TATA STEEL

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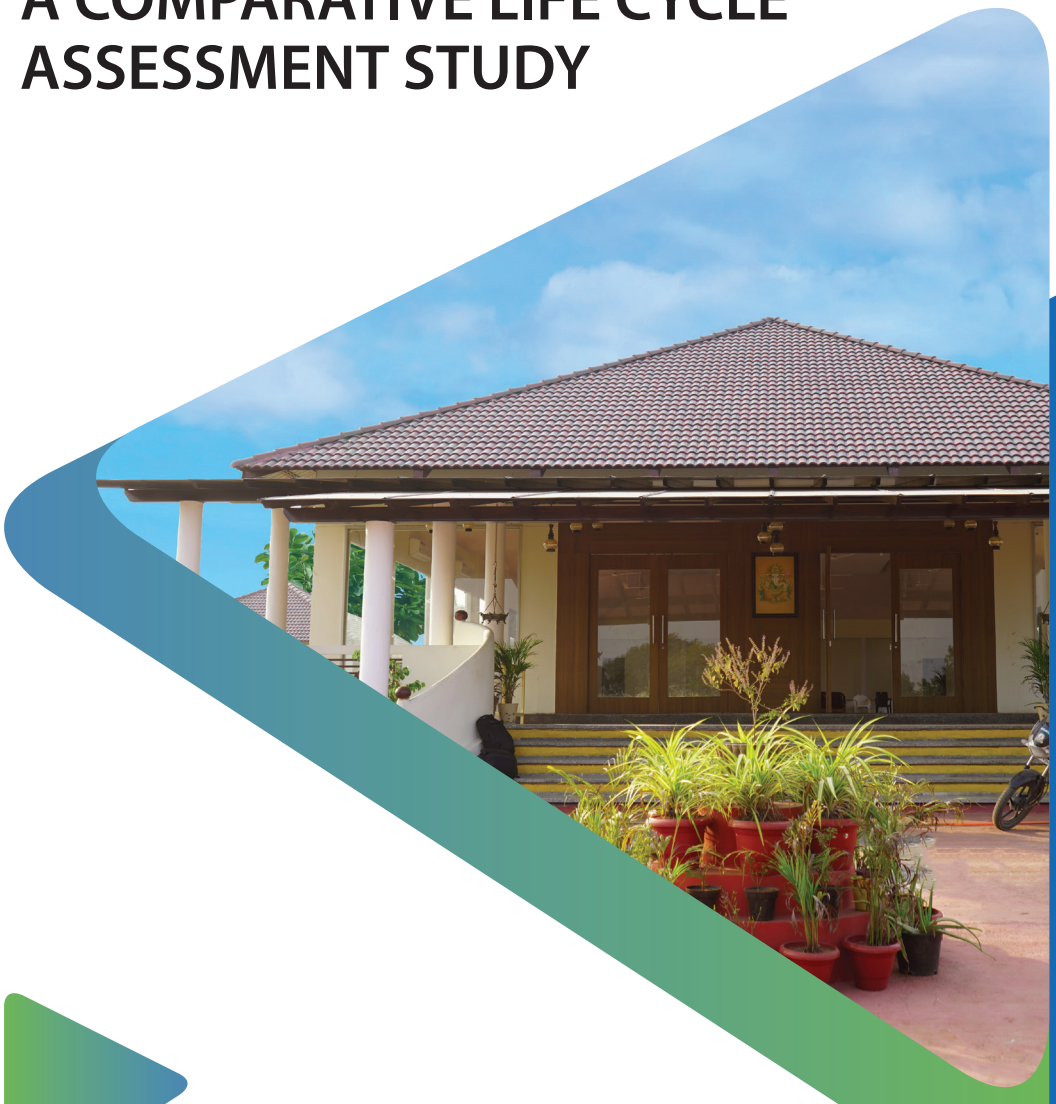
habinest
A Tata Steel Construction Solution

HABINEST & CONVENTIONAL BUILDING:

A COMPARATIVE LIFE CYCLE ASSESSMENT STUDY



WHAT IS LIFE CYCLE ASSESSMENT (LCA)?

LCA is a holistic way of accounting the environmental impact of a product considering the entire life cycle stages of the product thus avoiding any shifting of impacts between life cycle stages.

LCA studies are guided by ISO 14040 & 44 and involves a complete list of inventory flows in each stage that includes materials, energy, wastes, emissions, etc.

Objective of this Study

Quantify the life cycle environmental impacts of a HabiNest structure and compare it with a conventional structure of similar size and application.

Identify if HabiNest is an environmentally preferable solution as compared to conventional structure.

Study's Scope

Cradle to Grave (Raw Material production + Transportation of Raw Materials + Construction + End of Life).

Study excludes the "Use-Phase" operational impact of both the structures but considers end of life impact.

Key Findings

HabiNest offers significant environmental savings when compared with a similar size conventional structure, these savings are equivalent to:

GHG savings which are equivalent to 3 lakh kms of distance not driven by an average passenger car or 40,000 kg of coal not getting burned.*

Savings in Primary Energy Demand which are equivalent to saving 68,086 units of electricity in India.**

* Source: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator
** Source: GaBi database -1 unit of India Grid Mix electricity has PED of 13.25 MJ
Cover Images: HabiNest unit at Greenko (Left) & under construction HabiNest Classroom Building, Jamshedpur
Image : RMHS area inside TSL Jamshedpur Plant

NEST-IN HABINEST

HabiNest is one of the branded products of Tata Steel's Nest-In construction solution. It is a light gauge steel frame solution, suitable for building academic institutional buildings, residential buildings, plant offices, community centres, cafeterias and much more. The HabiNest buildings are constructed in almost one-third the time it takes for conventional construction, and are completely hassle-free.

A Life Cycle Assessment study was carried out for a recently constructed HabiNest structure of a classroom building for a new medical college coming up in Jamshedpur. The total built area of the construction is 2400 square feet. A similar size of conventional structure was considered for comparison.

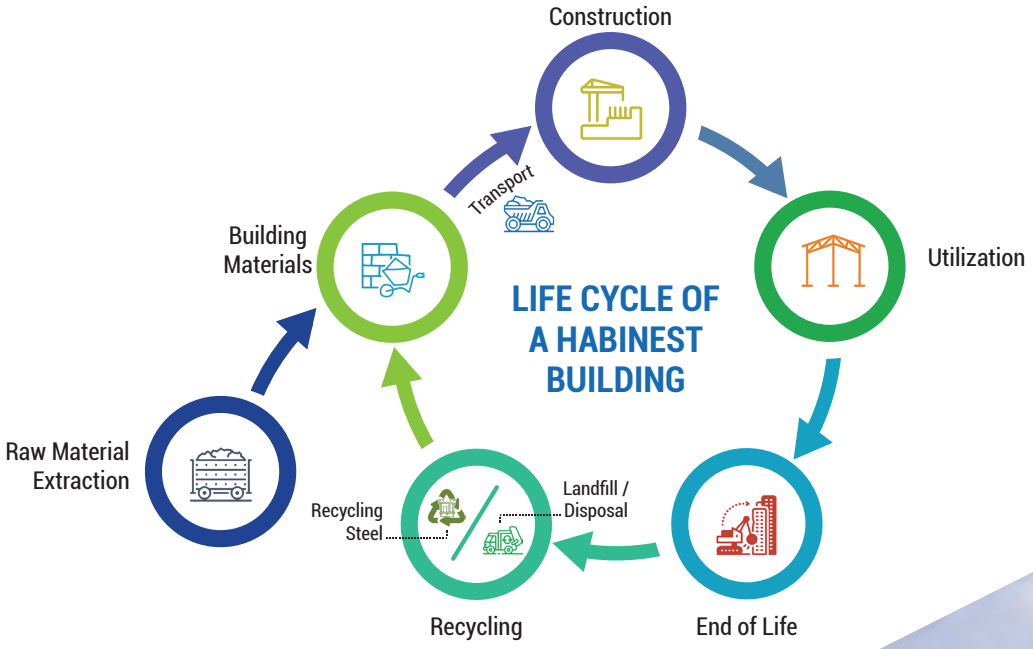
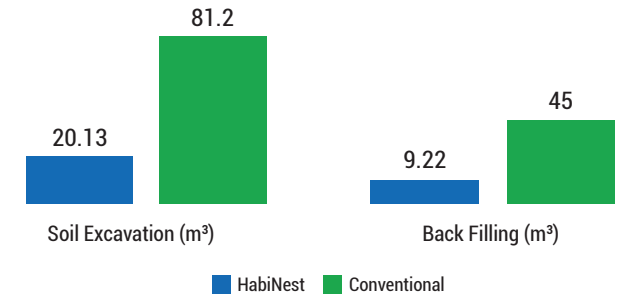


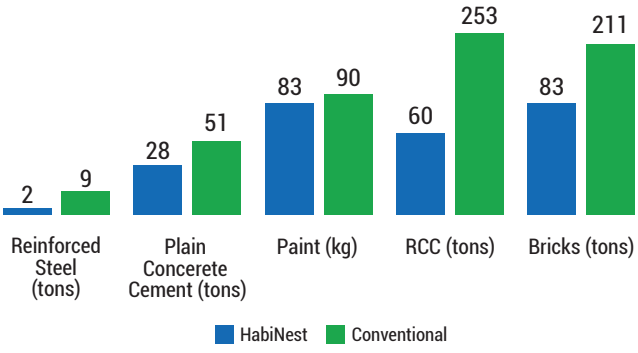
Image: HabiNest Classroom Building, Jamshedpur

COMPARISON OF MATERIAL CONSUMPTION BETWEEN HABINEST STRUCTURE AND CONVENTIONAL STRUCTURE

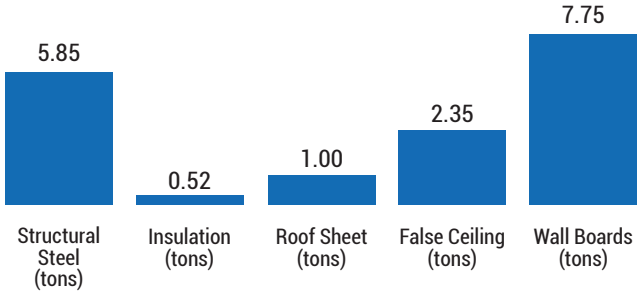
Earthwork Comparison



Comparison of Materials used in both Structures



Materials used only in HabiNest Structure



SUMMARY

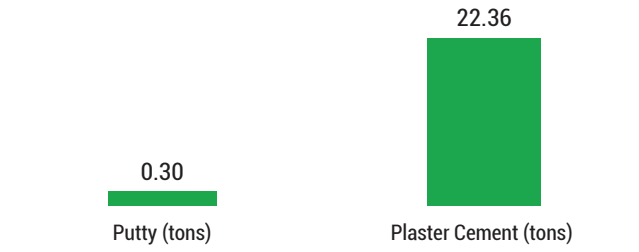
Total tonnage of materials used in HabiNest is about 192 tons while for a similar conventional structure it is about 547 tons. Though different types of materials are used in constructing HabiNest, this type of construction consumes only 35% of the material resources when compared with a conventional structure, thus conserves resources.

At the end of life, reduction of 66% waste to landfill is achieved using the HabiNest structure leading to less burdens on the waste disposal system and the existing landfills.

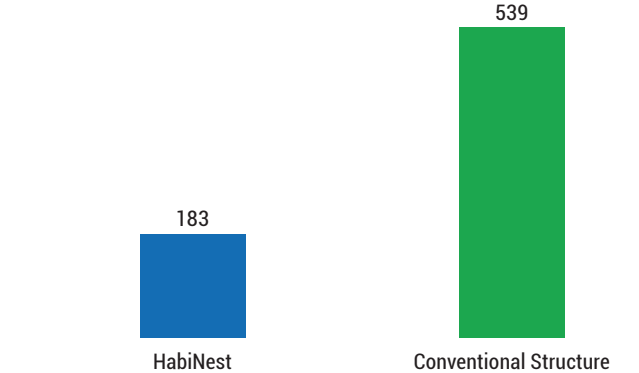
Life Cycle Inventory (LCI) data flows were collected, analysed and modelled into LCA software GaBi. Results were taken for HabiNest and Conventional structures on the following categories – Global Warming Potential, Acidification Potential, Eutrophication Potential, Human Toxicity Potential, Primary Energy Demand from renewable & non-renewable resources and Total freshwater consumption. It is assumed that both the HabiNest and Conventional structures have a life of 70 years.

Image: Inside BESU Canteen

Materials used only in Conventional Structure



Waste to landfill (tons)



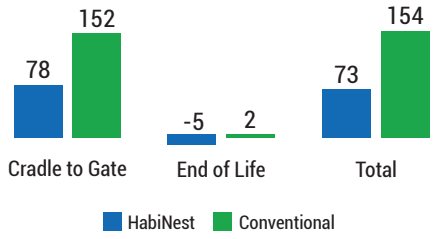
LIFE CYCLE IMPACT ASSESSMENT RESULTS OF HABINEST AND CONVENTIONAL STRUCTURE

LCIA Impact Categories	Unit of measurement	HabiNest			Conventional Structure			% savings w.r.t. conventional structure
		Cradle to Grave	End of Life	Total	Cradle to Grave	End of Life	Total	
Global Warming Potential (100 years), excluding biogenic carbon	ton CO_2 eq.	78	-5	73	152	2	154	53%
Acidification Potential	kg SO_2 eq.	407	11	418	948	57	1004	58%
Eutrophication Potential	kg PO_4^{3}-eq	34	3	37	85	8	93	61%
Human Toxicity Potential	kg DCB eq.	14836	-463	14373	35674	99	35773	60%
Primary energy demand from ren. and non ren. resources (net cal. value)	GJ	798	2	800	1599	103	1702	53%
Total freshwater consumption	m^3	450	16	466	810	79	889	48%

Environmental savings of HabiNest are found to be in the range of 48% to 61% when compared with a conventional structure.

Image: HabiNest Classroom Building, Jamshedpur

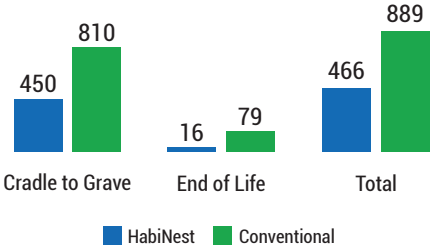
Global Warming Potential of HabiNest and Conventional Structure (tCO_2eq)



SUMMARY

Greenhouse gas related impacts (Global Warming Potential) of HabiNest structure is 53% lesser than Conventional structure. Constructing conventional structure releases 154 tons of CO_2eq whereas HabiNest releases only 73 tons of CO_2eq considering over its lifecycle.

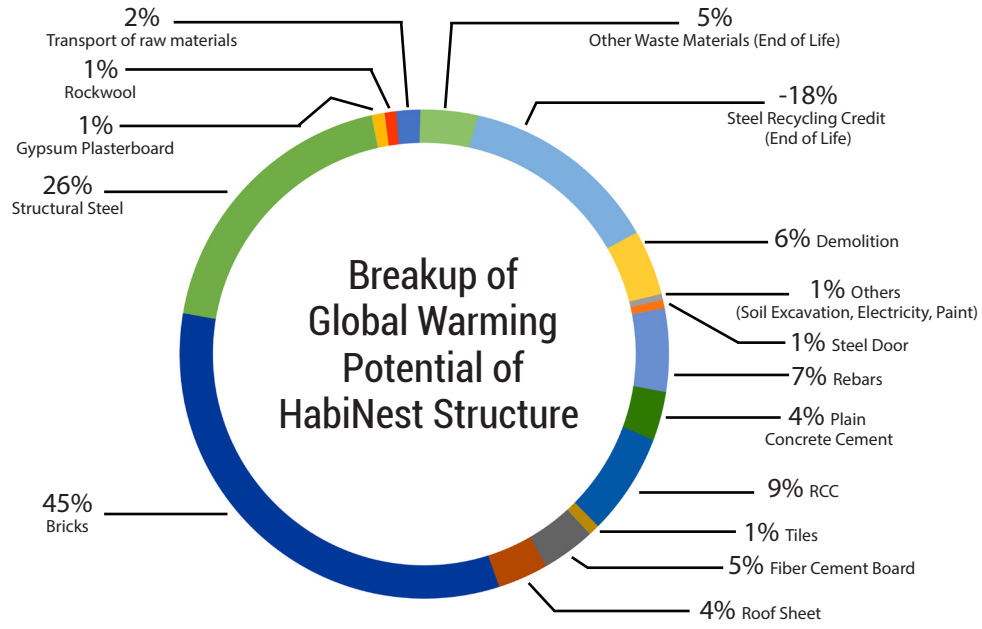
Fresh Water Consumption of HabiNest and Conventional Structure (m^3)

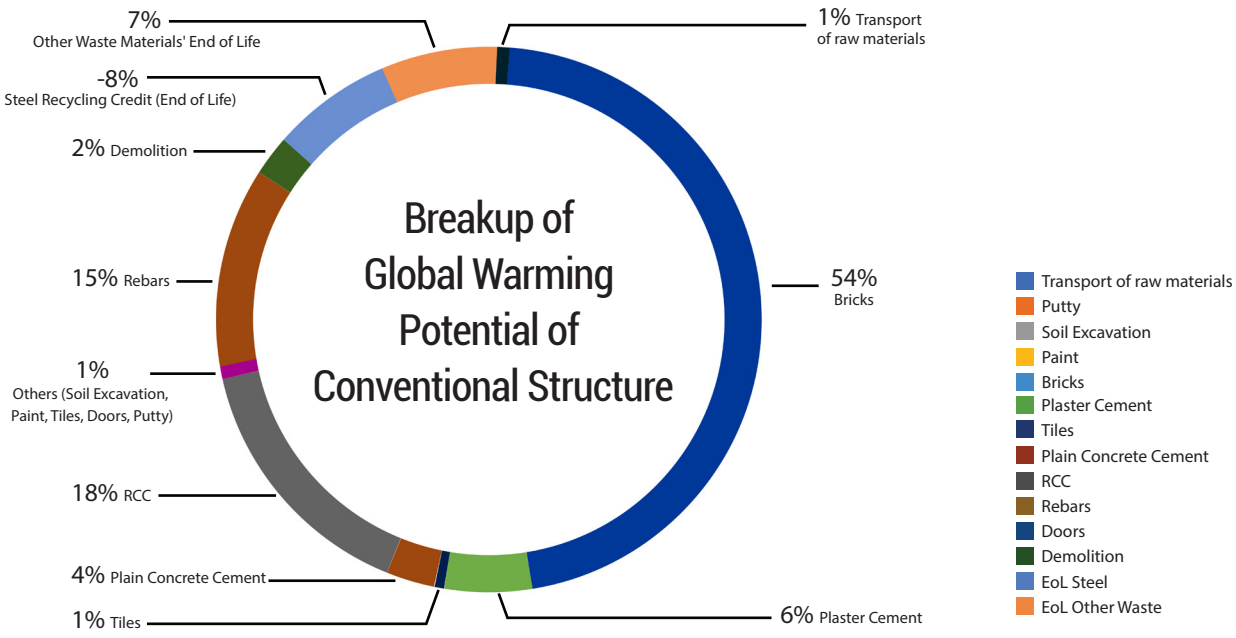


SUMMARY

Constructing HabiNest structure consumes 48% less fresh water than a similar conventional structure over its life cycle.

GLOBAL WARMING POTENTIAL





CONCLUSION

Overall, it was found that the environmental impacts of a steel based HabiNest structure is comparatively lesser than a similar conventional structure and so it is an environmentally preferable solution than a conventional one. In addition to having lesser “Cradle to Grave” impacts, HabiNest also offers environmental benefits during its end of life.

HabiNest structure is easy to disassemble during its end of life and the recovered steel materials can be recycled giving an environmental credit of -5 tons of CO_2eq, whereas in similar conventional structure, materials used are predominantly landfilled adding an environmental burden of 2 tons of CO_2eq.

Image: Guest house by VGS in South India

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nest-in
A Tata Steel Construction Solution

www.nestin.co.in

Disclaimer : These findings are based on an internal LCA study carried out by Tata Steel's Corporate Sustainability Team

Critical Review

Critical Review of the report

Comparative Life Cycle Assessment Study of HabiNest Structure with Conventional Structure

Commissioner: TATA Steel Limited (TSL), Jamshedpur

Reviewer: Dr. Rajesh Kumar Singh, Senior Director
thinkstep Sustainability Solutions Pvt. Ltd. A Sphera Company, India

Dr. G. S. Dangayach, Professor
Malaviya National Institute of Technology Jaipur

Mr. Girish Kumar, Independent Expert and Ex General Manager,
Total Quality Management, SAIL

Reference: ISO 14040 (2006): Environmental Management - Life Cycle Assessment - Principles and Framework
ISO 14044 (2006): Environmental Management - Life Cycle Assessment – Requirements and Guidelines
ISO/TS 14071(2014): Environment Management-Life Cycle Assessment- Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006

Scope of the Critical Review

The objective of the project is "to conduct ISO Panel Critical review as per ISO/TS 14071:2014, ISO 14040 (2006) and ISO 14044 (2006) for the Comparative Life Cycle Assessment Study between HabiNest Structure and Conventional Structure. The study compares the classroom building constructed using HabiNest solution of Tata Steel Limited with a conventional RCC structure of a similar size and application based on design data calculation.

Results of this study is intended to quantify the potential environmental benefits for further communication to external stakeholders as part of marketing purpose.

The review was performed according to paragraph 6.3 of ISO 14044, because the study is intended to be used for comparative assertions intended to be disclosed to the public.

The review panel had the task to assess whether:

1. The methods used to carry out the LCA are consistent and in accordance with international standards (ISO 14040 and ISO 14044) particularly.

2. The methods used to carry out the LCA are scientifically and technically valid.
3. The information and data used are appropriate and reasonable in relation to the goal of the study.
4. The interpretations reflect the limitations identified and the goal of the study.
5. The report of the study is transparent and consistent.

Notices

I. This review is valid for the report issued in May 2021.

II. A specific verification of individual TSL data and datasets representing theTSL specific technologies and LCA software models used to calculate the results are outside the scope of this review. Apart from this all other datasets used were reviewed and found to be valid and logically used.

III. Relevant background data was double checked and partly adapted to reflect the given situation more appropriate.

The Review Process

The review process was coordinated between TSL and the reviewers. The review process was started with the provision of the first draft of the final report on 12th March 2021. LCA report was discussed during the kick-off call between TSL and critical review panel members. The critical review panel evaluated the first draft and provided 58 comments of general, technical and editorial nature on 1st April 2021. TSL submitted revised report incorporating proposed changes by reviewers on 7th May 2021.

Besides few issues in first round, all comments were adequately addressed and the related modifications in the report completed. The critical review panel checked the implementation of the comments in the first draft report while closing down all comments. The reviewers checked the implementation of the pending comments and raised few additional comments. At the end of this review process, all comments and queries were addressed by TSL thereby bringing a closure to the review process in the 2nd round of submission. Final report was received on 18th May 2021 and agreed to the review panel members.

The reviewer acknowledges the unrestricted access to all requested information as well as the open and constructive dialogue during the critical review process.

General evaluation

The study is the result of a comprehensive effort by TSL to analyze the LCA model of product systems from cradle to grave for classroom building. The classroom building is constructed using HabiNest solution and a design data calculation has been done to compare it with a conventional structure of a similar size and application. Models are prepared based on a combination of primary data (TSL), technical literature and mostly reliable and consistent secondary data. The report is well written and contains comparative results and product systems. The defined scope for this LCA study was found to be

appropriate to achieve the stated goals. Various assumptions were addressed and backed by sensitivity analyses of critical data and methodological choices. The system under study was very carefully defined and modeled.

Due to the complex nature assumptions had to be done which is based on “precautionary principle” approach. This means if any doubt of the representativeness or choices of a technical parameter or data arose, a conservative choice or assumption was taken.

The assumptions are transparently described and are found to be suitable and acceptable concerning the conclusions. In absence of data, assumption has been taken that both buildings have similar repair, maintenance, replacement, refurbishment situation with life of 70 years based on the typical average life span of buildings. The LCI of datasets used in the study for steel are primary data for Tata Tiscon, Galvanised Steel (from Tata Steel CGL2 process), TSL Pravesh door instead of GaBi datasets which further increases the accuracy.

LCA standard databases, literature Information and suitable own engineering assumptions was used to model upstream process chains and closed data gaps adequately. The study has been performed in a professional manner using engineering expertise, state-of-the-art LCA methods, adequate LCA Software models and suitable background data,

The data quality of the foreground processes using primary data sources are found to be very high. As a result, the report is closer to representative for the production processes at TSL. The defined and achieved scope for this LCA study was found to be very appropriate to achieve the stated goals.

Conclusion

The study has been carried out in compliance with ISO 14040 and ISO 14044. The reviewer found the overall quality of the methodology and its execution to be adequate for the purposes of the study. The study is reported in a very comprehensive manner including a transparent documentation of its scope. The used secondary data sources, the used software and background data, the transparent documentation, the adequate combination with scenarios and sensitivity checks, as well as the discreet and careful interpretation make this report and its results very consistent, applicable and valuable.

The critical review panel found the overall quality of its methods scientifically and technically valid and the used data appropriate and reasonable. The study report is transparent and consistent, and the interpretation of the results fully reflects the goal and the identified limitations of the study.

Mumbai, India, 24.05.2021

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