

LOCATION-BASED ELECTRICITY MIXES VERSUS MARKET-BASED ELECTRICITY MIXES

WHAT RECOMMENDATIONS FOR LCA ?

25/09/2024

Why perform a study on the approach to modelling electricity in LCA?

The consideration of contractual instruments (Market-based) for electricity is currently on the rise in different environmental assessment frameworks

Questions from SCORE LCA members

- **Methodological rules** related to modelling electric mixes? (attributorial LCA context)
- Recourse to contractual instruments : what are the **positions of the actors?**
- Principles for building electricity mixes in the **generic databases** used in LCA?
- **Practical and methodological challenges** of implementation?
- What **recommendations** for LCA practitioners?

This study

- ▶▶ Underlying key concepts of the “market-based” approach
- ▶▶ Main arguments “For” and “Against” location-based and market-based approach
- ▶▶ 20 frameworks examined (EPD oriented & organisation-oriented frameworks...) and a case study
- ▶▶ Overview of methodological choices applied in generic LCA databases
- ▶▶ Recommendations and practical tools:
 - Decision flowcharts
 - Checklist

The market-based approach considers the environmental impacts specific of the kWh sold by the supplier

- Where renewable energy attributes are linked to the kWh consumed, the environmental profile of the kWh will correspond to that of the **production systems specifically used by the electricity producer**.
- Where the electricity consumed does not have attributes (with EAC/GO), the Market-based approach then requires the use of the supplier's mix or, failing that, to consider the **residual mix**.

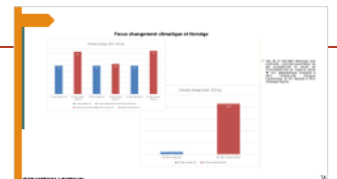
Residual mix

The residual mix is the consumption mix from which the guarantees of origin used are subtracted.*

* production mix corrected for physical imports and exports of electricity carried out outside the AIB calculation zone and for emissions, expirations and cancellations of guarantees of origin.

Guarantees of Origin(GO)

- **Electronic document** used solely to **prove to the end customer** that a specific part or quantity of energy was produced from renewable (and non-renewable) sources.
- 1 GO = 1 MWh injected into the network
- Can be **bundled** or **unbundled**
- Validity period : **1 year** after in Europe / **1 month** in France
- The Association of Issuing Bodies (AIB) aims to enable the exchange of GO through the "European Energy Certificate System" (EECS)



Contractual conventions in environmental assessment: a controversial topic



Strongly supported by certain stakeholders

- Allows for the reflection of **individual** companies' purchasing **choices**
- Consistency with legal instruments (GO in Europe)
- Holds electricity consumers accountable
- Should promote changes in electrical networks (aggregational theory of change)

BUT debates and contrasting positions among stakeholders in favor of this approach:

- Need to **better correlate** the **contractual** convention with **physical reality** and **address criticisms**
Ex: revise criteria for temporal correlation, geographical correlation, and additionality
- Conversely, need for **maximum flexibility** and less restrictive criteria

Contractual conventions in environmental assessment: a controversial topic

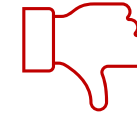


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Strongly criticized by other stakeholders

- ❑ **Excessive decoupling** between physical reality and certain contractual tools due to **non-restrictive** or minimally restrictive **eligibility criteria**
- ❑ Does not encourage prioritizing the most important levers for action / energy transition (efficiency, sobriety)
- ❑ Does not reflect dependence on the multiple functions provided by networks and financially supported by taxpayers or consumers
- ❑ Risk of **misleading information** related to the use of certificates issued for historical renewable energy production
Ex : Claiming emission reductions without actual global emission reductions

Location-based versus Market-based : how are key frameworks positioned?

Current state

LCA or GhG frameworks

	“Product” approach	“Organisation” approach	
Multi-impact quantification	• Product Envir. Footprint	JRC/EC	
	• International EPD® System	EPD Int. AB	
	• EN 15804+A2	CEN	
	• prEN 15941 : 2022	CEN	
	• PEP Ecopassport	PEP Ecopass.	
“GHG” targeted quantification	• Programme INIES	Alliance HQE-GBC	
	• ISO 14067 : 2018	ISO	
	• Product Carbon Footprint - Pathfinder- Framework	WBCSD	
Targeted climatic and financial risks	• Product Carbon Footprint - Guideline for the Chemical Industry	TfS (chemical companies)	
		• GHG Protocol	WBCSD/WRI
		• ISO 14064-1	ISO
		• BEGES regulations France	Ministry
		• ISO IWA 42:2022 - Net Zero Guidelines	ISO
	• SBTi Corporate Manuel	SBTi	
	• Net Zero Initiative – Collective Carbon Neutrality	Carbone 4	
	• SEC Climate-Related Disclosures for Investors	SEC (US)	
	• IFRS S2 Climate-related Disclosures	IFRS	

Global trends

EPD/Product Footprint frameworks prescribed the market-based approach (aligned with ISO 14067, PEF)

More contrasting positions of Organisation frameworks with several requiring Location-based or "dual" reporting.

Market-based application rules

Inconsistencies and gaps identified :

- Explicit or possible coexistence** of Market-based and Location-based approaches for the same study (regardless of **ISO 14040/44 consistency principle**)
- Lack of rules** on the choice of electricity mixes in the case of avoided electricity through end-of-life processes
- Eligibility criteria** : conditions to be met are rather less demanding and not particularly precise
- Modeling of contractual renewable electricity mixes** is poorly defined (for instance regarding infrastructure, network losses, temporal validity, etc.)

Three areas of recommendations to facilitate consistency, implementation and transparency

Choice of approach according to contexts of applying LCA

- ▶▶ Key points and recommendations for typical applications

Recommendations for Environmental Footprint and EPD applications

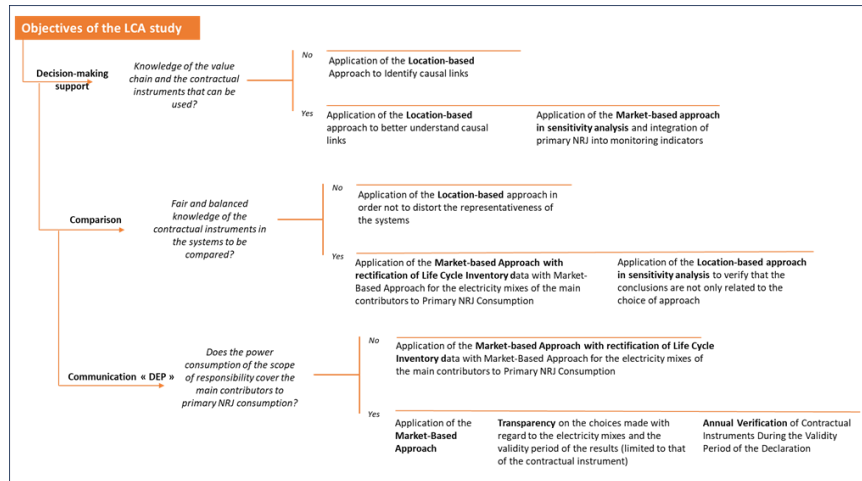
- ▶▶ Principles and decision flow chart for the main life cycle steps
- ▶▶ Checklist for practitioners and verifiers

Guidelines for modelling specific contractual mixes with Renewable Electricity attributes

- ▶▶ Eligible criteria
- ▶▶ LCA modelling

Choice of approach according to contexts of applying LCA Guidelines for modelling specific contractual mixes with EAC

Numerous **diagrams, tables and synoptics** to help in the **best choice of approach** according to the objective of the study and advices for the **operational implementation of the market-based approach** are proposed in the study report.



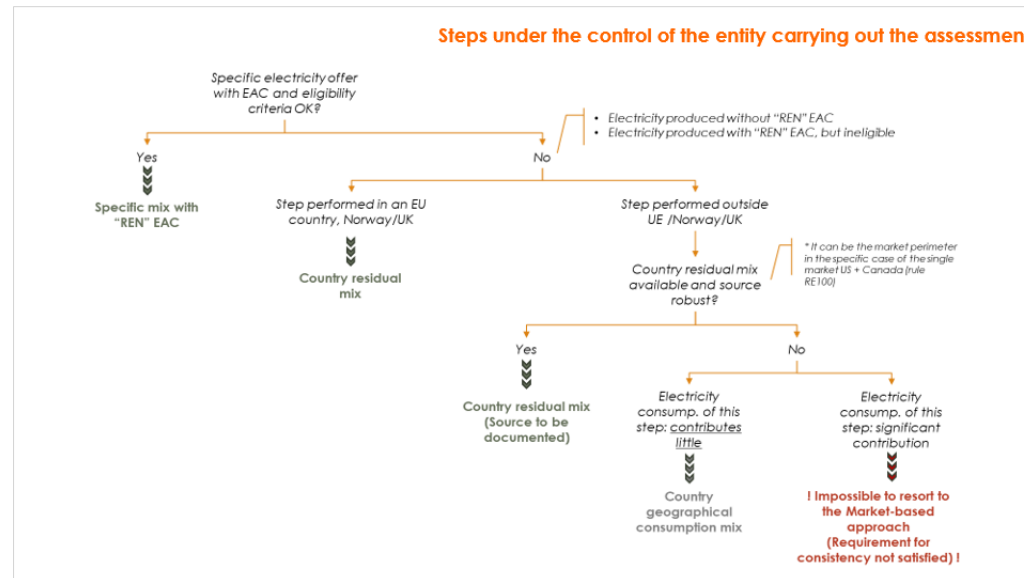
Objectives of the study	Challenges of the Market-based approach	Recommendations
Eco-design R&D works on new products, new processes	Little known or unknown information relating to the value chain and conditions of use of the product or service. Risk of systematically applying residual electricity mixes for a Market-based approach. Need to identify the links of causality.	To be avoided
Aid for the optimisation of products/services	Care is needed to avoid the temptation to reduce only the result of the carbon footprint by using contractual electricity of guaranteed origin. Need to incorporate the total primary energy consumption to assess the level of dependency on renewable energies and monitor efforts to achieve energy sobriety. Need to identify links of causality.	Privilege the Location-based approach
Aid in choosing a solution	Major risk of generating a distortion of representativeness of competing systems with the Market-based approach.	If the guarantee of equal treatment between systems is demonstrated.
Comparative assertion intended for the public	Need to check that the positioning between solutions is not linked only to the way electricity is modelled. Period of validity subject to the duration of validity of contractual instruments.	With a Location-based analysis. With rectification of electricity inventories. With limited lifetime duration of results.
Environmental communication based on LCA (e.g., EPD/ product footprint)	Need to reduce hybridisation in the way to model electricity mixes. Need for transparency regarding the choices made. Uniform application of the approach within the declaring entity.	With rectification of the inventories. Associated with transparent communication of the choices made.

Step	Information to be collected	Implementation	Potential sources
REN electricity production	One or more production technologies covered by the contractual instrument	For each contractual item: the quantity or share of the contractual electricity for each electricity production technology included in the package of the supplier(s).	EAC certificates or electricity supplier
	Localisation of production units	The geographic origin of the electricity produced is specified in the energy attributes certificates	EAC certificates or electricity supplier
	Temporal representativeness	Ensure that the period covered by the contractual item corresponds to the period when electricity consumption occurs at the purchaser's site(s)	EAC certificates or electricity supplier
	Choice of lifecycle inventories	Identify the lifecycle inventories corresponding to the technologies included in the specific contractual mix. OR: If available, collect directly from the supplier the life cycle inventory of the specific contractual mix or specific technology. In both cases: - check that the perimeter includes the production and end of life of the infrastructures , - check the effective inclusion of certain flows of materials or resources pertinent and specific to each technology.	LCA databases Electricity supplier (if the supplier mix inventory or the production technology is available)
Losses during electricity transformation and transport	Volume of electricity losses	For each contractual item: the quantity or share of contractual electricity for each electricity production technology included in the package of the supplier(s).	LCA databases IEA publications, etc.
	Breakdown of losses at each level of voltage	Based on the approaches implemented in the LCA databases	LCA databases
	Geographical representativeness	The losses must be representative of the country in which the electricity consumption site is located.	
	Temporal representativeness	Ideally, it should correspond to the period covered by the contractual item. Use the most recent data published.	IEA publications or equivalent Or LCA databases
Transformation and transport infrastructures: production, maintenance, and end of life	Choice of lifecycle inventory to model losses	By default, losses must be modelled according to the residual mix of the consumption of the country of localisation. If proven that the contractual instrument accounts for grid losses or if the purchase of GO/EAC is higher than consumption to account for the grid losses: specific contractual mix. Any recourse to another electricity mix must be duly justified.	LCA databases
	Choice of lifecycle inventory	Data on the transformation and transport infrastructures used (quantities and type of materials, inputs and outputs linked to the maintenance of infrastructures, emissions of NO _x , SF ₆ , ozone, etc.). Based on the model proposed in the main databases	LCA databases (see their documentation)

Environmental Footprint and EPD applications

□ Flowchart / rules guiding the choice and ranking of electric mixes (specific, residual, location-based, other) for :

- Steps under control
- Use phase
- Other steps not under control



Methodological drivers

- Consistency (ISO 14040/44)
- No double counting
- Fair representation of contractual choices

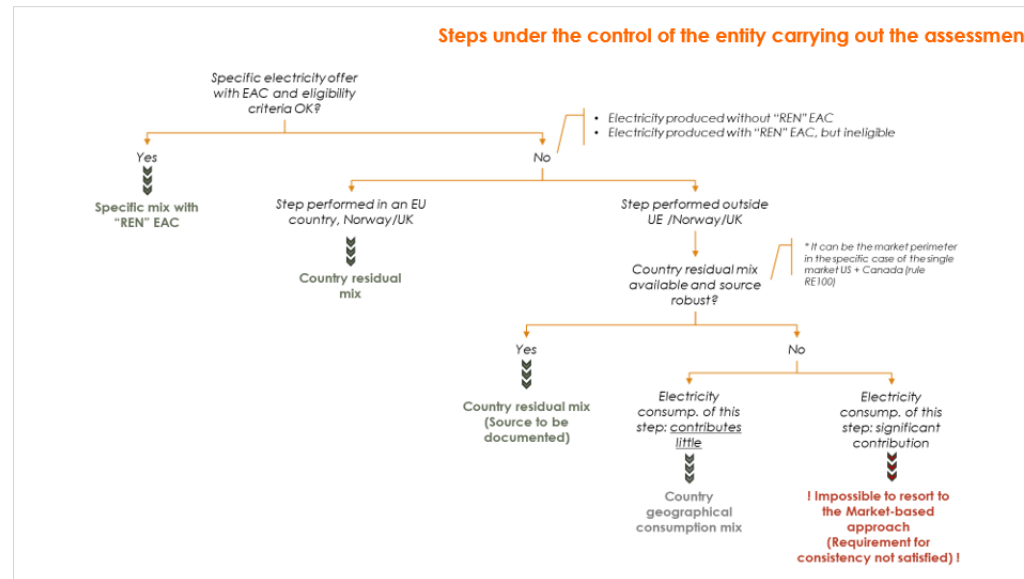
Application rules

- Adapt as much as possible background inventories initially modelled in location-based
- **Restricted use of location-based data** (need to demonstrate low contribution to env. Impacts)
Otherwise, impossible to resort to the Market-based approach
- Reflect suppliers' contractual choices (residual mix may not be relevant for them)

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□ Methodological developments to be elaborated by the frameworks Demonstrate low contribution of stages still modeled using the location-based approach, avoided electricity (recycling, etc.)



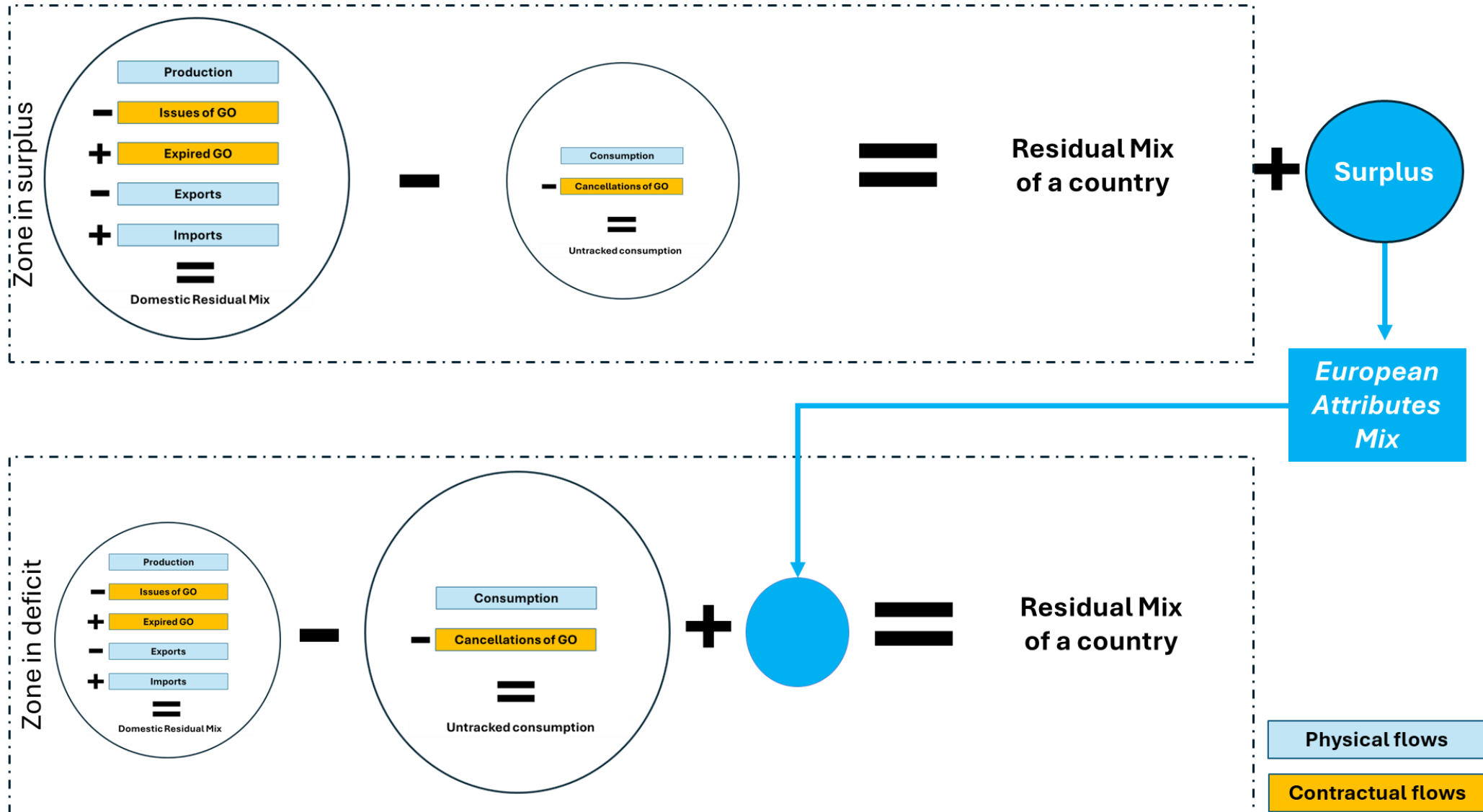
Find the complete study and its summary (in English, in French)
on the SCORE LCA website

Thanks for your attention !

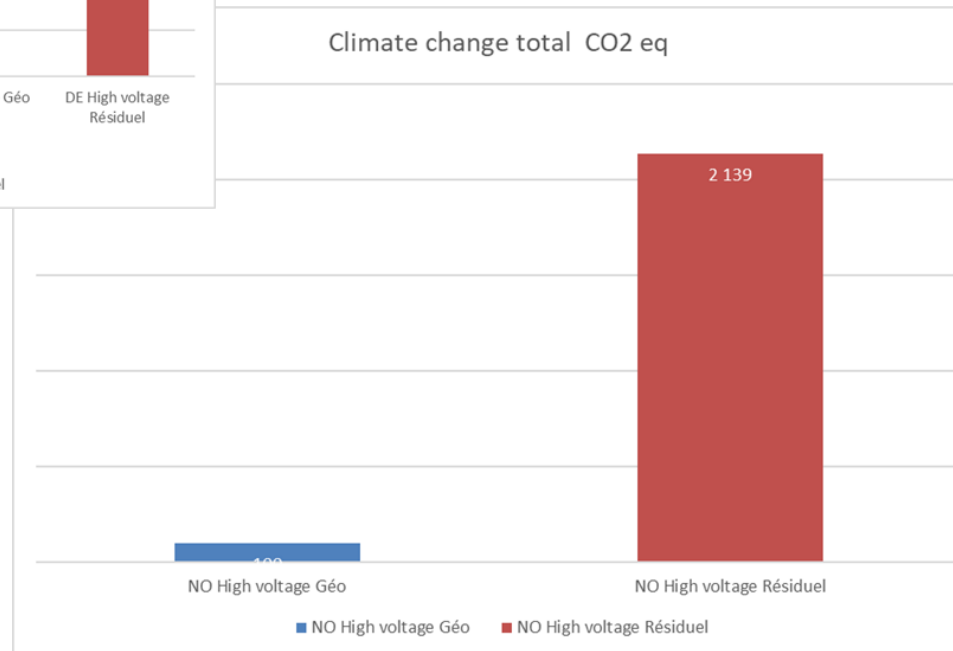
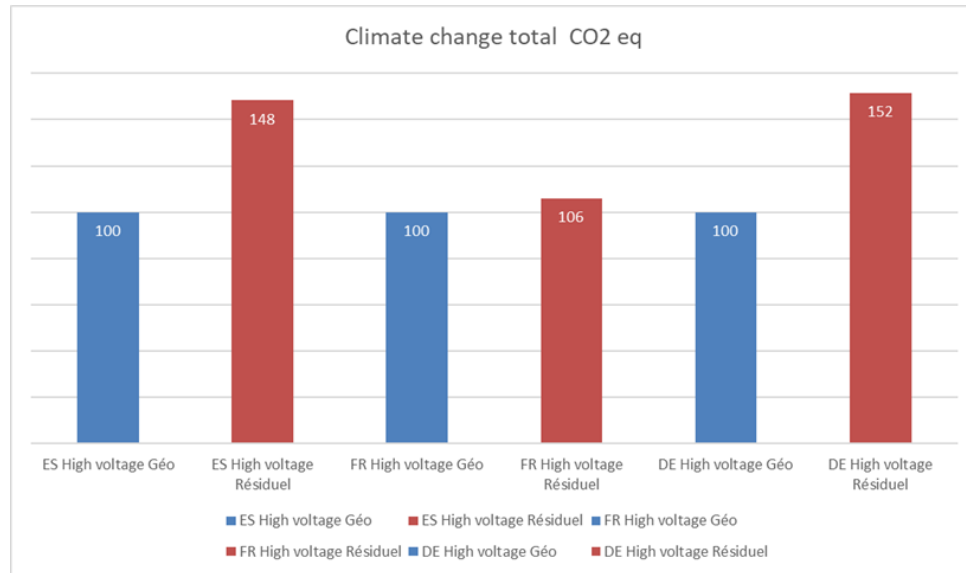


Annexes

Residual mix of a country (Europe)



Focus changement climatique et Norvège



- Cas de la Norvège beaucoup plus contrasté : principal exportateur de GO européennes et issues de l'hydroélectricité en majeure partie → mix géographique composé à 95% d'électricité d'origine hydraulique, le mix résiduel à 70% d'énergie fossile.

Steps under the control of the entity carrying out the assessment

