CLEVER

Initial definition of goal and scope of the CLEVER Framework

Draft for stakeholder consultation

EXECUTIVE SUMMARY

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1 BACKGROUND AND INTRODUCTION

The CLEVER project, funded by the European Union's Horizon Europe programme, aims to develop standardized, accurate, and future-proof emission factors and methodologies for the global transport and logistics sector. By supporting a comprehensive, harmonized framework for GHG emission accounting across all transport modes, CLEVER supports more consistent reporting, informed decision-making, and the adoption of sustainable practices in line with European and international climate goals.

CLEVER facilitates the *CountEmissionsEU* regulation (proposal for a regulation of the European Parliament and of the Council on the accounting of greenhouse gas emissions of transport services), introduced in July 2023, which currently is in the implementation phase. The *CountEmissionsEU* regulation itself is part of the broader "Fit for 55" legislative package of the EC's Green Deal, and strives for, at its core, a universal methodology for the calculation of GHG emissions from transport services (EU Legislation in Progress Briefing on *CountEmissionsEU*, September 2024).

The CLEVER framework has a specific role in the overall scope of the *CountEmissionsEU* regulation, covering major parts of the overall transport value chain with an emphasis on the upstream energy carrier provision and utilization within vehicles. CLEVER Emission Factors (EF) are generated by applying this CLEVER framework.

This document introduces and defines the Goal and Scope of the CLEVER framework. In accordance with ISO 14040/44:2006, both Goal and Scope are the key initial elements of any life cycle assessment (LCA).

The purpose of the Goal in the sense of an LCA is to describe the overall purpose of the assessment at hand, from which all other major relevant elements, in particular the functionality/functional unit, are derived. The Scope determines the framework for the assessment, both in conceptual as well as technical terms. A key element of the Scope is the applied system boundary, which further specifies key criteria and methodical decisions.

2 GOAL AND SCOPE DEFINITION IN CLEVER

2.1 GOAL OF CLEVER GHG EMISSION FACTORS

CLEVER aims at supporting *CountEmissionsEU* by establishing the *methodology* to accurately assess the **GHG emission factors** of current or emerging energy carriers, so called *pathways* (electricity and fuel pathways). These GHG emission factors are intended to be used in a subsequent calculation of the climate impacts (GHG emission intensities) from transport operations.

Thus, the goal of CLEVER assessment is to quantify all relevant contributions to climate change of energy carrier pathways by using the global warming potential in the form of CO_2-equivalents (CO_2-eq.) with emphasis on the production and provision of the energy carrier(s). All relevant climate impacts – from the production and use of energy carriers within vehicles for passenger and freight transport – are assessed. This includes liquid and gaseous fuels of fossil, biogenic or other origins as well as electricity used in transportation. To accurately assess these impacts, the whole energy carrier lifecycle must be considered and included in the GHG emission factor for all energy carrier pathways.

In combination with additional information and data, CLEVER emission factors will help to accurately compare the climate impact of different transport and logistic options.

To do so, CLEVER both entails a list of default emission factors ready for use, as well as the methodical framework to calculate actual specific values for a given value chain, helping organisations in the field of

transport to more accurately report emissions. Thus, the intended audience primarily consists of organisations intending to calculate the GHG-intensity and total GHG emissions of transport services together with a range of interested parties, decision makers and consumers in the field of transport and logistics, as well as suppliers of the energy carriers used in transport.

2.2 SCOPE OF CLEVER GHG EMISSION FACTORS

The objective of the CLEVER framework is to provide guidance to calculate CLEVER emission factors. In accordance with the principal LCA ISO norms ISO 14040/44:2006, the scope of any CLEVER assessment must be consistent with the defined goal.

The following aspects are elements of the overall scope and shall be considered:

a) A clear **description** of the product system under investigation (fuel pathway / energy carrier pathway utilized within a given vehicle) shall be given. In particular, all relevant characteristics (e.g. lower heating value, density or carbon content) as well as technological, geographical and temporal context of the assessed energy carrier pathway shall be defined, with the goal of identification of the specific situation for which the derived results apply[1] and how they might compare to other values. Limitations shall be stated.

b) **Classification** of fuel pathways. The CLEVER framework provides a classification metric to facilitate identification of energy carriers as well as some further methodical aspects that can be specific to a category but might not apply to another. The classification scheme is aligned with the terminologies utilized within the RED (Renewable Energy Directive, Directive (EC) 2001/2018) and adjacent to other key legislation in the context. Energy carriers are defined as either: fossil, renewable electricity (non-biogenic), biogenic, RFNBO (renewable fuels from non-biological origins), RCF (recycled carbon fuels), other low carbon fuels. Any assessed energy carrier shall be classified according to this scheme.

c) The **functionality** of *CountEmissionsEU* is tonne-kilometre or person-kilometre in line with any GHG assessment following ISO 14083 as basis for any assessment or comparison, defined a priori by the specific purpose (chapter 2.1 Goal of CLEVER GHG Emission Factors) of *CountEmissionsEU*. As such, besides energy provision, a broad range of different aspects need consideration to meet the scope of *CountEmissionsEU*. The CLEVER framework only covers a part of this overall scope and thus cannot assess the final transport services (tkm/pkm). Therefore, it specifies a **declared unit of one MJ** (Megajoule) of an **energy carrier used within a vehicle**.

d) In particular, the applied **system boundary** shall be described in detail. By default, any CLEVER assessment shall consider a **WtW** (Well to Wheel/Wake) system boundary (illustrated in Figure 1), covering both, emissions and expenditures associated with **energy carrier provision** (“upstream”), including distribution and supply as well as operational emissions from **fuel utilization and – to a degree – vehicle operation**, taking into account expenditures and emissions e.g. from fuel utilization (“tailpipe” emissions), emissions from exhaust gas treatment and additional climate impacts from vehicle operation.
Additional climate impacts comprise methane slip, high altitude emissions, black carbon formation and the GWP of hydrogen emissions. Assessed elements of the system boundary shall be described, disaggregated into WtT (Well to Tank, focussing on fuel production and distribution) & TtW (Tank to Wheel/Wake, focussing on fuel utilization and vehicle operation) specific parts. This further entails information on the geographical and temporal scope, and the applied boundary cut-offs.

[1] This can be the specific real situation of an economic operator, but also an average (default) value.

Noticeable exemptions from the CLEVER system boundary are: infrastructure expenditures, hub operations, vehicle manufacturing and first life cycle of a waste feedstock (cut-off by classification).

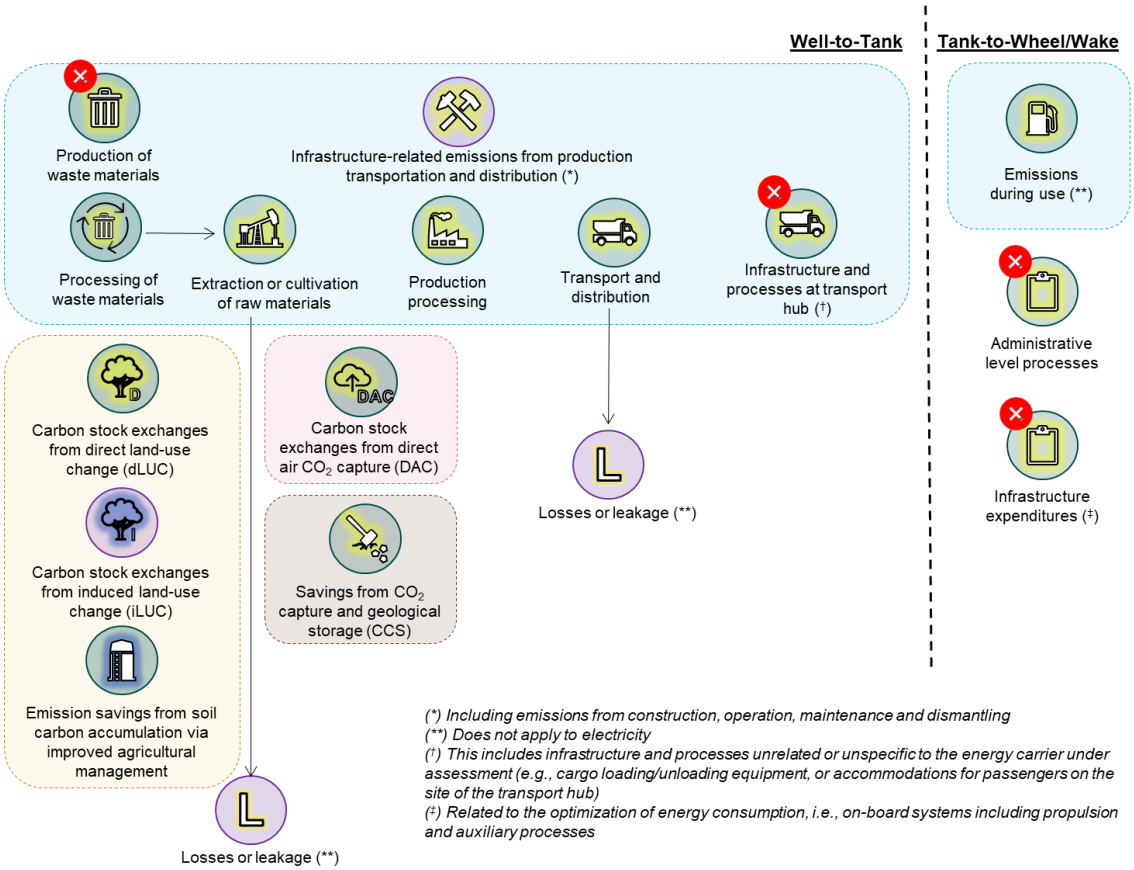

Figure 1 Simplified depiction of the CLEVER system boundary

Colour:	Key:
	Baseline process. The process requirement is considered "baseline" and as such its inclusion is always required for compliance.
	Advanced process. The process is required by CLEVER but is considered "advanced" as it is not included within RED methodology.
	The process is always excluded from the system boundary.
	Process is considered a "must".
	Process is considered a "should".
	Process is considered "universal" and is thus applicable to all energy carriers.
	Process is considered specific to bio-fuels, and to biomass used for electricity generation.
	Process is considered specific to some RFNBO pathways.
	Process is considered specific to some thermal electricity generation pathways (e.g. from coal, natural gas and biomass).

e) **Life cycle inventory modelling and multifunctionality**: Any assessment applying the CLEVER framework shall follow an **attributional** ('descriptive') approach to inventory modelling [2]. Furthermore, multifunctionality shall be solved applying the hierarchy as defined in ISO 14044:2006. Further key methodical choices / settings to be described are (among others):
    a. Handling of multifunctionality / co-product allocation i.e., **energy based (LHV) allocation**[3] as a default,
    b. Consideration of end-of-life modelling (allocation methodology) i.e. the 'Cut-Off-method', where the burden of primary production of a good always remains with the first life cycle (100:0) and no credits are given. Wastes are thus burden free at the point of collection for any further utilization.
    c. Definition of material flows, i.e., waste vs co-product classification and respective methodical handling.

f) To contextualize the applied **data** as the basis for the calculation of a CLEVER EF, their **origin** and **quality** shall be described. Furthermore, applied data shall be appropriate to the investigated product system and moreover consistent with the geographical and temporal scope. Any deviations shall be stated and justified, as well as any resulting limitations disclosed.
CLEVER distinguishes ten different data quality aspects (e.g. completeness, consistency, or time-related coverage) to be considered and assessed. The assessment for each aspect is either undertaken qualitatively or quantitively, depending on the aspect. Where PEF[4] has established a quantitative scoring procedure for a specific aspect, this shall be used, otherwise, a qualitative assessment is sufficient.
Furthermore, CLEVER defines additional ('minimum') data requirements, if an EF shall become a default value.

g) **Assumptions and limitations**: When assumptions are made, especially ones with substantial influence or impact on results, they shall be mentioned, described and justified. If an assumption – be it methodical or (choice of) data – greatly / significantly influences overall results, a **sensitivity analysis** shall be performed to assess the significance of the assumption. Limitations might pertain e.g. temporal or geographical coverage or the utilised data.
Furthermore, the influence of assumptions and limitations shall be reflected when results are described and interpreted.

h) If **carbon (dioxide) removals** occur as a part of the energy carrier lifecycle, they shall be reported separately and specific to the origin of the carbon (fossil, renewable). Likewise, if carbon (dioxide) emissions from land use change (LUC) occur, they shall be assessed and reported separately. Special attention shall be paid to avoid any double counting of removals and ensure consistency regarding the system boundary.

i) **Attribution of biogenic carbon in multi-outputs**: If biogenic and fossil carbon containing feedstocks are processed together (i.e. co-processing within a conversion unit of a conventional petrochemical refinery) and multiple outputs result from this process, the biogenic carbon shall be **attributed** to all outputs according to **physical causalities**, based on rules laid out in Delegated Regulation (EU) 2023/1640. The **radio carbon method** (^{14}C) shall be chosen as default option.

[2] With the exception of consideration of iLUC, where a consequential approach is favoured.

[3] The secondary allocation approach favoured is economic allocation, in cases energy allocation an applicable option.

[4] PEF: Product Environmental Footprint, a LCA methodology framework recommended by the EC

j) **Emissions from land use / land use change**. When land is required to produce fuels, e.g. to cultivate biomass, **direct or indirect land use change** and associated emissions can occur.[5] This pertains in particular crop-based biofuels. Emissions from direct and indirect land use change shall be considered within CLEVER emission factors but reported separately to the base emission factor (see concept of scope modularity further below). Direct land use change (dLUC) shall be based on current **IPCC guidelines**, more specifically Volume 4: Agriculture, Forestry and Other Land Use, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Indirect land use-change (iLUC) shall be assessed according to the ICAO **CORSIA approach** (extended to cover also other fuels as well as SAF) for induced land use-change.

k) **Impact assessment methodology**. The scope of *CountEmissionsEU*, and therefore also of the CLEVER framework, is currently limited to the climate impact of transport services resulting from GHG emissions, expressed via the impact category **"Climate Change"**. As default metric and indicator for the impact assessment in CLEVER, the latest characterization factors for GHG emissions from the IPCC Assessment Reports (currently, Assessment Report 6, IPCC 2023) using the **GWP_{100}** (global warming potential with a 100-year perspective without feedback) shall be utilized. The total climate change impacts are the sum of all GHG emissions multiplied with their respective GWP_{100y} factor**. Biogenic carbon** uptakes and emissions shall be included, utilizing a characterization of **-1** for biogenic carbon dioxide sequestration and **+1** for biogenic carbon dioxide emissions.

l) **Results and Interpretation**: Results and their interpretation shall be reflective of the goal and scope of the assessment and the specific pathway under investigation. Moreover, they shall consider limitations and assumptions made, and cannot make any generalized claim regarding the environmental impact beyond the impact on climate change. Furthermore, the interpretation of results shall also reflect the data quality, appropriateness and completeness as well as the influence of potential cut-offs.

m) Whenever a result of a CLEVER assessment is communicated, it must include all information on the chosen energy carrier pathway as well as the usage (vehicle type and engine/ aftertreatment, if relevant) and shall be given per MJ of fuel consumed.

n) **Verification and certification requirements**. When economic operators calculate and report their own values applying the CLEVER framework instead of using CLEVER default values, additional requirements regarding verification of results as well as certification of claimed feedstocks or fuels have to be met. Verification in the form of a **Conformity Assessment** ensures plausibility of calculated results and assesses compliance with the CLEVER framework. Certification is required, when specific feedstocks or fuels are claimed, instead of utilizing respective defaults and aims at ensuring that no false claims are made as regards in particular limited alternative fuels.

o) **Reporting requirements**. Any calculation of CLEVER values shall be accompanied by a report describing all relevant aspects. The aim of the report shall be firstly, to **demonstrate compliance** with the applied CLEVER framework and secondly, to describe and inform about the pathway under study, documenting all relevant aspects pertaining to the applied methodical approach and decisions, as well as disclose and provide information on data and data quality.

[5] These LUC related emissions can be substantial, depending on a range of factors, such as agricultural circumstances or the characteristics of local/regional (soil) conditions.

2.3 MODULARITY PRINCIPLE OF THE CLEVER FRAMEWORK

In order to allow for a flexible utilization of CLEVER values for multiple purposes, CLEVER emission factors are modularly structured. The concept of modularity in principle aims at partitioning the overall CLEVER scope into smaller components to reflect the contributions of specific elements (such as impacts from iLUC or additional climate impacts from operation).

$$EF_{Total} = EF_{Core} + EF_{iLUC} + EF_{ACI}$$

With EF_{Total} constituting the total CLEVER emission factor, EF_{Core} includes all relevant commonly assessed energy provision (also called well-to-tank or WtT) and operational (also called tank-to-wheel or TtW) elements, and thus includes some disaggregated values, such as values for dLUC EF_{dLUC}, or methane $EF_{Methane}$ and N_2O emissions EF_{N2O}.

EF_{iLUC} represents contributions from iLUC (indirect land use change).

EF_{ACI} comprises additional climate impacts (not uniformly assessed across different frameworks), such as values for the GWP of hydrogen $EF_{Hydrogen}$, impacts from high altitude emissions of air planes EF_{HAE}, and for the GWP of black carbon $EF_{Black\ Carbon}$.

3 NEXT STEPS AND INVITATION FOR FEEDBACK

The CLEVER project is committed to developing a transparent and comprehensive framework. The goal and scope outlined in this summary form the foundation for the detailed calculation methodologies to follow.

We invite all interested stakeholders to review these principles and provide feedback. Your input is essential to ensure the CLEVER methodology is scientifically sound, practical for real-world application, and effectively supports the decarbonization goals of the European transport sector.