

Supplementary Material

Critical review: a standardized blueprint for green certificate integration in life cycle assessment

Given the standardization proposal outlined in the chapter 4, the first three stages encompass: the generation and trading of GCs, qualification checking of GCs prior to their application in LCA, and the detailed rules governing GCs use during LCA process. In the final phase, transparent and verifiable reporting of such GCs application should be incorporated into the LCA report to enhance the reliability of the results reliability and the credibility of the underlying data. For example, electricity balance sheet and background documentation of GC-level metadata, presented as Supplementary Table 1 and Supplementary Table 2 in Annex.

Supplementary Table 1. Electricity balance sheet format ^[1]

Data category	Data field	Definition
Record identifier (ID)	Record#	A unique series of number assigned to each specific renewable allocation to a product
Company and facility information	Company name	Name of the company responsible for the product
	Facility name	Name of the production facility where the product is manufactured
	Locale	Name of the town, city, or village where the facility is located
	State/province	State or province where the production facility is situated
	Country	Country in which the manufacturing facility is located
Production volume	Product ID	A unique ID assigned to the product
	Product name	Commercial or trade name of the product as stated in the EPD
	Unit	Declared unit of measurement as defined by the product's Product Category Rules
	Quantity	Total annual production volume of the product
	Start date	Start date of the period considered for the production volume
Electricity consumption	End date	End date of the period considered for the production volume
	Life cycle module	Life cycle stage during which the electricity consumption occurs
	kWh	Total electricity consumed at the given stage, allocated to the specific product at the specified facility
	kWh per unit	Electricity consumption per declared product unit
	Grid region	Name of the regional power grid for electricity consumption
Allocated renewable electricity	Registry/serial#	Serial or registry number associated with the procured renewable electricity allocated to the production volume
Allocated renewable electricity	Purchaser	Name of the organization that purchased the renewable electricity
	Source type	The type of renewable energy contractual instrument
	Grid region	Regional grid where the renewable energy was generated

kWh per product unit	kWh allocated	Quantity of renewable power allocated to the production volume
	Generation start date	Start date of the renewable power generation relevant to the allocation
	Generation end date	End date of the renewable power generation relevant to the allocation
	Meets time threshold?	Verification to ensure that renewable energy generation period falls within the accepted temporal range relative to the production period
	Renewable electricity consumed?	Verification to ensure that the amount of allocated renewable electricity does not exceed the total electricity consumption for the production volume
	kWh allocated	Quantity of renewable power allocated to the production volume
	a. Renewable electricity per unit	Amount of renewable electricity allocated per declared unit of the product for the specified life cycle stage
	b. Residual per unit	Amount of residual grid electricity allocated per declared unit of the product for the specified life cycle stage
	a + b = Total per unit	A verification test confirming that sum of renewable electricity and residual mix equals the total electricity consumption per declared unit

Supplementary Table 2. Renewable energy certificate details sheet ^[1]

Parameter	Unit	Value/Text
Renewable generator project name	—	
Generator tracking ID	—	
Owner of renewables generation facility	—	
Location of renewable facility	—	Country/ province
Commissioning year (built date)	Year	
Initial production year for renewable energy	Year	
Rated capacity of project	MW	
Type of GC	—	
Certificate ID	—	
Specific month and year during which renewable electricity was generated	Month / year	
Certificate issuance date	Month / year	
Utility that the project is connected to	—	

REFERENCE

[1] Boguski , T.; Cassese, B.; Conroy, A.; Cooney, G.; Cross, J.; DeRousseau, M.; Englert, M.; Fetizanan, F.; Gueiros, S.; Guest, G.; Hensler, C.; Johnson, L.; Koffler, C.; Lasso, A.; Lindemulder, K.; Montazeri, M.; Norman, C.; Pearson, C.; Rybl, V.; Smith, C.; Tan, E.; Xue, C. *Guidance for quantifying renewable electricity instruments in environmental product declarations (EPDs)*; American Center for Life Cycle Assessment, 2023. Available online: https://aclca.org/wp-content/uploads/2022-ACLCA-PCR-Open-Standard_Addendum_Quantifying-Renewable-Electricity-Instruments-in-EPDs_FINAL_061323.pdf (accessed 2024-06-08).