



Between disagreement and consensus in waste LCA: Illustration with a comparative LCA of different grape pomace recovery options

**Discussion Forum 46:
“End-of-life and waste management in LCA”
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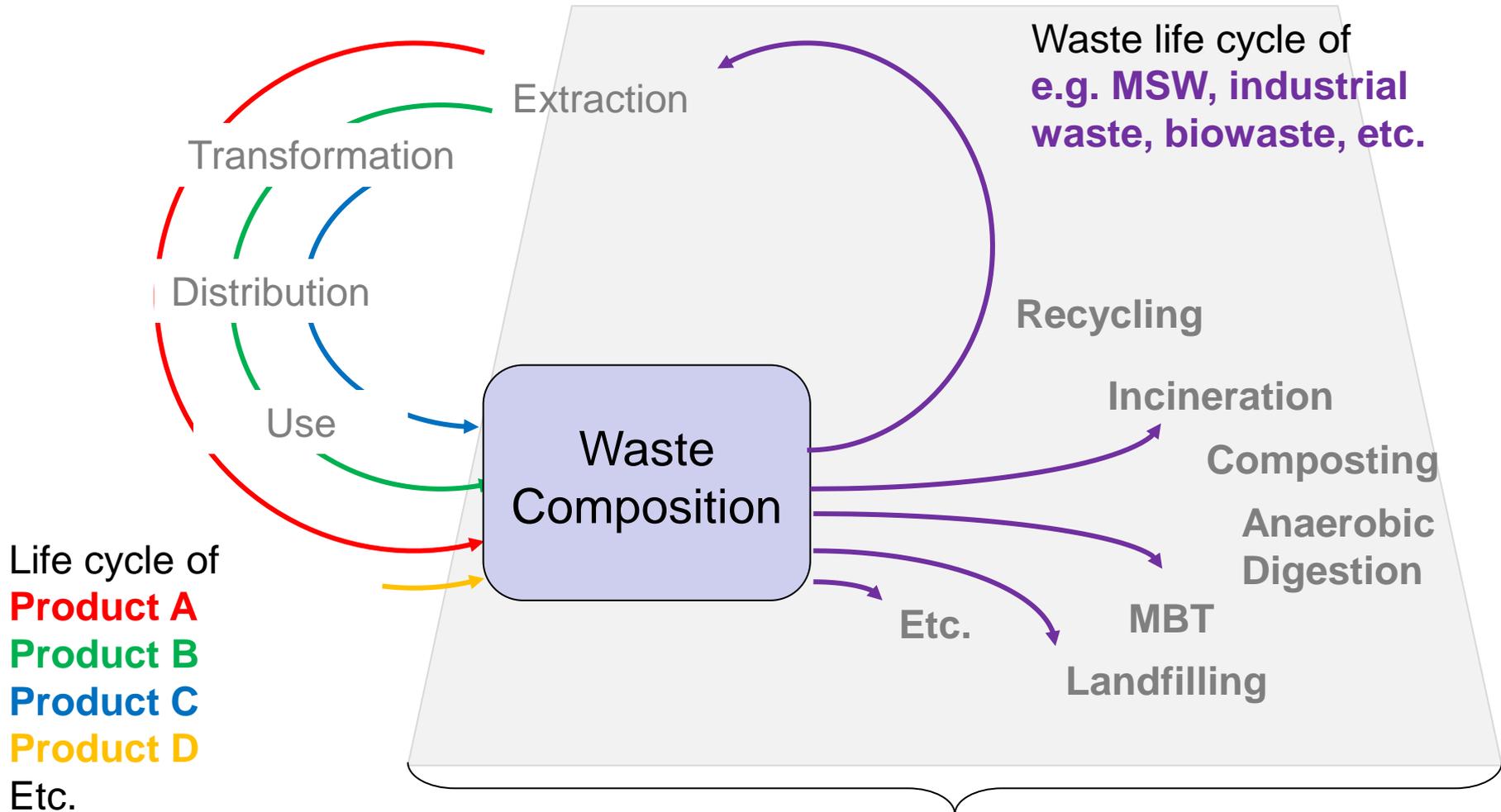
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Presentation outline

- An overlook of some waste LCA dedicated issues
 - A gate-to-grave approach LCA of several products
 - Carbon-related issues
 - How to model a waste LCA? Which LCI data to use? Which software?
- Application to a comparative grape pomace recovery LCA
 - Goal and scope
 - Results and interpretation
- Conclusions

A gate-to-grave approach LCA of several products



Issues related to waste LCA boundaries

- How to take into account waste prevention?
 - Most of the time a Waste LCA Functional Unit is expressed by amount of waste to manage
 - JRC, 2011: “You can use LCT to guide you in making decisions between waste prevention options and to demonstrate the benefits of waste reduction measures on site, in contract specifications, or in policy choices.”
 - Waste LCA community: “The application of LCA to MSW rarely incorporates the effects of waste prevention activities”
- Waste = Zero Burden?
 - Waste entering the system boundaries is most often not associated with its embedded environmental impacts
 - Eventually not valid if the waste considered is actually a by-product

Issues related to waste LCA boundaries

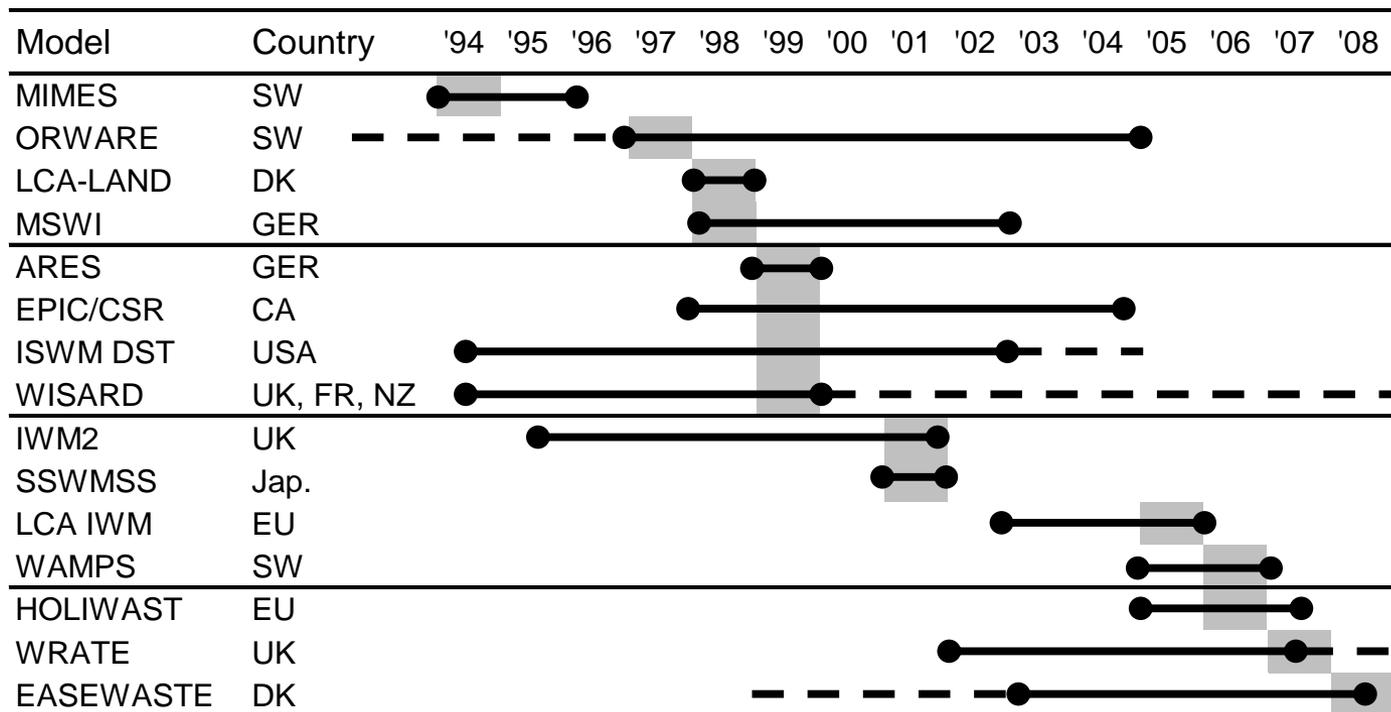
- How to take into account the energy and material recovery ?
 - Several methodologies and approaches to be applied
 - closed /open loop recycling, recyclability, down-cycling, product substitution, etc.
 - Consolidated on different boundaries
 - Issues of attributing the benefits to the overall product chain
 - Issues related to the energy recovery mix (peak or base energy mix)
- How to evaluate the environmental benefits of land spreading composts/digesters ?
 - Some of the environmental benefits are actually included
 - avoiding fertilizers, potential carbon storage
 - Does not take into account physical, biological, chemical, mechanical soil improvements
 - JRC, 2011: “There are many other indirect environmental effects which still need research in order to develop LCA tools and account for these benefits properly. ”

Carbon related issues

- How to account for biogenic carbon
 - GWP CO₂bio=0 / CH₄bio=CH₄ : Rather consensual until now
 - At present questionable
 - Most of the recent guidelines now recommend to account for them separately (ILCD Handbook ; JRC, 2011)
- Temporary/Permanent storage of carbon in soils/landfills
 - Seems that there is a consensus on its integration, but reported separately
 - Also directly depend from the biogenic carbon accounting
 - Integration in dynamic LCA is potentially solving the problem

Modeling issues

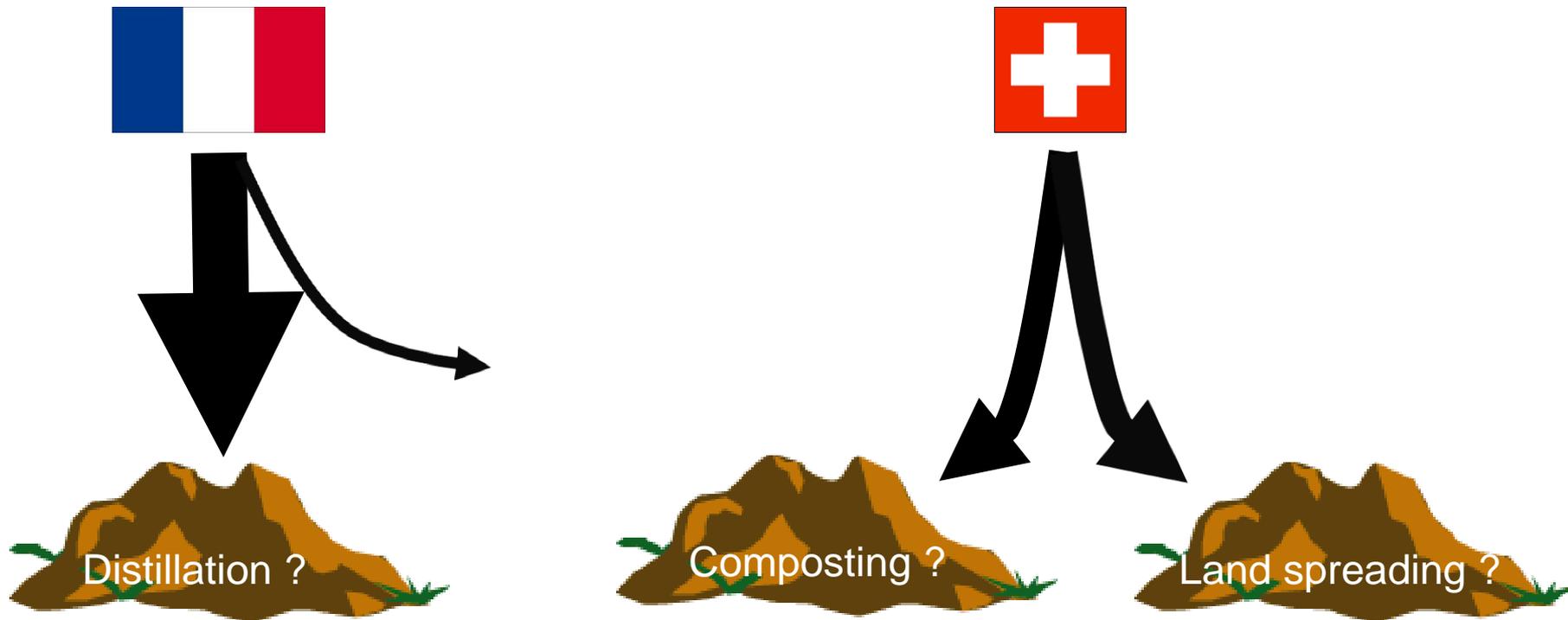
- Lack of LCI data dedicated to waste
 - LCA Databases are still lacunar
 - Some efforts are done to adapt the databases
 - Need for more dedicated LCI database to capture the reality of the field
- Existence of dedicated waste LCA software



Source : Gentil, 2009

Context: alternative pathways to recover grape pomace

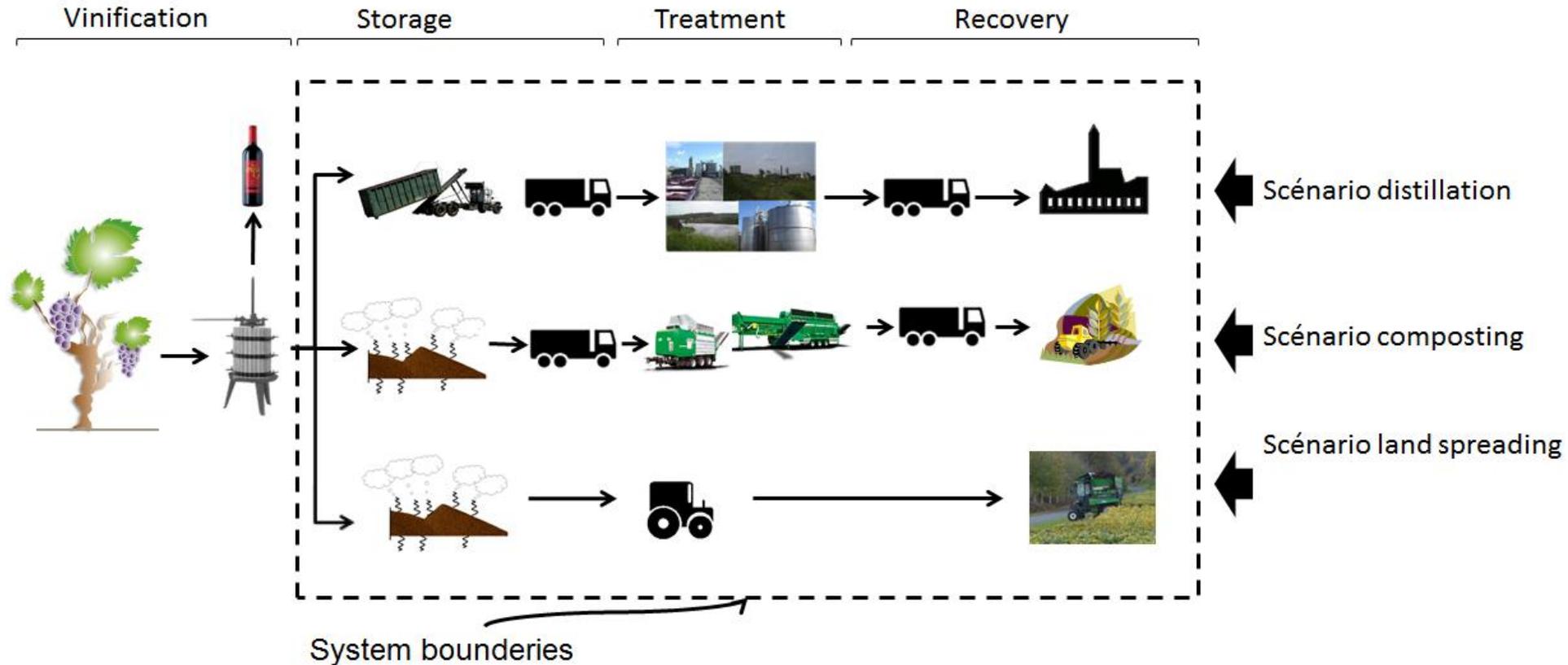
1 millions tonnes of alcohol containing grape pomace to be treated in France:
which treatment is the best option?



Introduction

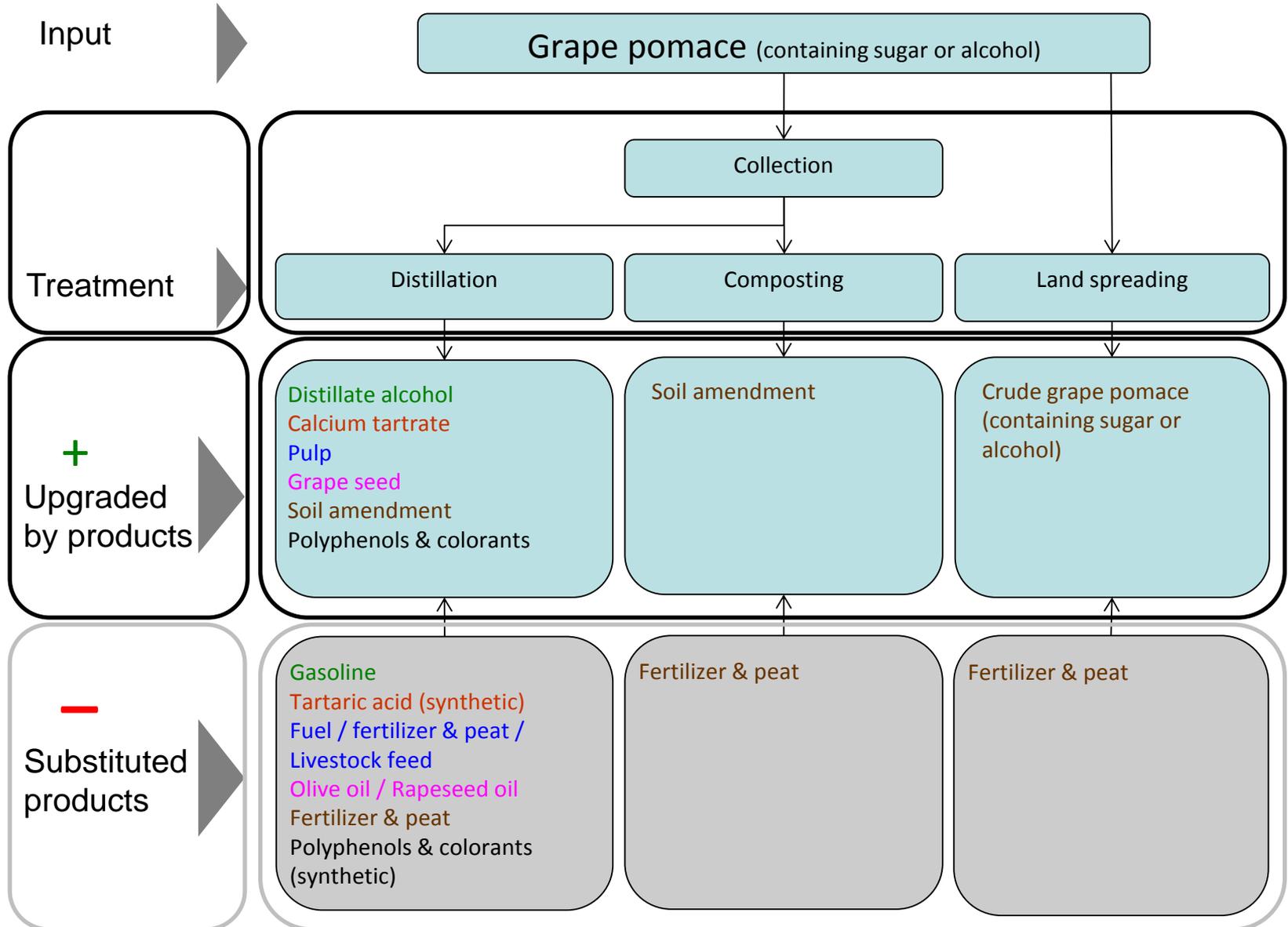
- **Issues to be resolved**
 - Is grape pomace recovery by distillation advantageous from an environmental point of view?
 - Which alternative is the most favorable among three treatment options studied?
- **Objective**
 - To perform a comparative life cycle assessment of different treatment options to recover alcohol containing grape pomace from winemaking
- **Functional unit**
 - Treating and recovering 1 tonne of alcohol containing grape pomace

System boundaries for the three treatment options studied



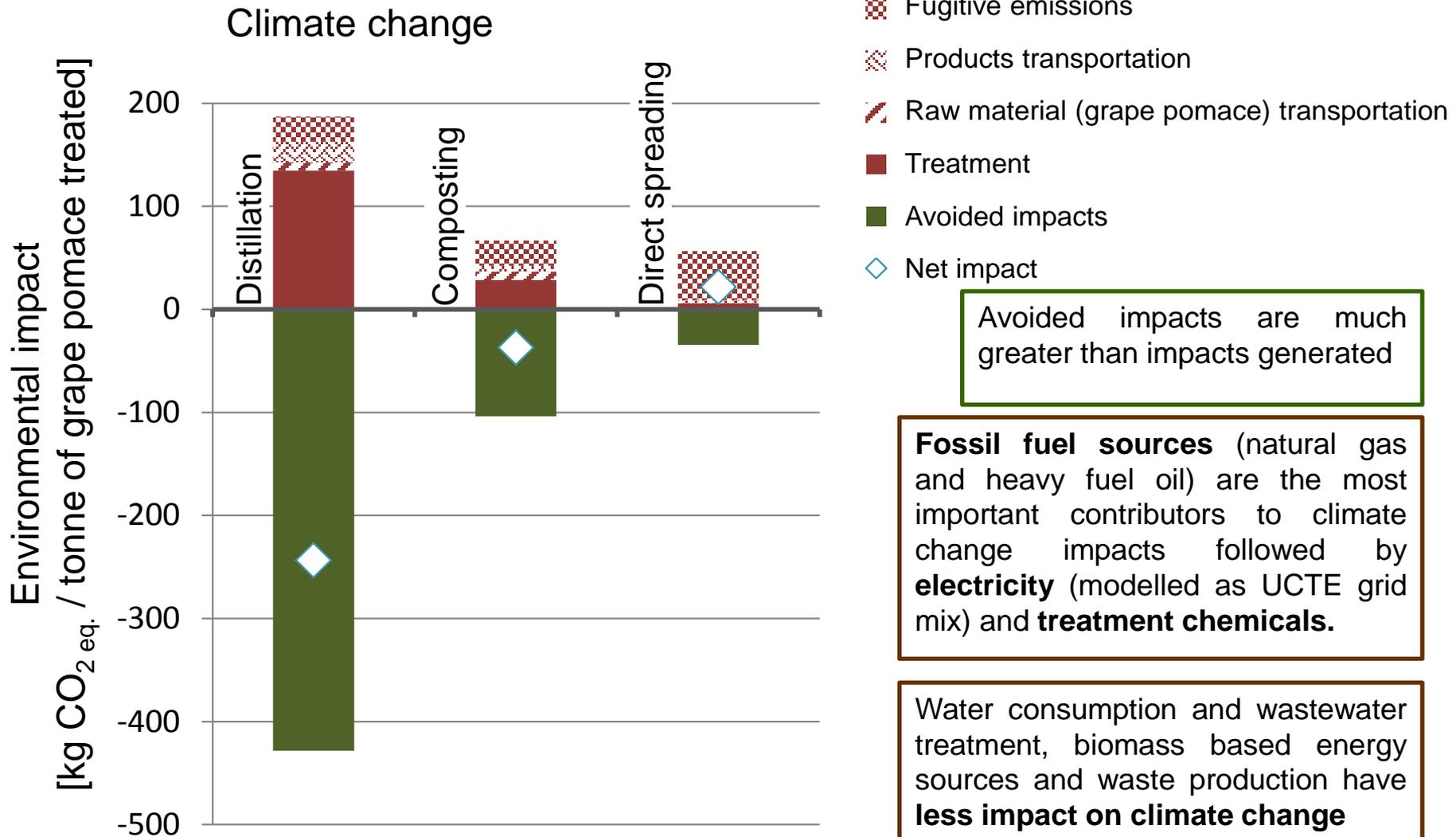
How can the different scenarios be compared?
Co-products are not recovered the same way

Description of the different treatment options

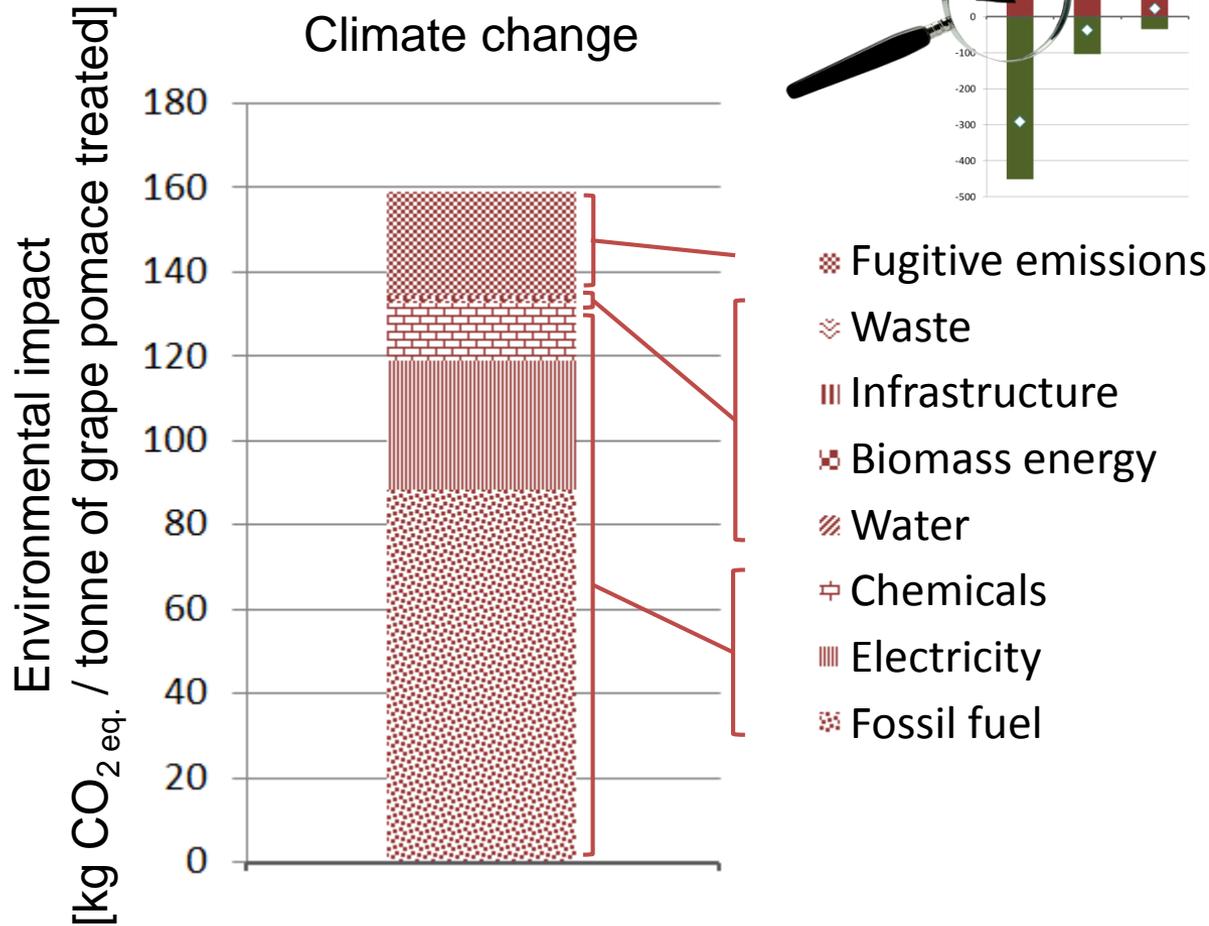


system boundaries expansion

Potential impacts and benefits on climate change

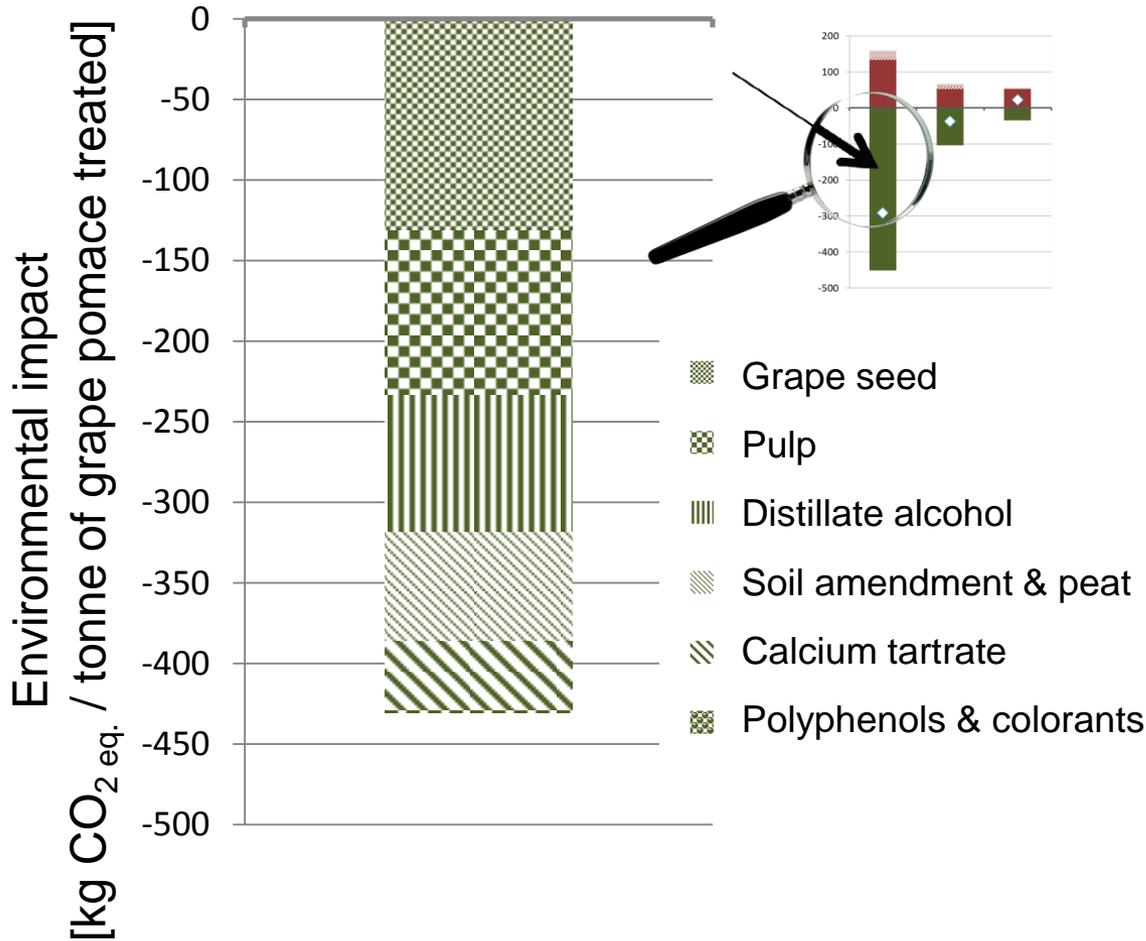


Focus on impacts: climate change



Focus on avoided impacts: climate change

Climate change



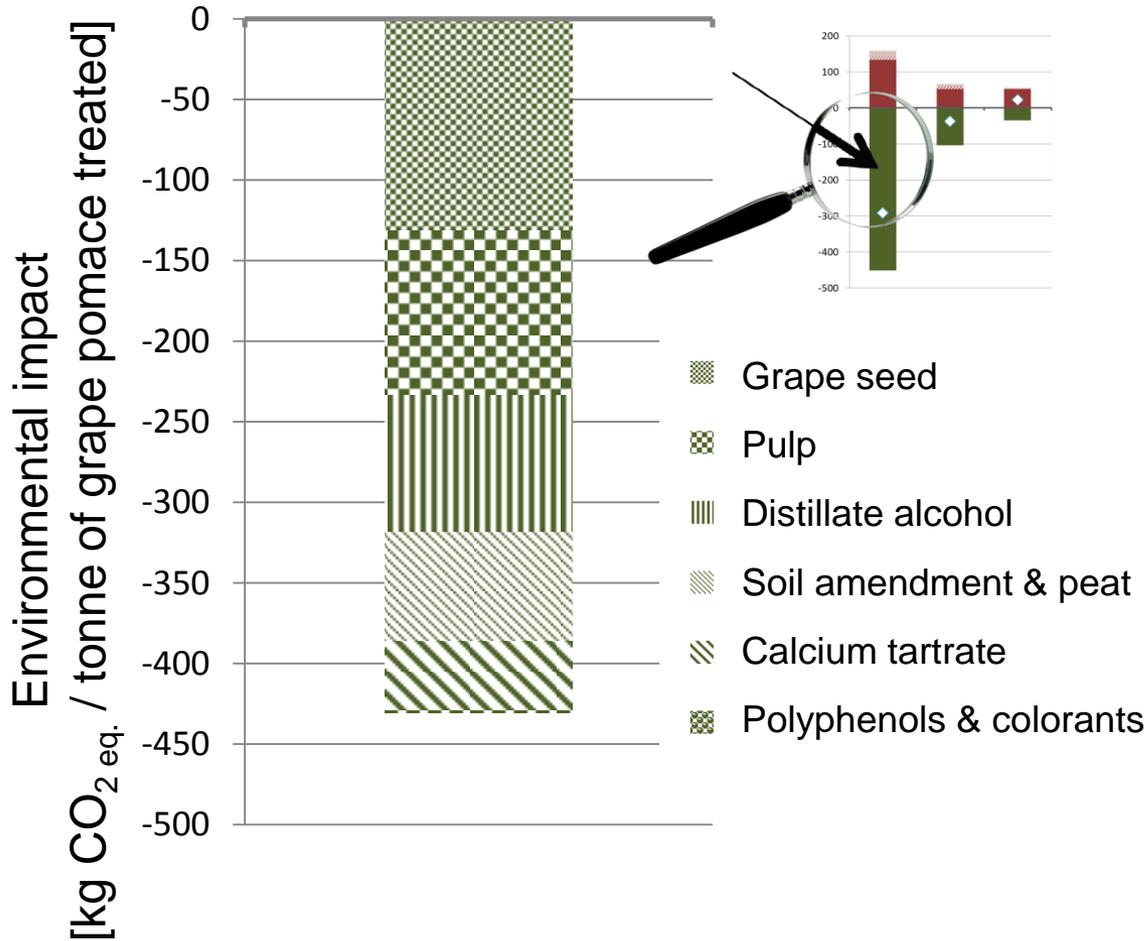
Significant benefits are provided by the **grape seed**. It is assumed that the oil extracted from the seeds replace olive oil and rapeseed oil. Seed residues are used as fuel and thus assumed to replace fossil fuels

Grape pulp is assumed to be **incinerated** with heat recovery and replaces an important amount of fossil fuels, animal feed or soil amendment

Crude alcohol can be converted into **bioethanol** and **replaces fossil fuels**, providing an important benefit

Focus on avoided impacts: climate change

Climate change

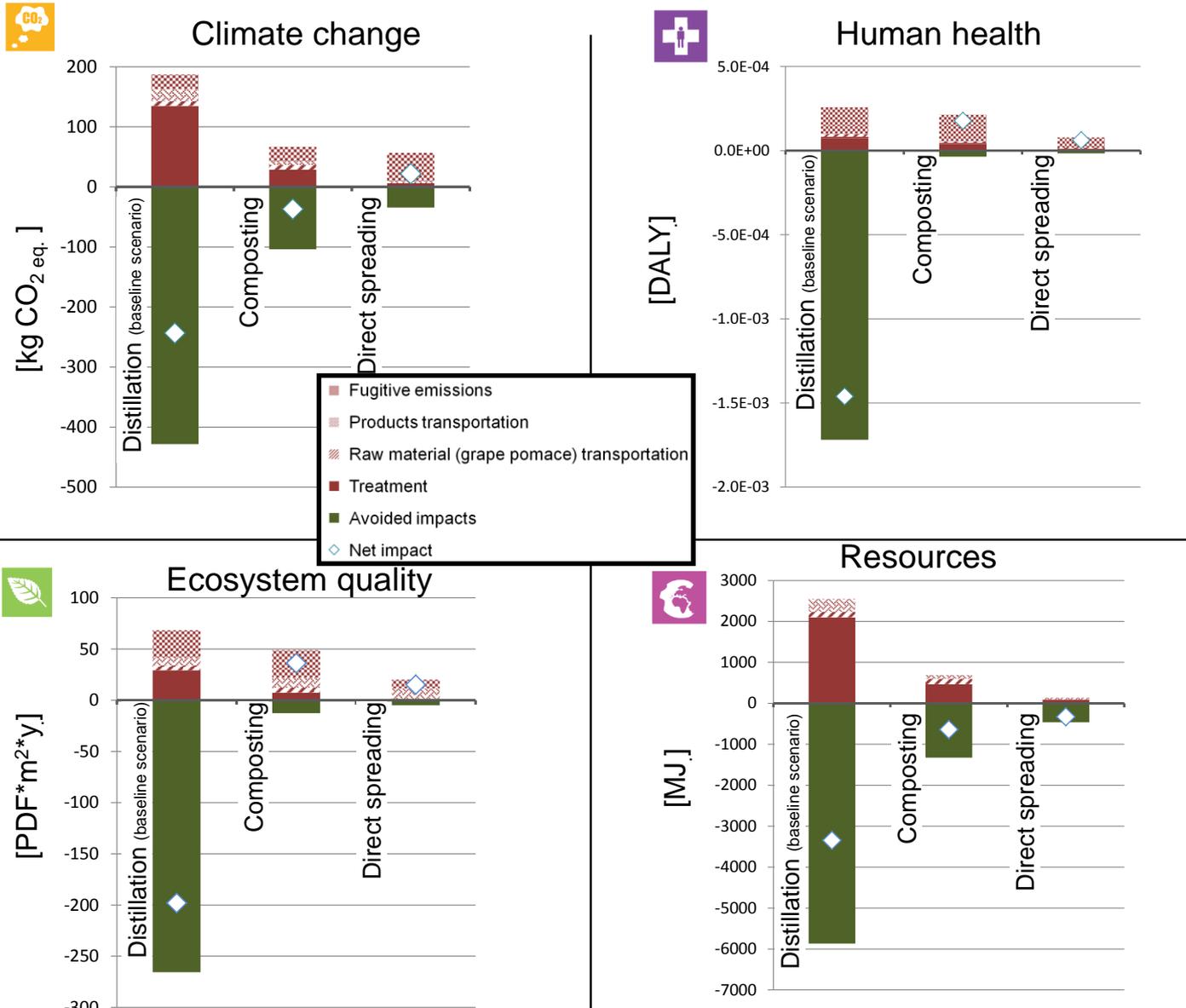


Compost from the distillation process can have a positive effect on the soil quality (as it is **similar to peat**) and **replaces fertilizers**

Calcium tartrate is used for manufacturing of tartaric acid and replaces Maleic Anhydride which is obtained commercially (either by oxidation of butane or benzene)

Impacts generated and avoided: IMPACT 2002+ indicators

Environmental impact
[to treat 1 tonne of grape pomace]



Key learnings from the case study

- Distillation process :
 - Needs more resources (energy, transport, water) than the other treatment options
 - But important potential avoided impacts, higher than the other options (depending on the what the co-products replace)
- Overall, the distillation process provides an environmental benefit
- Treatment of alcohol containing grape pomace by distillation is the favored treatment option, compared with composting and direct land application
- The distillation process can be further improved by using renewable energy resources

Issues in waste LCA for this case study

- **Representativeness**
 - In France, 50 distilleries, not all of them producing the same co-products. The study only took into account 4 representative distilleries
- **Biogenic carbon**
 - Fossil fuel substitution by bioethanol avoids fossil CO₂ emissions
- **System boundaries**
 - Important to consider system boundaries expansion when comparing scenarios with several different coproducts
- **Avoided impacts**
 - It is crucial to choose consistently the avoided product
 - Example: seed grape oil substituting olive oil, rapeseed oil or any type of oil
 - Example: substitution of fossil fuels for bioethanol
- **Land spreading benefits or composts or digestates:**
 - Lack of characterization of the benefits
 - Should we take into account the benefits of substituting fertilizers in Switzerland, where soils are overloaded with N,P,K



Thank you for your attention!

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