

Overview on capability of LCA databases in providing Carbon Calculators with the required data to measure GHG emission of the food sector

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Abstract: Food sector has a considerable contribution in producing GHG emissions. In order to respond to self-imposed or mandated emission-reduction targets, businesses and other entities in this sector increasingly measure and report their GHG emissions. LCA databases, as providers of inventory data for Carbon Calculators have an important role in helping to develop more complete and accurate tools to measure and report GHG emissions produced by the food sector.

Introduction

Carbon Calculators are employed as a tool to measure the carbon foot print of products produced by the industry or consumed by the end consumer. These calculators measure and communicate the overall magnitude of impacts and also the extent to which different processes and products contribute to GHG emissions. Related calculations would be made based on the method applied by the calculator and also the underlying data. These data are sourced through LCA databases and typically categorized as process data, or industry sector data. LCA databases typically contain more finely aggregated process data across a breadth of food-related processes.

This research aims to analyze whether the inventory data related to food chain activities provided in currently available LCA databases are completely employed by the carbon calculators or calculators can still be improved in terms of using capabilities LCA databases provide. For this purpose available LCA databases with the focus on food sector has been collected and evaluated in terms of processes and products covered by these databases. The results could help in paving the way for developing more reliable and accurate Carbon Calculators.

Review on food focused LCA databases

In this study six LCA databases developed by different organizations with the focus on the food sector had been studied. These databases had been chosen from collection of databases found through search engine Google. Selection of databases in the peer studies had also been considered such as [Ki2008]. These databases have different focuses and cover different criteria, the products and processes covered by them are collected from available data in databases websites and summarized in table 1.

LCA Food Database developed by 2-0 LCA Consultants, <http://www.lcafood.dk/>

Processes included production of pig farms, vegetables flour, dairy, soy, grass and feed, bread baking, fish canning, peeling; pig slaughtering, packing materials, unpacking, cutting, mixing, heating, cooling, washing and cleaning. Energy required for the storage, cold and frozen, and lightening. Different means of transportation truck, ship, train, pipeline, air-plane, private car and bicycle and wastewater treatment planning. Products included are carrots, onions, tomato, cucumber, vegetable, potatoes, rape seed, pork, beef, chicken, fish, grains, soy bean, milk, cream, butter, cheese, sugar, bread, flours, oat flakes

EIO-LCA developed by Carnegie Mellon Green Design Institute, <http://www.eiolca.net/>

Processes included are oilseed, grain, vegetable, fruit, crop farming, greenhouse and nursery production, tobacco, cotton, cattle ranching and farming, poultry and egg production, wet corn milling, logging, forest nurseries, forest products and timber tracts, fishing, hunting and trapping, packaging materials, light, energy, cooking, refrigerating, cooling, transportation through air, land and water, waste management. Products included are fruit and vegetable, meat, poultry, seafood, rice, malt, breakfast cereal, soybean, cacao beans, milk, butter, cheese, dry condensed or evaporated dairy, chocolate, frozen food, canned and dried fruit and vegetable, coffee and tea, spices, flour, oilseed, bread, sugar, cookie and cracker, flavoring syrup, mixes and dough, dry pasta, Tortilla, roasted nuts and peanut, snack food, ice cream and frozen dessert, mayonnaise, dressing and sausages, soft drink, breweries, wineries and distilleries

ESU, developed by ESU Services <http://www.esu-services.ch/cms/index.php?id=database>

Processes included are plant and vegetable production, vegetable mix, animal production, slaughtering, cooking, cooling, food packaging, storage, cooking stoves and ovens, microwaves, refrigerators, carbonization devices, different transportation means such as road, ship, train, consumption patterns and waste treatment. Products included are fruits including apples, strawberries, cherries, grapes, oranges, vegetables, spinach, vine, melons, salad, tomatoes, lettuce, potatoes, onions, asparagus, pork, veal, beef, lamb, poultry, eggs, cheese, butter, milk, milk powder, yoghurt, coffee, chocolate, noodles, pasta, bread, wheat flour, tofu, lasagna, ice cream, apple & orange juice, mineral water, tap water, beer, wine, coffee, soymilk

Eco Invent DB, developed by Swiss Center for LCI, <http://www.ecoinvent.ch/>

Processes included are agricultural means of production: feed, machinery, fertilizer, pesticides. Seed growing, cultivation, harvesting, organic, integrated production methods, extensive and intensive production, processing sugar, plant production, animal

production, slaughtering, and sheep husbandry, packaging materials, transport by air, oversee and on land by train, van and truck, energy, distribution, building material, waste management, waste treatment. Products included are sugar cane, sunflower, sugar, peas, potato, sheep, sorghum, wheat, barley, corn, maize, rice, soy bean, cheese, butter, milk.

IVAM LCA Data 4.04, developed by IVAM Environmental Research, University of Amsterdam. www.ivam.uva.nl

This database contains over 1.300 unit processes. Food production (including animal, crops and feeds, agriculture plant and seeds production), slaughtering, pig and chicken fodder, milk powdering, sow meat, glass, metal, plastic and paper packaging, fuel, energy, light, rail, road, water, waste management, waste treatment. Products included are sugar cane, sunflower, peas, potato, sheep, beef, chicken, fish, pork, wheat, barley, corn, maize, sorghum, soy bean, cheese, butter, milk, sugar, mineral water.

SALCA 06, SALCA 071, developed by Agroscope Reckenholz-Tänikon <http://www.agroscope.admin.ch/oekobilanzen/01199/index.html?lang=en>

This database contains models for assessing direct field and farm emissions, such as nitrate, nitrous oxide, methane, ammonia, phosphorus and heavy metals for the purposes of analyzing and optimizing the environmental impacts of agricultural production, animal production and packaging. Products included are potato, beef, pork, poultry, egg, wheat, maize, seed, corn, cheese, butter, milk.

	Agriculture	Processing	Packaging	Distribution	Logistics	Consumption
Fruit and Vegetables	LCA Food EIO/SALCA ESU/IVAM Eco Invent	LCA Food EIO/SALCA ESU/IVAM Eco Invent	LCA Food EIO/CPM ESU/SALCA Eco Invent	LCA Food EIO ESU/IVAM Eco Invent	LCA Food EIO ESU/IVAM Eco Invent	LCA Food EIO ESU/IVAM Eco Invent
Meat and Egg	LCA Food EIO/SALCA ESU/IVAM Eco Invent	LCA Food EIO/SALCA ESU/IVAM Eco Invent	LCA Food EIO/SALCA ESU/IVAM Eco Invent	LCA Food EIO ESU/IVAM Eco Invent	LCA Food EIO ESU/IVAM Eco Invent	LCA Food EIO ESU/IVAM Eco Invent
Cereal and Pulses	LCA Food EIO/SALCA Eco Invent IVAM	LCA Food EIO/SALCA Eco Invent IVAM	LCA Food EIO/SALCA Eco Invent IVAM	LCA Food EIO Eco Invent IVAM	LCA Food EIO Eco Invent IVAM	LCA Food EIO Eco Invent IVAM
Diary	LCA Food EIO/SALCA ESU/IVAM Eco Invent	LCA Food EIO/SALCA ESU/IVAM Eco Invent	LCA Food EIO/SALCA ESU/IVAM Eco Invent	LCA Food EIO ESU/IVAM Eco Invent	LCA Food EIO ESU/IVAM Eco Invent	LCA Food EIO ESU/IVAM Eco Invent
Proceed Food	IVAM EIO	IVAM EIO	IVAM EIO	IVAM EIO	IVAM EIO	IVAM EIO
Beverages	EIO ESU/IVAM	EIO ESU/IVAM	EIO ESU/IVAM	EIO ESU/IVAM	EIO ESU/IVAM	EIO ESU/IVAM

Table 1 – Process vs. Product covered by LCA databases

Analysis and Results

According to [Am2010], there is a considerable lack of food specification in Carbon Calculators as most of the calculators studied by these authors lack the sufficient categorization necessary to draw the conclusions about the product or chain GHG emissions. In some calculators no food categorization has been reported and in some, just number of the meals was requested as the input data including number of meals in the week with red meat inside while rest of food categories was totally ignored.

Considering different food categories covered in LCA databases and comparing it to the result of the research done by [Am2010] it can be concluded that there are considerable amount of inventory data of different food categories available in databases which is still not employed by the Carbon Calculators.

Besides different food categories, different processes are covered by the databases. However, less than half of Carbon Calculators reviewed by [Am2010] contain data regarding processes such as production methods which reveals the gap between the available inventory data and its application in impact assessment by Carbon Calculators in food sector.

Conclusion and recommendations

Food chain contributes to considerable amount of GHG emissions. Measuring this emission requires accurate Carbon Calculators and complete databases to provide them with the required data. From the LCA databases reviewed, some have food as a part of their focus or specifically designed for the food chain. These databases cover different food categories such as fruits, vegetables, meat, egg, dairy, cereals, pulses, processed food and beverages. Besides that, different processes such as agriculture, processing, packaging and labeling, distribution and wholesaling, retailing, logistics, transportation, consumption and waste management are included. Gathering these data required a considerable amount of investments. Therefore, an update in Carbon Calculators is required to use LCA databases more efficiently in assessment of the GHG emissions of the food chain. However, for databases there are still substantial opportunities for improvement in term of food categories and also processes covered.

References

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