SESSION 1
How to assess climate impacts of forest-based bioenergy?

Attributional Modelling
vs
Consequential Modelling

Alessandro Agostini

JRC-IET-Petten

Alessandro.agostini@ec.europa.eu

Definitions

Attributional modelling

The attributional inventory modelling principle depicts the potential environmental impacts that can be attributed to a system (e.g. a product) over its life cycle, i.e. upstream along the supply-chain and downstream following the system's use and end-of-life. The system is embedded into a static technosphere.

Consequential modeling

The consequential inventory modelling aims at identifying the consequences that a decision in the foreground system has for other processes and systems of the economy. The system interacts with the markets and the changes that an additional demand for the analysed system is expected to have in a dynamic technosphere that is reacting to this additional demand are depicted.

Attributional approach

For **accounting**: a purely descriptive documentation of the potential environmental impacts of the system under analysis (e.g. a product, sector, or country).

For **micro-scale decision support:** the decisions, actions or products analysed are assumed to have limited or no structural consequences outside the decision-context, i.e. they are supposed not to change available production capacity

How do you go to the beach for an ice-cream???

E-Bike 9 gCO2/km

EU mix electricity
No infrastructures

Car 229 gCO2/km

EU fuel mix
No infrastructures

E-Bike GHG savings = 220 gCO2/km

Consequential approach

European Commission

Decision support at strategic level : Decisions aimed at causing structural consequences outside the decision-context, (i.e. they are supposed to change available production capacity). (e.g. raw materials strategies, technology scenarios, policy options).

Expected impacts of a policy target of 1 M E-Bikes?

Reference scenario

E-Bike 22 Gt CO2
1000 km/y
(9 WTW+ 13 production and disposal)

Competition for raw materials

Competition for lithium batteries
Higher cost Li = Less electric cars that may actually replace fossil fueled cars

iLUC (indirect Lithium Use Change)

E-Bike 27 Gt CO2
(9 WTW+ 13 construction and disposal + 5 iLUC)

Reduced consumption of other goods

Higher taxation = Lower income
E-Bike 26 gCO2/km
(9 WTW+ 13 prod. +5 iLUC -1 LowCons.)

Counterfactual baseline scenario

Car 271 Gt CO2 5 %
(229 WTW + 42 constr)

Bike 5 Gt CO2 75 %
Only construction and disposal

Bus 101 Gt CO2 3 %
6 construction and disposal + 95 WTW

Walking 0 Gt CO2 7 %

Weighted average 23 gCO2/km

Couch 0 Gt CO2 10 %
Rebound effect
Weighted average 20

Food consumption
Bike 21
(16 food + 5 production)
Weighted average 35

E-Bike GHG savings = 9 Gt CO2

Conclusions

Results of Attributional LCAs should not be used to support the planning of policies that are aimed to cause structural changes in the economy, a consequential approach is needed

References:

European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. First edition March 2010. EUR 24708 EN. Luxembourg. Publications Office of the European Union; 2010

European Cyclists' Federation, Quantifying CO2 savings of cycling, http://www.ecf.com/wp-content/uploads/ECF_BROCHURE_EN_planche.pdf

QUESTIONS TO BE ADDRESSED

What methodologies can be applied in assessing climate effects of forest-based bioenergy? LCA
What methods are suitable for different purposes (e.g. national GHG inventory, product environmental labelling, sustainability certification, emissions trading, policy planning, policy implementation…)? ALCA: accounting or microscale, CLCA: policy planning)
How can ALCA/CLCA be used to assess forest-based bioenergy, and for what purposes? Inventory compilation, environmental impacts evaluation)
- What is the appropriate system boundary for each purpose? Encompass all relevant flows
- Should we deal explicitly with uncertainty? Possibly yes

What metrics can be used to quantify climate effects of bioenergy? GWPs?
What reference system/baseline/counterfactual should be considered? Depends on the goal of the analysis
Should the forest reference system include expectations of management responses, and/or natural regeneration, with/without natural disturbance? Yes
At what scale should the analysis be applied (spatial and temporal)? (Stand, product, combustion facility, policy/program, forest estate, region, nation, globe; product life cycle, scheme life?) Depends on the goal of the analysis