
4.02 107 Mount St

North Sydney NSW 2006

Phone: 02 9409 6999
Fax: 02 99543133

Email: research@aecl.org

In submitting this report, the researcher has agreed to the Australian Poultry CRC publishing this material in its edited form.

Australian Poultry CRC Contact Details

PO Box U242

University of New England

ARMIDALE NSW 2351

Phone: 02 6773 3767

Fax: 02 6773 3050
Email: info@poultrycrc.com.au
Website: http://www.poultrycrc.com.au

FINAL REPORT

PROJECT NO:

Published in April 2010

Executive Summary

This strategic research project had three main objectives: to collaborate with an Australian Egg Corporation project regarding the analysis of carbon use in egg production; to the use this analysis to review the exposure of egg production businesses to impending carbon regulation; and to prepare communication material to extend these finding to egg producers,

The project assessed carbon use in egg production using life cycle analysis (LCA). A preliminary assessment of energy use and greenhouse gas emissions from egg production throughout the supply chain was conducted. A review of Government regulations with respect to energy, water and green house gas (GHG) reporting was completed.

The rapid LCA results show Australian egg production to have a very low level of GHG emissions (measured as GWP, which is analogous to a comprehensive carbon footprint). Through to the point of distribution, the GWP was 1.64 kg CO_2-e / kg eggs (not including packaging). It must be stressed that the rapid LCA was not comprehensive in its coverage of the supply chain and is based on data from a limited number of sources. ***Considering this, these results should not be released or quoted outside AECL, the Poultry CRC and the industry project participants at this stage.***

Because of the uncertainty within the regulatory framework regarding climate change and the Carbon Pollution Reduction scheme (CPRS) this project focussed on the underlying reporting framework, the National Greenhouse and Energy Reporting System (NGERS). The data suggest that resource usage varies between producers, even for highly regulated systems as are found with controlled environmental sheds. An egg production facility would need to house 8 – 14 M birds to exceed the current thresholds which are reportable under the NGERS based on GHG for energy emissions (electricity only). It is noted that most businesses will have energy usage and GHG emissions from liquid fuel, pullet rearing, grading and possibly feed milling. At this stage the total contributions are not known but it is highly unlikely that these would amount to sufficient emissions to exceed the current thresholds. As a precaution, businesses with more than 4 M birds on one site, together with additional activities, are recommended to review their emissions exposure under the NGERS.

This project has enabled the collection of valuable data and information to assist egg producers in understanding the implication of potential carbon pollution and government reporting regarding GHG emissions. The main findings of the study were prepared as communication extension material to assist informing the industry of the implications of regulations and benchmarking of carbon use. The outcomes of this project help enable egg producers to understand the implications of the most predominant climates change regulation and ultimately to benchmark and improve efficiency with their supply chain which will reduce the environmental impact of their production systems.

Contents

Introduction

In response to resource demand and climate change, the Australian government and community are demanding more information on the environmental impacts of food products produced and consumed in Australia. Little data are currently available on the environmental and resource efficiency parameters (water usage, energy usage and greenhouse gas emissions) that affect the environmental performance of the egg industry. These data are likely to be of greater importance to the industry in the future from likely increased resource costs and regulatory burdens.

One potential future regulatory burden is the National Greenhouse and Energy Reporting System (NGERS), where companies are required to report their resource usage and greenhouse gas emissions. The NGERS also forms the basis for the proposed CPRS. The impacts of these (and other) regulations have not been previously assessed for the egg industry. At the product level, Life Cycle Assessment (LCA) is another tool used to quantify the resource usage and environmental impacts of egg production.

A large degree of uncertainty exists with respect to the introduction of the Carbon Pollution Reduction Scheme (CPRS) and its effects on the poultry industry including egg producers. Although this uncertainty exists with respect to the final policy implications and its relative effect on egg production, it is important for egg producers to have an assessment of the carbon profile of their production business.

Objectives

There were three main objectives of this strategic project. Firstly, it was a strategic collaboration to augment an AECL LCA project, enabling a more comprehensive analysis for the industry. Secondly, the project was able to use data collected for the initial LCA analysis and literature review to provide information of the egg industries exposure to the regulatory implications of the emerging carbon economy (CPRS). Finally, to produce extension material regarding greenhouse gas (GHG) emissions and water and energy use for industry bench marking and knowledge transfer regarding carbon regulations.

Methodology

Part 1

This project was run concurrently with the egg industry LCA project to be funded by AECL. Industry partners were engaged and the following data collected:

Energy: transport, electricity, gas, liquid fuel and other energy usages from on-farm operations.

Greenhouse Gas: emissions from energy usage (above) and estimated emissions from waste streams (scope 1 and 2 emissions including agriculturally relevant emissions proposed but not currently included under the CPRS).

Water usage: drinking, cleaning water, cooling, sundry usage and losses on farm (these were collected in conjunction with the energy data and will contribute significantly to the LCA project and to the broader issue of climate change adaptability).

Life Cycle Assessment

An LCA project comprises four parts, i) goal and scope definition, ii) inventory analysis or LCI, iii) impact assessment and iv) interpretation. Goal and scope definition is the first step in conducting a LCA and 'frames' the whole project. The stages are interactive and dynamic. For example, the goal and scope of the project may need to be modified if the inventory is found to be incomplete.

Goal and scope

Definition of the goal and scope is presented here for discussion with the industry R&D organisation (Australian Egg Corporation Limited – AECL) and the industry participants. Goal definition covers the intended application and target audience for the LCA project. The project goals were initially developed as part of the project outline.

Application

An LCA study may have several applications. Some intended applications for the present study include:

1. To provide environmental impact information on egg production to the general public

2. To identify environmental research priorities throughout the supply chain and to validate these research aims (this will inform industry and government research investment)

Part 2

Following production of the technical LCA report, Stage 2 provided a review of government regulations for water, energy and GHG reporting with respect to the egg industry and developed extension materials with basic benchmarking data on energy, water and GHG from egg farms. These materials were based on data collected in Stage 1 of this project and the LCA project. The following titles were developed:

- Energy and GHG regulations, what does it mean for the egg industry?
- Benchmarking energy and water usage and GHG emissions in the egg industry
- Worked examples for calculating GHG emissions from an egg farm.

Results

Comprehensive technical reports are available after joint CRC and AECL publication (Wiedemann and McGahan, *in press*; Wiedemann *et al.*, *in press*) Three draft extension articles have been prepared; these are attached to this report (Appendix A).

The initial data collection and analysis stage provided an estimation of energy use for the industry. Energy usage (electricity) for hen production ranged from 1.7-3.0 kWh / hen / year, while pullet rearing electricity usage ranged from 0.56 – 0.91 kWh / pullet reared to 17 weeks. Gas usage for pullets ranged from 0.03 – 0.27 L / pullet reared to 17 weeks. The weighted average energy proportions (on a MJ basis) for the three farms indicated that electricity dominated energy usage for pullet rearing, accounting for 66% of energy usage. Gas usage contributed the remaining 34% (petrol and diesel not included).

Water usage for egg production was in the order of 77 – 114 L / hen / year. Of this, drinking water contributed 56 – 79% of total water usage, with the remaining water being used for cooling and sundry purposes. Cooling water data were available for two farms only at the time of reporting and a weighted average was not collated for water usage until these data are incorporated.

Drinking water for pullets was in the order of 11.8 – 12.1 L / pullet reared. One farm did not have any cooling or cleaning water (deep litter), while another farm has not yet reported cooling and cleaning water for their production system. The remaining farm reported cleaning and cooling water usage of 33.3 L / pullet reared.

Greenhouse gas emissions for energy usage (electricity only) ranged from 1.8 – 3.1 kg CO_2-e / hen / year. On a per egg basis, emissions were 0.10 – 0.16 CO_2-e / kg eggs. 'Agricultural' emissions (from manure handling, storage and application) ranged from 4.25 – 4.68 CO_2-e / hen / yr. Emissions ranged from 0.22 – 0.24 CO_2-e / kg eggs. Agricultural emissions exceeded energy related emissions, making up 64% of total 'scope 1 and 2' emissions (agricultural emissions included) for egg production.

Greenhouse gas emissions for energy usage (electricity only) ranged from 0.162 – 0.264 kg CO_2-e / pullet reared. 'Agricultural' emissions (from manure handling, storage and application) ranged from 0.68 – 1.48 CO_2-e / pullet reared. Agricultural emissions exceeded energy related emissions, making up 82% of total 'scope 1 and 2' emissions (agricultural emissions included) for pullet rearing.

Discussion

Benchmarking Data

To provide an indication of the exposure of the egg industry to water, energy and GHG regulations a preliminary assessment of energy and water usage, and direct GHG emissions was made for three egg farms in the northern region of eastern Australia. The assessment represents the first attempt to collate such data from Australian egg production and aims to establish an approach that can be adopted more broadly in the industry to improve environmental performance and reduce resource usage.

The assessment was based on historical data collected during the normal course of management at the farm, either from production or financial records. Some additional data for water usage was collected from water metering on-farm. Estimation of GHG emissions were based on energy usage and production records. The scope of the project determined the number of farms assessed (3) which were considered the minimum number possible for a preliminary assessment (rapid LCA). Considering the very small sample size, these data could not be extrapolated to the whole industry but do represent a starting point for wider benchmarking efforts.

Data were collated on a 'per hen / year' and 'per kilogram of eggs' produced basis, to provide two perspectives for resource usage and impacts. The per hen data may prove more useful

when considering impacts in a static situation, such as regulations that relate to the size of a facility. Egg production data on the other hand are more sensitive to production parameters and are a better estimate of the 'year to year' resource usage and environmental impacts.

Rapid LCA

The rapid LCA investigated GHG emissions only, and included additional 'embedded' GHG emissions associated with farm purchases such as poultry feed. The assessment identified feed production as the single greatest contributor to global warming potential (GWP) at 67%. This was followed by electricity consumption (16% - this represents electricity consumption at the feed mill, pullet production farm and layer farm) and the manure management system for the layer farm (7 % - methane and nitrous oxide from the shed and surrounds as per the Department of Climate Change (DCC) methodology).

In comparison to the literature, GWP results for this study are 60-70% lower than other studies published. While the rapid study had several omissions that are likely to result in slightly higher burdens, the major difference relates to feed production. Australian grain production is subject to far lower emissions of nitrous oxide (DCC 2007) than European grain production or global averages. The result of this one difference is a significantly lower GWP burden for Australian egg production compared with Europe. Australian bird performance data also appear to be significantly better than the studies reported from Europe, leading to further environmental efficiency gains.

The preliminary findings also identify where industry participants should focus resources to ensure the data supplied are representative and accurate. This analysis indicates that the greatest research attention in the data collection and impact assessment phase should be directed towards:

- Accurately quantifying rations and ration components, including upstream grain production.
- Accurately quantifying energy usage and services used at the layer farm and during pullet rearing.
- Accurately quantifying bird production (particularly for sensitive factors such as feed consumption).
- Accurately quantifying manure management emissions using both the DCC methodology and mass balance principles for the layer farm to provide a range of values for the sensitivity analysis.
- Accurately quantifying the transport component within the supply chain.

It is noted that at this stage data for feed grain production and some smaller feed additives rely on desktop studies rather than detailed assessments of Australian supply chains. Considering this, it is recommended that AECL and the Poultry CRC support future collaborative efforts to improve the quality of LCI data for Australian grain production. This is particularly important for feed wheat, barley, sorghum and soybeans produced in the eastern states.

Implications for the egg industry

The review of regulatory exposure of the egg industry was limited by the volatile political nature of the proposed regulations. Consequently, this report focussed on the underlying reporting framework, the NGERS. The data reported provids a starting point for review of regulations when further details are known.

The data suggest that resource usage varies between producers, even for highly regulated systems as are found with controlled environmental sheds. With the data available it was not possible to do a detailed interrogation of differences between systems, however from the

ranges present for energy usage and GHG emissions it appears likely that greater efficiencies can be gained.

An egg production facility would need to house 8 – 14 M birds to exceed the current thresholds which are reportable under the NGERS based on GHG for energy emissions (electricity only). It is noted that most businesses will have energy usage and GHG emissions from liquid fuel, pullet rearing, grading and possibly feed milling. At this stage the total contributions are not known but it is highly unlikely that these would amount to sufficient emissions to exceed the current thresholds. As a precaution, businesses with more than 4 M birds on one site, together with additional activities, are recommended to review their emissions exposure under the NGERS.

While at this stage 'Agricultural' emissions (from manure handling, storage and application) are not reportable, they are clearly the main area in which improvements can be made to the GHG emissions intensity of egg production. Because these emissions have been estimated using formulas and emission factors that are unlikely to reflect Australian production conditions, it is highly likely that the true GHG emissions would be lower than estimated here.

The rapid LCA results show Australian egg production to have a very low level of GHG emissions (measured as GWP, which is analogous to a comprehensive carbon footprint). Through to the point of distribution, the GWP was 1.64 kg CO_2-e / kg eggs (not including packaging). It must be stressed that the rapid LCA was not comprehensive in its coverage of the supply chain and is based on data from a limited number of sources. ***Considering this, these results should not be released or quoted outside AECL, the Poultry CRC and the industry project participants at this stage.***

Recommendations

This study has highlighted a number of areas that may warrant further research. The benchmarking data presented are preliminary in nature and represent a limited number of farms. To give a more representative estimate of industry performance, a larger number of farms and a wider range of production systems are recommended.

Considering the limitations to the regulatory review, it is recommended that the industry use these data to conduct economic modelling when further policies are released or legislation is agreed upon.

The study identified a noticeable range in energy usage between environmentally controlled sheds. This may warrant a detailed study of energy efficiency and improvement options to reduce input costs and exposure to increased electricity expenses from an emissions trading scheme.

Several knowledge gaps were identified in the GHG estimation methodology provided by the DCC (2007). These included estimation of nitrogen and volatile solids excretion from layers and pullets; tracing N and VS through the manure handling processes; housing emissions factors to accurately reflect Australian egg production systems and land application emission factors that more closely reflect inorganic fertiliser emission rates for Australia.

A first step to address these knowledge gaps would be to commission an extensive literature review of estimation and emission equations and factors for poultry, with recommendations for updating the Australian methodology and recommendations where further research may be required. This could be done in conjunction with a nitrogen and volatile solids mass balance study which provides real data to cross check total losses from each stage of the manure management system.

Conclusion

This preliminary project indicated that Australian egg production is relatively efficient compared to international production systems. Feed was identified as that largest contributor energy use and GWP.

Although there is regulatory uncertainty, this project showed that large production facilities (with more than 4 M birds) should consider reviewing their reporting requirements under the National Greenhouse and Energy reporting System (NGERS).

The project enabled a strategic collaboration with AECL that provided a more representative estimate of energy usage and GHG emissions from egg production across multiple farms with differing management (covering approximately 5% of the industry). The project also developed communication material to aid the transfer of information to egg producers. Eventually the information from this project will be used to compare management practices, to understand variability in energy and GHG emissions from egg production, and enable producers to identify where economic and environmental improvements can be made.

Appendix A:

The following appended draft factsheets have been prepared in preparation for joint AECL and Poultry CRC editing and publication:

"Understanding GHG Regulations in the Egg Industry (Factsheet 1)"

"Benchmarking GHG efficiency in the Egg Industry (Factsheet 2)"

"Benchmarking Energy Usage in the Egg Industry (Factsheet 3)"

References

S.G. Wiedemann and E.J. McGahan Environmental Assessment of the Egg Industry Using Life Cycle Assessment Milestone 2 Report: Literature review and rapid GHG assessment. A report for the Australian Egg Corporation Limited and the Poultry CRC (in press).

S.G. Wiedemann, E.J. McGahan and E.N. Zadow Environmental Assessment of the Egg Industry: Milestone 3 Draft Report: Water, Energy and GHG benchmarking and industry exposure to the proposed CPRS. A report for the Australian Egg Corporation Limited and the Poultry CRC (In Press)

Plain English Compendium Summary

Project Title:	**Determining Egg Production Exposure to the Carbon Pollution Reduction Scheme (CPRS)**
Project No.:	09-07
Researcher:	Dr Angus Crossan and Mr Stephen Wiedemann
Organisation:	The Australian Egg Corporation and FSA Consulting
Phone:	02 94096999
Fax:	0299543133
Email:	research@aecl.org
Objectives	
Background	In response to resource demand and climate change, the Australian government and community are demanding more information on the environmental impacts of food products produced and consumed in Australia. Little data is currently available on the environmental and resource efficiency parameters (water usage, energy usage and greenhouse gas emissions) that affect the environmental performance of the egg industry. This data is likely to be of greater importance to the industry in the future from likely increased resource costs and regulatory burdens.
Research	The project assessed carbon use in egg production using life cycle analysis (LCA). A preliminary assessment of energy use and greenhouse gas emissions from egg production throughout the supply chain was conducted. A review of Government regulations with respect to energy, water and green house gas (GHG) reporting was completed.
Outcomes	The rapid LCA results show Australian egg production to have a very low level of GHG emissions (measured as GWP, which is analogous to a comprehensive carbon footprint). Through to the point of distribution, the GWP was 1.64 kg CO2-e / kg eggs (not including packaging). It must be stressed that the rapid LCA was not comprehensive in its coverage of the supply chain and is based on data from a limited number of sources. ***Considering this, these results should not be released or quoted outside AECL, the Poultry CRC and the industry project participants at this stage.***
Implications	Because of the uncertainty within the regulatory framework regarding climate change and the Carbon Pollution Reduction scheme (CPRS) this project focussed on the underlying reporting framework, the National Greenhouse and Energy Reporting System (NGERS). The data suggest that resource usage varies between producers, even for highly regulated systems as are found with controlled environmental sheds. An egg production facility would need to house 8 – 14 M birds to exceed the current thresholds which are reportable under the NGERS based on GHG for energy emissions (electricity only). It is noted that most businesses will have energy usage and GHG emissions from liquid fuel, pullet rearing, grading and possibly feed milling. At this stage the total contributions are not known but it is highly unlikely that these would amount to sufficient emissions to exceed the current thresholds. As a precaution, businesses with more than 4 M birds on one site, together with additional activities, are recommended to review their emissions exposure under the NGERS.
Publications	Understanding GHG Regulations in the Egg Industry (Factsheet 1) Benchmarking GHG efficiency in the Egg Industry (Factsheet 2) Benchmarking Energy Usage in the Egg Industry (Factsheet 3)

	S.G. Wiedemann and E.J. McGahan Environmental Assessment of the Egg Industry Using Life Cycle Assessment Milestone 2 Report: Literature review and rapid GHG assessment. A report for the Australian Egg Corporation Limited and the Poultry CRC (in press). S.G. Wiedemann, E.J. McGahan and E.N. Zadow Environmental Assessment of the Egg Industry: Milestone 3 Draft Report: Water, Energy and GHG benchmarking and industry exposure to the proposed CPRS. A report for the Australian Egg Corporation Limited and the Poultry CRC (In Press)