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A Stepwise Methodological Framework for Enhancing Comparability in Life Cycle Assessment of CO_2 Adsorption in Hard-to-Abate Industries

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Introduction

CO_2 adsorption is one of the most promising decarbonization method for hard-to-abate industries, but the comparability and credibility of life cycle assessment remains insufficiently evaluated.

Fig. 1. Research question in this work.

Methodology

This study followed the process in Fig. 2 to screen out 31 cases, summarize their commonalities and differences, and build a stepwise enhancement framework to meet the ideal LCA methodology.

Fig. 2. The process of conducting a literature review and developing an enhanced framework.

Results

Fig. 3 shows the condensed hierarchical structure of comparable CO_2 adsorption, which can be divided into five levels and seven sub-categories to help more clearly present the positioning of comparable objects in the entire system.

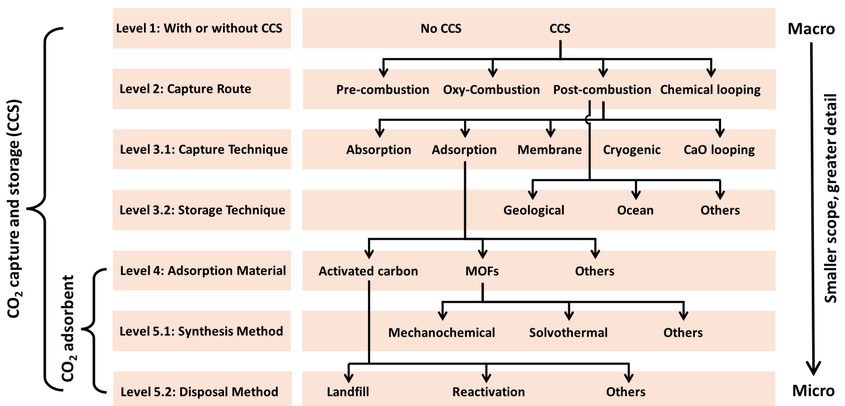

Fig. 3. A hierarchical framework of comparative LCA for CO_2 adsorption.

Fig. 4 shows the matching relationship between the system boundary and the technical process chain of CO_2 adsorption, which helps to ensure the comparability of LCA from the physical process.

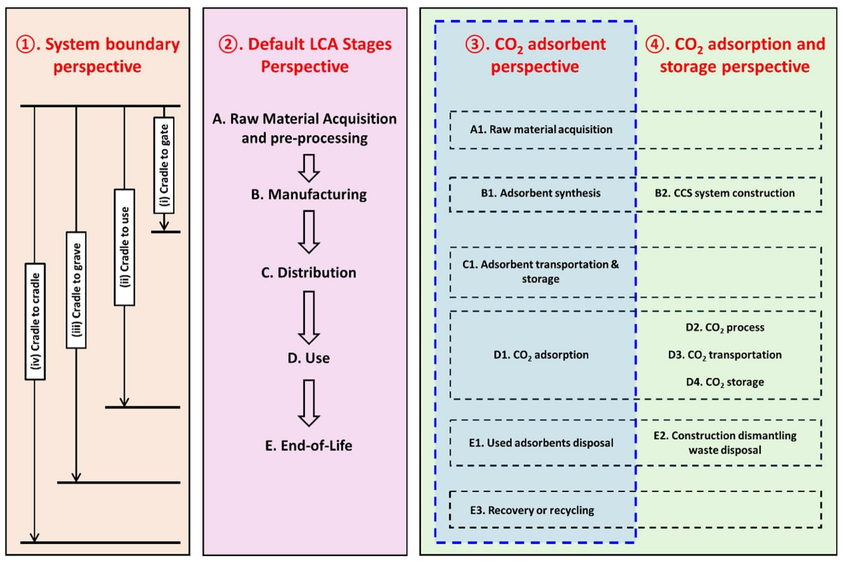

Fig. 4. A schematic diagram showing the system boundary, LCA stage and technological process chain

Conclusion

Barriers to comparability in existing LCA methodologies are identified. Fig. 5 shows the hierarchical improvement framework consist of three levels based on required additional effort levels — minor, moderate, and major efforts, could enhance the comparability of LCA.

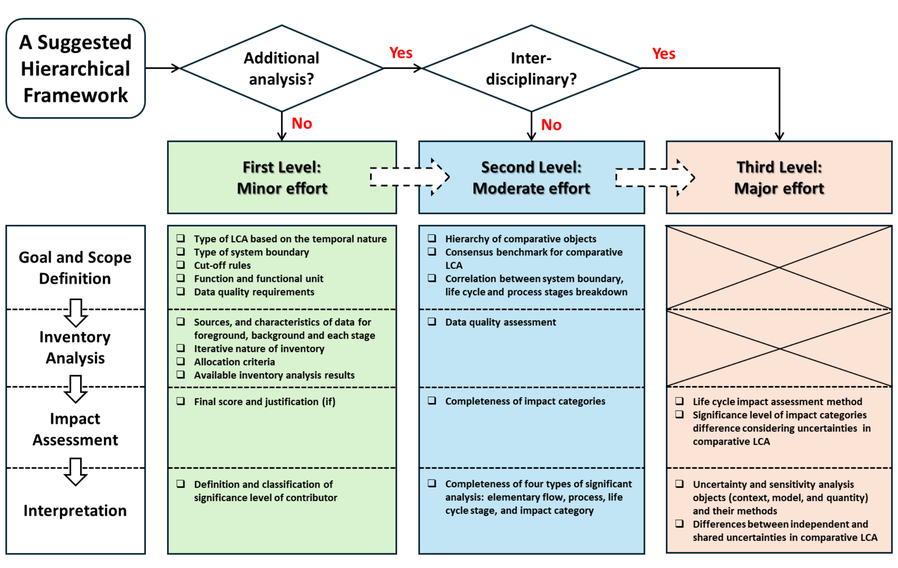

Fig. 5. A hierarchical methodological framework to enhance the LCA comparability for CO_2 adsorption.

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