

## Land Use Change and Electricity Models in a Multi-regional Hybrid Input Output Framework

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This paper shows an extended version of the hybrid multi-regional Input-Output table (MR-HIOT) derived from Exiobase v.3.

The multi-regional hybrid supply-use tables (MR-HSUTs), which are used to derive the input-output tables where tangible goods are accounted in metric tons, energy flows in TJ and services in euros. They respect mass, energy and monetary balances. The extensions include emissions, stock addition, stock reduction/depletion, supply and use of waste, supply and use of packaging, extraction of resources, use and withdrawal of water and land use.

The MR-HIOT here presented adopts a generalized version of by-product technology model (Stone's method). Furthermore, a cause-effect based electricity model and indirect land use change (iLUC) model are inserted.

The generalized by-product technology model extends the Stone's method to a multi-regional framework and focuses on the respect of mass balance, whenever by-products substitute products with different properties produced elsewhere as principal productions.

The electricity model introduces the concept of national electricity grid where only non-constrained and competitive producers react to changes in demand. The electricity model was introduced by Schmidt et al (2011).

The iLUC model considers the substitution effects of the land use. The model was introduced by Schmidt et al. (2015). It simulates the effect of the substitution of land anytime a new production comes into place in any region of the world. Depending on the peculiarities of a country, the new demand of land may be obtained either by intensification the crops or occupying new land, i.e. forest or grassland. The emissions due to intensification and land use changes are taken into account.

The transaction matrix presented in this paper has a format 8213x8213; 164 products for 48 countries/world regions, 48 national electricity markets, six types of national land use markets for each of the 48 regions, and 5 world land use markets.

Schmidt J, Merciai S, Thrane M, Dalgaard R (2011). Inventory of country specific electricity in LCA – Consequential and attributional scenarios. Methodology report v2. 2. LCA consultants, Aalborg, Denmark. <http://lca-net.com/p/212>

Schmidt J, Weidema B, Brand M (2015). A framework for modelling indirect land use changes in life cycle assessment. *Journal of Cleaner Production* 99:230–238.