Addressing Induced Land Use Change (ILUC) emissions in LCA of road vehicles

UNECE IWG on A-LCA, SG6 (Fuel and Energy cycle)

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Induced Land Use Change (ILUC) emissions

General context

- **Induced, and specifically indirect, land use change (ILUC) emissions** from bio-fuel supply chains have been the object of increasing scientific scrutiny and concern over the last decade, with increasing evidence emerging that indicates that – in many cases – they **may be the single most important factor determining the veracity of the overall "green" credentials of bio-fuels**.

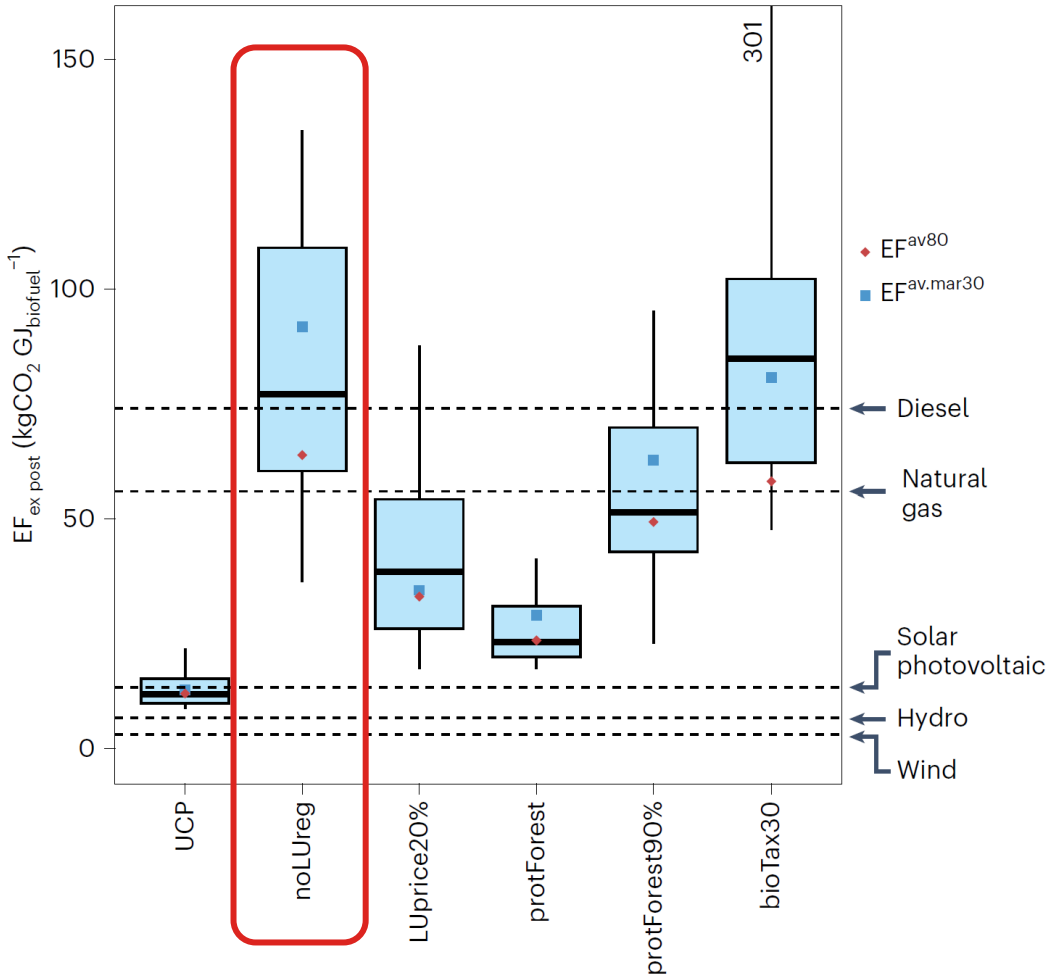
- Different land-use and energy sector policies (and potential future regulations) on specific bioenergy emissions have been identified as key factors in drafting possible future ILUC scenarios.

- A recent reputable study concluded that at present, however, "**Under current land-use regulation (noLUreg scenario), carbon dioxide emissions from biofuel production exceed those from fossil diesel combustion.**"

Bioenergy policy https://doi.org/10.1038/s41558-023-01711-7

State of global land regulation inadequate to control biofuel land-use-change emissions

Leon Merfort, Nico Bauer, Florian Humpenöder, David Klein, Jessica Strefler, Alexander Popp, Gunnar Luderer & Elmar Kriegler



Modelling ILUC emissions in bio-fuel LCAs

Attributional vs. Consequential LCA

- All of the fundamental models used to estimate ILUC emissions implicitly entail elements of a consequential approach to LCA (C-LCA), since they rely on assumption on induced changes on the large scale.

- Therefore, it *could* be argued that ILUC emissions fall outside of the scope of a purely attributional LCA.

- On the other hand, carrying out **a purely attributional LCA (A-LCA) of a bio-fuel is in fact questionable**, since A-LCA is not suitable for the key goal of assessing the extent to which a bio-fuel may represent a viable and environmentally preferable alternative to its conventional fossil counterpart (e.g., biodiesel vs. fossil diesel) when the results are extrapolated to a **"meaningfully large scale"** (where induced land-use changes become a dominating factor).

- Therefore, given that **ILUC emissions from many (most) bio-fuel pathways may be large enough to completely subvert the results of most of these (explicit or implied) bio- vs. fossil comparisons**, excluding them on the mere grounds that one should not mix C-LCA with A-LCA would be conducive to **lower accuracy and potentially misleading results**.

Modelling ILUC emissions (main underlying models)

ILUC models

- Estimating ILUC emissions requires the use of complex models that entail many parameters and assumptions on secondary market effects.
- The two most widely-adopted, mainstream models used to estimate ILUC GHG emissions are:
  - **GTAP-BIO,** a General Equilibrium model, developed in the USA by Purdue University
    (widely used especially in the USA, and also specifically referenced in the US Renewable Fuel Standard Programme)
  - **GLOBIOM,** a Partial Equilibrium model, developed in Europe by IIASA
- These two models differ significantly is in terms of a number of key assumptions on:
  (i) Land type displacement, (ii) Crop-specific carbon sequestration, (iii) Productivity change due to increased demand, (iv) Demand elasticity in other sectors, (v) Livestock rebound effect, (vi) Foregone sequestration
- In ALL of these areas, **GTAP-BIO** makes significantly more **OPTIMISTIC** (i.e., less conservative) assumptions, leading to **LOWER ILUC emission estimates**
- In fact, **GTAP-BIO** has been **widely criticized** as having "*introduced a significant optimism bias into the ILUC emissions results reported in more recent studies using the GTAP-BIO framework*" (https://doi.org/10.1016/j.jclepro.2020.120716)

Modelling ILUC emissions in bio-fuel LCAs - recommendation

ILUC emissions estimates for LCA

- ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (**CORSIA**) mandates using an average of the results from GTAP and GLOBIOM, but ONLY where the two estimates are very similar to begin with.

- Instead, in all "controversial" cases, where the two estimates differ by more than 8.9 gCO2e/MJ, CORSIA defaults back to the LOWER (almost always GTAP-BIO) estimate (plus a small 4.45 gCO2e/MJ "adjustment factor")

- **This is concerning, as it likely leads to an UNDERESTIMATE of real-world ILUC emissions.**

- **Ricardo's viewpoint is that aiming for the most accurate ILUC emission estimates is of paramount importance, given the potential for these emissions to completely subvert the overall CO2e emission ranking of some bio-fuels vs. their fossil counterparts.**

  - **Suggestion: adopt the straight GLOBIOM ILUC emission estimates, as the ones that are best-aligned with the "precautionary principle" which should always be at the basis of these assessments.**