LCI Review report

Review Version: 1.0

Table 1: General information

Field	Source/Specification
Data set name	methanol production; carbon dioxide hydrogenation route, CCUS; single route, design based, at plant; liquid, 1 bar
Represented year	2025
Represented geography	KR
UUID (aggregated process)	
UUID (corresponding level-1 partly aggregated process)	n.a.
Data set version number	26.11.0011
Data set access point (node URL)	
Data set owner	T-GARC
Data set provider	KRICT
Data set commissioner	T-GARC
Review commissioner	KRICT
Reviewer name(s), role(s), affiliation(s), contact	Dr. Chulgye LEE Mr. Sungmo YEON Dr. Suckjin HONG
Date of review completion	November 2026
Reviewed against / Compliance system name	ILCD Data Network – Entry-level requirements Environmental Footprint 3.1
Overall DQR	1.75
Statement of EF compliance	Not compliant (methodological: cut-off approach)
Review type	**Independent external review (three reviewers)**

Table 2: Reviewer Assessment

Aspect	Yes	No	Comments
Quality compliance fulfilled	X		See table 3
Method compliance fulfilled		X	Cut-off approach; Circular Footprint Formula not applied; background data not EF-compliant (ecoinvent v3.12 cut-off)
Nomenclature compliance fulfilled	X		See table 4
Documentation compliance fulfilled	X		See table 4

Aspect	Yes	No	Comments
Review compliance fulfilled			Independent external review + review report (ISO 14040/14044, ILCD Entry-level); EF review requirements not defined
Compliant with ISO 14040 & 14044	X		Data set reviewed by three independent external reviewers
Overall compliant with compliance system		X	ISO 14040/14044 and ILCD Data Network Entry-level: fully compliant. EF 3.1: not compliant (methodological).
LCIA results consistency	X		LCIA results in the dataset were calculated with the official EF 3.1 method (default characterisation factors) and checked for consistency.
Review Panel Statement The dataset was reviewed by three independent Korean LCA experts against ISO 14040, ISO 14044 and the Guideline for the Development of LCI Databases for Carbon-Neutral Technologies. The dataset is compliant with both the ISO 14040 and 14044 standards as well as the ILCD Data Network compliance rules and entry-level requirements. The documentation describes in adequate detail the type of activity modelled, data quality, modelling choices, system boundaries as well as other relevant information. The dataset represents the activity modelled using the best available data from both primary and secondary sources.			
Date, location, reviewer signature	November 2026		
Dr. Chulgye LEE			
Mr. Sungmo YEON			
Dr. Suckjin HONG			

Table 3: Review findings for the Data Quality Ratings and Method compliance

Review approach The review has been carried out on each dataset, including on the unit process of the last process step, on parameterised process models (where used) and - where seen needed - also on the specific parameter settings. Comparisons of the LCIA results have been done moreover with equivalent - or where such were not available - similar datasets that were independently modelled.	
ITEMS	**DQR result / Comments**
DQI Technological representativeness: “specific technology or technology mix” “qualitative assessment of the degree to which the data set reflects the true population of interest”	**2**

DQI Time-related representativeness: “represented age of the data set, considering the age of all ingoing data” “qualitative assessment of the degree to which the data set reflects the true population of interest”	**2**
DQI Geographical representativeness: “geographical area from which data for unit processes should be collected to satisfy the goal of the study” “qualitative assessment of the degree to which the data set reflects the true population of interest”	**1**
DQI Precision/uncertainty: “measure of the variability of the data values for each data expressed (e.g. variance)”	**2**
Completeness: “to be judged with respect to the coverage of EF impact categories”; assessed on the level of process	**Compliant** All 16 EF 3.1 impact categories can be assessed. Full compliance with the PEF method is required for EF compliant datasets, therefore the criterion completeness is not rated.
Overall DQR	**1.75** The results of the contribution analysis and calculations for each DQR score have been checked.
Plausibility issues: Including from coherence check across all datasets and against similar datasets (e.g. similar material or same material but different country or produced by different technology) from the same database and as suitable against same datasets from different database	**Plausible** The mass and energy balances of the foreground process were checked, and the inventory and LCIA results were compared with the source data (design, simulation, pilot or demonstration results) and, where available, with similar datasets from the literature and from the ecoinvent database. Remaining differences are explained by technology, geography and modelling choices. The results for this dataset are plausible.
Methodology compliance : Review against adherence to ISO 14044 and the Guideline for the Development of LCI Databases for Carbon-Neutral Technologies, using the methodological items of the EF method as a checklist: • Completeness • Water use • Cut off • Handling multi-functional processes • Direct land use change • Carbon storage and delayed emissions • Emissions off-setting • Capital goods (including infrastructures) and their End of life	**Completeness**: all known material and energy flows of the foreground process with available data are included. All EF 3.1 impact categories can be calculated from the inventory. **Water use**: water flows are modelled with the EF 3.1 list of elementary flows (not regionalised). **Cut off**: no quantitative cut-off rule is applied to the foreground process; flows were excluded only where no data were available, and these exclusions are documented in the dataset. Background data follow the ecoinvent system model "Allocation, cut-off by classification". **Handling multi-functional processes**: the ISO 14044 hierarchy has been applied: (1) subdivision or system expansion; (2) allocation based on an underlying physical relationship; (3) allocation based on some other relationship. Where CO2 is captured at a host plant, the changes caused by capture are allocated to the captured CO2 following an underlying physical relationship (equivalent to direct substitution of the same plant without capture). Recycling and end of life follow the cut-off approach; the Circular Footprint Formula is not applied. **Direct land use change**: not relevant for the foreground process; included in

• System boundaries
• Time period
• Fossil and biogenic carbon emissions and removals
  o GHG emissions – fossil
  o Carbon emissions and uptakes – biogenic
  o Carbon emissions and uptakes – land use and transformation
• Model and data consistency
	the background data as provided by ecoinvent.
	Carbon storage and delayed emissions: credits associated with temporary (carbon) storage or delayed emissions are not considered.
	Emissions off-setting: not included
	Capital goods (including infrastructures) and their End of life: included in the background data as provided by ecoinvent; capital goods of the foreground process are included or excluded as documented in each dataset.
	System boundaries: cradle-to-gate; the system boundaries, included processes and excluded downstream steps are documented in each dataset.
	Time period: emissions and removals are modelled as if released or removed at the beginning of the assessment period (no time discounting).
	Fossil and biogenic carbon emissions and removals: removals and emissions are modelled as follows:
	• GHG emissions from fossil sources (including limestone calcination) are modelled consistently with the EF 3.1 list of elementary flows. Emission reductions caused by CO2 capture are modelled as negative fossil CO2 emissions where applicable.
	• Carbon emissions and uptakes – biogenic: biogenic emissions and uptakes are modelled separately from fossil emissions, as provided by the foreground data and by ecoinvent.
	• Carbon emissions and uptakes from land use and transformation are modelled consistently with the EF 3.1 list of elementary flows, as provided by ecoinvent.
	Model and data consistency: background data are consistently taken from ecoinvent v3.12 (cut-off system model), and Korean electricity from the dataset developed by KEITI. Elementary flows are converted to the EF 3.1 nomenclature with a documented mapping; flows without an EF 3.1 counterpart are removed and recorded.

Table 4: Nomenclature and documentation compliance

ITEMS	Comments	
Nomenclature		
Adherence to the "ILCD Nomenclature …" document and the ILCD reference elementary flow list	Yes	• Nomenclature is compliant; elementary flows are compliant with the EF 3.1 reference elementary flow list (ecoinvent and KEITI flows mapped with a documented mapping file). • The dataset name follows the ILCD nomenclature (base name; treatment, standards, routes; mix and location type; quantitative flow properties). Product flow names of background data follow ecoinvent naming. • Waste flows remaining in the aggregated inventory from background data are removed and recorded; open product flows of partially aggregated datasets are kept and documented.
Documentation		
Adherence to the ILCD "Documentation of LCA datasets" document	Yes	ILCD Validation Tool (EF 3.1 profile) applied, no errors detected. All required documentation fields are used and provide supportive meta data about the LCI data set.
Appropriateness of documentation form (ILCD Format)	Yes	Documentation of the dataset uses ILCD format, exported from openLCA 2.7.0; LCIA results and fields not exported by openLCA are added by a supplementary script.