Matching bottom-up and top-down for verification and integration of LCI databases

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Bottom-up and top-down

- Bottom-up: Specific unit process data – linked or aggregated
- Top-down: Economic Input-Output statistics linked with national emissions registration data – disaggregated
- Integration provides several advantages:
  - ✓ Combining detail and completeness
  - ✓ Mutual verification
  - ✓ Continuously updated normalisation references

Closing in on data gaps

- Bottom-up may have data gaps up to 50%
- Top-down data rely on more data sources and are thus easier to verify
- Bottom-up can provide the resolution lacking in top-down data
- Should be seen as complementary – not as incompatible!

Combining the two data sources in the same database

Few practical problems:

- Same data format (ISO 14048)
- Top-down data may be seen as default processes, which are then broken down by the aid of the bottom-up data, either completely or resulting in a residual default process

Combining the two data sources in the same database

Example:

- Dairy industry as one IO-process
- High quality industry data for milk, yellow cheese, powder milk, butter and spreads.
- Residual: Caseinates, fermented milk, processed cheese, ice cream, whey, lactose and ready-made foods, for which we only have an average emission factor – until more data become available

Examples of verification by combining the two data sources

The Danish LCA Food Data Base:

Data on 28 farm types, together representing all Danish farms.

Each farm type represented by a technical model based on standard recommended requirements and empirical technical coefficients. Validated for coherence at the internal farm level.

At the national level, the sum of all farm models are validated against the national statistics (e.g. areas of each individual crop, trade data on diesel, fertilizer, concentrated feeds).

In first run, the high quality technical models captured only 50% of the energy use reported in national statistics!

Examples of verification by combining the two data sources

The Danish input-output based LCA-database:

Covering the entire Danish production and consumption.

Covering all major emissions as determined by the Danish normalisation reference for LCA (EDIP 2000).

Comparing to traditional bottom-up data:

- In many bottom-up LCAs, transport is underestimated. The reason is that it is spread out over many different products, each with their cut-off.
- Emissions from retail trade, repair and maintenance may be underestimated for the same reason.

Updating normalisation references

Typical normalisation references are simply LCIs of national economies.

Bottom-up data may improve national (regional and global) normalisation references.

Examples from Danish IO-based LCA-database:

- Detailed farm models led to revision of national totals for CH_4 and N_20
- National VOC emission data appears to be underestimated

Updating normalisation references

Due to the completeness of the input-output based databases, national normalisation references can be kept as updated as the corresponding national LCA databases, i.e. annually.

Our 1999 update reveals differences up to 80% in 5 years.

As long as normalisation references play a significant role in impact assessment, any unnecessary delay in revision of normalisation references should be avoided.

Key message:

Bottom-up and top-down should be seen as complementary – not as incompatible

Integration provides several advantages:

- ✓ Combining detail and completeness
- ✓ Mutual verification
- ✓ Continuously updated normalisation references