

Lessons Learned from the JIE Special Issue on the LCA of Emerging Technologies



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Motivation

While the fundamental approach to conducting an LCA of emerging technologies is akin to that of LCA of existing technologies, emerging technologies pose additional challenges. Despite the growing interest in applying LCA at early stages of technology development, there is a lack of systematic guidance for LCA practitioners to evaluate emerging technologies.

Our History of Discourse

- ISSST, ACLCA conferences – special sessions for the past three years
- Expert workshop in Banff, Canada in 2017

The Special Issue

The purpose of the special issue was to begin a dialogue within the research community about the research needs related to the LCA of emerging technologies, to reflect on what has been accomplished to date in this area, and to propose the concept of working as a community to continue to articulate these insights and methodological advancements to better serve the community.

- 19 research papers (and 2 additional came in after the launch)
- 2 foundational, 2 advancing methods, the rest primarily case studies (in novel materials, transportation, infrastructure, energy)

New Research Network: LCA of Emerging Technologies



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METHODS, TOOLS, AND SOFTWARE

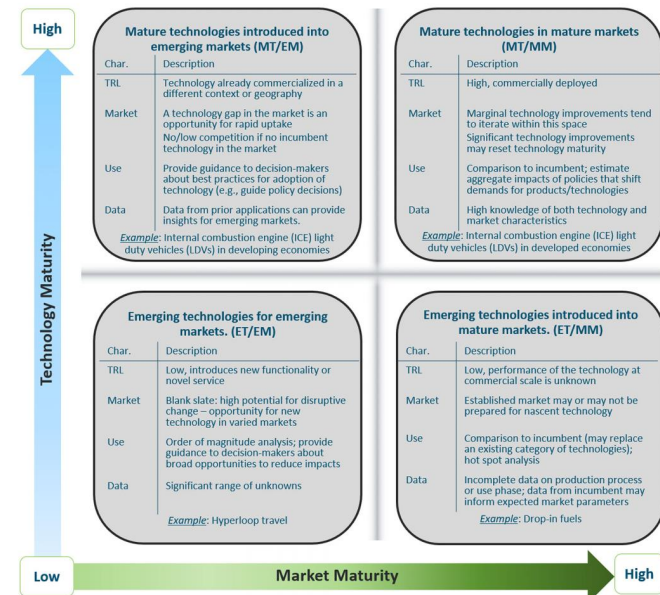


Life cycle assessment of emerging technologies

Evaluation techniques at different stages of market and technical maturity

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Wiley JIE: Top Downloaded Paper 2018-2019





High

Mature technologies introduced into emerging markets (MT/EM)

Char.	Description
TRL	Technology already commercialized in a different context or geography
Market	A technology gap in the market is an opportunity for rapid uptake No/low competition if no incumbent technology in the market
Use	Provide guidance to decision-makers about best practices for adoption of technology (e.g., guide policy decisions)
Data	Data from prior applications can provide insights for emerging markets.

Example: Internal combustion engine (ICE) light duty vehicles (LDVs) in developing economies

Mature technologies in mature markets (MT/MM)

Char.	Description
TRL	High, commercially deployed
Market	Marginal technology improvements tend to iterate within this space Significant technology improvements may reset technology maturity
Use	Comparison to incumbent; estimate aggregate impacts of policies that shift demands for products/technologies
Data	High knowledge of both technology and market characteristics

Example: Internal combustion engine (ICE) light duty vehicles (LDVs) in developed economies

Emerging technologies for emerging markets. (ET/EM)

Char.	Description
TRL	Low, introduces new functionality or novel service
Market	Blank slate: high potential for disruptive change – opportunity for new technology in varied markets
Use	Order of magnitude analysis; provide guidance to decision-makers about broad opportunities to reduce impacts
Data	Significant range of unknowns

Example: Hyperloop travel

Emerging technologies introduced into mature markets. (ET/MM)

Char.	Description
TRL	Low, performance of the technology at commercial scale is unknown
Market	Established market may or may not be prepared for nascent technology
Use	Comparison to incumbent (may replace an existing category of technologies); hot spot analysis
Data	Incomplete data on production process or use phase; data from incumbent may inform expected market parameters

Example: Drop-in fuels

Technology Maturity

Low

Market Maturity

High

Key Messages

- Growing interest from the LCA community
- However, we still struggle some fundamental issues
 - Terminology!
 - More focus on case studies rather than advancements or reflections on methods
 - Divergence in perspectives on methods
 - Isn't this just good LCA?
 - How to
 - Biggest issues identified:
 - This stage coincides with the least available data, greatest uncertainty and a paucity of analytic tools for addressing these challenges
 - Engagement with stakeholders and communication

Next Steps

- Working to formalize the research network (e.g., NSF RCN grant proposal)
- A paper focused on early-stage technology opportunities and challenges
- A paper focused on a more harmonized connection between LCA and TEA
- An opportunity to connect discourse in NA and Europe?



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Thank you!

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