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GHG benefit of Novel Transport Fuels

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This is JRC’s draft method

- JRC offers science support to EU policy makers
- Legislation is decided between the Commission’s policy DGs, the Parliament and the Council
- The method in RED1 for biofuels does not work for CCUs
- The Commission has to propose a methodology for accounting for GHG emissions savings from CCUs in RED2.
- This is our suggestion for a rational methodology.
- An earlier version of this methodology was proposed for calculations under Fuel Quality Directive

Existing LCA standards don't help much

- e.g. ISO 14040/44, ILCD handbook*
- Are mostly about transparency
- Many methodological choices are left to the user
- Do not give unambiguous LCA results
- They only help guide disinterested scientists
- Recognise that no method works in all cases

*http://eplca.jrc.ec.europa.eu/?page_id=86#

Method was designed for two types of CCU fuels:

1. Power-to-fuels (electrofuels) that borrow CO_2

- …use only renewable electricity (RE) as an energy source
- captured CO_2 is released again at the tailpipe
  - So no fundamental difference with RE-hydrogen in vehicles

2. Industrial exhaust-streams to fuels (e.g. blast furnace gas)

- some of the energy in the fuel can come from industrial gas streams
- They usually need much electricity, too

THE METHOD

1. General Provisions
2. GHG intensity of feedstocks
3. Electricity as a feedstock
4. Accounting for CO_2 capture
5. Allocation to multiple products
6. What about CCU materials?

1. General provisions of the method

- For simplification, the emissions for construction are not counted

- But we *do* consider CO_2, CH_4 and N_2O emissions arising from:
  - supplying and processing the feedstocks
  - process emissions
  - transport and distribution

- Miscellaneous input chemicals: GHGi from RED2 defaults for biofuels (etc.)

- To find % savings, the total emissions per MJ of CCU road transport fuel are compared to the “fossil fuel comparator” (94 gCO_{2e}/MJ in RED2)

2. GHG INTENSITY OF FEEDSTOCKS

- To calculate GHG intensity of a feedstock for a fuel process…
- it **doesn’t matter** what you call it (product, waste, residue, by-product, co-product, intermediate product…)
- The first question is…
  “is the source **elastic or rigid**?”

Elastic vs. rigid feedstocks

- **Elastic** if the supply expands with increasing demand:
  - e.g. crude oil, crops, algae
  - ➢ **Estimate the emissions for increasing the supply**

- **Rigid** if the supply doesn't expand if you increase the demand:
  - **e.g.** Municipal waste
  - intermediate products of existing processes, e.g. blast furnace gas
  - by-products that don't change the process profitability much

  - Therefore it can only be diverted from an existing use
  - ➢ **the GHG intensity is the emissions saved in its existing use**
    - can be negative: e.g. if municipal waste is otherwise burnt without energy recovery
    - can also be very high, if the existing use saves lots of GHG

3. ELECTRICITY AS A FEEDSTOCK

You don’t save emissions by diverting renewable electricity from other users

Renewable electricity: is it rigid or elastic?

- **Rigid** if it is already counted towards renewable electricity targets
  (then it is just being diverted from other users)
  - Its GHG intensity is that of the extra grid electricity that replaces the diverted RE
- **Elastic** if it is **additional** to what would have been consumed anyway:
  e.g. from peak-shaving, or not grid connected,
  ….or **maybe** an improved guarantees-of-origin scheme that deals also with grid stabilization issues
  e.g. similar to GOplus (©Oekoinstituut)
  - Its GHG intensity is that of the renewable source

Analogous logic for use of biogas

Average grid-electricity emissions

- …used for grid electricity or "renewable electricity" that is ***not additional***

For RED2, JRC calculated the **average** GHG intensity of electricity **consumed** in each EU member state .

That means, including not only power-station emissions (IEA 2018 data), but also…

– upstream emissions for supplying the fuel
- transmission losses
- accounting for power station own-use and heat export
- accounting for trade between states

There is also a way for updating for future emission improvements.

Emissions from additional renewable electricity

- Elastic source, so estimate the emissions for increasing the supply
- For simplicity, RED gives zero emissions to PV and wind (remember we don't count construction emissions anyway)
- Latest draft of RED2 includes various additionality rules (later!)

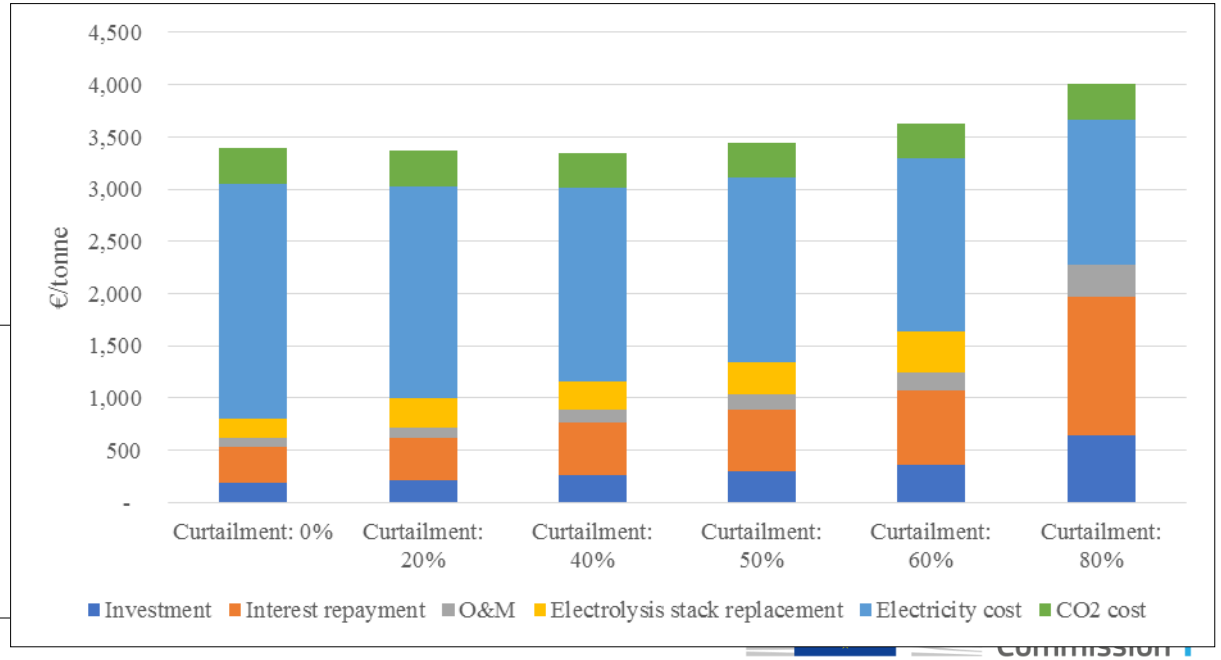
But grid-connected CCU can be used for grid stabilization

- You can decide to operate an electrofuels plant only when there is more than a given % of renewable electricity in the grid mix.
  - the electricity costs less, and has lower emissions
  - *(curtailed* wind electricity is free and has zero emissions)
  - **but** using your electrolysers only part of the time increases your capital costs (Eur/MJ)

➢ Economically-optimum fraction of shut-down time>>>

➢ What about the optimum emissions?...

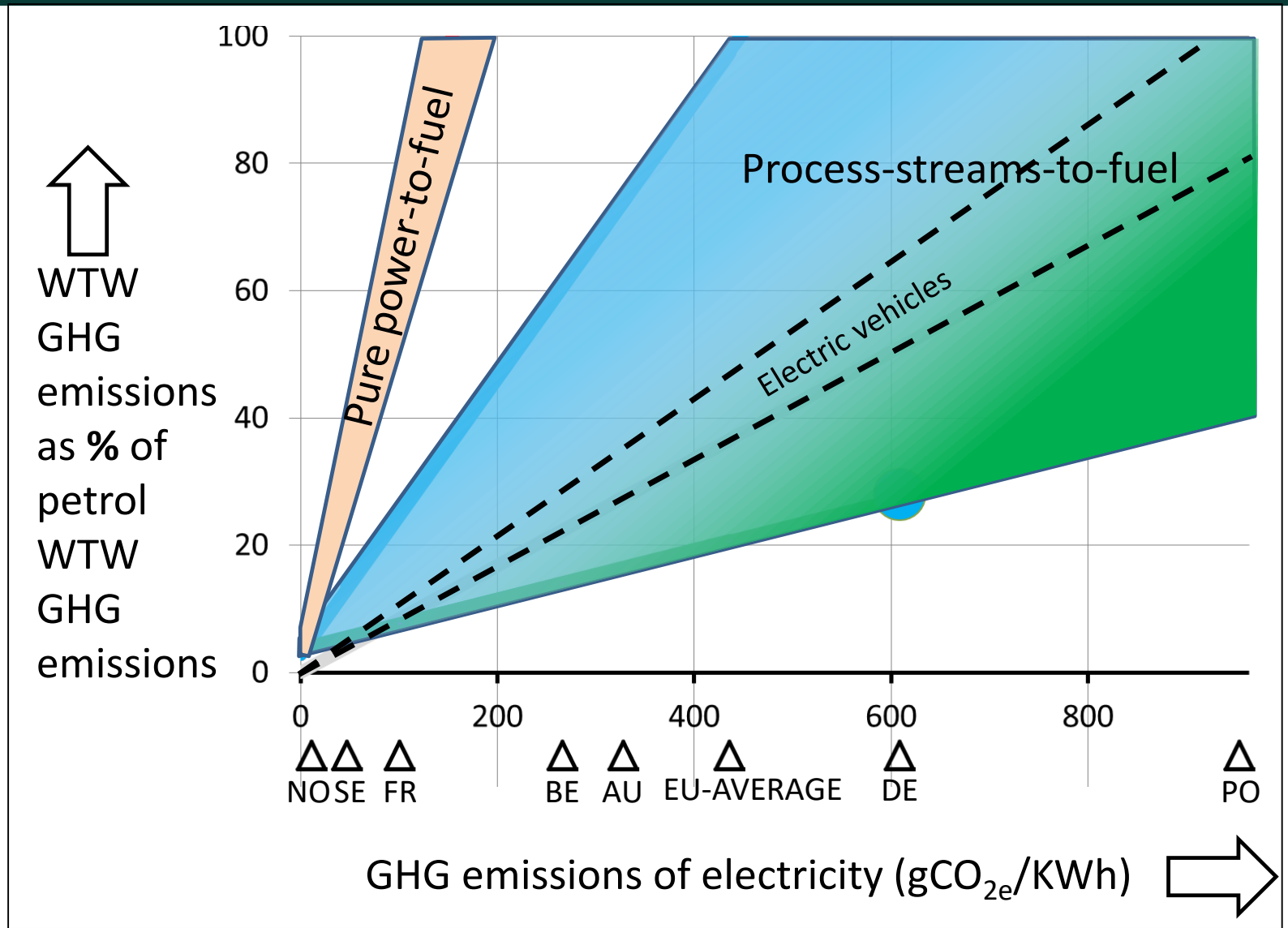
C. Malins: "Power to the people: the role of electrofuel technologies in European transport's low carbon future" http://www.cerulogy.com



Optimizing GHG emissions by part-time electrolyis + hydrogen storage

- Rational planning of electrofuels and electric vehicles needs (statistics on) marginal electricity emissions as a function of time.

Range of results calculated from JRC draft method



- **Pure electrofuels save less GHG than electric cars using the same electricity**
- Using energy in exhaust gases can save more GHG than EVs.
- It depends on the alternative use of the gas.

- My graph shows an indicative range of emissions for projects proposed to Commission.
- WTW emissions: battery production emissions not included
- Approximate EV/gasoline comparison based on similar vehicles
- National emissions are for **consumed** electricity, but need to be updated.

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But electrofuels have other advantages…

- They can export renewable fuels from regions with unexportable excess renewable electricity (Iceland, ??Sweden??)

- They can stabilize the grid over longer periods than electric cars,

(by part-time electrolysis + hydrogen storage)

- Electric aeroplanes are unlikely

The END

Any questions?

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