Submission on:

The Climate Change (Stationary Energy and Industrial Processes) Regulations 2009 (Draft for Consultation)

from

Ballance Agri-Nutrients Limited

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0 Executive Summary

1) Ballance believes that the New Zealand Emissions Trading Scheme (NZ ETS) as currently legislated does not meet the Government's stated objectives.

2) It is therefore appropriate to take this opportunity to highlight concerns not only on the regulations, but on the Climate Change Response Act (the Act) itself.

3) Ballance believes, and has consistently maintained, that the NZ ETS implementation approach for domestic urea production is seriously flawed.

   a) Ballance considers the use of the IPCC 1996 methodology to be an appropriate approximation at a national inventory level, however strict adherence to the IPCC 1996 methodology for a domestic emissions trading scheme is considered inappropriate due to the treatment of domestic and imported urea, and on a process with no mitigating opportunities.

   b) Ballance strongly recommends that the Act is revised with appropriate recognition of the atypical nature of the industrial process emissions from urea manufacturing. This recognition would take the form of an exemption for such emissions pending adoption of the IPCC 2006 methodology.

   c) To ensure that the CCRA is robust for both Government and participants Ballance strongly recommends the separation of urea production as an industrial process in primary legislation to enable the adoption of IPCC 2006 methodology post 2012.

4) Ballance believes that the practicalities of the opt-in regulations are unworkable and minor clarifications suggested at the workshop on 22nd June will not result in a workable process for gas users to opt-in as a participant.

5) Ballance recommends the provision for a unique emission factor for non-combustion feedstock gas given the current focus on increasing the precision of the calculation methodology for combustion.

6) Ballance fully recognises that the Act was developed in a short time period and there may not have had the time to fully consider the points raised above. To develop an NZ ETS that will be enduring, time now needs to be utilised to ensure that all issues are appropriately addressed.

1 Company Overview

1.1 Ballance Agri-Nutrients Limited

7) Ballance Agri-Nutrients Limited (*Ballance*) is one of New Zealand's leading fertiliser specialists, with manufacturing plants located in Whangarei, Mount Maunganui and Invercargill. In addition the company owns the ammonia-urea manufacturing plant at Kapuni in Taranaki, Super Air one of the country's largest agricultural aviation companies, and Summit Quinphos New Zealand's third largest fertiliser company.

8) Ballance is a 100-percent farmer-owned co-operative, with some 18,000 shareholders throughout New Zealand. It was officially launched in 2001, the final step in a series of company amalgamations and alliances that saw regional fertiliser co-operatives come together under the umbrella of what was then Bay of Plenty Fertiliser.

9) Today, Ballance is a truly national company, with over 750 staff located from the Far North to the Deep South. The company places a strong emphasis on delivering value to its shareholders and on the use of a scientific approach to sustainable plant nutrient management.

1.2 Ballance Agri-Nutrients (Kapuni) Limited

10) Ballance Agri-Nutrients (Kapuni) Limited (*Ballance-Kapuni*) is a wholly owned subsidiary of Ballance Agri-Nutrients Limited.

11) Ballance-Kapuni owns and operates New Zealand's only ammonia-urea plant located on a 32.4 hectare site at Kapuni in South Taranaki.

12) Using some 7 petajoules of natural gas, the plant produces 150,000 tonnes of ammonia per year, most of which is converted to 260,000 tonnes a year of premium grade granular urea. The high quality granular urea product is used as a nitrogen-rich fertiliser in the agricultural, horticultural and forestry sectors, and as a component in the manufacture of other products (primarily resins).

13) The Kapuni plant production meets less than one half of New Zealand's demand for urea. Remaining demand is met through imports sourced primarily from the Middle East, Far East and China. <u>Ballance is therefore in direct competition against countries with less stringent international climate change obligations.</u>

14) The company makes a significant economic contribution to the local economy and employs 127 permanent staff and 17 contractors.

15) The company has a strong environmental record and has been proactive in greenhouse gas issues through its participation in the Voluntary Agreement programme of the mid 1990's and in assisting Government greenhouse gas emissions reporting through provision of data.

16) In September 2005, Ballance lodged an application for a Negotiated Greenhouse Agreement (NGA) with the Ministry for the Environment. Internal assessment of the application showed that Ballance met the criteria to be deemed Competitiveness at Risk and therefore would have been eligible to enter into an NGA with the Crown.

17) In the context of future energy and climate change policy, the company is reliant on:

- Secure gas supply (approximately 7 PJ per annum) at internationally competitive gas prices;
- Secure electricity supply (approximately 32 GWh per annum) at internationally competitive electricity prices; and
- Recognition of “trade exposure” in any price based climate change policy measures, until such time that competing nations impose climate change policy with equivalent stringency and impact.

2 Introduction

18) Ballance would like to thank the Emissions Trading Group and The Ministry for the Environment for the opportunity to make this submission on the Climate Change (Stationary Energy and Industrial Processes) Regulations 2009 (Draft for Consultation) ("the Regulations") released for consultation in June 2009.

19) This submission presents a summary of our analysis of the Regulations taking into account the wider context of New Zealand Emissions Trading Scheme (NZ ETS) as legislated through the Climate Change Response Act as at 26 September 2008 ("the Act").

20) The submission focuses on Ballance's urea operations, as this is the most significantly impacted part of the business.

21) In light of the current review of the legislation, where appropriate we have sought to identify the root cause of issues providing context to the symptoms exhibited in the Regulations.

22) Noting the specific issues identified, Ballance requests a meeting with officials to discuss this written submission and additional materials.

23) The submission structure is set out below:

- Section 3 provides the context to the submission through a brief description of the urea production process;
- Section 4 highlights how urea production is treated under the NZ ETS, identifying specific issues of ETS design philosophy that drive concerns with regulations;
- Section 5 presents specific comments on the development of the regulations including (i) commentary on the government's stated objectives for the ETS and (ii) the philosophy around use of natural gas emission factors; and
- Section 6 provides Ballance's concluding comments.

3 Description of the Urea Production Process

24) At the Kapuni site, urea is produced from natural gas feedstock. Of 7 PJ of gas (predominantly CH_4), approximately half is used as an energy source, while the remainder is reacted with steam, forming CO, CO_2 and H_2. This mixture of gases is then mixed with air. During this process all of the CO is converted to CO_2, which is removed, for use in a later step (see below). The hydrogen and nitrogen (from the air) are reacted over a catalyst to form ammonia (NH_3). Liquid ammonia and CO_2 are subsequently reacted together to form urea ($H_2N\text{-}CO\text{-}NH_2$).

25) The process is described in more detail in Appendix 1.

4 Treatment of Urea Production under the NZ ETS

26) Urea production is not discretely identified as an Industrial Process within the NZ ETS.

27) As such, in the NZ ETS, urea production is treated solely as a stationary energy user with no distinction being made between:

a) natural gas as a fuel component with resulting combustion emissions (CO_2, CH_4 and N_2O); and

b) natural gas as a feedstock to a chemical reaction ("feedstock gas") with resulting offsite "industrial process" emissions (CO2 only).

28) Ballance accepts the principles set out in the NZ ETS for the fuel component and views it to be on common ground with other users of gas for combustion.

29) Ballance is strongly opposed to the current treatment of feedstock gas as set out below.

4.1 Nature of "Industrial Process" Emissions for Urea Production

30) "Industrial process" emissions for urea production are not released in the manufacturing process nor are they released while under the control of Ballance.

31) Instead these ascribed industrial process emissions relate to the carbon content of the finished urea product (H_2N-**<u>C</u>**O-NH_2) and its <u>potential</u> conversion to carbon dioxide in downstream applications:

a) On farm release through the use of urea as a fertiliser.

$$CO(NH_2)_2 \leftrightarrow 2NH_4+ \;+\; 2OH- \;+\; CO_2$$

This reaction is directly comparable to the application of lime to soil which also releases CO_2, however in the case of lime these emissions are not accounted for in the NZ ETS.

b) Industrial uses such as the manufacture of urea formaldehyde resin (adhesive) used for making plywood, particle board, abrasive papers and fibreboards where there is no short term release of carbon.

32) That the emissions ascribed to be industrial process emissions are atypical is clearly set out in the table below:

Comparison of Urea industrial process emissions against others.

Criteria	Urea	Others	Comments
Technology options exist?	No	In some cases	For urea manufacture there is no operational or technological investment option to reduce the industrial emissions from urea. In other cases such options often do exist.
On-site emissions release?	No	Yes	For urea the industrial process emission is offsite and outside the control of the manufacturer. This is not the case for other industrial processes.
Ascribed emissions actually released?	Part	Yes	Many industrial applications of urea do not result in the release of CO_2.

33) It is therefore appropriate that the NZ ETS should recognise the uniqueness of urea manufacture in the legislation; it does not.

4.2 Treatment of Urea Manufacture in the NZ ETS

Urea manufacturing not specificed in legislation

34) Urea manufacture is not a specified activity in the NZ ETS legislation. Unlike other industrial processes, it is not listed in Schedule 3, Part 4 Industrial processes. Instead it is assumed to be just another stationary energy gas user.

35) This is inconsistent with the government's own reporting of emissions:

> *"Prior to 2004, all emissions from urea production were included under "Manufacturing Industries" emissions. These emissions are now allocated between both "Manufacturing Industries" and "Industrial Processes" to reflect that emissions that arise from fuel combustion during urea production are accounted for distinctly from those arising from the chemical process. This is in line with the IPCC Revised Guidelines (IPCC, 1996)* [1]*.*

36) As it was not listed as a mandatory participant activity in the NZ ETS, urea manufacture was excluded from timely discussion on scheme design.[2]

IPCC methodology issues

37) Since the NZ ETS legislation was passed in 2008, Ballance has carried out significant further reviews and analysis. Through discussion with officials it has been identified that the treatment of the atypical "industrial process" emissions differs significantly between IPCC 1996 and IPCC 2006 methodologies as set out in Appendix 2. Summarising:

[1] NZ Energy Greenhouse Gas Emissions 1990-2007, Ministry of Economic Development, p19, Urea.
[2] The SEIP TAG did not discuss urea manufacture for this reason as it was deemed by officials to be outside the Terms Of Reference.

a) The IPCC 1996 methodology assumes that carbon contained in urea produced will be released within a short time period and that this carbon should therefore be attributed to the manufacturing step rather than the end user.

b) The IPCC 2006 Methodology which will likely be adopted for any post 2012 international agreement takes a different approach. While still focusing on ammonia production as an industrial process, it specifically provides for the deduction of CO_2 recovered for downstream use including urea production. CO_2 emissions from urea usage as a fertiliser are addressed separately and consistently to imports and domestic manufactured urea.

38) Officials have taken the approach of strictly applying the IPCC 1996 methodology in the NZ ETS as this is the basis for New Zealand's Kyoto Protocol commitments. This is not a requirement in the NZ ETS legislation – it is a choice.[3]

39) The Emissions Trading Bulletin No. 10, June 2009[4] ("the Bulletin") issued with the 2009 Regulations clearly states in the Introduction that;

"The Government wishes to apply the Act in a way that minimises compliance and administrative costs, and treats all participants fairly. The principles underpinning the methods for calculating emissions are that they should:

- *neither advantage nor disadvantage the Crown fiscally ie. result in a true reflection of New Zealand's Kyoto liability*
- *send a clear price signal, with no perverse incentives*
- *minimise transactional costs for participants and the Government*
- *provide for an accurate and verifiable statement of emissions*

40) While urea is treated in line with the IPCC 1996 guidelines this treatment fails the government's own stated objectives in the following ways:

[3] Although the purpose of the Climate Change Response Act 2002 as set out in Section 3 includes the statement "*The purpose of this Act is to enable New Zealand to meet its international obligations under the Convention and the Protocol*", this is a "carry over" from versions of the act preceding the development of the NZ ETS. There is nothing in the current Act which stipulates that IPCC 1996 methods must be applied in domestic policy.
[4] http://www.mfe.govt.nz/publications/climate/emissions-trading-bulletin-10/emissions-trading-bulletin-10.pdf

Objective:	**Assessment:**
Treat all participants fairly	Importers see no cost of carbon.
Neither advantage nor disadvantage the Crown fiscally	True, but at the expense of a domestic manufacture of urea. The devolvement of the cost of an international policy good to firms who cannot reduce emissions and have no control of them is inappropriate.
Send a clear price signal	Importers see no cost of carbon.
Have no perverse outcomes	Urea imported from countries that do not price carbon will be preferred over locally produced urea.
Minimise compliance and administrative costs	Adoption of IPCC 2006 methodology in 2013 (within 3 years of the sectors entry) will have impacts on primary legislation, regulations and allocation plans leading to significant compliance and administration costs.
Provide for an accurate and verifiable statement of emissions	The upstream point of obligation for gas with emission factors that assume combustion of feedstock gas may overstate industrial process emissions. Industrial applications may not release emissions.

41) As stated above Ballance opposes the strict adherence to the IPCC 1996 Guidelines. This creates a perverse incentive for Ballance to increase import at the margin. Some 60% of New Zealand's urea demand is already met by imports, which do not attract a cost of carbon.

42) It has been argued by officials that this situation is no different from other trade-exposed firms. Ballance strongly disputes this based on the nature of the industrial process emissions as set out in Section 5.1 above.

43) In summary, the strict adherence to the IPCC 1996 Guidelines in the development of the legislation has excluded urea manufacture from meaningful consultation and debate in the development of the NZ ETS, resulting in an unacceptable outcome for both the Crown and Ballance.

Recommended Way Forward

44) As the NZ ETS is intended to be a key component of New Zealand's climate change policy in the long term, it is appropriate to design the scheme on a long-term durable basis. Ballance recommends changes to the Act on that basis:

a) List urea manufacture as a mandatory participant in Schedule 3, Part 4. In this way Ballance would be a Participant in the scheme

b) Grant an exemption to Ballance solely for the industrial process emissions from urea manufacture in accordance with Clause 60 for the period to end 2012.

(i) This could be enabled through a 100% allocation for that element or alternative means;

(ii) The cost to the Crown of this exemption would not be the full amount – it is the difference between the cost of the exemption and the cost of the units awarded under a trade exposure protection allocation plan.

c) Post 2012, upon adoption of IPCC 2006 rules, incorporate the CO_2 emissions associated with use of urea as a fertiliser in the emission factor to be applied for synthetic fertilisers containing nitrogen (Schedule 3, Part 5).

(i) As the “industrial process emissions” are now accounted for in the agriculture sector in combination with nitrous oxide emissions, the exemption to Ballance for the industrial process emissions from urea manufacture for agriculture should be retained.

(ii) A default position for industrial application emissions would need to be defined, taking into account that such services may be eligible as a removal process.

45) It has been established that the Act will be changed, following the emissions trading review and to incorporate other policy considerations. Ballance strongly recommends that a discussion document be prepared setting out the above approach for consideration in the amendment process.

4.3 Summary of Issues

46) The use of the IPCC 1996 methodology may be an appropriate approximation at a national inventory level, however Ballance opposes strict adherence to the IPCC 1996 methodology for a domestic emissions trading sheme.

47) It is important to recognise that Ballance has no mechanism to control or reduce the quantity of industrial process emissions as it is simply a function of stoichiometry. In layman’s terms the industrial process is one of controlled chemical reactions occurring in defined ratios, with no option for emissions mitigation.

48) Due to the nature of the process Ballance cannot reduce industrial process emissions through operational improvement or capital investment. Any price signal (marginal or otherwise) on Ballance with respect to this carbon content is simply a tax.

49) Ballance appreciates that this submission is technically in response to the Draft Regulations published for consultation but in light of the current Select Committee review of the NZ ETS Ballance wishes to restate its position on the inclusion of urea in the ETS;

50) Ballance requests that the production and use of Urea is included in the Act as an Industrial Process to allow for the inclusion of urea in any consultation, design deliberations and development of regulations going forward.

5 Specific Comments on Draft SEIP Regulations

5.1 ETS Development Process

51) Ballance continues to advocate proper consultation so that all identified matters will be resolved and a workable outcome achieved for both the Crown and industry.

52) Ballance's submission points on the Regulations are made in the context of the broader concerns relating to the need to include urea production and use in the CCRA and associated regulations raised in Section 4 above. The submission points should not be assessed in isolation.

5.2 Upstream Point of Obligation on Natural Gas

53) The NZ ETS operates on an upstream Point of Obligation basis. For natural gas this point of obligation, i.e. the mandatory Participant, is the gas miner (Schedule 3 Part 3 of the Act).

54) The provision for "opt-in" on this gas supply is provided for (Schedule 5 Part 4 of the Act) however as the gas supply chain is complex, and as opt-in is restricted to being one step in the supply chain away from the mandatory participant, the opportunity for Ballance (downstream user) to opt-in is constrained.

55) During discussions at the ETS Regulations Gas Sector Workshop on 22 June it became apparent that the practicalities of the opt-in process for a large gas user are problematic in that (to ensure volume integrity with and without opt-in) the point of "opt-in" is likely to be at the miner's "delivery point" (where gas is injected into the pipeline system) rather than at the users "receipt point" (where gas is received from the pipeline system).

56) This presents a number of issues for the user who elects to "opt in" to the ETS;

   a) The required data is not readily available to the "user" (the opt-in participant),

   b) The general reaction from the miners present at the meeting did not provide any level of confidence that this data would or could be made available to opt-in participants, and

   c) In the case of incorrect data being provided, the question remains whether this will be an adequate defence for an incorrect inventory return.

57) Ballance recommends further consultation with potential opt-in participants on this matter.

5.3 Natural Gas Emission Factors

58) Ballance would like to take this opportunity to congratulate the Emissions Trading Group for adopting the emissions calculation methodology that employs actual gas values as measured at point of sale for mining of gas.

59) Ballance submits that the methodology of using actual gas values must also be used for large users of gas in the determination process for the allocation of units to trade exposed businesses.

60) With regards to additional detail around N_2O and CH_4 emissions Ballance has significant reservations regarding the approach taken in their development and intended application.

61) Ballance considers the inclusion of such detail with regard to accounting for N_2O and CH_4 emissions arising from combustion to be inappropriate, for the following reasons:

a) The emission factors used for N_2O and CH_4 are clearly defaults as they are invariable across all processed natural gas streams.

b) The level of accuracy of these default factors is low. To quote the Ministry of Economic Developments Energy Greenhouse Gas Emissions Report"

> In contrast to CO_2 emissions, the non-CO_2 emissions from combustion depend on the precise nature of the activity in which the fuel is being combusted. A PJ of diesel used for industrial heating produces a different level of methane emissions compared with the same amount used in road vehicles. Given that we have an imprecise knowledge of where and how fuel is being consumed and also because the emission factors used are inherently imprecise, there is a much greater level of uncertainty surrounding estimates of non-CO_2 emissions than there is for CO_2 emissions.[5]

c) While the inclusion of N_2O and CH_4 default factors arising from combustion may assist the Government to devolve its Kyoto deficit by an extra 0.2% of fuel emissions, Ballance considers additional complexity it introduces as unwarranted.

62) If the level of accuracy hoped for in reporting N_2O and CH_4 combustion emissions is considered material to the Government, it follows that the same approach should be taken for feedstock gas.

63) This requires a distinction between the use of gas for feedstock (CO_2 only emissions) and combustion (CO_2, CH_4 and N_2O).

64) As noted above the Government has stated that one of its objectives is to treat participants fairly, therefore inclusion of emissions of CH_4 and N_2O from combustion must be complemented with separate discrete emissions calculations for gas used in combustion and industrial processing in urea manufacture.

[5] MED Energy Greenhouse Gas Emissions 1990-2007, August 2008, p35.

5.4 Losses

65) During the aforementioned Gas Sector Workshop on 22 June, the issue of losses was discussed. In a document issued by the Ministry for the Environment dated 2 July 2009 to workshop participants, it is proposed that:

Proposed solution: *remove both the factor for losses and the oxidation factor.*

The factor for 'losses' included in the emissions calculation methodology is not double counting. The combustion oxidation factor in the existing equation accounts for gas that is not completely combusted downstream, which mainly consists of the gas termed "losses". If the factor for losses is removed, the oxidation factor should also be removed. …

66) Ballance does not agree with this statement:

a) The oxidation factor reflects the incomplete combustion of the gas supplied – it is not related to "losses".

b) Should the oxidation factor be set to 1.0 as proposed, this would lead to an overstatement of combustion emissions and would further compound the imprecision in relation to feedstock industrial process emissions.

5.5 Unique Emission Factors

67) In the same document issued by the Ministry for the Environment dated 2 July 2009 to workshop participants, the possibility of a UEF process for methane and nitrous oxide emissions that result from combustion is raised.

68) Ballance recommends that such a provision be extended to industrial process emissions, noting that this could account for the disparity associated with the non-combustion use of natural gas as feedstock.

6 Concluding Comments

69) Ballance believes that the Act, as currently legislated does not meet the Government's stated objectives.

70) It is therefore appropriate to take this opportunity to highlight concerns not only on the regulations, but also on the Act itself.

71) Ballance believes the NZ ETS implementation approach for domestic urea production is seriously flawed.

   a) Ballance considers the use of the IPCC 1996 methodology to be an appropriate approximation at a national inventory level, however strict adherence to the IPCC 1996 methodology for a domestic emissions trading scheme is considered inappropriate due to the treatment of domestic and imported urea, and on a process with no mitigating opportunities.

   b) Ballance strongly recommends that the Act is revised with appropriate recognition of the atypical nature of the industrial process emissions from urea manufacturing. This recognition would take the form of an exemption for such emissions pending adoption of the IPCC 2006 methodology.

   c) To ensure that the CCRA is robust for both Government and participants Ballance strongly recommends the separation of urea production as an industrial process in primary legislation to enable the adoption of IPCC 2006 methodology post 2012.

72) Ballance believes that the practicalities of the opt-in regulations are unworkable and minor clarifications suggested at the workshop on 22nd June will not result in a workable process for gas users to opt-in as a participant.

73) Ballance recommends the provision for a unique emission factor for non-combustion feedstock gas given the current focus on increasing the precision of the calculation methodology for combustion.

74) Ballance fully recognises that the Act was developed in a short time period and there may not have had the time to fully consider the points raised above. To develop an NZ ETS that will be enduring, time now needs to be utilised to ensure that <u>all</u> issues are appropriately addressed.

Appendix 1

Detailed Description of Urea Production Process

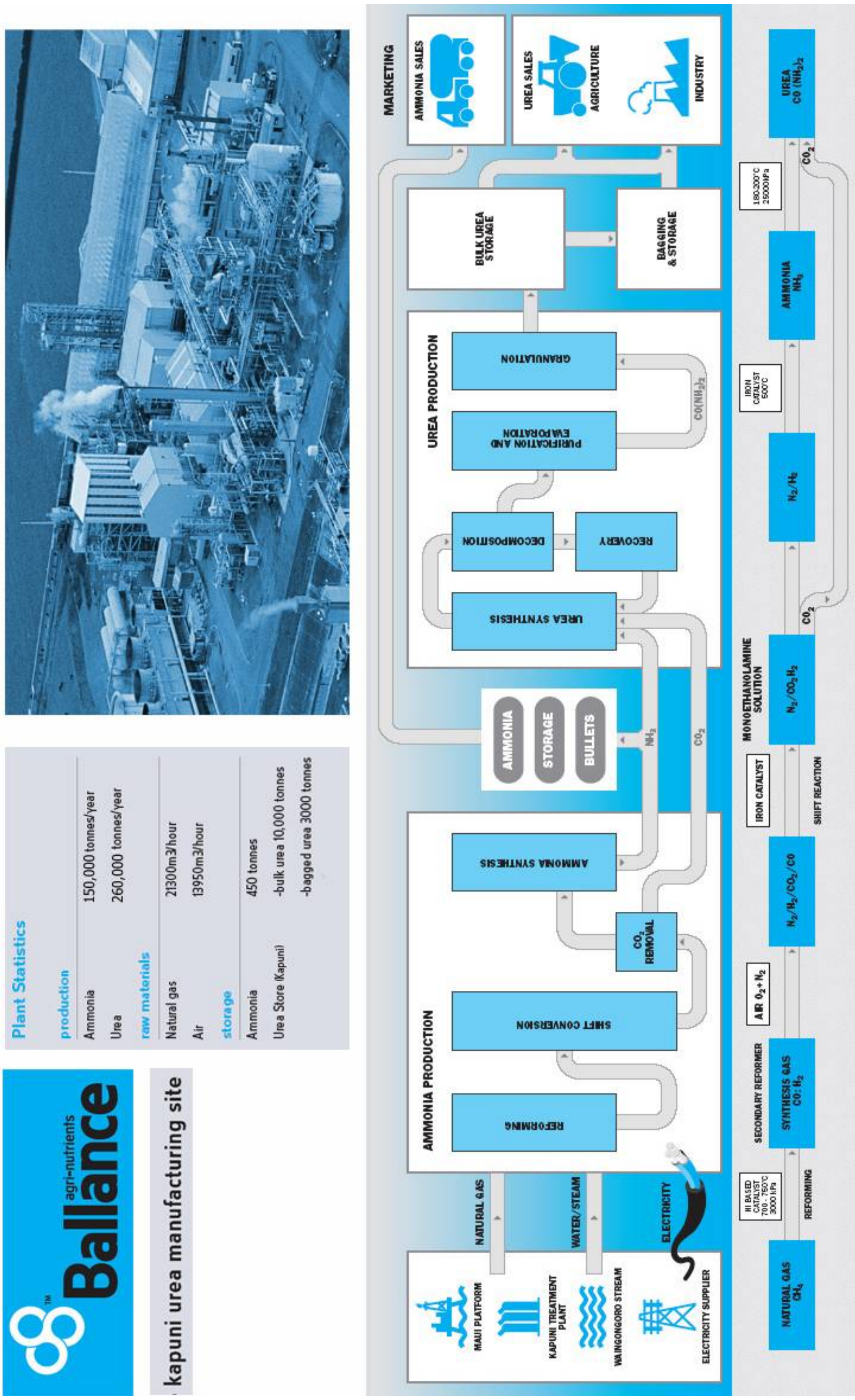
Step 1: Ammonia (NH3) Production

Pre-heated and desulphurised natural gas is reacted with steam in the primary reformer. This is a gas fired furnace containing vertical, catalyst-filled tubes through which the reacting mixture passes to produce carbon monoxide, carbon dioxide and hydrogen. A controlled quantity of air is then added to this mixture in the secondary reformer to produce synthesis gas containing the correct ratio of hydrogen to nitrogen. The gas then passes to the shift converters, where carbon monoxide is converted to carbon dioxide. This is subsequently removed in an absorber-stripper unit to provide one of the feedstocks of the urea plant. After removal of the last traces of carbon oxides in the methanator, this synthesis gas is compressed by two 3700kW - and one 4800kW - Cooper Bessemer Compressors, operating in parallel (which also provide compressed air and ammonia refrigeration compression for the plant). The compressed process gases, consisting mainly of nitrogen and hydrogen, are fed into the ammonia loop and pass through the ammonia synthesis convertor. The gases are then refrigerated and ammonia condensed to be drawn off from the circulation synthesis gas as a liquid. This product is over 99.5% pure and is stored as a liquid in three tanks with a combined capacity of 450 tonnes.

Step 2: Urea ($H_2N\text{-}CO\text{-}NH_2$) Production

Anhydrous liquid ammonia, both direct from the ammonia plant and from storage, is combined with carbon dioxide (separated from the ammonia synthesis gas) in the urea synthesis reactor. The resulting product is a mixture of urea, water and an intermediate by-product, ammonium carbonate, which is separated from the aqueous urea in a three-stage decomposition and absorption process. This purification section produces a liquid stream which is recycled to a second urea reactor. Aqueous urea is concentrated by evaporating water from the molten solution, which is then granulated in a mixed fluid-spouting bed granulator.

Figure 1 – Kapuni Ammonia Urea Plant Production Process



Appendix 2

Synopsis of IPCC 1996 and 2006 Methdologies

IPCC 1996 Methodology

The IPCC 1996 Methodology relates primarily to ammonia and splits the emissions into those associated with energy and non-energy industrial process emissions.

a) Emissions from natural gas used as an energy source are calculated by multiplying the quantity of natural gas by an emissions factor.

b) For the industrial process emissions it is assumed that from the reacted gas in the ammonia production step "all of the carbon content is emitted to air".

An extract from the IPCC 1996 Methodology is provided below[6]:

> The most accurate method of estimation will be:
>
> Emission (kt) = Consumption of gas (kt) x carbon content x 44/12
>
> If the gas consumption is not available, an alternative is to calculate the emissions from the ammonia production:
>
> Emission (kt) = Production of ammonia x Emission factor
>
> In both cases, in order to avoid double counting, the quantities of oil or gas used must be subtracted from the quantity reported under energy and non-energy use in the Energy Chapter.
>
> The CO_2 from ammonia production may be used for producing urea or dry ice. This carbon will only be stored for a short time. Therefore, no account should consequently be taken for intermediate binding of CO_2 in downstream manufacturing processes and products.

Notably, the IPCC 1996 methodology assumes that carbon contained in urea produced will be released within a short time period and that this carbon should therefore be attributed to the manufacturing step rather than the end user.

[6] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories : Reference Manual Chapter 2 Section 2.8.3

IPCC 2006 Methodology (Likely Post 2012)

The IPCC 2006 Methodology[7] which may be adopted for any post 2012 international agreement takes a different approach. While still focusing on ammonia production as an industrial process, it specifically provides for the deduction of CO_2 recovered for downstream use including urea production. This is shown below:[8]

EQUATION 3.3
CO_2 EMISSIONS FROM AMMONIA PRODUCTION – TIER 2 AND 3

$$E_{CO2} = \sum_i (TFR_i \bullet CCF_i \bullet COF_i \bullet 44/12) - R_{CO2}$$

Where:

E_{CO2} = emissions of CO_2, kg

TFR_i = total fuel requirement for fuel type *i*, GJ

CCF_i = carbon content factor of the fuel type *i*, kg C/GJ

COF_i = carbon oxidation factor of the fuel type *i*, fraction

R_{CO2} = CO_2 recovered for downstream use (urea production, CO_2 capture and storage (CCS)), kg

The CO_2 emissions associated with the use of urea are then accounted for in the corresponding sector of use. This is explained in Box 3.2 from the same source.

Box 3.2
DOUBLE COUNTING

In order to avoid double counting, the total quantities of oil or gas used (fuel plus feedstock) in ammonia production must be subtracted from the quantity reported under energy use in the **Energy Sector**.

In addition, the quantity of CO_2 recovered for downstream use in **urea production** must be subtracted from the total quantity of CO_2 generated to derive CO_2 emitted. Emissions of CO_2 from urea use should be accounted for in the corresponding sectors. In particular, emissions from urea use as fertiliser should be included in the **Agriculture Forestry and Other Land Use (AFOLU) Sector** (see Volume 4). Emissions from urea use in automobile catalytic converters should be accounted for in the Energy Sector (Volume 2). Emissions from any other chemical products manufactured using CO_2 recovered from the process (e.g., emissions from carbonic acid use) are covered by methodology suggested in this section and should not be accounted for in other IPPU sections or in other sectors.

The 2006 IPCC guidelines have specific methodologies for CO_2 emissions from Urea fertilisation.[9] In the simplest Tier 1 calculation, the following approach is taken:

[7] Refer Attachment 1 for full copy of relevant sections.
[8] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Process and Product Use, Chapter 3: Chemical Industry Emissions Section 3.2 Ammonia Production
http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_3_Ch3_Chemical_Industry.pdf
[9] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other land Uses, Chapter 11: N_2O Emissions from Managed Soils, and CO_2 Emissions from Lime and Urea Application
http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_11_Ch11_N2O&CO2.pdf

Tier 1

CO_2 emissions from urea fertilisation can be estimated with Equation 11.13:

EQUATION 11.13
ANNUAL CO_2 EMISSIONS FROM UREA APPLICATION

$$CO_2\text{–}C\ Emission = M \bullet EF$$

Where:

CO_2–C Emission = annual C emissions from urea application, tonnes C yr^{-1}

M = annual amount of urea fertilisation, tonnes urea yr^{-1}

EF = emission factor, tonne of C (tonne of urea)$^{-1}$

Procedural Steps for Calculations

The steps for estimating CO_2–C emissions from urea applications are:

Step 1: Estimate the total amount of urea applied annually to a soil in the country (M).

Step 2: Apply an overall emission factor (EF) of 0.20 for urea, which is equivalent to the carbon content of urea on an atomic weight basis (20% for $CO(NH_2)_2$). A default -50% uncertainty may be applied (Note: uncertainties can not exceed the default emission factor because this value represents the absolute maximum emissions associated with urea fertilization).

Step 3: Estimate the total CO_2–C emission based on the product of the amount of urea applied and the emission factor.

Multiply by 44/12 to convert CO_2–C emissions into CO_2. Urea is often applied in combination with other nitrogenous fertilizers, particularly in solutions, and it will be necessary to estimate the proportion of urea in the fertilizer solution for M. If the proportion is not known, it is considered *good practice* to assume that the entire solution is urea, rather than potentially under-estimating emissions for this sub-category.

75) The IPCC 2006 approach clearly relates the emissions from the use of urea to the end use.

<u>Consequences of IPCC 1996 Approach Being Strictly Adhered To</u>

76) The consequences of the choice of application of the IPCC 1996 guidelines are a series of economically and environmentally significant approximations:

a) Only domestic (Ballance Kapuni) produced urea emissions are incorporated in the national inventory;

b) Emissions from the application of imported urea (by Ballance and others) in New Zealand are not taken into account in the national inventory; and

c) It presumes that all of the urea is used in applications such as fertiliser where release of CO_2 within a short period of time occurs. This ignores the use of domestic urea in applications such as formaldehyde resin where the carbon is bound in the final product.