The European Commission's science and knowledge service

Joint Research Centre

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Potential methodologies for quantification of GHG emissions savings

Energy intensive industries

Robert Edwards, JRC Ispra

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Relation with ETS, RED2, FQD

The Commission already consulted on, and published, these basic principles for *Renewable Fuels of Non-Biological Origin* in the Fuel Quality Directive, but they now fall under RED2

IF – RED2 alignment

- Some **I**nnovation **F**und projects may produce transport fuels that fall under **RED2** (*Renewable Fuels of Non-Biological Origin*, and *Recycled Carbon Fuels)*…

  …so IF should probably not fund projects producing fuels that do not qualify under RED2.

  - RED2 = emissions per MJ fuel: IF applies to **projects** to save emissions: There may be multiple *products.*
  - RED2 accounts for life-cycle emissions, unlike ETS…

IF – ETS Alignment

  - ETS concerns only direct emissions from the factory

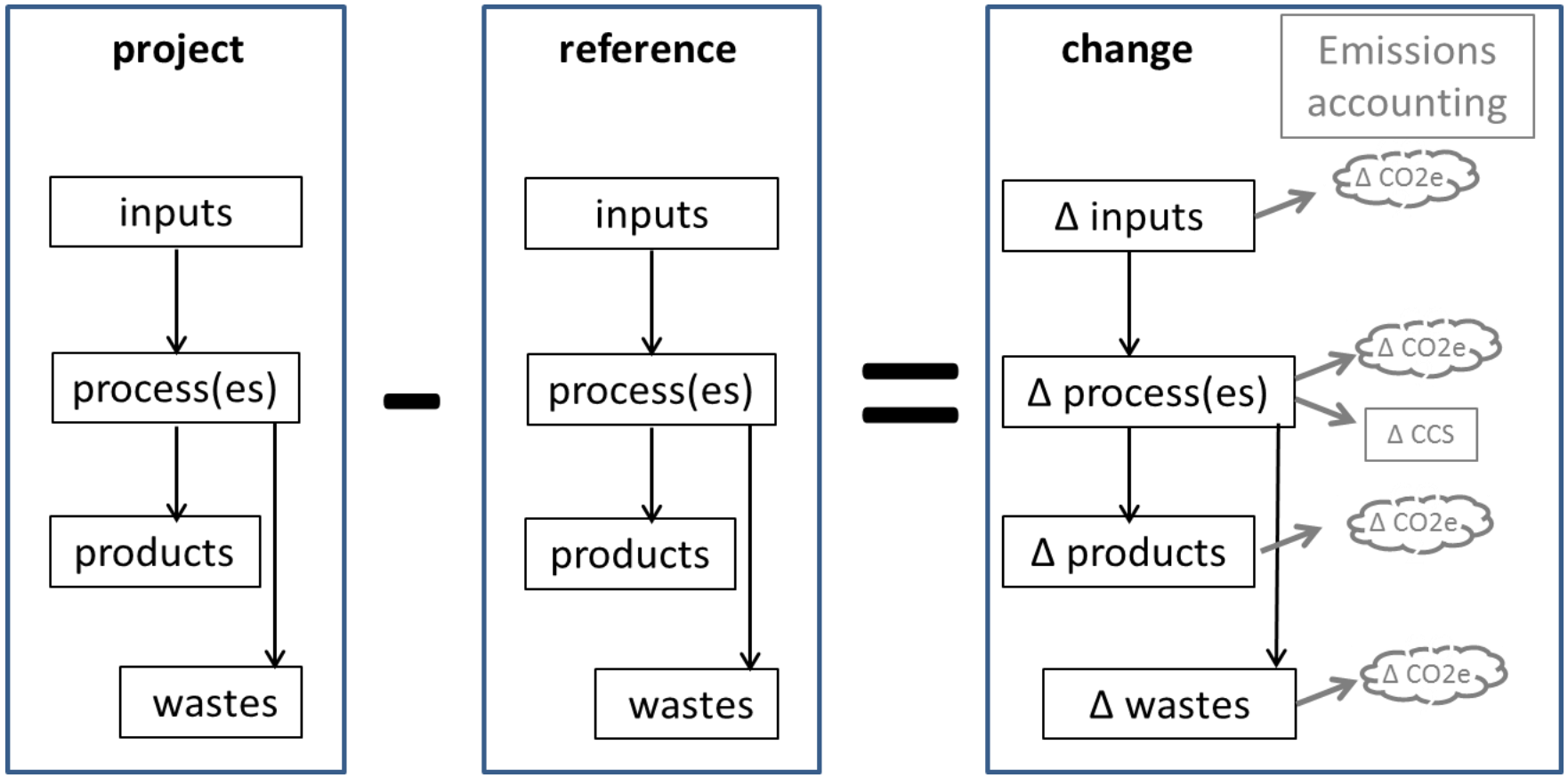
IF is concerned with technologies, which save emissions in the future**.**

Why not just use existing LCA guidelines?

- e.g. ISO 14040/44, ILCD handbook*, PEF
- Studies often falsely claim to follow ISO
- (e.g. even PEF has a non-ISO hierarchy of allocation methods)
- Some important methodological choices are left to the user
- Choice of literature data left to users
- Do not give unambiguous LCA results
- They help guide disinterested scientists
- No good by themselves for legislation

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

Basis of the method



ΔEmissions(project) =
ΔE(inputs) + ΔE(processes) + ΔE(products) + ΔE(wastes)

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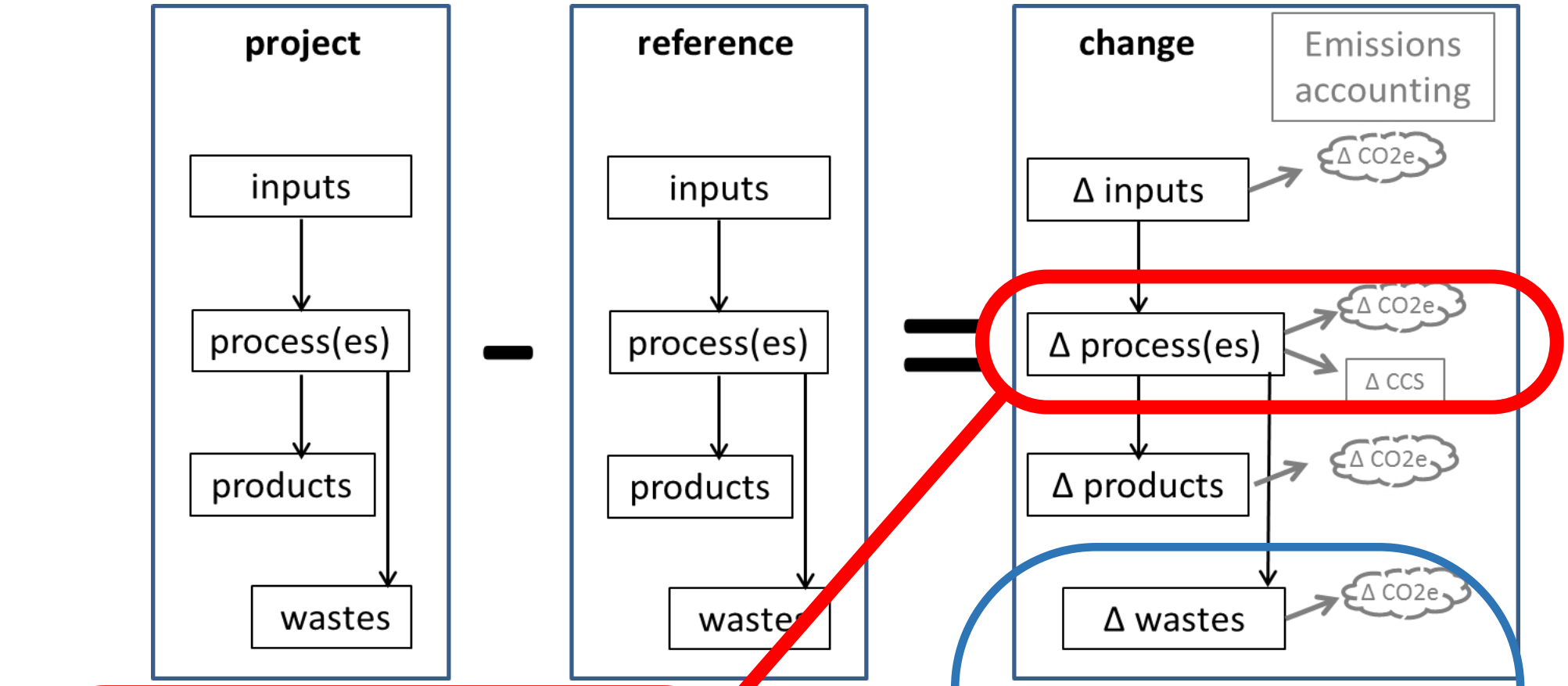
1. Changes in **process** emissions



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Discussion point: what is the **reference process**? …

SUGGESTION:

- FOR NEW PLANTS,
  - Emissions from an ETS baseline installation,
- FOR MODIFICATIONS OF EXISTING PLANTS
  - The unmodified plant PROVIDED that the overall emissions of the modified plant reach the emissions from an ETS baseline installation.

Discussion point: "**grey" emissions**

1. The "grey" emissions for **construction** are not counted in RED2 or ETS.

But they could be significant in some cases:

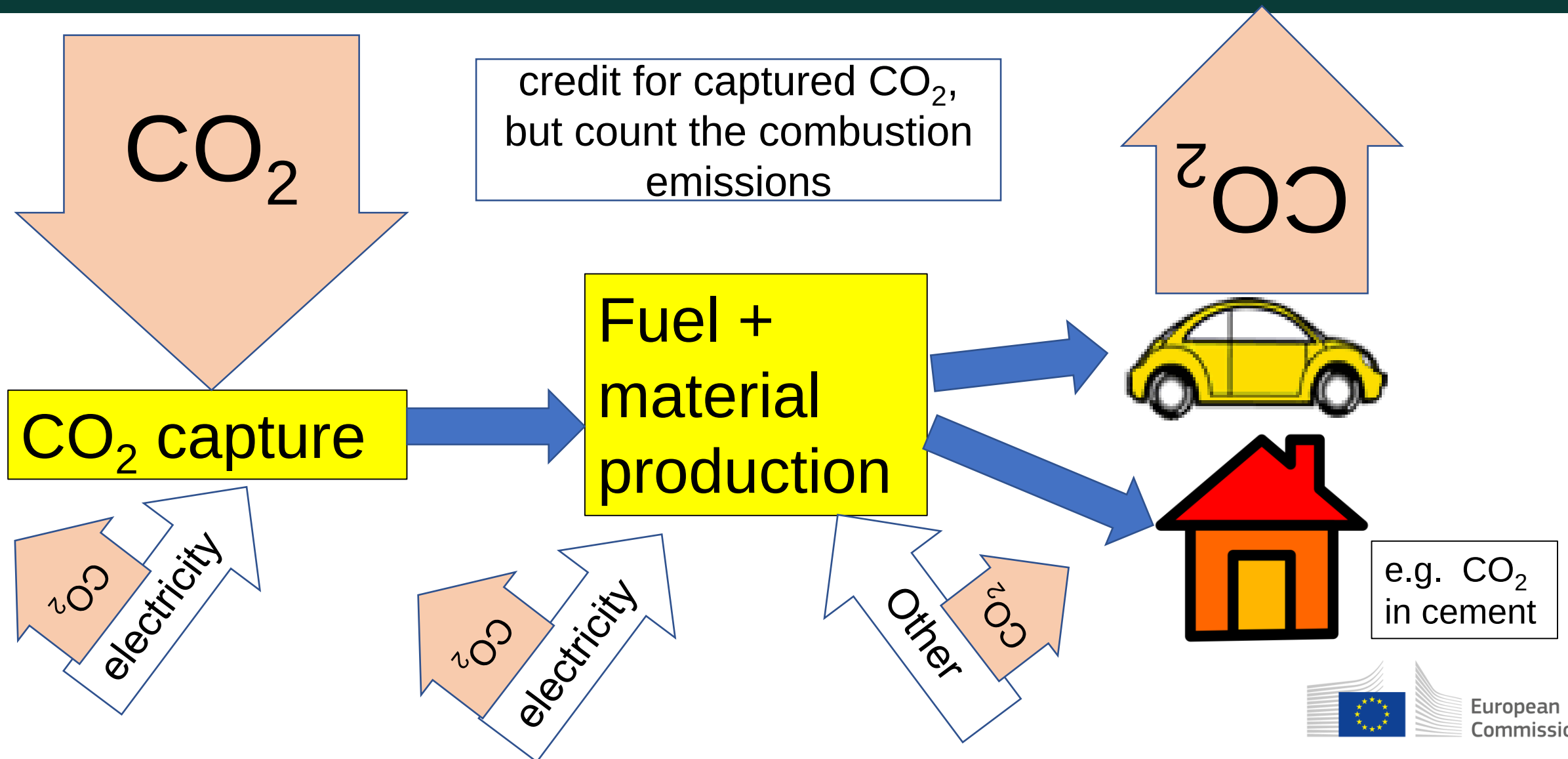
e.g. solar electricity to fuel: ~20g CO_{2e}/MJ fuel

Suggestions: "…unless they account for >5% of overall emissions change"

"… unless the Commission has reason to believe…"

Accounting for CO_2 capture and use

CCU accounting: CO_2 credit for captured CO2, but count combustion emissions



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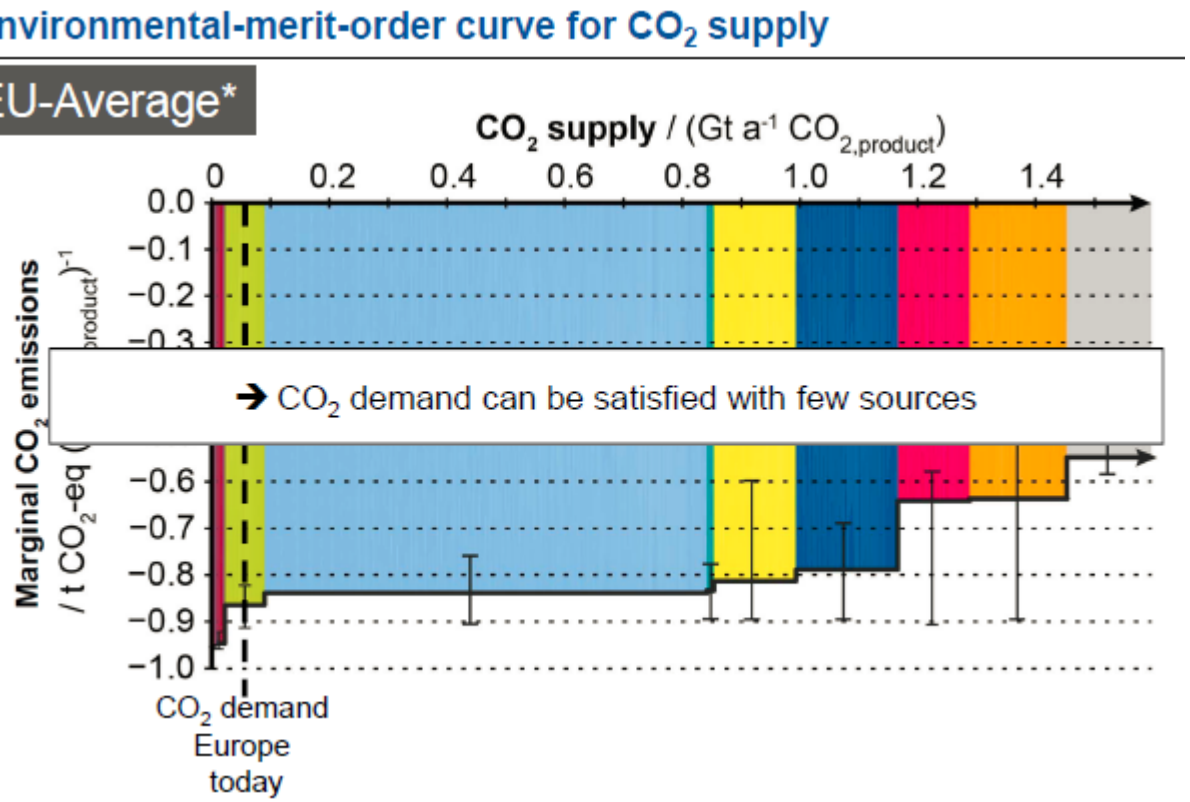
CCU credit goes to the use of CO_2

There is much more concentrated-CO_2 available than industry needs.

- So an increase in industrial CO_2 **demand** will result in more capture. …But increasing CO_2 capture *without increasing the CO_2 demand* will just displace other captured CCO_2, with nc emissions savings.
- Therefore, incentives should be for the ***use*** of captured CO_2 to replace fossil C.
- So must surrender any CO_2 credit at the capture plant (e.g. under ETS).



Reference: N. von der Assen, L.J. Müller, A. Steingrube, P. Voll, A. Bardow, Environ. Sci. Technol., 2016, 50 (3), pp 1093–1101

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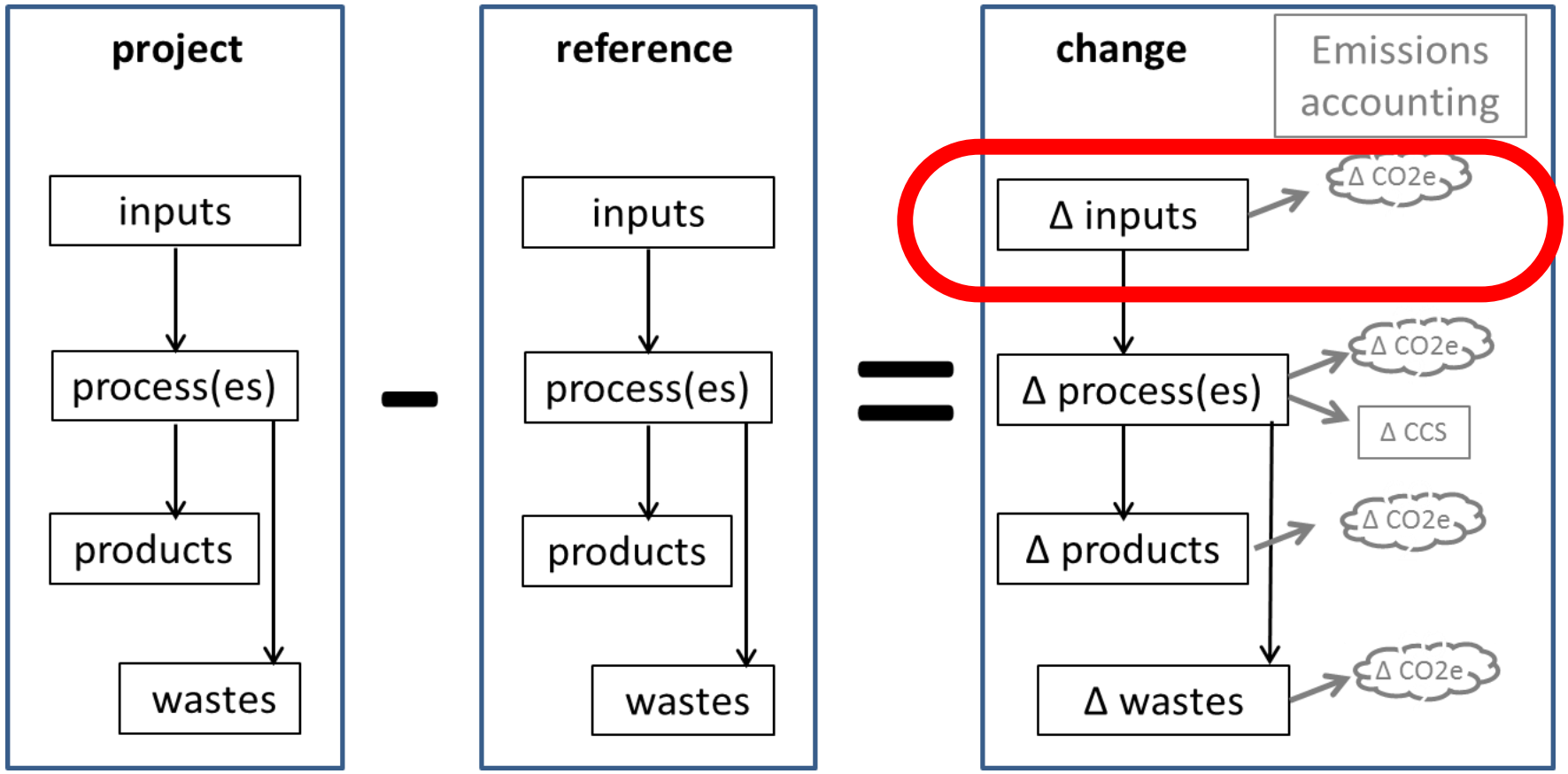
2. GHG INTENSITY OF INPUTS



ΔEmissions(project) =

ΔE(inputs) + ΔE(processes) + ΔE(products) + ΔE(wastes)

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IT DOESN'T MATTER WHAT YOU CALL YOUR INPUT…

- To calculate GHG intensity of an input in a project calculation…
- it **doesn't matter** what you call it (by-product, "co-product", product, "waste", "residue", intermediate product…)
- The important question is…
  "is the source **rigid or elastic** ?"…

Let's start with an example….

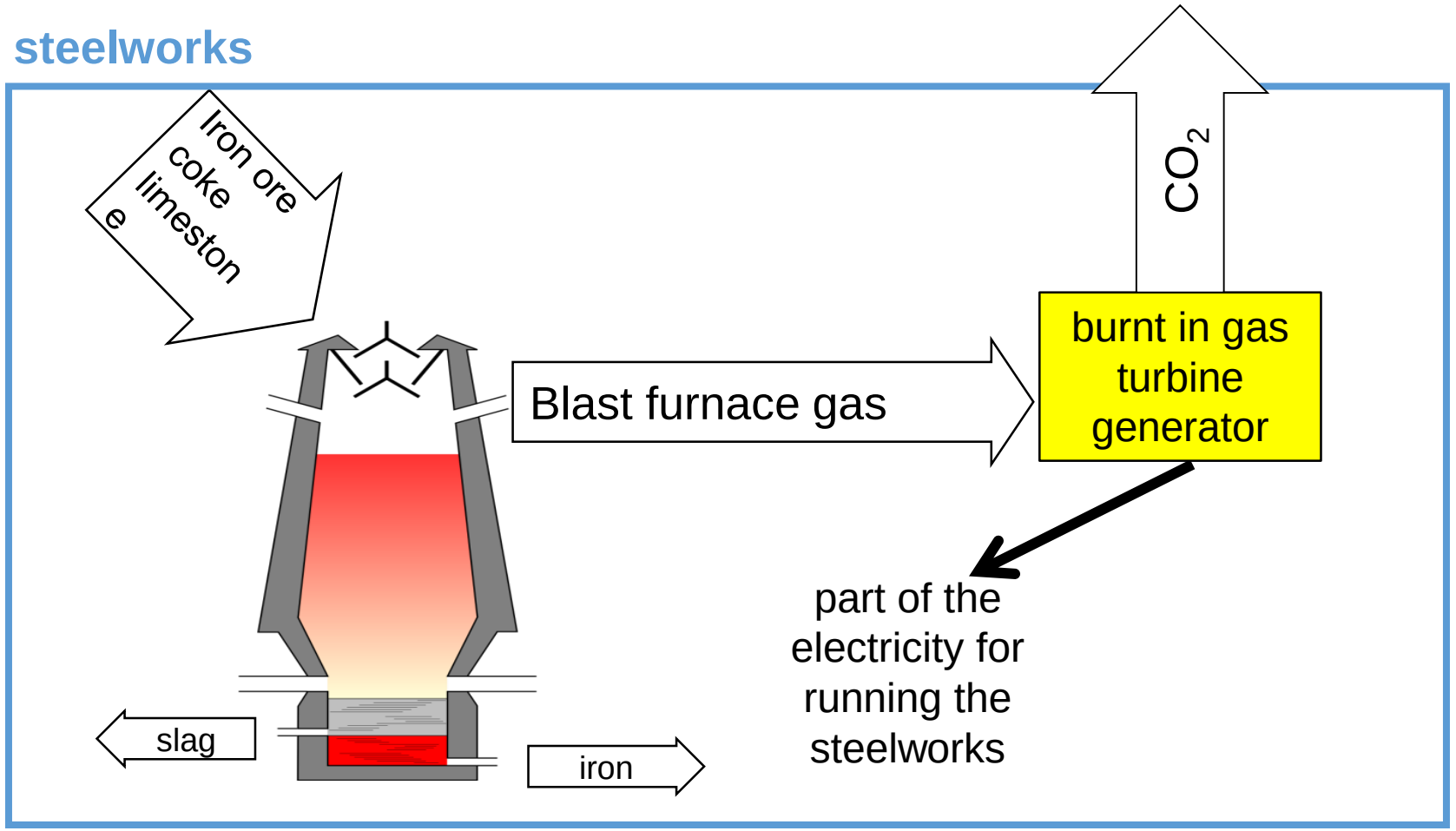
Is my input rigid or elastic?

Rigid when the supply is fixed

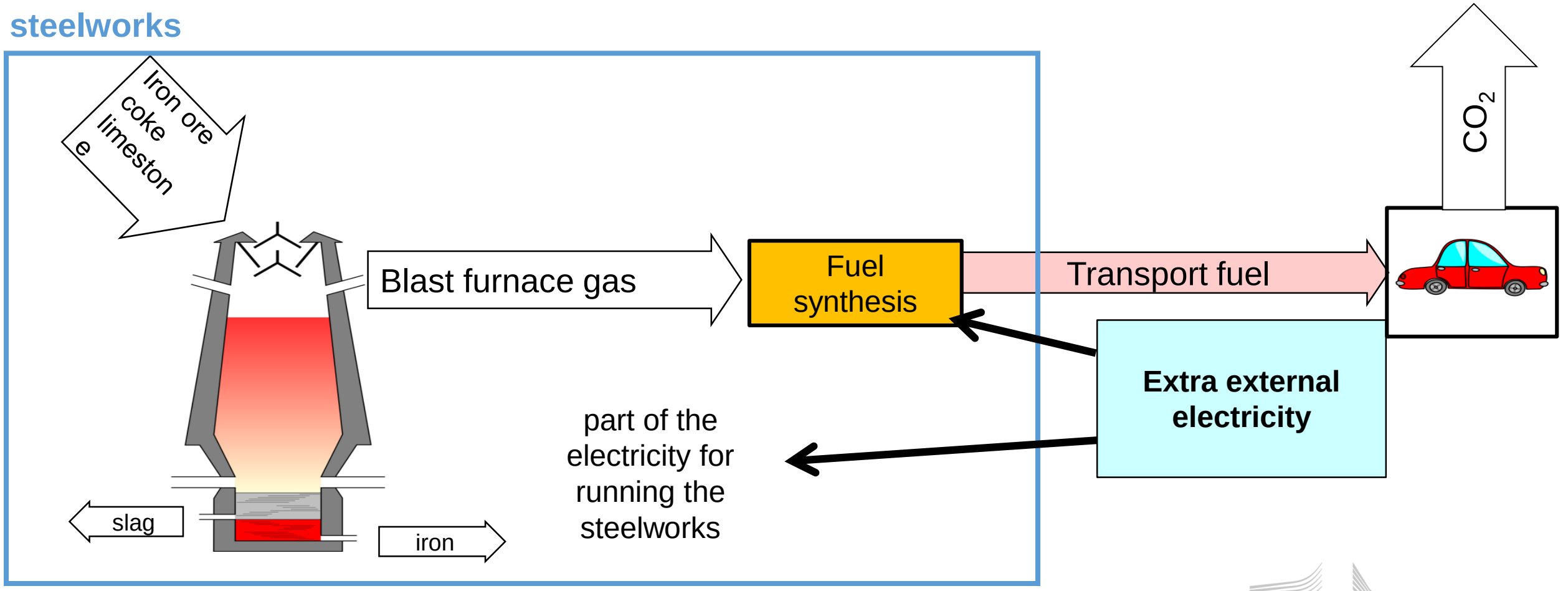
Elastic when the supply expands with increasing demand

EXAMPLE OF RIGID INPUT

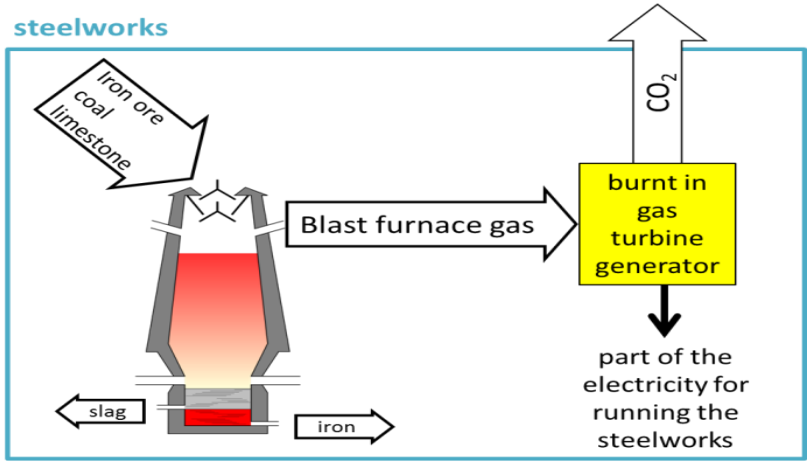
e.g. Blast furnace gas which is presently burnt to generate electricity for use inside the steelworks



(Diverted blast furnace gas) + electricity = transport gas



We only added external electricity…

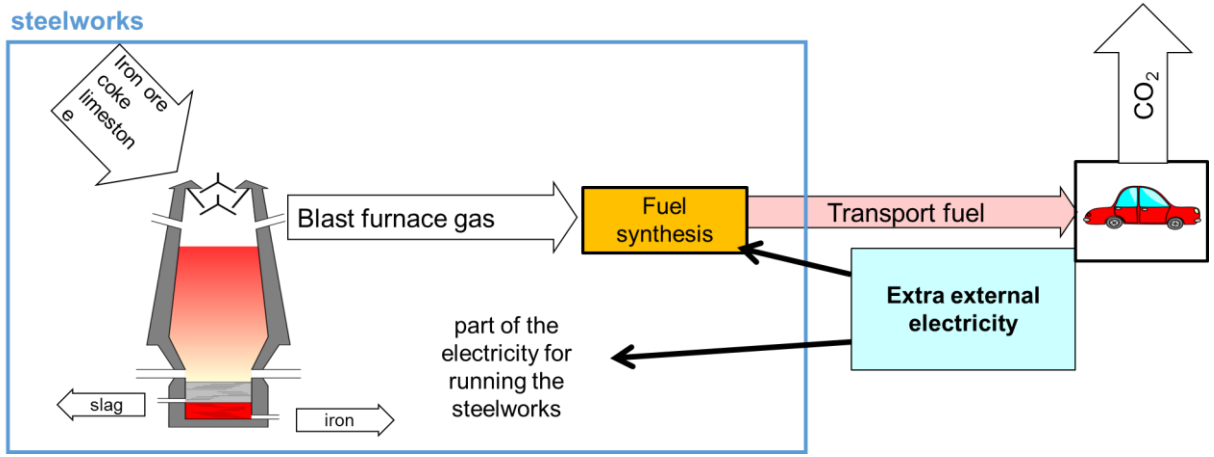


BEFORE

Emissions intensity of transport-fuel

=

Emissions from providing the extra external electricity



AFTER

Blast furnace gas is a **rigid** input.
Its emissions are the difference between its use “before” and “after”

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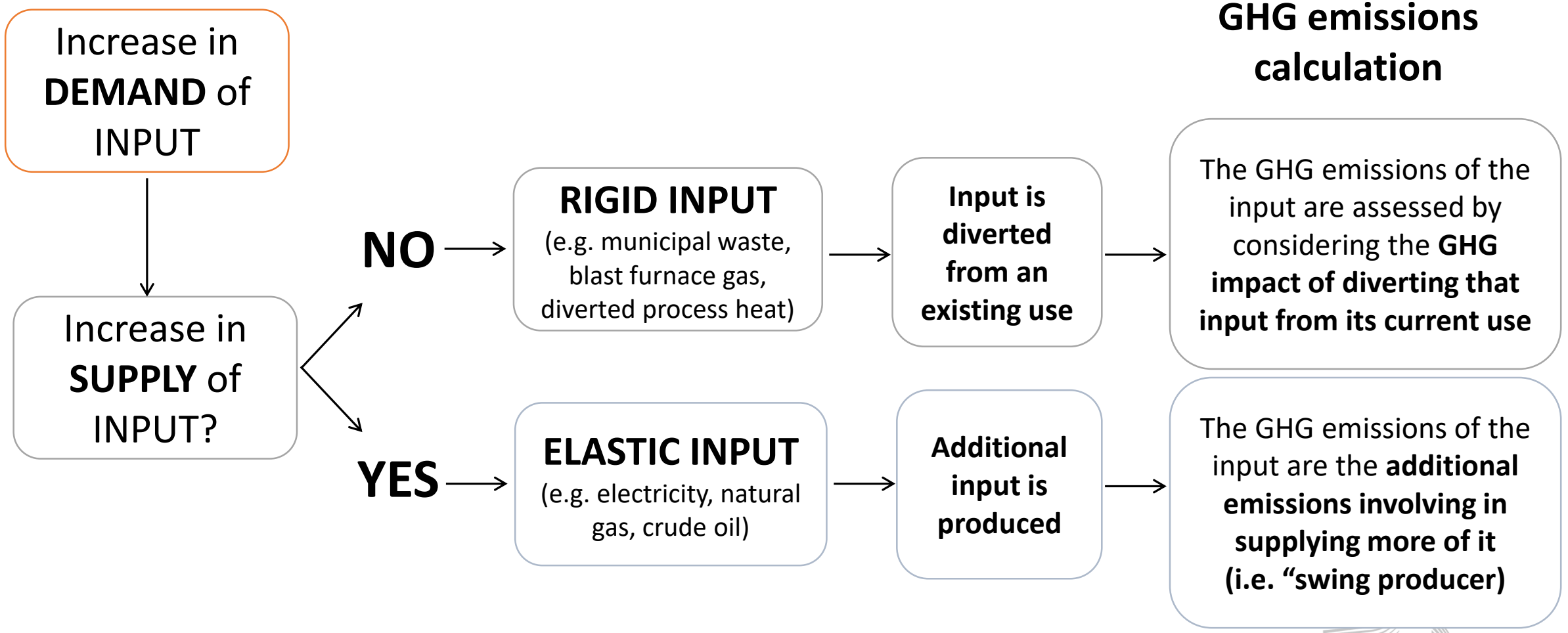
Rigid or elastic input?



Elastic or **rigid** input: where do we draw the line?

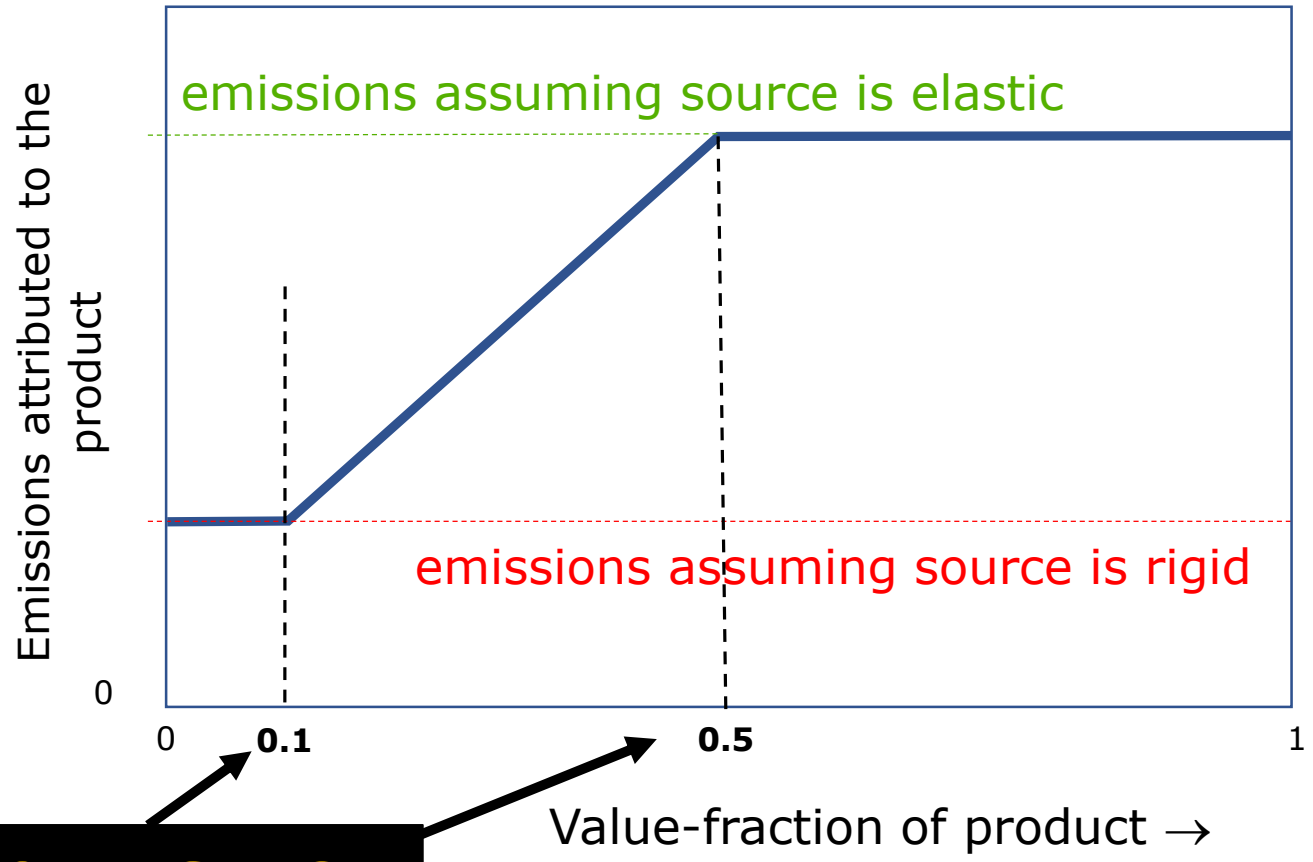
Most inputs are clearly either mostly elastic or rigid, but there are always borderline cases with co-products.

The parameter describing the elasticity of the supply of co-product "A" can be defined as the fraction *of A in the total value of the products of the process*.

A *sudden* transition from "rigid" to elastic" will give problems in borderline cases.

To avoid a sudden transition, but to keep most inputs either elastic or rigid, we envisage a "transition region".

Emissions for inputs in the transition region get a proportional mix of the rigid and elastic results.



Discussion: are 0.1 and 0.5 OK?

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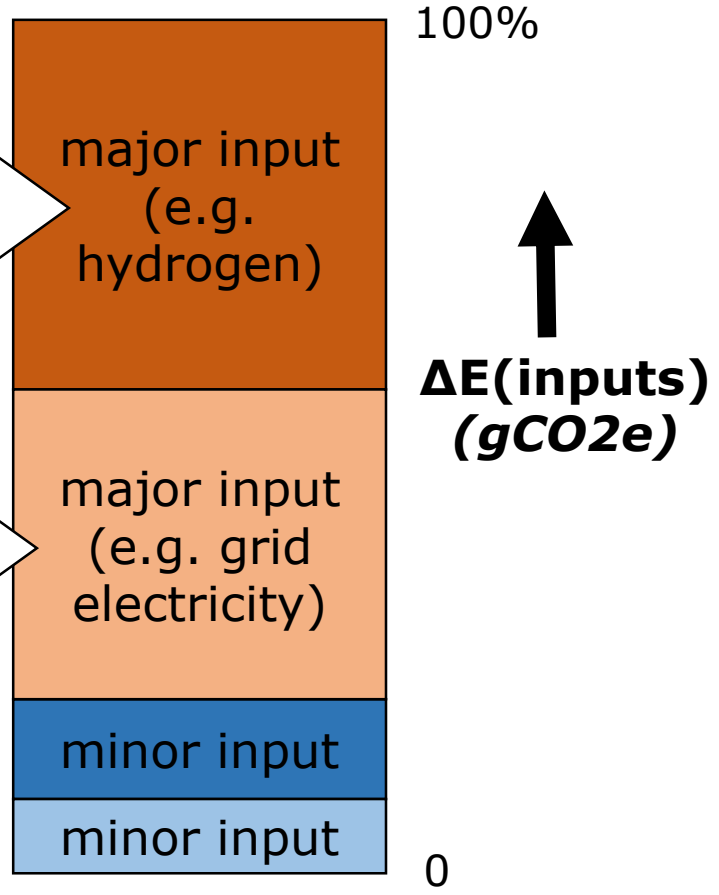
Simplification: “minor inputs”

Major inputs: dedicated calculation

(= include the source inside the system boundary)

Rules for electricity inputs

“standard values” (“activity factors”) for minor inputs

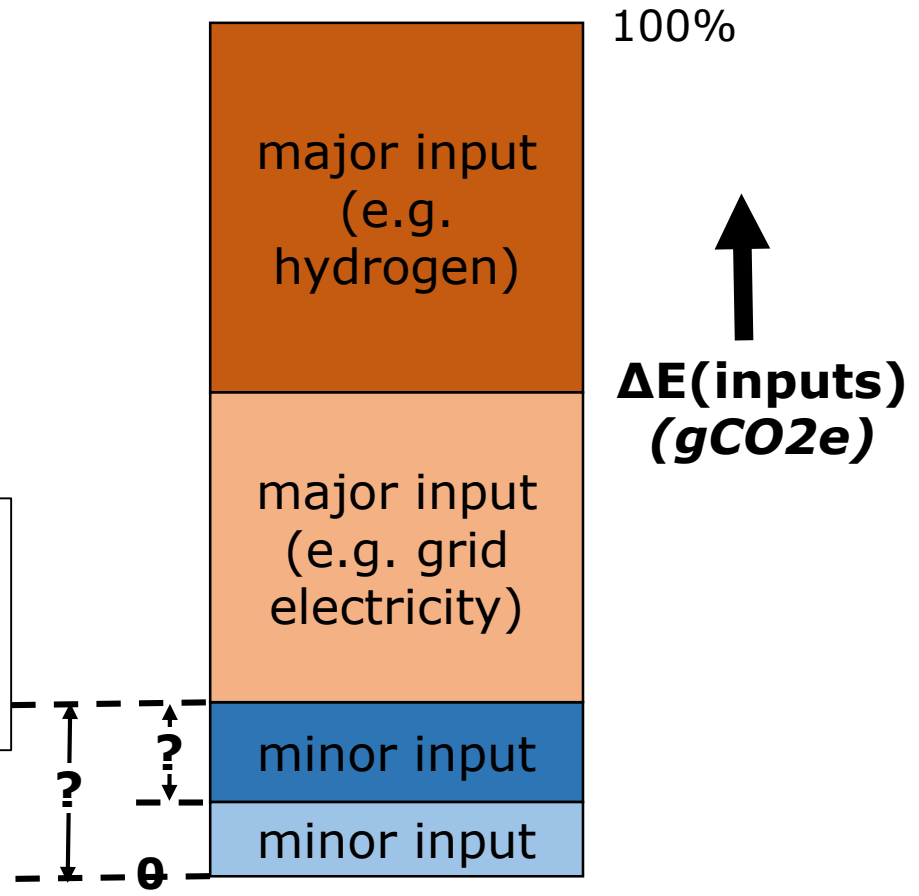


“Standard values”: hierarchy of data sources to avoid cherry-picking (annex 2.4 of discussion paper)

Discussion points: thresholds for “minor inputs”

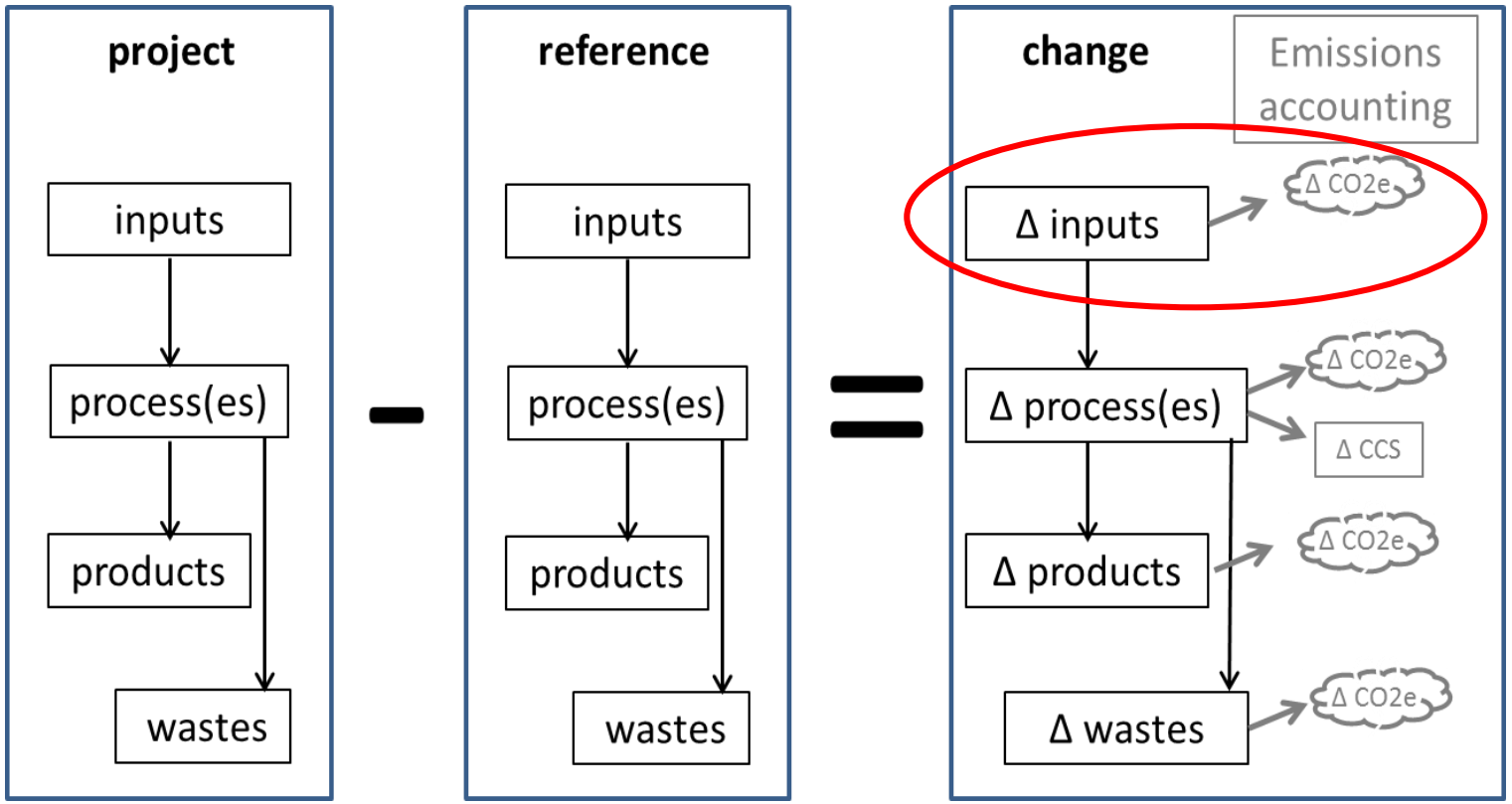
Should the thresholds for “minor inputs” be expressed *per input*?
….or as a *total for all minor inputs ?* (or both?)

What should the threshold(s) be?
e.g. 5% of ΔE(inputs)?



Sharing emissions between products used for inputs

If a major **input** comes from **another process** which has **multiple products**, we have to share the emissions between those different products.



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emissions PER UNIT OF PRODUCT : attribution

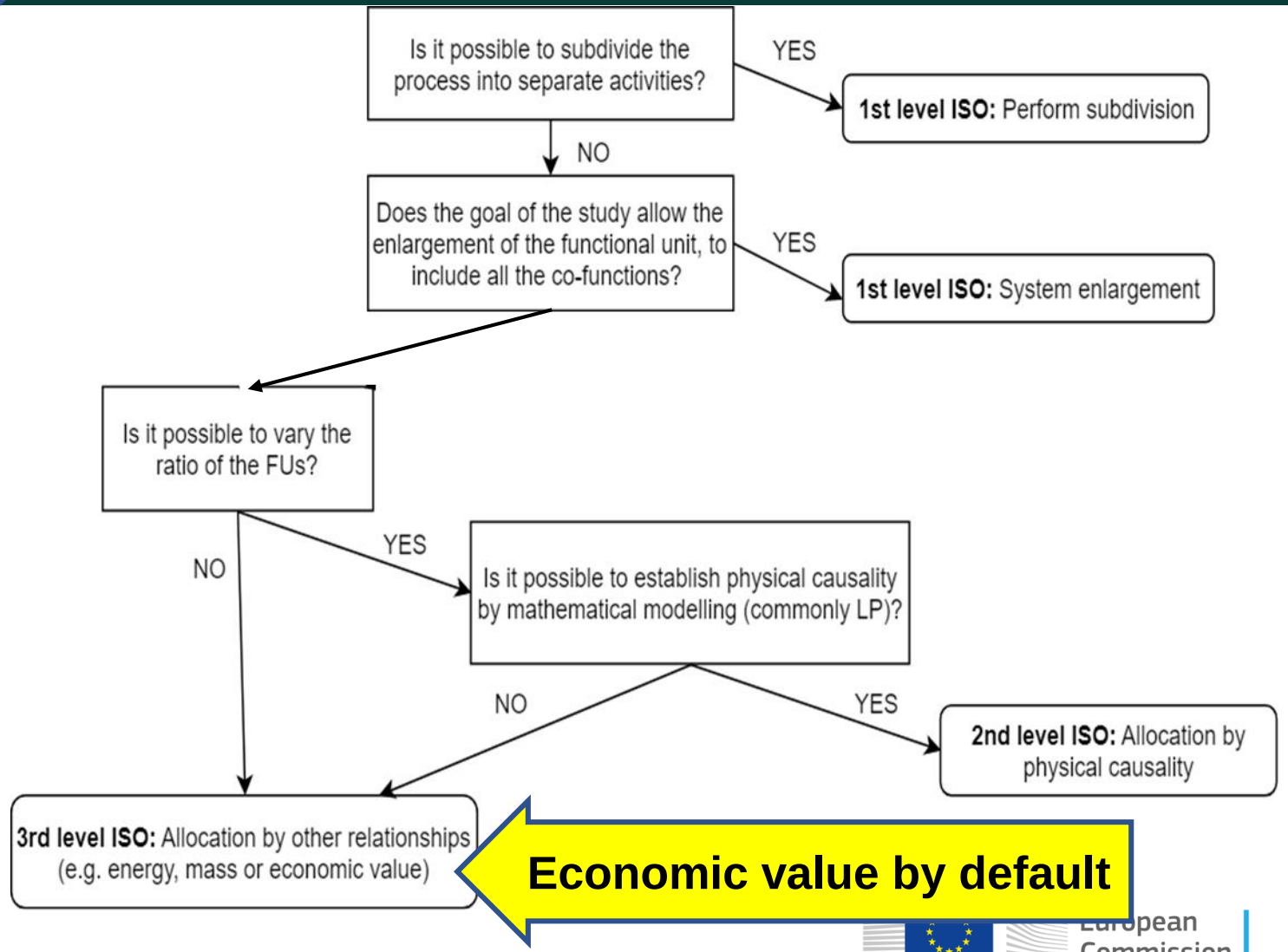
Our proposed scheme
(based on ISO for attributional LCA)

- Allocation applies to elastic products/inputs only

ISO 14041 deals with it correctly but is very often misinterpreted.

Main problem in the literature:

- To use allocation by a physical property (e.g. energy content), you must prove a causal connection between emissions and that property!
- At the moment practitioners often choose one or two arbitrary allocation keys that are easy to measure or give them the result they want. This is malpractice.
- Allocation at 3rd ISO level must be by economic value unless there is a very good excuse.



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3. ELECTRICITY AS AN INPUT

3.1 "Renewable" electricity

3.2 "Other" electricity

3.3 "**Timed**" grid electricity

3.1 "Renewable" Electricity as an input

- If it's already counted towards renewable electricity targets, you are just diverting it from other users.

➢So its GHG intensity is that of the extra grid electricity that replaces the diverted RE

> i.e. you don't save emissions by diverting renewable electricity from other users.

- But if the RE is **additional** to what would have been consumed anyway:

  e.g. curtailed wind electricity,

  …or a wind farm that is not grid connected,

➢…its GHG intensity is really that of the renewable source

Criteria in RED2
for additionality of renewable electricity

Grid-connected electricity is counted as renewable only if …

- it does not count towards national RE targets
- the RE installation is additional and part of the project
- it is only used when the RE installation is producing that electricity
- it does not contribute to grid congestion

- More work needed to **develop schemes** to ensure this (PPAs etc.).

3.2 OTHER electricity (i.e. not additional RE)

Discussion:

e.g. Continuous (or random) use of electricity:

The problem:

- If we choose EU-mix emissions, we could end up financing some projects (in high-emission countries) that do not save GHG emissions.
- But choosing national grid emissions could lead to wasting valuable dam-hydro capacity which will be needed as backup in future to allow more wind and solar in Europe, without power cuts.
  - Furthermore, backup use (instead of fossil) saves >7 times more emissions than e.g. making electrofuel!

- So here is a pragmatic suggestion:

Use the average of (EU-mix and national) emissions

(other possibilities to consider: marginal emissions, marginal residual emissions…)

We should consider the emissions for electricity CONSUMPTION (not just the power station CO_2)

- Consumption emissions include:
  - upstream emissions for supplying the fuel
  - transmission losses
  - accounting for power station own-use and heat export
  - accounting for **trade** of electricity

JRC already calculated these data for Member States using 2015 (IEA 2017) input data; can be updated with new data.

Projecting future electricity emissions

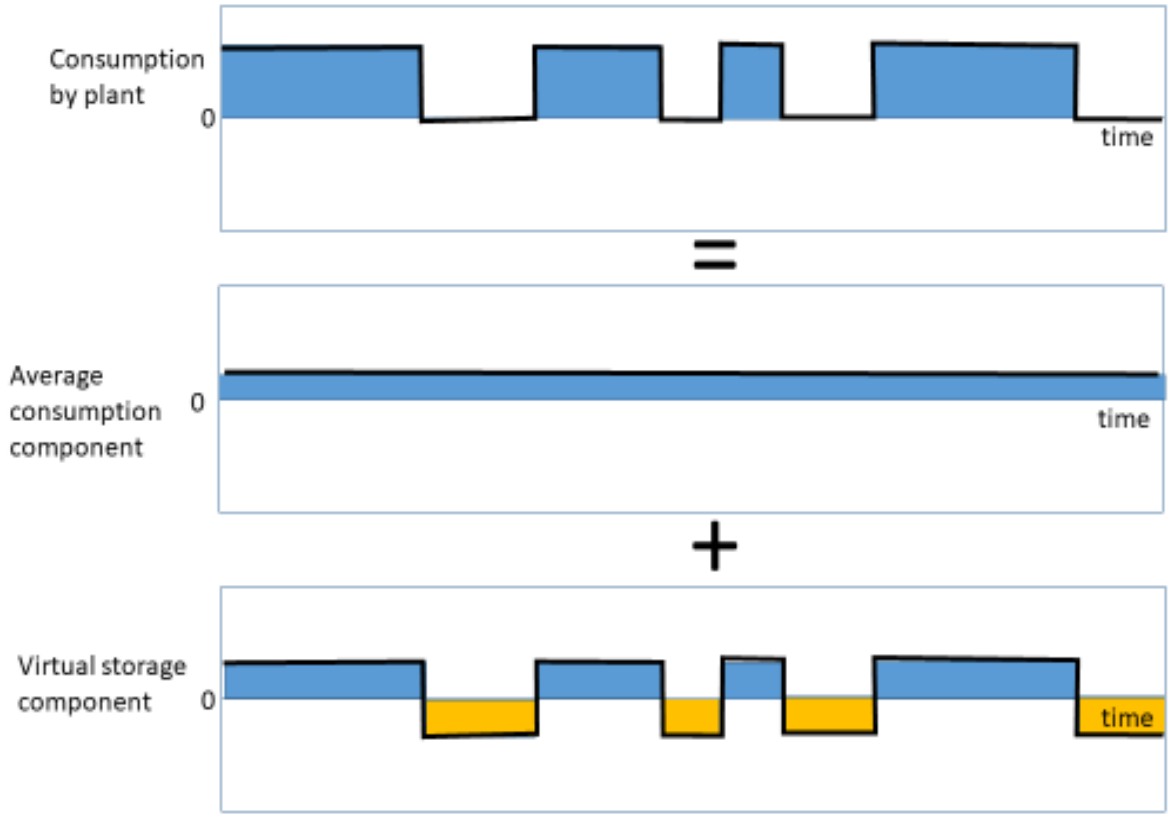
We need to estimate emissions saved by FUTURE operation of a project

We suggest % “improvement factors” per member state based on

EU’s *Clean energy for all Europeans* package, and the *National Energy and Climate Plans* (NECPs)

3.3 “Timed” electricity consumption: only use it when grid emissions are low

- e.g. an electrolysis part of an electrofuels plant can be operated part-time, and the H2 stored.
- The resulting GHG benefit can be calculated by resolving the electricity demand into 2 components:



…so we just combine the rules for continuous grid electricity and electricity storage*

*see ICF/ Fraunhofer presentation

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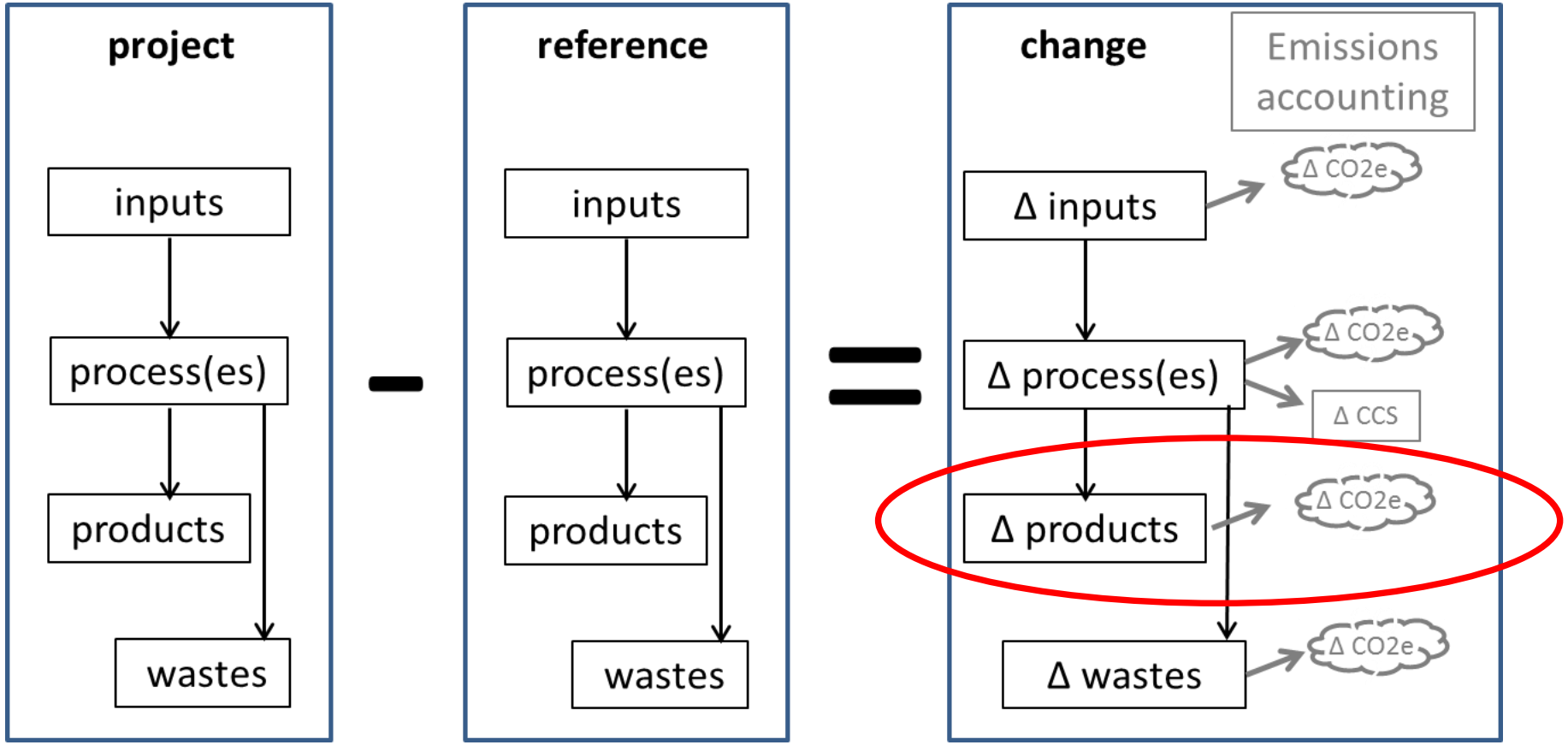
4. Accounting for savings in the usage phase…

- Some projects get emissions savings from the **use phase**
  - Some projects have GHG effects (also) in the use phase
  - e.g. H_2 cars, alternative refrigerants, production of components for RE and energy storage, better plastic for thinner bottles…

…considering both zero tailpipe emissions and better fuel efficiency compared to petrol.

GHG savings in the usage phase fit under Δ(emissions of products)



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Break-out sessions: main points from discussions

REFERENCE SCENARIO SUGGESTION

1. Reference scenario:

Suggestion was:

- *New plants vs. ETS benchmark (if it exists)*
- *Modified plants vs. existing plant, as long as modified plant reaches ETS benchmark*

Discussion:

- "You need to make rules where the reference scenario is built up from ETS benchmarks and others"
- "But that favours modifying plants over building new ones"
- e.g. making fuel in a steel works: "It should be the product emissions that are compared to the conventional way of making fuel, not the whole steel plant"

RULES FOR INPUTS

INPUTS

If the supply of an input is **fixed**, you must look at the emissions saved in its existing use.

RENEWABLE ELECTRICITY AS INPUT

RED2 rules: for electricity to be "renewable", it must be **additional renewable** electricity: otherwise you are just diverting it from another user.

Discussion:

"More demand for Guarantees of Origin will stimulate more RE investment"

" I think we should be able to use renewable electricity in any member state: it's not our responsibility to supply the grid infrastructure"

RULES FOR INPUTS

GRID ELECTRICITY AS AN INPUT

We suggested using an average of national and EU-mix grid emissions for continuous/random use of electricity.

This is to allow the future decarbonized EU grid to use the full variable output of hydroelectricity to prevent power cuts when the wind stops blowing. That saves >7 times more emissions than using it for making gasoline.

Discussion:

"The grid is not perfect: we cannot even get all the hydropower out from one part of Norway to the rest of the country"

The END

Any questions?

robert.edwards(at)ec.europa.eu

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