PEFCR Feed for food producing animals

Version 1.2

Draft version 1.2 after EF Steering Committee

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Technical Secretariat for the Feed Pilot

Abstract

This section will be completed at a later stage

Authors

The Technical Secretariat is composed of EU and national feed associations (FEFAC, FEFANA, SNIA, ASSALZOO, DVT, NEVEDI, FHL, AIC, DAKOFO), feed companies (ForFarmers, AB Agri, Denkavit, Agrifirm, Sanders, DTC, Union Agricole, Evonik, DSM, Ewos, Ajinomoto Eurolysine), upstream and downstream partners of the feed industry (FEDIOL, UECBV, FEAP) and the Food and Agriculture Organisation of the United Nations (FAO). The Technical Secretariat is supported by Blonk Consultants.

FEFAC

Table of Contents

FEFAC

List of figures

List of tables

Abbreviations and Units

COD	= Chemical Oxygen demand
DE	= Digestible Energy
DM	= Dry matter content
DQA	= Data Quality Assessment
DQS	= Data Quality Score
EF	= Environmental Footprint
ELCD	= European reference Life Cycle Database
EPD	= Environmental Product Declaration
Feed Pilot	= PEF pilot feed for food producing animals
FEFAC	= European Feed Manufacturers Federation
GE	= Gross Energy
GHG	= Greenhouse Gases
GWP	= Global Warming Potentials
Ha	= Hectare
HH	= Human health (used in ionizing radiation HH)
ILCD	= International Reference Life Cycle Data System
IPCC	= Intergovernmental Panel on Climate Change
ISO	= International Organization for Standardization
kWh	= kilowatt hour
LCA	= Life Cycle Assessment
LCI	= Life Cycle Inventory
LCIA	= Life Cycle Impact Assessment
LHV	= Lower Heating Value (or net calorific value)
LUC	= Land Use Change
NACE	= Statistical classification of economic activities in the European Community
NPK	= Nitrogen (N), Phosphorus (P) and Potassium (K)
OEF	= Organisation Environmental Footprint
PCR	= Product Category Rules
PEF	= Product Environmental Footprint
PEFCR	= Product Environmental Footprint Category Rules
RER	= Region Europe
ReCiPe	= Impact assessment method
SC	= Steering Committee
TS	= Technical Secretariat
TS feed	= Technical Secretariat of the pilot feed for food producing animals

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Definitions

Feed ingredient: These are either feed materials or feed additives. Ingredients are of plant, animal or aquatic origin, or other organic or inorganic substances and include:

- Feed materials[1] - means products of vegetable or animal origin, whose principal purpose is to meet animals' nutritional needs, in their natural state, fresh or preserved, and products derived from the industrial processing thereof, and organic or inorganic substances, whether or not containing feed additives, which are intended for use in oral animal-feeding either directly as such, or after processing, or in the preparation of compound feed, or as carrier of pre-mixtures;

- Feed additive[2] means substances, micro-organisms or preparations, other than feed material and pre-mixtures, which are intentionally added to feed or water in order to perform, in particular, one or more of the functions

Food producing animals refers to any animal that is fed, bred or kept for the production of food for human consumption, including animals that are not used for human consumption, but that belong to a species that is normally used for human consumption.

[1] As defined in Regulation (EC) No 767/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 on the placing on the market and use of feed, amending European Parliament and Council Regulation (EC) No 1831/2003 and repealing Council Directive 79/373/EEC, Commission Directive 80/511/EEC, Council Directives 82/471/EEC, 83/228/EEC, 93/74/EEC, 93/113/EC and 96/25/EC and Commission Decision 2004/217/EC

[2] as defined in Regulation (EC) No 1831/2003 of the European Parliament and of the Council of 22 September 2003 on additives for use in animal nutrition

1. Introduction

This draft PEFCR shall be used in parallel with the PEF Guide (European Commission, 2013) and the latest version of the Guidelines from the European Commission (for the time being: Version 4.0 - Guidance for the implementation of the EU Product Environmental Footprint (PEF) during the Environmental Footprint (EF) pilot phase (European Commission, 2014)) for the PEF supporting studies for compound feed.

It is drafted according to the PEF Guide requirements and the Template provided in Annex B to the guidance document (version 4.0). Where the requirements in this draft PEFCR are in line with but more specific than those of the PEF Guide, such specific requirements shall be fulfilled.

This draft PEFCR will be revised on the basis of the comments received during the virtual consultation and of the results supporting studies.

The use of the present PEFCR is optional for PEF guide in-house applications, it is recommended for external applications without comparison/comparative assertions, while it is mandatory for external applications with comparisons/comparative assertions.

Since feed is an intermediate product, this PEFCR can be used in different contexts. First there is the context of the LCA operator that conducts a PEF study for a food producing animal according to a specific PEFCR or the PEF guidelines itself if no PEFCR is available. For this use the PEFCR of feed for food producing animals provides the requirements of accurate transfer of LCI information.
Then a second use of this PEFCR is to perform cradle to gate feed PEF studies used for in house-application or for external communication.

So, this PEFCR supports the following purposes:

1) Provision of LCI information on compound feed in the context of food producing animals PEF studies ;
2) Cradle to gate PEF studies of compound feed for either internal or external use but without comparison
3) Cradle to gate PEF studies of compound feed for comparison, either between alternatives (e.g. sourcing, raw materials choices,..) or over time (e.g. trend monitoring)

The requirements set up by this draft PEFCR may vary according to the purpose of the study.

1.1 General information about the PEFCR

1.1.1 Technical Secretariat

The Technical Secretariat of the feed pilot consisted during the drafting of this PEFCR of the following members:

- AB AGRI
- Agrifirm Group
- AIC – Agricultural Industries Confederation
- Ajinomoto Eurolysine
- Assalzoo - Associazione Nazionale tra i Produttori di Alimenti Zootecnici
- Blonk consultants
- Dakofo, The Danish Grain- and Feed Trade Association
- DENKAVIT
- Deutsche Tiernahrung Cremer GmbH & CO.KG
- DSM Nutritional Products AG
- DVT - Deutscher Verband Tiernahrung e. V.
- Evonik Industries AG Health&Nutrition Division
- EWOS AS
- FAO, Food and Agriculture Organisation of the United Nations
- FEAP – Federation of European Aquaculture Producers
- FEDIOL, the EU Proteinmeal and Vegetable Oil Industry
- FEFANA, EU association of Specialty Feed Ingredients and their mixtures
- FEFAC, European Feed Manufacturers Federation
- NSL – The Norwegian Seafood Federation
- ForFarmers B.V.
- Nevedi - Dutch Feed Industry Association
- Sanders
- SNIA, Syndicat National de l'Industrie de la nutrition Animale
- UECBV - European Livestock And Meat Trades Union
- Union Agricole Holding AG

1.1.2 Consultation and stakeholders

The development of this PEFCR can be followed on the dedicated page of the EU pilots' website: https://webgate.ec.europa.eu/fpfis/wikis/display/EUENVFP/PEFCR+Pilot%3A+Feed+for+food-producing+animals

The Technical Secretariat of the PEF pilot on feed for food producing animals has on several occasions invited relevant stakeholders to participate in the PEFCR development.

The relevant stakeholders for the PEFCR development include representatives from feed material suppliers, farm and trade associations, compound feed producers, consumers, government representatives, non-governmental organizations (NGOs), public agencies and independent parties and certification bodies.

A first virtual consultation was organised in October 2014 on the scope and representative product of the Feed pilot. This consultation phase also included a physical consultation which took place on 28

October 2014. The Technical Secretariat of the PEF pilot on feed for food producing animals produced a document describing the major comments received and how they have been addressed. This document is available in the EF virtual consultation Forum. In this framework the Technical Secretariat created and maintained a log of the stakeholders that have been communicated with and responded to.

This draft PEFCR is now the object of a virtual public consultation. In the pilot phase, a third public consultation (including a physical meeting) will be organised later on in the pilot process to gather feedback on the second draft PEFCR which will be developed on the basis of the comments received during the second consultation and of outcome of the supporting studies.

1.1.3 Date of publication and expiration

Version number: 1.0 (first draft for virtual consultation)
Date of publication/revision: 4 September 2015
Date of expiration: N/A

1.1.4 Geographic region

The PEFCR is valid for all EU feed mill operations and the supply chains that provide these operations.

1.1.5 Language(s) of PEFCR

This PEFCR has been written in English. It is not foreseen at this stage to make this document available in other languages. Should this PEFCR be translated, the English version supersedes translated versions in case of conflicts.

2. Methodological inputs and compliance

This draft PEFCR s has been developed according to the requirements of the PEF Guide (Annex II to Recommendation (2013/179/EU) and the Product Environmental Footprint Pilot Guidance (version 4.0).

Where relevant, the recommendations of the Cattle Model Working Group (CMWG) are implemented in this draft PEFCR (JRC, 2015). These recommendations are available on the EU pilot wiki page. The CMWG involved the red meat, dairy, pet food, leather and feed for food producing animals pilots and was operational in the second half of 2014.

To the extent possible, the issue papers approved by the Technical Advisory Board have been implemented in the draft PEFCR, for the purpose of being tested in the upcoming supporting studies.

The Guidelines for assessment of environment performance of animal feed supply chains, released in April 2015 by the FAO-led Livestock Environmental Assessment and Performance partnership (LEAP) (FAO LEAP, 2015) were also an important methodological input for the development of this draft PEFCR. These guidelines are less prescriptive than what is needed in PEFCR. Many of the suggestions on how calculations should be done in the LEAP guidelines are therefore translated to requirements that shall be fulfilled in this PEFCR.

3. PEFCR review and background information

3.1 PEFCR review panel

This section will completed at a later stage

3.2 Review requirements for the PEFCR document

The critical review is essential for ensuring that the PEFCR:

- is consistent with the guidance provided in the PEF Guide and the PEFCR guidance (version 4.0);
- complements the PEF guide requirements with additional requirements specific to the particularities of the life cycle of compound feed;
- provides guidance to conduct a compliant PEF study enables comparisons and comparative assertions in all cases when this is considered feasible, relevant and appropriate.

3.3 Reasoning for development of PEFCR

This PEFCR aims at providing guidance on how to assess the environmental performance of compound feed in a harmonised way. Considering the relative importance of compound feed in the environmental footprint of animal products, it is justified to harmonize the feed-specific aspects of the methodology across all food-producing animals.

3.4 Conformance with the PEFCR Guidance

This PEFCR has been developed in compliance with the "Guidance for the implementation of the EU PEF during the Environmental Footprint (EF) pilot phase – Version 4.0".

This section will be completed after the critical review of the PEFCR.

4. PEFCR scope

4.1 Functional unit

The reference flow is 1 tonne of animal feed product delivered to the livestock farm (or fish farm) entry gate.

What?	Animal feed for food-producing animals
How much?	1 tonne as fed
How well?	To be able to conduct meaningful LCAs for food producing animals. For this purpose, nutritional and other parameters could be provided as additional information to the animal pilots for LCA purposes (for instance , the dry matter (DM), gross energy (GE), Carbon (C), Phosphorus (P), Nitrogen (N), Zinc (Zn), Cu, content based on the needs of the animal species reared).
How long?	Fulfil its function well until the expiry date, when stored under specified conditions. Normally feed is consumed in a short period after delivery. Losses during storage are uncommon and can usually be neglected.

The majority of the feed is sold in bulk, however if feed is sold in smaller packed units the packaging materials should be included in the analysis. The quantity of packaging material will be additional on top of the 1000 kg feed materials.

4.2 Representative product(s)

The representative product is a virtual compound feed product and consists of the average composition of feed materials consumed by the EU compound feed industry in the time period 2009-2013.

As feed is an intermediate product, the representative product does not correspond to a functional benchmark. The potential applications of the benchmark will however be tested during the supporting studies.

The representative product is further described in the screening report available in Annex I.

4.3 Product classification (NACE/CPA)

The scope of the PEFCR is compound feed produced in feed mills and provided as a partial or complete ration to food-producing animals. It belongs to the CPA 10.91 product group “Manufacture of prepared feeds for farm animals (Eurostat ISSN 1977-0375)”

The total CPA 10.91 includes:

- manufacture of prepared feeds for farm animals
- preparation of unmixed (single) feeds for farm animals
- treatment of slaughter co-products to produce animal feeds and explicitly excludes:
  - production of fishmeal for animal feed, see CPA 10.20
  - production of oilseed cake, see CPA 10.41
  - activities resulting in by-products usable as animal feed without special treatment

The PEFCR for feed focuses on compound (mixed) feed produced in a feed mill because it is the predominant industrial product that farmers buy as an external input. Moreover the majority of feed products sold by EU feed manufactures are compound feeds. Code 10.91 is a close reference, but the scope of this PEFCR is actually narrower.

Following this reasoning, the following products do not formally belong to the scope of this PEFCR, although there are no methodological reasons for treating them differently when assessing their impact as part of a feed ration:

1. Single feed materials products, i.e. products that originate at a specific food, drink or biofuel processing plant and are sold directly to farmer (e.g. rapeseed meal, wet gluten feed and distillers supplied to dairy farms).
2. Feed materials that are produced on (or under the control of) the animal farm such as grass (silage), maize (silage) or grains fed directly to farm animals.

However the feed PEFCR provides consistent methodological requirements for the entire upstream cradle to gate LCA of feed materials. So the feed PEFCR can also be used by the operators that produce single feed products, either industrially or on the farm. The PEFCR is therefore useful for other CPA codes, such as 10.20; 10.41 and 10.61, but it is not intended to be “the” PEFCR for these sectors. In other words, in the absence of PEFCR for home-mixing and straight-purchased feed ingredients, the feed PEFCR can be used for these products.

4.4 Purposes of LCA assessment of feed supported by this PEFCR and related requirements

This PEFCR can be used as follows:

1) Provision of LCI information of feed to PEF studies for food producing animals;
   a) without comparison nor external communication
   b) with comparison and/or external communication
2) Cradle to gate PEF studies on compound feed for food-producing animals, without comparison
   a) for internal use;
   b) for external use/communication;
3) Cradle to gate PEF studies on compound feed for food-producing animals, with comparison
   a) *comparison between alternatives:* such as, different manufacturing methods, evaluation of alternative feed configurations to the same or different nutrient profiles, feed ingredient sourcing and their manufacturing methods, on the basis of upstream life cycle emissions of feed ingredients and feed formulation;
   b) *comparison in time:* monitoring trends/progress in environmental impact of feed products related to measures aimed at reducing environmental impact.

Different requirements apply according to the purpose of the PEF study. Table 4-1 shows the relation between purposes and PEFCR requirements and the sections where they are elaborated. The rationale of this distinction in purposes is that methodology, accuracy and effort for data collection should be proportionate to the purpose of the study.

For LCA studies on food producing animals not intended for external communication or comparison (1a), default methodology and reporting requirements are formulated. Further collaboration with the animal PEF pilots (red meat, dairy and seafood) is required to finalize the requirements for purposes 1a and 1b.

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Table 4-1: Overview of potential purposes of PEF study on feed in relation to requirements (for testing in the supporting studies)

	Purpose 1: Feed PEF study to provide information for animal PEF study		Purpose 2. Cradle to gate PEF study without comparison		Purpose 3. Cradle to gate PEF study including a comparison	
	1a. without comparison nor public communication involved	1b with comparison and/or public communication involved	2a. without public communication	2b.with public communication	3a comparison between existing or new alternative products"	3b comparison in time" Trends progress in environmental impact
System boundaries [CH 4.5]	Default system boundaries	System boundaries in relation to goal of study	Default system boundaries	Default system boundaries	System boundaries can be adapted to goal of study	System boundaries can be adapted to goal of study
Additional modelling [CH 4.7 AND ANNEX]	NO	To be determined per animal PEF study	NO	NO	Depending on comparison	Depending on comparison
Type of data [CH 5]	Secondary data (low threshold)	To be determined per animal PEF study	Primary data for data in control, Secondary data for feed ingredients	Primary data for data in control, Primary data for feed ingredients (mostly out of control) allowed when data are available	Primary data for data in control, Primary data for feed ingredients if they are relevant for comparison	Primary data for data in control, Primary data for feed ingredients if they are relevant for comparison
Data Quality [CH 5.4]	Minimum allowed level DQR 3 or 4 depending on contribution	To be determined per animal PEF study	Minimum allowed level DQR 1.6 or 3 depending on accessibility	Minimum allowed level DQR 1.6 or 3 depending on accessibility	Minimum allowed level DQR 1.6 or 3 depending on relevance	Minimum allowed level DQR 1.6 or 3 depending on relevance
Allocation [CH 5.7]	Default option: economic	Economic plus two physical alternatives to ensure that the influence of allocation is properly described in the conclusion of the study.	Economic plus two physical alternatives to ensure that the influence of allocation is properly described in the conclusion of the study.	Economic plus two physical alternatives to ensure that the influence of allocation is properly described in the conclusion of the study.	Economic plus two physical alternatives to ensure that the influence of allocation is properly described in the conclusion of the study.	Economic plus two physical alternatives to ensure that the influence of allocation is properly described in the conclusion of the study.
Communication [CH. 8]	PEF report with explicit communication that results might be insufficient for comparisons and public communication	PEF report in compliance with requirements of animal PEF study	PEF report with explicit communication that results might be insufficient for comparisons and public communication	* PEF report with explicit communication that results might be insufficient for comparisons and public communication	PEF comparison report	PEF performance tracking report

				* PEF declaration		

4.5 System boundaries – life-cycle stages and processes

The system boundaries are described in Figure 4-1. The Figure shows all the different routes for feed production, the grey fields relate to the production of compound feed and are in the scope of the PEFCR.

The majority of feed ingredients used in compound feed originate from crop cultivation in its broad sense. The cultivation of crops requires the input of manure and fertilisers as well as, energy carriers, water, pesticides and auxiliary materials. The full lifecycle of the production of these products, including transport and depreciation of capital goods is in the scope of this PEFCR. The cultivation of crops can yield one main product, or yield two or more co-products. The crop (co-)product goes through one or more processing stages to separate fractions of the product and refine or purify for use in the animal feed. Processing usually requires energy, water and auxiliary materials (e.g. hexane for oilseed extraction). Waste water from processing will require treatment.

Other sources for feed are co-products from animal products processing and feed additives which partly originate from industrial processes. Minerals are also used as feed ingredients.

Feed compounding is the next phase, in which multiple feed ingredients are mixed together to produce a compound feed for food producing animals. In terms of access to information for a compound feed company, the activities taking place in the feed mill are considered as foreground processes.

The delivery of the feed to the farm also belongs to the scope of this PEFCR but the following life cycle stages: feed utilisation in the animal production system, processing of animal products, retail and end of life are considered to be outside the system boundaries in this PEFCR.

However, manure from the animal husbandry phase can re-enter the lifecycle at the cultivation of crops stage. Other products also re-enter the lifecycle at the compounding of feed as feed ingredients from the processing of animal products from the slaughterhouse for instance, e.g. plasma protein or the dairy processing industry such as whey powders. It should be noted that these products should be modelled using 'average' data as an attributional approach as prescribed in the PEF (thus using an 'average' LCI of the animal product).

It is common LCA practice to consider farm soil as part of the economic system. It means that changes in soil quality are not captured as such. The only aspect of farmland that is considered is the remaining biodiversity as part of the measurement of biodiversity loss to be reported as additional information.

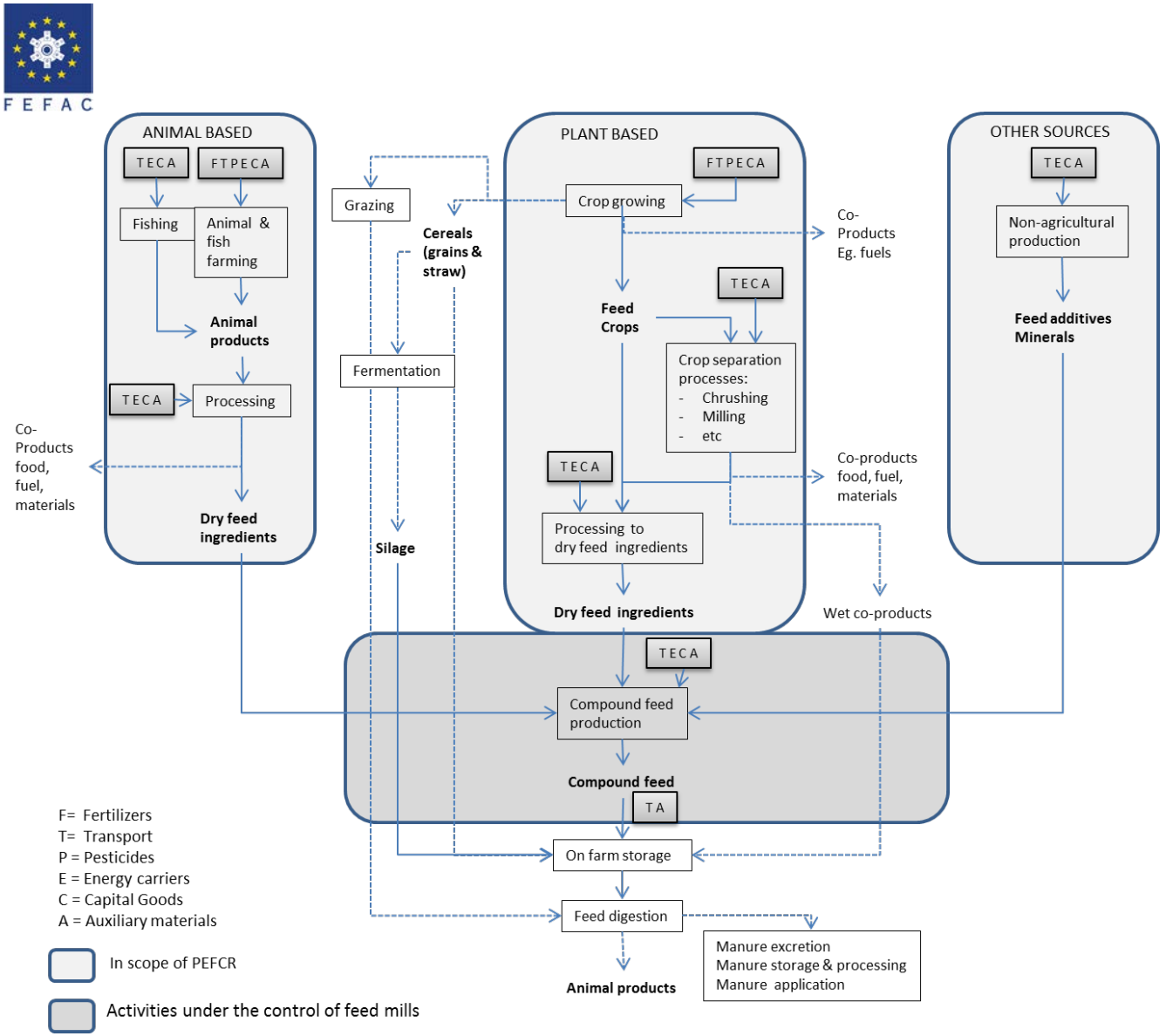

Figure 4-1: System boundaries for the production of animal feed. All grey blocks are in the scope of the PEFCR, the dark grey block corresponds to the foreground processes

For some purposes the system boundaries need to be extended. This can be the case for studies where the impact of modifications in the feed formulation is assessed. Such modifications can indeed have consequences on feed utilisation digestion (formally outside the scope of this PEFCR) which require to be captured.

Table 4-2: Adaptation of system boundaries in relation to the goal of the study.

	Purpose 1: Feed PEF study to provide information for the animal PEF study		Purpose 2. Cradle to gate PEF study without comparison		Purpose 3. Cradle to gate PEF study including a comparison	
	1a. without comparison nor public communication involved	1b with comparison and/or public communication involved	2a. without public communication	2b.with public communication	3a comparison between existing or new alternative products"	3b comparison in time" Trends progress in environmental impact
System boundaries [CH 4.5]	Default system boundaries [CH 4.4]	**System boundaries in relation to goal of study**	Default system boundaries	Default system boundaries	**System boundaries can be adapted to goal of study**	**System boundaries can be adapted to goal of study**

A comparative PEF study can be used for evaluation of alternative feed configurations. This could support decisions in changing the feed composition to improve environmental performance. However the system boundaries of the cradle to gate assessment are insufficient in several situations Table 4-3 gives an overview of these situations and to how to extend the system boundaries in the PEF study to come to definitive conclusions. These solutions **shall** be applied.

Table 4-3: Conditions that require extension of system boundaries

Insufficiency conditions	Solution
1. the ***nutritional value*** of the feed changes in a way so that it affects the production performance of food producing animals,	Full Lifecycle approach on the basis of measured or estimated use phase at production of food producing animals.
2. the ***chemical composition*** of the feed changes so that it affects the environmental performance of the farming systems where the feed is consumed (including digestion and manure management) or where the manure is applied,	Full Lifecycle approach applying parameterized models for digestion and manure management. Lifecycle shall be extended with animal manure application if relevant changes occur due to content of N, P, Zn and Cu in manure.
3. it involves an intentional change in constrained /residual co-products or an intentional change in location of feed material production on a scale that requires additional LCA modelling (see annex XII for further explanation). "If the change in the feed lifecycle involves more than 5% of the national supply of a raw material or area for cultivation then the need for additional LCA modelling should be considered."	Cradle to gate life cycle but with additional modelling to calculate impacts related to the supply and demand of raw materials or reallocation of processes.

4.6 Selection of the EF impact categories indicators

Since feed is an intermediate product all default impact categories being selected in the PEF guide shall be included in the assessment, see Table 4-4 .

Table 4-4: Impact categories to be quantified for feed for food producing animals

No.	Impact category	Description	Source	ILCD quality classification
1	Climate change	Global Warming Potential calculating the radiative forcing over a time horizon of 100 years.	IPCC 2007.	I
2	Ozone depletion	Ozone Depletion Potential (ODP) calculating the destructive effects on the stratospheric ozone layer over a time horizon of 100 years.	World Meteorological Organization (WMO) 1999.	I
3	Human toxicity, cancer effects	Comparative Toxic Unit for humans (CTUh) expressing the estimated increase in morbidity in the total human population per unit mass of a chemical emitted (cases per kilogramme).	USEtox.	II/III
4	Human toxicity, non-cancer effects	Comparative Toxic Unit for humans (CTUh) expressing the estimated increase in morbidity in the total human population per unit mass of a chemical emitted (cases per kilogramme).	USEtox.	II/III
5	Particulate matter	Quantification of the impact of premature death or disability that particulates/respiratory inorganics have on the population, in comparison to PM2.5. It includes the assessment of primary (PM10 and PM2.5) and secondary PM (incl. creation of secondary PM due to SOx, NOx and NH3 emissions) and CO.	Rabl and Spadaro 2004.	I
6	Ionizing radiation HH (human health)	Quantification of the impact of ionizing radiation on the population, in comparison to Uranium 235.	Frischknecht et al. 2000.	II
7	Photochemical ozone formation	Expression of the potential contribution to photochemical ozone formation. Only for Europe. It includes spatial differentiation	van Zelm et al. 2008.	II
8	Acidification	Accumulated Exceedance (AE) characterizing the change in critical load exceedance of the sensitive area in terrestrial and main freshwater ecosystems, to which acidifying substances deposit. European-country dependent.	Seppälä et al. 2006 and Posch et al. 2008.	II
9	Terrestrial eutrophication	Accumulated Exceedance (AE) characterizing the change in critical load exceedance of the sensitive area, to which eutrophying substances deposit. European-country dependent.	Seppälä et al. 2006 and Posch et al. 2008.	II
10	Freshwater eutrophication	Expression of the degree to which the emitted nutrients reaches the freshwater end compartment (phosphorus considered as limiting factor in freshwater). European validity. Averaged characterization factors from country dependent characterization factors.	ReCiPe version 1.05.	II
11	Marine eutrophication	Expression of the degree to which the emitted nutrients reaches the marine end compartment (nitrogen considered as limiting factor in marine water). European validity. Averaged characterization factors from country dependent characterization factors.	ReCiPe version 1.05.	II
12	Freshwater ecotoxicity	Comparative Toxic Unit for ecosystems (CTUe) expressing an estimate of the potentially affected fraction of species (PAF) integrated over time and volume per unit mass of a chemical emitted (PAF m3 year/kg).	USEtox.	II/III
13	Land use	Soil Organic Matter (SOM) based on changes in SOM, measured in (kg C/m2/a). Biodiversity impacts not covered by the data set.	Mila i Canals et al. 2007.	III
14	Water resource depletion	Freshwater scarcity: Scarcity-adjusted amount of water used.	Swiss Ecoscarcity 2006.	III
15	Mineral, fossil & renewable resource depletion	Scarcity of mineral resource with the scarcity calculated as 'Reserve base'. It refers to identified resources that meets specified minimum physical and chemical criteria related to current mining practice. The reserve base may encompass those parts of the resources that have a reasonable potential for becoming economically available within planning horizons beyond those that assume proven technology and current economics.	van Oers et al. 2002.	II

In addition the impact on climate change, as implemented in the ILCD method, shall be reported, with emissions from land use change excluded. This will be reported additionally as “Climate change ex LUC” according to the recommendations of the ENVIFOOD Protocol (Food SCP, 2013) and the LEAP feed guidelines (FAO LEAP, 2015).

The calculation and reporting of midpoint impact categories is the same for all defined Feed PEF purposes. However the PEF studies on food producing animals may only use a part for their external communication.

4.7 Additional environmental information

In the screening study, the possibility to assess impact on biodiversity was tested using ReCiPe (see screening report for more information). This will be further tested in the supporting studies and the outcome will be reported in an annex of the second draft PEFCR.

4.8 Assumptions/limitations of the PEFCR

This PEFCR assumes that a user of this PEFCR has access to information from a specific feed manufacturer. This PEFCR can only be used if sufficient information is available on feed ingredients, and nutritional analysis data.

There is insufficient secondary data available to make the distinction between specific cultivation practices. This lack of data and the unresolved methodological issues limit the possibility to menaningfully compare feeds on the basis of the cultivation practices of the feed ingredients.

It is assumed that a feed manufacturer has knowledge, or access to knowledge, about the origins of purchased feed ingredients, and associated logistics.

5. Life cycle inventory analysis

5.1 Definition of foreground and background data in relation to contribution and access

This PEFCR is based on the outcome of the screening study. This screening study gave insight into the main causes (due to emissions and resource use) of the environmental impact of the cradle to gate compound feed lifecycle. They are listed in Table 5-1 (see screening report for more information)

Table 5-1: Dominant determining flows, processes and activities for environmental impact of feed lifecycle

Inventory flow	Contributing Processes
Metals (Zn, Cu, Cr, Pb, Hg) relevant for human toxicity and eco-toxicity.	**Fertilizer** and **manure** application at farm
Pesticides mainly relevant for eco-toxicity scores	Farming
N relevant for eutrophication, acidification and climate change impact	**fertilizer** and **manure** application
P relevant for eutrophication and resource depletion	**Fertilizer** and **manure** application
Land transformation	**Soy bean** growing in Argentina & Brazil
Land occupation	All crops
Water depletion	**Irrigated crops** in regions with **water stress**
Energy determines the impacts (photochemical smog formation, PM, Ionizing radiation) and has a relevant contribution to Climate Change, Acidification and Eutrophication	All processes in life cycle

Most of the determining emissions and resource use of the compound feed lifecycle happen at processes (mainly cultivation) in the supply chain that are outside the scope of influence of most feed companies. For these processes often only secondary data can be used. (See section 5.3-5.4 for assigned data sources and required modelling in case primary data are derived).

The following processes are considered to be within the span of influence of a compound feed company: purchase of feed materials, formulation of the compound feed, operations in the feed mill, delivery of the compound feed to the farm. Therefore, the feed mill operator has specific knowledge of:

1. List of feed ingredients
2. Nutritional analysis data of compound feed
3. Transport activity data related to procurement of feed materials, packaging and auxiliary materials from their suppliers. This transport information only concerns the last step of transportation from the supplier to the feed mill and not the transport of the supply chain of the supplier.
4. Activity data of the compound feed mill including use of energy carriers and potential on-site energy production, feed materials, packaging and auxiliary materials.
5. Transport activity data of delivering compound feed to farms.

All these processes are considered to be foreground processes. The list of feed ingredients and the compound feed nutritional analysis (1 and 2) are important in terms of lifecycle impact contribution. The list of feed ingredients is required for determining the impact of production of feed ingredients and the nutritional analysis is relevant for the determining the impact of feed use downstream of the

feed mill. Section 5.2 describes the data collection procedure for primary activity data and section 5.4 defines which type of data shall be used (primary or secondary) and what are the data quality requirements according to the purpose of the study.

Other processes, such as the production of feed ingredients and off-site generation of energy are considered background processes for which secondary data can be used. The further definition of background data and the procedures to derive primary data to replace secondary data are described in section 5.3.

5.2 Data collection for foreground processes

5.2.1 *List of feed ingredients*

The list of feed ingredients is always regarded as activity data for which high quality information shall be used. In section 5.4 the data quality requirements for the list of feed ingredients in relation to the purpose of the study are explained.

The list of feed ingredients entails the following data:

- Types and quantities of feed materials
- Types and quantities of feed additives

The reference to define the feed materials is the EU Catalogue of feed materials[3].

The reference to define the feed additives is the EU Register of Feed Additives[4].

For processed feed materials the country of processing shall be recorded.

For crop products used directly in the feed mill, the country of origin shall be recorded when possible (see also section on cultivation).

5.2.2 *Nutritional analysis data*

The nutritional analysis data is especially relevant for PEF studies for food producing animals. In section 5.4 the data quality requirements for nutritional analysis data in relation to the purpose of the study are explained.

The nutritional analysis data needed for the purpose of the PEF study are:

- Nitrogen (N), Phosphorus (P) content in g/kg
- Cu, Zn content in g/kg
- Gross Energy (MJ/kg net calorific value or LHV) and digestible energy fraction[5] (% of gross energy)
- Biogenic and Fossil carbon content, listed separately

[3] Commission Regulation (EU) No 68/2013 of 16 January 2013 on the Catalogue of feed materials

[4] http://ec.europa.eu/food/food/animalnutrition/feedadditives/docs/comm_register_feed_additives_1831-03.pdf

[5] The digestible energy varies per animal species.

The provision of the biogenic and fossil carbon content – although not strictly a nutritional property - is required to complete the assessment of carbon related emissions in later life cycle stages.

5.2.3 Collection of Activity data of feed mill

Primary activity data for a feed mill shall be collected on the basis of average inputs over the last 3 most recent years. The activity data to be collected are mentioned in Table 5-2. The data should be recorded according to the format in Table 5-2. In the fourth column, the method of measurement should be explained. This includes the sources of information and any conversion of information and related assumptions.

Table 5-2: Collection of activity data at the feed mill

Activity data	**Unit per ton of feed out**	**Quantity**	**Source and method of measurement (if relevant)**
Electricity use	kWh		
Gas use	MJ LHV		
Heat use	MJ LHV		
Other energy inputs	MJ LHV (specify type)		
Water	m^3 (specify type)		
Packaging (only in case of feed sold in small units e.g 25 kg bags of calf feed)	kg (specify type)		
Other (if occurring and substantial)	kg (specify type)		

5.2.4 Collection of Activity data of transport to farm

If actual fuel use data of outbound transport can be collected, because there is a suitable accounting system in place, these data shall be used. Fuel use data will be connected to secondary LCI data for fuel production and combustion[6]. See Table 5-3 for a format that can be used for data collection.

If no fuel use data is available, transport emissions can be estimated by collecting activity data on transport distance, transport vehicles, load fractions, load fraction of the return trip and share of biofuel use. With this information transport inventories can be selected in the secondary database[7].

[66] This secondary data source will be selected and acquired by the EC in a tender and will become available before the supporting studies will start

[7] The level of detail and PEF compliance of secondary data for transport differ. It depends on the acquired secondary dataset which LCI data for transport should be selected. In the final version of the PEFCR specific further guidance on secondary data selection for transport will be given.

Table 5-3: Data collection for feed transport to farm if fuel use can be collected

Activity data	Unit	Quantity	Technology (e.g.EURO-class 1, 2, 3, etc.)	Source and method of measurement (if relevant)
Fuel use (type 1)	unit/tonne delivered feed (specify unit)			
Fuel use (type 2)	unit/tonne delivered feed (specify unit)			
Fuel use (type 3)	unit/tonne delivered feed (specify unit)			
Fuel use (type 4)	unit/tonne delivered feed (specify unit)			

Table 5-4: Data collection for feed transport to farm if information on actual fuel use cannot be collected

Activity data	Unit	Quantity	Source and method of measurement (if relevant)
Vehicle type 1	[-]		
• Load capacity	Tonne		
• Technology	EURO-class		
• Distance per trip	Km		
• Load fraction	%		
• Empty return transport	%		
• % biofuel	%		
Vehicle type 2 etc.			

The load capacity and the EURO-class are the basic parameters that define the emissions profile of the transport vehicle. The other parameters affect its efficiency. The final version of the PEFCR will specify how this information can be used.

5.2.5 Collection of activity data of transport to feed mill

Feed mill producers shall collect the following information of logistics from their suppliers:

- The last production location of the feed ingredient before transport to the feed mill and its distance to the feed mill (in case of a processed material this is the processing plant, in case of a crop this is the location of cultivation).
- The average transport scenario of the feed ingredient differentiated per transport means. Table 5-5 gives an example how this could look like.

Editorial note: There can be several traders between feed ingredient production and the feed mill, not all steps may be known to the compound feed producer. In the supporting studies the feasibility of getting sufficient knowledge of the final transportation stage from either cultivation or processing (e.g. warehouse/port) will be tested.

Table 5-5: Example of transport data to be collected from suppliers of the feed materials per feed material

Activity data	Unit	Quantity	Source and method of measurement (if relevant)
Feed material A			
• Supplier 1	Share	20%	Internal procurement records (3 years average)
o Transport means x	Truck	32 tonnes load capacity	Information from supplier
o Distance	Km	150	Distance of fastest route determined by route planner software …
o Load fraction	%	100%	Information from supplier
o Load fraction return	%	100%	There is no additional information collected so worst case assumption is applied
o Transport means y	Barge	1000 tonnes	Information from supplier
o Distance	Km	300	Distance of fastest route determined by route planner software …
o Load fraction	%	100%	
o Load fraction return	%	100%	
• Supplier 2			
o Transport means x	Truck	32 tonnes	Information from supplier
o Distance	Km	420	Distance of fastest route determined by route planner software …
o Load fraction	%	100%	Information from supplier
o Load fraction return	%	100%	There is no additional information collected so worst case assumption is applied
Etc			

5.3 Requirements regarding background generic data and (re)modelling

The environmental footprint of a cradle to gate feed product is mainly determined by the environmental footprint of its feed ingredients. In many cases secondary data will be used. However, when considered relevant and feasible and on a voluntary basis, it is possible to model the production of feed ingredients and to use primary data instead of secondary. Primary data replacing secondary data for feed ingredients shall fulfil the same requirements described in this section and its sub-sections (5.3.1, 5.3.2, 5.3.3).

The secondary data used for background processes shall fulfil the following requirements[8]:

1. Compliance to ILCD/PEF nomenclature
2. Acceptable DQR (Data Quality Requirement score) according to relevance (will be determined)

[8] The first three requirements are generic PEF compliance requirements. Requirements 4 and 5 are additionally formulated within the framework of this PEFCR for several reasons. Both are related to the fact that feed materials are collected from a great variety of industries and farming systems, Differences in environmental performance of feed is highly correlated to differences in the list of feed ingredients. If differences in environmental performance of feed ingredients would not be related to actual difference in impact but only on using different methodology in deriving LCI data, the main reason for calculating and communicating PEFs would disappear. Since the environmental impact of feed ingredients is in many cases highly correlated with the applied allocation method it is essential that feed ingredients LCI data are available for different allocation methods. Then, it is possible to make sensitivity assessments to explore if differences in performance are allocation dependent.

3. Modelling of LCI data sets on unit process level for reasons of transparency of LCA PEF operators and PEF target groups and for supporting easy adaptation to build similar processes if needed
4. Supporting multiple allocation methods
5. Consistent modelling of the LCI data sets of feed materials according to the requirements specified in section 5.3.1, 5.3.2 and 5.3.3

For the pilot phase the Agri-footprint 2.0 database fulfils most of these requirements and could be used as secondary database. It is the objective of the TS feed and the EU feed industry to develop a free database to accompany this PEFCR.

The modelling requirements of the sections 5.3.1, 5.3.2 and 5.3.3 shall apply to any primary data replacing default secondary data in background processes. Procedures that can be followed in the case of data gaps when missing raw materials or countries of production are mentioned in section 5.7 and annex IX.

In this draft PEFCR, there is no guidance yet on modelling data of fisheries and animal products that are used as feed materials. This will be implemented in the next version in cooperation with the pilots on red meat, dairy and seafood. In this draft PEFCR there is no further guidance on deriving LCI data for feed additives other than the generic requirements on deriving process data.

5.3.1 Cultivation

This section summarizes and translates the LEAP guidelines (FAO LEAP, 2015) to PEFCR requirements. Further guidance on how to do the assessment in practice can be found in the LEAP guidelines.

Editorial note: Generally secondary data for cultivation can be used for the feed PEF studies. However, in some cases a PEFCR user may want generate new LCIs for crop cultivation. For example, to model specific crop products (e.g. certified sustainable products or specific cultivations not covered in secondary databases). In those cases, it is important that these LCIs are consistent with other datasets and cover all relevant elementary flows. This section provides some guidance on what data shall be collected as a minimum, to meet these consistency requirements. All requirements in this section are now formulated as a "shall". In practice information can be incomplete or hard to access for the LCA PEF operator. In the guidance document additional guidelines formulate how to operate when information is missing or not accessible.

Cultivation includes all field and storage operations until the product is being sent for transport to the feed mill or further processing. Cultivation may also involve land use change.

The following inputs shall be quantified per hectare of crop cultivation:

- Seeds, NPK-fertilizers, manure, fuels, irrigation water, crop protection (pesticides), chemicals, auxiliary materials taking into account crop rotation and steady state of production (averaging over more years, see LEAP guidelines and PAS2050/1 (BSI, 2012) for further guidance in case of perennial crops)
- For the LCIs of production and logistics of agricultural inputs (fertilizers, pesticides, fuels etc.) the secondary dataset as mentioned in Annex IX shall be used.

The following economic outputs shall be quantified per hectare:

- Main crop product (mass, DM, value, gross energy content (LHV))
- Co-product(s) (mass, DM, value, gross energy content (LHV))
- Residual materials that remain on the field or in soil (mass, DM)

- Residual materials that are burnt and associated emissions
- Waste flows and destinationThe following background information shall be collected on region of cultivation and farm management:
- Country of production
- Soil type (organic and mineral soils)
- Blue water consumption in country/region of production
- Land transformation in past 20 years
- Description of farm practices
    - Farm rotation scheme
    - Tillage/ no tillage
    - Method of pesticides application
    - Method of manure/fertilizers application

The following outputs shall be quantified per hectare

1. Emissions from combustion of fuels
2. CO_2 emissions related to application of fossil carbon containing products (lime, peat, etc.)
3. N_2O emissions related to manure and fertilizer application to crop residues and N fixing of crops
4. NH_3 emissions related to manure and fertilizer application
5. Nitrate emissions to water related to manure and fertilizer application
6. P emissions to soil and water related manure and fertilizer application
7. Heavy metals emissions related to manure and fertilizer application on basis of mass balance approach
8. Pesticides emissions

These emissions shall be calculated according to broadly accepted method of calculating emissions, such as methodologies outlines in IPCC 2006 Guidelines (IPCC, 2006), EEA (European Environment Agency, 2013) or other reputable source.

Editorial note: In the coming period the requirements on calculation rules for calculating emissions will be further specified.

All economic inputs and elementary flows (resource use and emissions) per hectare shall be related to the net yields (after losses) per hectare.

Allocation in case of crop rotation and co-production (e.g. wheat and straw) shall be treated according to the decision-tree and recommendations mentioned in the LEAP guidelines.

5.3.2 Processing

This section is now an outline of a more detailed description that will be included in the final PEFCR.

The following inputs shall be quantified per tonne of raw material input.

- fuels, electricity, auxiliary materials taking into account steady state of production (averaging over appropriate period)
- for the LCIs of production and logistics of these inputs the following secondary dataset shall be used (for the supporting studies: Agri-footprint 2.0 (Blonk Agri-footprint BV, 2015)).

The following outputs shall be quantified:

- Product of interest (mass, DM, value, gross energy content (LHV))
- Co-product (mass, DM, value, gross energy content (LHV))
- Residual materials that are considered to have zero value (mass, DM)
- Waste flows and destination

The following background information shall be collected on region of production:

- Country of production
- Blue water consumption in country/region of production

The following outputs shall be quantified

- Emissions from the combustion of fuels
- Process specific emissions to water, air and soil

5.3.3 Logistics

This section will be completed at a later stage

5.4 Use of primary and secondary data and data quality requirements

5.4.1 Data quality criteria

The selection of which data to use (primary or secondary) and the data quality rating system is derived from the recommendations of the European Commission as mentioned in the PEF guide (European Commission, 2013).
The TS feed implemented the PEF data quality rating to make it usable for the assessment of data quality for the list of feed ingredients and the nutritional analysis of compound feed.
Table 5 shows the preliminary data quality system rating that will be tested in the supporting studies.
The approach on completeness of the list of feed is an important addition. As a minimum 80% of the list of feed ingredients should be available. Below this threshold it is considered not possible to conduct a PEF compliant study.

Editorial Note: The minimum level of data completeness of 80% means in practice that the LCA operator has insufficient access to the list of feed ingredients to deliver results that are sufficiently reliable.

The total data score builds upon the following six criteria:

- Technological representativeness (TeR)
- Geographical representativeness (GR)
- Time-related representativeness (TiR) or Time related variability (TiV)
- Completeness (C)
- Parameter uncertainty (P)
- Methodology appropriateness and consistency

For time related representativeness, the age of the process data is the most relevant criterion. This is not the most relevant parameter for the list of feed ingredients because this can fluctuate strongly and frequently depending on prices and availability of feed ingredients. Here the alternative criterion “time related variability” has been applied. The rationale is that good data regarding the list of feed ingredients should be both recent and averaged over three years. Data averaged over a shorter period and older data are considered as poor quality data and receive a lower rating (see Table 5.5 for preliminary criteria and thresholds). The feasibility of this approach will be tested in the supporting studies.

Five quality levels are defined for each criterion:

- Very good (1)
- Good (2)
- Fair (3)
- Poor (4)
- Very poor (5)

The overall data quality rating (DQR) of a dataset is the average of the scores obtained for all six data quality criteria.

Editorial Note: Further explanation of split in data quality criteria for the list feed ingredients and nutritional analysis:

The nutritional analysis date could be calculated from the list of feed ingredients if 100% of the information is available. The final small additions to complement the compound feed may contain a large part of the elements that are highly relevant for nitrogen content (e.g. in the form of amino acids and urea) and for P, Zn and Cu (in the form of minerals). So in LCA practice the estimation of the nutritional analysis of compound feed is quite often done separately from the ingredient information. For instance estimated on the basis of allowable contents and additions (e.g. Zn, Cu) or what is common for a certain feed in a certain region (e.g. N, P, GE and DE). In the supporting studies we should test the best practical method which could involve the definition of secondary data per feed type and region.

Editorial Note: Use and communication of list of feed ingredients and nutritional analysis

To conduct a PEF study, it is important to use good quality data for the list of feed ingredients and the nutritional analysis. The intention is to pursue working with primary and accurate data. However the information about feed ingredients composition and some physical/chemical characteristics is considered confidential in many situations. This implies that the PEFCR should foresee the possibility to keep this information confidential in case of external communication. The checking of the correctness and accuracy of the data should then be done by an external validation party. In this situation communication is only allowed with a 'stamp of approval' by the external validation body.

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Table 5-6: Preliminary table of data quality criteria and quality levels that shall be used for the DQR for process, list of feed ingredients and nutritional analysis data. This table will be tested in the supporting studies

			Process Data	List of feed ingredients	Nutritional analysis data (N,P, Zn, Cu, GE, DE, $C_{bio/fossil}$)
Technological representativeness	1	Very good	Specific technology	Data are specific for growth stage and breed of the animal and of the specific production system that is under study, e.g feed for young animals in dairy system	Data are specific for growth stage and breed of the animal and of the specific production system that is under study, e.g feed for young animals in dairy system
	2	Good	Average technology for the specific product as EU-specific consumption mix	Data are specific or the growth stage of the animal e.g young cattle feed	Data are specific or the growth stage of the animal e.g young cattle feed
	3	Fair	Average technology for the specific product as EU-specific production mix	Data are specific for the production system e.g. dairy feed	Data are specific for the production system e.g. dairy feed
	4	Poor	Average technology for a group of similar product as EU specific consumption mix	Data are animal specific e.g. cattle feed	Data are animal specific e.g. cattle feed
	5	Very poor	Other process or unknown	Not animal specific feed data (EU average feed)	Not animal specific feed data (EU average feed)
Geographical representativeness - if scope country specific	1	Very good	Country specific		
	2	Good	Continent specific data		
	3	Fair	One or several country(ies) in the specific continent		
	4	Poor	Another continent		
	5	Very poor	Global or unknown		
Geographical representativeness - if scope is larger than a country specific	1	Very good	Geographical scope specific		
	2	Good	Some countries in the geographical scope		
	3	Fair	One country in the geographical scope		
	4	Poor	Geographical scope with the same technological level		
	5	Very poor	Geographical scope with lower/higher technological level or unknown		
Time-related representativeness	1	Very good	≤ 3 year old data	NA	NA
	2	Good	3-5 years old data	NA	NA
	3	Fair	5-10 years old data	NA	NA
	4	Poor	10-15 years old data	NA	NA
	5	Very poor	≥ 15 years old data	NA	NA
Handling time related variability	1	Very good		Average of last three years	Average of last three years
	2	Good		Average of last 2 years	Average of last 2 years
	3	Fair		Average of one calendar year (last one or previous)	Average of one calendar year (last one or previous)
	4	Poor		Average of shorter time period than a year	Average of shorter time period than a year
	5	Very poor		Based on one batch, expert judgement or data older than 3 years	Based on one batch, expert judgement or data older than 3 years
Completeness	1	Very good	≥ 90% of a full LCI	Data cover 100% of raw materials composition	Data are based on a calculation that involved 100% of the feed ingredients compositon
	2	Good	80%-90% of a full LCI	Data cover ≥ 98% of raw materials composition, rest determined on the basis of secondary data or upscaling the 98% average to 100%	Data are based on a calculation that involved 100% of the feed ingredients compositon, DE is a fixed percentage of GE
	3	Fair	70-80% of a full LCI	Data cover ≥ 95% of raw materials composition, rest determined by filling gaps on the basis of secondary data or upscaling	Data are based on a calculation that involved 95% of ingredients, but information of N and P is complete. Zn and Cu is based on country and feed specific averages
	4	Poor	50-70% of a full LCI	Data cover ≥ 90% of raw materials composition, rest determined by filling gaps on the basis of secondary data or upscaling	Data are based on country and feed specific information on average N,P, Zn, Cu, GE, and DE
	5	Very poor	<50% of a full LCI	Data cover ≥ 80% of raw materials composition, rest determined by filling gaps on the basis of secondary data or upscaling	Data are based on EU average N,P, Zn, Cu, GE, and DE content in feed
Parameter uncertainty	1	Very good	Very low uncertainty (≤ 10%)		
	2	Good	Low uncertainty (10% to 20%)		
	3	Fair	Fair uncertainty (20% to 30%)		
	4	Poor	High uncertainty (30% to 50%)		
	5	Very poor	Very high uncertainty (> 50%)		
Methodological appropriateness and consistency	1	Very good	Full compliance with all requirements of the PEF guide	NA	NA
	2	Good	Attributional process-based approach AND the following three method requirements of the PEF guide are met: Dealing with multi-functionality, End-of-life modelling, System boundary	NA	NA
	3	Fair	Attributional process-based approach AND two of the following three method requirements of the PEF guide are met: Dealing with multi-functionality, End-of-life modelling, System boundary	NA	NA
	4	Poor	Attributional process-based approach AND one of the following three method requirements of the PEF guide are met: Dealing with multi-functionality, End-of-life modelling, System boundary	NA	NA
	5	Very poor	Attributional process-based approach BUT none of the following three method requirements of the PEF guide is met: Dealing with multi-functionality, End-of-life modelling, System boundary	NA	NA

5.4.2 *Data quality requirements in relation to contribution and access of data, testing of the data need matrix.*

To define the data quality requirements in relation to lifecycle contribution and access of data the EC provided a method which is summarized in Table 5-7. This matrix is the outcome of the discussions at the Technical Advisory Board. In the same way as for the data quality rating system, the Feed TS implemented this matrix to make it usable in a compound feed-specific context, for the purpose of being tested in the supporting studies.

Table 5-7: Data quality requirements in relation to lifecycle contribution and access of data

<table>
<tr><th colspan="2"></th><th>Most relevant process</th><th>Other process</th></tr>
<tr><td rowspan="2">Situation 1: process run by the company applying the PEFCR</td><td>Option 1</td><td>Provide company-specific activity data (as requested in the PEFCR) and create a company specific unit process dataset with DQR ≤1.6.</td><td>Substitute the process-independent[9] default activity data provided in the PEFCR with primary (company-specific) ones and use default secondary unit process dataset with DQR ≤3.0</td></tr>
<tr><td>Option 2</td><td></td><td>Provide company-specific activity data (as requested in the PEFCR) and create a company specific unit process dataset with DQR ≤1.6.</td></tr>
<tr><td rowspan="3">Situation 2: process not run by the company applying the PEFCR but with possibility to have access to company specific data</td><td>Option 1</td><td>Provide company-specific activity data (as requested in the PEFCR) and create a company specific unit process dataset with DQR ≤1.6.</td><td rowspan="5">Use default secondary dataset with DQR ≤4.0</td></tr>
<tr><td>Option 2</td><td>Substitute (if available) process-independent default activity data provided in the PEFCR with primary (company-specific) data and, starting from the secondary dataset provided in the PEFCR, remodel/adapt it to supply-chain and process specific situation (including energy mix, transport modes, EoL treatment systems) achieving a DQR ≤3.0</td></tr>
<tr><td>Option 3</td><td>Use default secondary dataset with DQR ≤3.0</td></tr>
<tr><td rowspan="2">Situation 3: process not run by the company applying the PEFCR and without possibility to have access to company</td><td>Option 1</td><td>Substitute (if available) process-independent activity data (e.g. transport distance) and use default secondary dataset with DQR ≤3.0</td></tr>
<tr><td>Option 2</td><td>Use default secondary dataset with DQR ≤3.0</td></tr>
</table>

[9] The independence shall be identified by the TS and could be subject to verification during an audit.

This proposal needs to be tested in the supporting studies. For this testing we defined this approach in a preliminary system for selection of primary and secondary data and data quality requirements for LCA operators that have access to feed mill operation data.
The final requirements will be clarified on the basis of the outcome of the supporting studies.

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Table 5-8: Preliminary system for selection of secondary or primary data and definition of DQR for LCA operators at feed companies or that work on behalf of feed companies

	Purpose 1: Provision of LCI compound feed information to PEF studies for food producing animals				**Purpose 2: cradle to gate Feed PEF study without comparison nor public communication involved**		**Purposes 3 and 4: cradle to gate Feed PEF study involving comparison (in time or with alternatives) or public communication**	
	without comparison nor public communication involved		with comparison and/or public communication involved					
	type of data	DQR	type of data	DQR	type of data	DQR	type of data	DQR
1) list of feed ingredients	to be determined in collaboration with animal pilots		to be determined in collaboration with animal pilots		Primary	≤ 1,6	primary	≤ 1,6
2) nutritional analysis	to be determined in collaboration with animal pilots				will be tested in the supporting study	≤ 3	will be tested in the supporting study	≤ 3
production of feed ingredients	secondary	≤ 3			secondary	≤ 3	secondary primary allowed/required in relation to purpose of study and control of information	?
transport of feed ingredients to feed mill	Secondary				Primary/secondary (activity)	≤ 3	Primary/secondary (activity)	≤ 1,6
feed mill operations	Secondary	≤ 4			primary (activity)	≤ 3	primary (activity)	≤ 1,6
transport of feed to farm	Secondary	≤ 4			primary (activity)	≤ 3	primary (activity)	≤ 1,6

5.5 Data gaps

There are several types of data gaps for which procedures will be developed and tested in the supporting studies. It involves

- Selecting similar processes/products (feed ingredients proxies) from secondary database when data is not available.
- Selecting similar datasets when countries of production are not available (procedure to determine which countries have comparable impact and which datasets from the secondary database can be used as proxies)
- Adapting logistics and energy provision when other datasets are used as a proxy.

Editorial note: Here we would also suggest introducing a threshold. If too many data points need to be filled with proxies, the study should not qualify as PEF compliant.

5.6 End-of-life stage

In case of packed feed ingredients or compound feed, the packaging materials will be discarded at the farm of use for which the PEF End of Life Formula should be applied by the LCA operator for the study.

5.7 Requirements for multifunctional products and multiproduct processes allocation

The requirements on treatment of multi-functionality differ per purpose and are summarized in the Table 5-9.

Table 5-9: Allocation requirements

	Purpose 1: Provision of LCI compound feed information to PEF studies for food producing animals		Purpose 2. Cradle to gate PEF study without comparison		Purpose 3. Cradle to gate PEF study including a comparison	
	1a. without comparison nor public communication involved	1b with comparison and/or public communication involved	2a. without public communication	2b.with public communication	3a comparison between existing or new alternative products"	3b comparison in time" Trends progress in environmental impact
Allocation	Default option: economic	Economic plus two physical alternatives depending on the purpose of the study	Economic plus two physical alternatives depending on the purpose of the study	Economic plus two physical alternatives depending on the purpose of the study	Economic plus two physical alternatives depending on the purpose of the study	Economic plus two physical alternatives depending on the purpose of the study

Economic allocation will be conducted on the basis of the method and default allocation fractions in Annex XI unless it is clear that the process under study deviates from the default processes. Then economic allocation will be done according to the procedure as being explained in the LEAP guidelines for feed.

Two alternative and meaningful allocation options will be analysed, appropriate to the purpose and scope of the specific study.

6. Benchmark and classes of environmental performance

This section will be completed at a later stage.

7. Interpretation

According to the PEF Guidance (2014), the interpretation phase shall include the following steps:

- Assessment of robustness of the Product Environmental Footprint model
- Identification of hotspots
- Estimation of uncertainty; and
- Conclusions, recommendations and limitations

The limitations of the study shall be clearly stated and described.

8. Reporting, Disclosure and Communication

This section will be completed at a later stage.

9. Verification

This section will be completed at a later stage.

10. Reference literature

Blonk Agri-footprint BV. (2015). *Agri-footprint 2.0 - Part 1 - Methodology and basic principles*. Gouda, the Netherlands. Retrieved from http://www.agri-footprint.com/methodology/methodology-report.html

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JRC. (2015). Baseline Approaches for the Cross-Cutting Issues of the Cattle Related Product Environmental Footprint Pilots in the Context of the Pilot Phase.

11. Supporting information for the PEFCR

This section will be completed at a later stage.

List of annexes

Annex I – Representative product

The screening report and its annexes are available from the stakeholders' workspace of the wiki page.

Annex II – Supporting studies

This section will be completed at a later stage

Annex III – Benchmark and classes of environmental performance

This section will be completed at a later stage

Annex IV – Upstream scenarios (optional)

Not applicable

Annex V – Downstream scenarios (optional)

Not applicable

Annex VI – Normalisation factors

This section will be completed at a later stage

Annex VII – Weighting factors

This section will be completed at a later stage

Annex VIII – Foreground data

This section will be completed at a later stage

Annex IX – Background data

This section will be completed at a later stage

Annex X – EOL formulas

This section will be completed at a later stage

Annex XI – Background information on methodological choices taken during the development of the PEFCR

This section will be completed at a later stage

Annex XII: Discussion on need for additional modelling

Introducing a threshold in relation to the scale of national production volume/area of a feed material follows the line of reasoning in the ILCD LCA guide where a split between micro and meso/macro level is made. The ILCD guide does not give concrete recommendations that help the LCA user the scale in quantitative terms. The threshold of 5% is arbitrary but it is more practical than the ILCD qualitative approach and gives the PEFCR user a tool to prove that additional modelling is not required for his study.

The 5% threshold is sometimes lower than for instance the annual fluctuations in European feed material availability. The yields of crops in a certain country and the related production volume of the processed crops can fluctuate 15% or more over the years [sugar and grain statistics]. This means that the availability of feed materials and their price also strongly fluctuate through the years. The 5% is a considerable part of the normal fluctuation but at the same time it is still far away from the more extreme fluctuations.

The introduction of rape seed cultivation in Europe for bio-fuels is an interesting example. This did not have big implications on land use and shifts in commodity flows right away but it got implications when it grew to a certain scale. It triggered for instance the replacement of significant volumes of imported soybean meal by domestic rapeseed meal in compound feed

The biofuels case has been extensively assessed and could give a bit more information on if and how a threshold should be defined.

<u>Example regarding using additional constrained feed materials.</u>

A feed company reduces the environmental impact of its dairy feed by using in the composition of the dairy feed on average 10% dried sugar beet pulp and 15% palm kernel expeller. Normally the composition would on average be 6% dried sugar beet pulp and 10% palm kernel expeller. The company is situated in the Netherland and sells 2 Mt of this dairy feed. The dried beet pulp is bought in the Netherlands and the additional 4% equals to 80.000 ton dried beet pulp which is nearly 10% of the Dutch market of available beet pulp. The palm kernel expeller is bought from Malaysia that produces 2.4 Mt of expeller per year. So the 5% additional expeller equals 100.000 ton which is 4% of Malaysian production. In this case, the feed company has to assess if its additional use of dried beet pulp leads to changes in the market of processing and use of beet pulp that changes the initial estimate of improved environmental performance. The increased demand of dried beet pulp will not affect the amount of sugar production due to the low contribution to revenues of a sugar factory. So there should then be a change in the processing of beet pulp or the destination of the pulp. There could be an increased drying of beet pulp at the cost of fresh beet pulp that was directly sold to (other) dairy farms. In this case energy use becomes higher (the impact of extra drying is bigger than reduced transport) and increases the environmental impact. (Also the feeding performance of wet and dry beet pulp can be different). So the additional assessment would show that the substantial increased use of dried beet pulp cannot be considered as an environmental improvement and should not be communicated as such.