

Carbon Utilization Infrastructure, Markets, Research and Development: Primary Commodity Chemicals

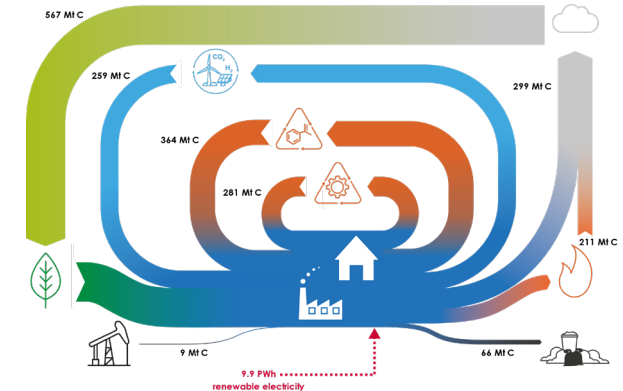
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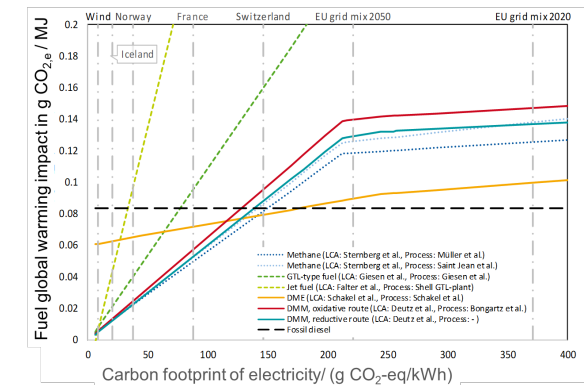


Key messages on CO₂ use for Commodity Chemicals

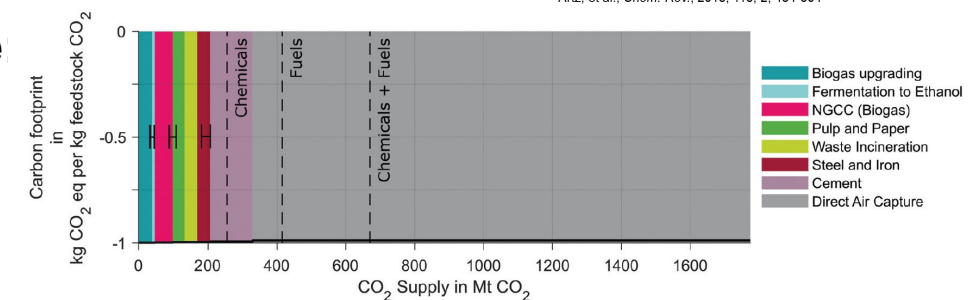
- **GHG of chemicals and plastics are usually underestimated**
major driver for global oil demand
fossil-based growth projected to 4.7 GtCO_{2e} over the full life cycle in 2050
- **CO₂ utilization can enable carbon-neutral chemicals**
as circular carbon jointly with biomass and recycling
while also reducing the impact on other planetary boundaries
- **CO₂ utilization requires clean energy**
grid projections for 2040 often not sufficient for breakeven
- **Explore CO₂ sources of the future beyond direct air capture**
bio-economy, waste incineration, cement



Meys et al., *Science*, 2021

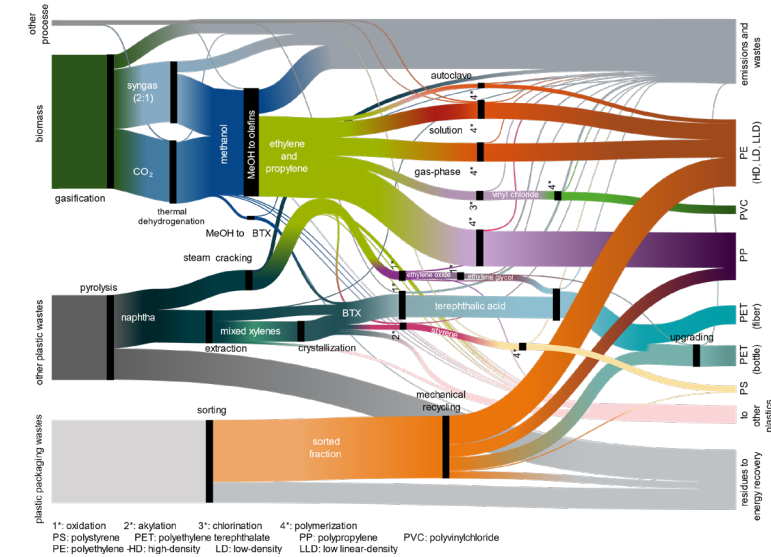


Artz, et al., *Chem. Rev.*, 2018, 118, 2, 434-504

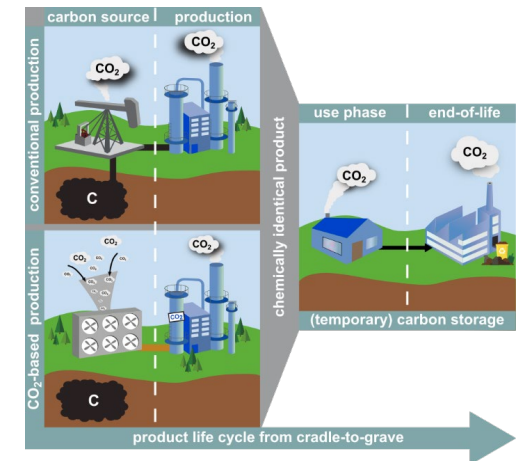


Key messages on CO₂ use for Commodity Chemicals

- **Syngas and methanol as commodities** for CO₂ use
- and other sustainable carbon sources
high TRL, needing demonstration & supply chain development
- **Direct routes to higher-value chemicals promising**
to reduce resource need & environmental impacts
- but are at lower TRL, needing R&D
- **Exploit synergies** with fuels, CCS infrastructure and bio-economy
- Establish **regulatory and financial support** basis:
 - Proper carbon accounting and targets based on life-cycle assessment
 - Standards for recycled carbon



Meys et al., *Science*, 2021



Kätelhön et al., *PNAS*, 2019