

- Critical Review Statement -

Review of “REEL LCI Database; Version 1.0; 21 August 2026”

Reviewer: Arpad Horvath; Consultant; Berkeley, California

Date of completion of review: August 25, 2026

Scope of the Critical Review

The Critical Review focused on the “REEL LCI Methodology Report” and custom reports extracted from the REEL LCI database upon the Reviewer’s request.

The goals of the Critical Review were to assess whether:

- the methods underlying the life-cycle inventory (LCI) and data collection are consistent with the guidance in ISO 14040 and ISO 14044 (to the extent they are applicable) and the best practices,
- the described methods and assumptions are scientifically and technically valid,
- the collected data are appropriate and reasonable for the goals of the database,
- the methodology report and additional documentation are transparent and consistent.

Critical Review Process

The review was conducted in 6 one-to-one sessions (carried out in July and August 2026) that reviewed all aspects of the REEL LCI database and additional, offline reviews of the requested and provided documentation of REEL LCI. The Reviewer received all the information he requested, and additional information was provided by the database author.

General Evaluation

The REEL LCI database provides an inventory of cradle-to-gate data (energy, water, and material inputs and air emissions and wastes) for 18 categories of electronics components: semiconductor-integrated circuits across technology nodes from 180 nm to 3 nm, memory devices (DRAM, NAND flash, HBM), printed circuit boards, passive components (capacitors, resistors, inductors), integrated-circuit packaging, cables and interconnects, and electromechanical components. Of the life cycle stages, manufacturing (including processing, facility overhead, and testing) and transportation are included.

The way the database was set up includes several distinctive features. Methods and data are derived exclusively from publicly available sources. It is using a bottom-up “virtual factory” modeling approach. Most values in the database are calculated rather than copied from a single reference. A handful of specialty inputs have no public dataset, so the database author estimated them or used a documented stand-in. The approach to

methodology is, from best to last resort: (1) build a transparent dataset from public chemistry and energy data; (2) use a documented same-family stand-in; (3) cut it off with a written reason if it is below materiality. It reports physical units for elementary and technosphere flows (kWh, liters, kilograms), not environmental scores, so anyone can apply their own impact method. Water use is reported net of recycling, not as the total demand of a facility.

The REEL LCI database has several distinctive strengths.

The range of included electronics components is significant and representative. The components are modeled at a sufficiently granular process (and some on flow) level, with important and necessary details provided, rather than reporting just one number for a technology (e.g., 40 nm wafer) that then one uses for reporting or extrapolation. Gases and precursors are shown for fab processes. Allocation calculations are documented. There are hundreds of datasets in the database.

There is necessary and expected transparency present in the documentation. There are no silent omissions. It is stated what is included in the REEL LCI database versus what is not. Cut-off decisions are described. Every assumption is documented and independently verifiable.

Every numerical value traces to a publicly available source (equipment specifications, peer-reviewed articles, patents, government data, corporate sustainability reports) or an engineering estimate and is documented on process or flow level. No licensed commercial databases are used for inputs or outputs values. The review did not include a verification of individual numerical values.

For every source, the basis of how numerical values were derived from it are stated (evidence-based derivations, declared estimates, or “flagged conflicts” when the evidence is inconclusive).

Detailed citation maps for components’ wafer, printed circuit board, packaging, upstream materials, and facility overhead stages were made available to the Reviewer. Each specific value (or method) in the database connects to one or more sources, with a link to the source and a short note on how the source was actually used, as well as where to find the information. The links go to the original documents. The database also holds archived copies of nearly all source documents in case a link becomes dead.

Uncertainty is accounted for and discussed. The Reviewer was provided with “pedigree matrix” scores for data quality and uncertainty ranges for the data, with recorded exemptions.

The Reviewer was able to review two detailed examples of how a numerical value is created and cited.

The datasets and their documentation can be viewed in the Data Explorer, accessible at reellci.com.

Conclusions

The methods underlying the life-cycle inventory (LCI) modeling and data collection are consistent with the guidance in ISO 14040 and ISO 14044 (to the extent they are applicable) and the best practices.

The described methods and assumptions are scientifically and technically valid.

The used data are appropriate and reasonable in this moment in time with respect to the goal of the database and public availability of data.

The methodology report is sufficiently transparent and consistent. It documents every aspect of the database: system boundaries, allocation procedures, data quality indicators, and sector-specific modeling approaches.

This review statement is only valid for the specific report named in the title, dated August 21, 2026, and information received and discussed up to the same date, thus, it does not apply to any other report versions, derivative reports, excerpts, press releases, and similar documents.

The Critical Reviewer signs this review statement as an independent expert. No statement should be construed as comparative. The Reviewer's signature does not constitute an endorsement of the REEL LCI's potential uses or results.

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