

Carbon footprint reduction in PtX systems

While electric energy for the coming decades will still be partly generated from fossil sources, improvements in system efficiency and productivity of grid connected PtX systems will continue to be of high priority; both to reduce LCoH₂ and to reduce the carbon footprint from the systems.

Besides documenting actual footprints, system operators may be requested to put up improvement targets and validate improvements. This gives rise to at least 3 research questions:

1. How can you track the equivalent CO₂ emissions from your PtX system
2. How can you minimize the CO₂ footprint
3. How can you validate the improvements made

Ad 1) To address the first research question, you may need to develop means to adequately account for the accumulated CO₂ load, e.g. based on real time information on the CO₂ content in the electric energy supply.

Ad 2) The second research question is comprehensive. A starting point for efficiency and productivity improvements will be adequate system understanding and modeling supported by data collection and state monitoring at system and sub-system levels tracking energy loss and operation inefficiencies. It is the expectation that basically all key sub-systems can contribute to the improvements. This includes electrolyzer stacks, power converters, electrical and thermal energy storages, balance of plant equipment, system and sub-system level controls and more.

Ad 3) The third research question, which is relevant when requested to document/prove results of improvements, may be straight forward for PtX system operators (in relation to scope 2 emission target commitments) but much more of a challenge for component and subsystem suppliers to the PtX systems (in relation to their scope 3 emission targets). Here detailed information on baseline performance should be tracked and compared with results with improvements implemented at relevant sub-system level.

Actual validation of improvements and monitoring methods should take place in full scale demonstration plants with sector coupling.