Assessing the negative emission potential of CCU with LCA

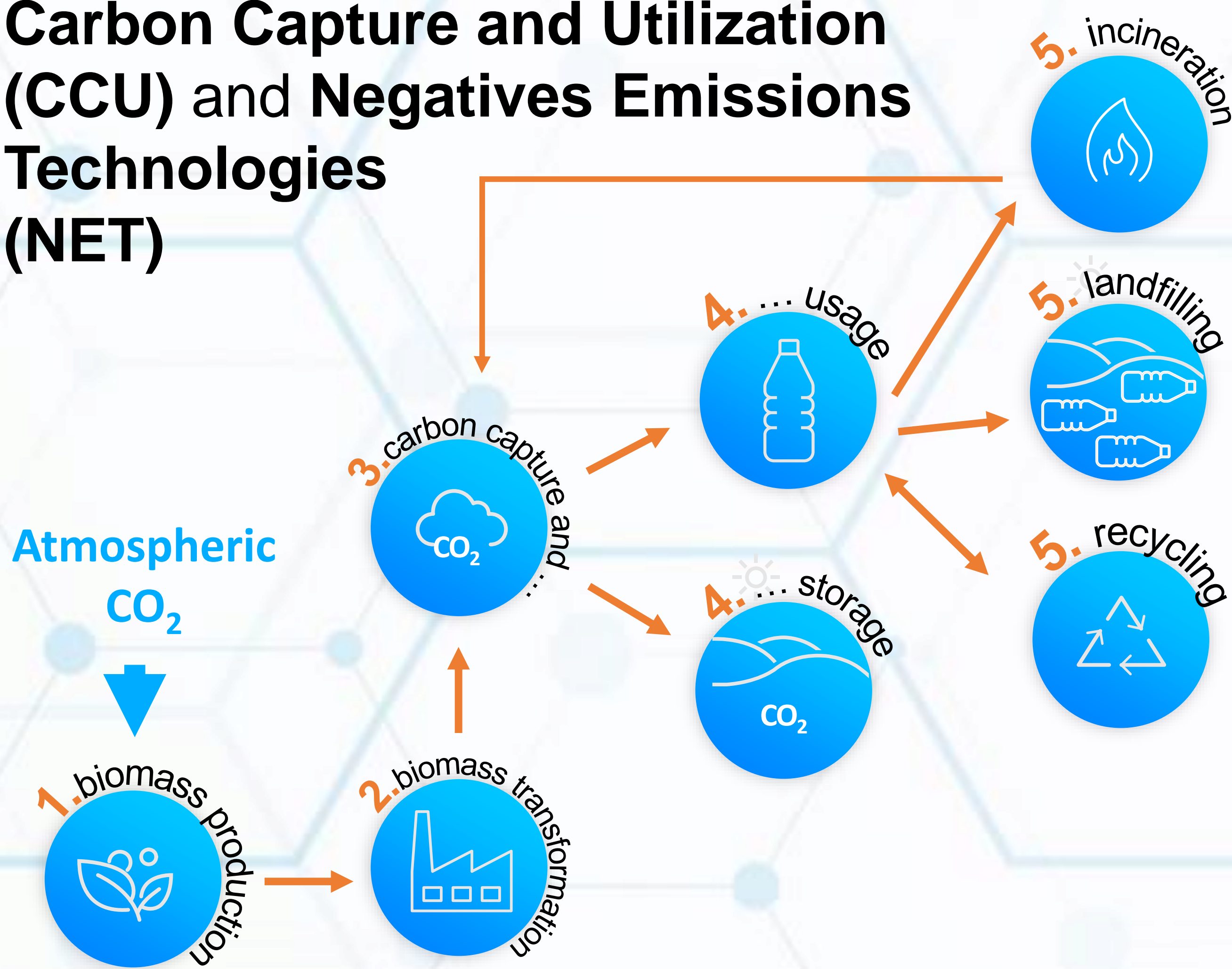Sibylle Duval--Dachary, IFPEN - INRAE

Example of systems combining **Carbon Capture and Utilization (CCU)** and **Negatives Emissions Technologies (NET)**

1. Environmental benefits are not guaranteed.

Processes, like biomass growth or CO_2 capture, consume energy and chemicals that may:
- offset the benefit of the CO_2 capture,
- be responsible of other impacts (ex: acidification).

2. Life Cycle Assessment (LCA) guidelines, specific to CCU+NET systems, are necessary.

LCA is a standardized multicriteria tool (ISO 14040-44). Specific guidelines are needed to:
- harmonize LCAs on CCU + NET systems to facilitate comparison between studies,
- integrate relevant new developments in the methodology.

3. What are the methodological challenges in applying LCA to a CCU +NET system?

3.1 Choosing the reference system. In LCA, the results are always interpreted in relation to either the total impact (contributions) or to another system. The choice of the reference system is not easy due to numerous possibilities and time variability.

3.2 Using Dynamic LCA: more precise but more complex than static LCA. And will it really change comparison conclusions?

Fig. d: Illustration of Dynamic LCA principle:
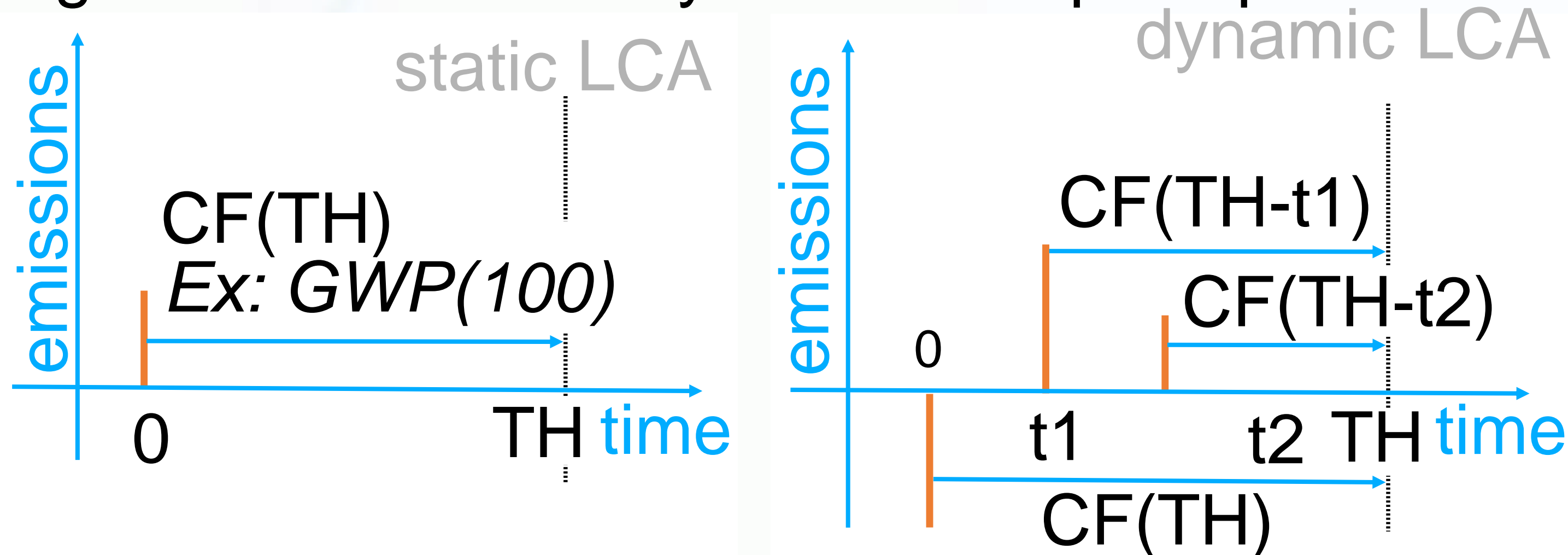
Calculation of the impact (I) for a chosen time horizon (TH):

$I = \sum$ emission*characterization factors (CF)

3.3 Shifting from the carbon neutrality assumption to a full accounting of biogenic carbon. This means being able to model the CO_2 captured during biomass growth.
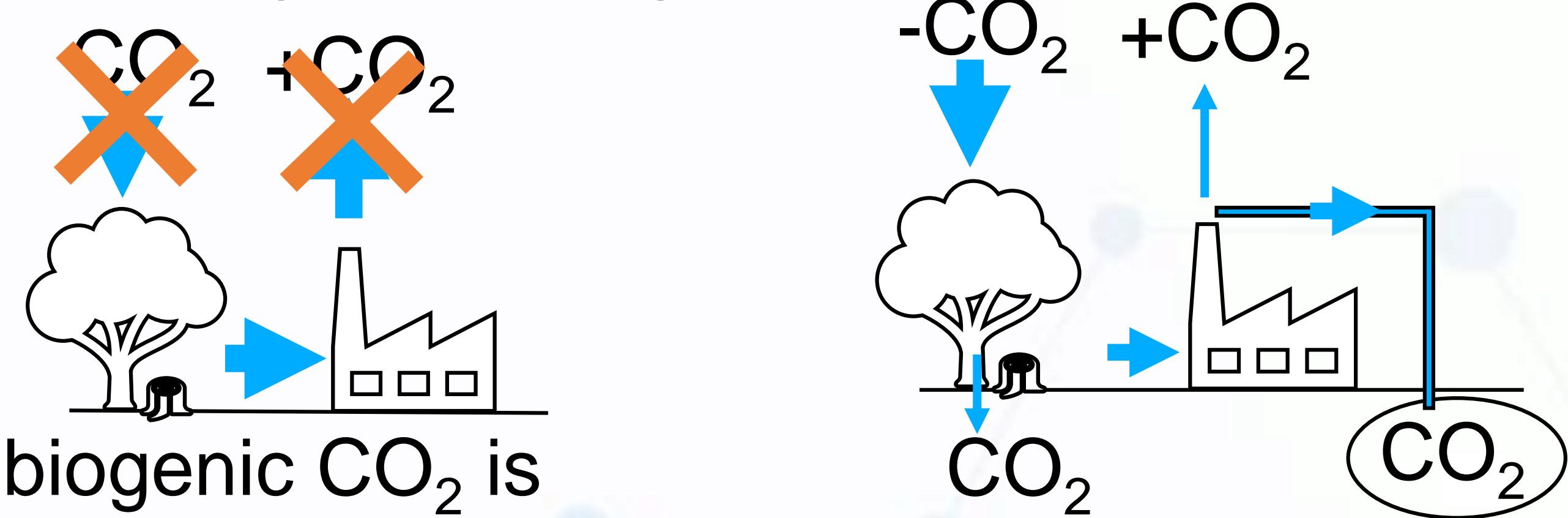

Fig. a: biogenic CO_2 is assumed to have no effect on climate change

Fig. b: full accounting

3.4 Choosing the impact assessment method for climate change (CC).

Default method: global warming potential at a TH of 100 year (GWP100).

Use global temperature potential (GTP) for multiple TH instead? enables to visualize three components of CC, see Fig. c
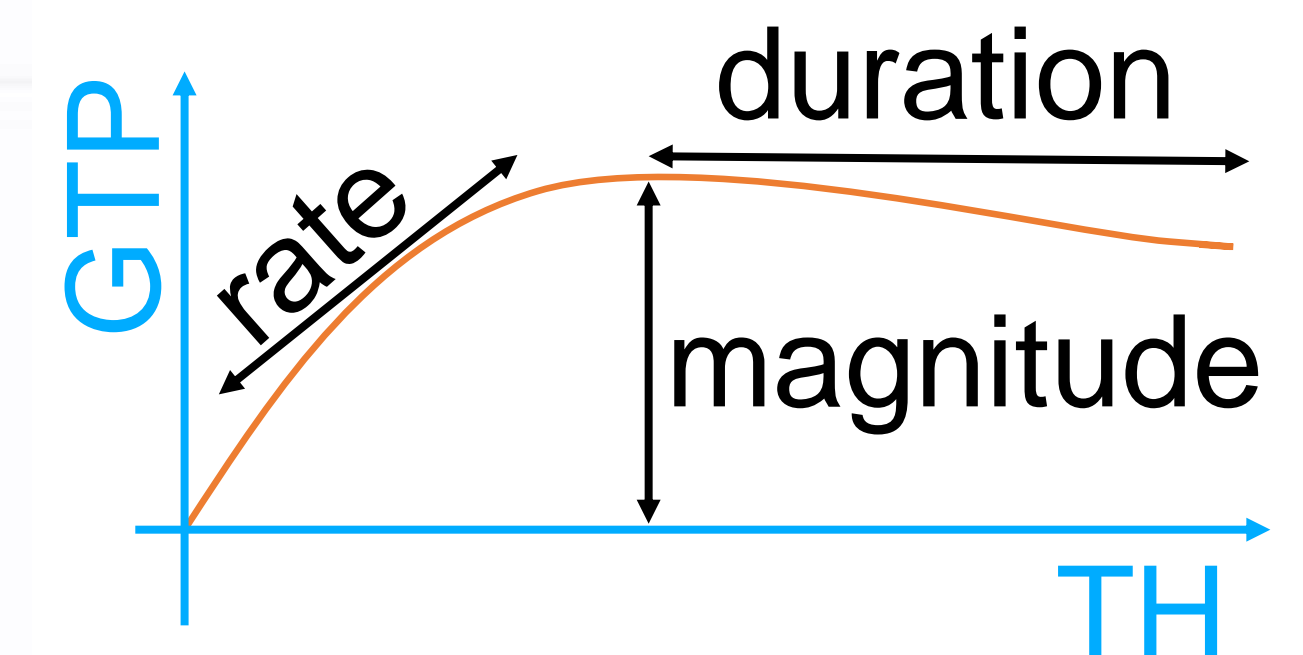

Fig.c: 3 components of CC

TAKE-HOME MESSAGE

LCA methodology is explored and further developed to provide guidance for assessing the negative emission potential of CCU