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**METHODS FOR ESTIMATING GREENHOUSE GAS  
EMISSIONS FROM FOOD SYSTEMS  
PART III: ENERGY USE IN FERTILIZER MANUFACTURING,  
FOOD PROCESSING, PACKAGING, RETAIL AND  
HOUSEHOLD CONSUMPTION**





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### PART III: ENERGY USE IN FERTILIZER MANUFACTURING, FOOD PROCESSING, PACKAGING, RETAIL AND HOUSEHOLD CONSUMPTION

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## Abstract

This paper is part of a series detailing new methodologies for estimating key components of agri-food systems emissions, with a view to disseminate the information in FAOSTAT. It describes methods for estimating greenhouse gas (GHG) emissions from fossil fuel-based energy use in agri-food system processes outside agricultural land, i.e. those associated with pre- and post-production activities – in an effort to inform countries of the environmental impacts of agri-food systems and the possible options to reduce them. Based on the proposed methodology, we build a new database of the annual carbon footprint of energy use in pre- and post-production agri-food system processes, on a country basis and with global coverage, for the period 1990–2019.

Our efforts help to better characterize agri-food systems and the role they can play in achieving the Sustainable Development Goals (SDGs). In particular, they align well with SDG 12 to ensure “sustainable consumption and production patterns”, specifically Target 12.2, “achieve the sustainable management and efficient use of natural resources” and Indicator 12.2.1, which monitors the “material footprint, material footprint per capita, and material footprint per GDP” of different products.

This paper covers five categories of energy use in agri-food systems: (1) fertilizer manufacturing; (2) food processing; (3) packaging; (4) retail; and (5) household consumption. Methods for estimating GHG emissions from other agri-food system processes and complementing this work are discussed elsewhere (Tubiello *et al.*, 2021), specifically in relation to estimating emissions from food transport (Karl and Tubiello, 2021a), waste disposal (Karl and Tubiello, 2021b) and on-farm energy use (Flammini *et al.*, 2021).



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