



## Roadmap for development of Indian LCA datasets

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## Executive summary

Amidst intensifying global concerns over environmental issues, developing countries like India must respond to at least four different triggers for change:

- **Greening of global markets** implying pressure from trading partners to address environmental and social impacts of exports
- **Public health imperatives** to address environmental problems and deal with public concerns over pollution, water and waste management
- **Decoupling** of economic growth from resource use, efficient and sustainable use of resources in an era of increasing prices and looming shortages of exhaustible natural resources
- **Development of new products** to meet evolving needs and national priorities while also giving due consideration to improving sustainability performance

While different countries experience these triggers with varying intensity and try to fix resulting problems in one way or another, there is little clarity on how to fix the problems in a sustainable way. Life cycle assessment (LCA) is among the best tools to assess and thereby support improvements of sustainability performance in a holistic manner. LCA compiles and examines inputs/outputs of materials/energy and associated environmental impacts of product/service systems throughout the life cycle from raw material extraction to end-of-life disposal. This kind of analysis helps avoid fixes that merely shift burdens and do not deliver net benefits. LCAs are “data hungry” as all flows from and to the environment, of all processes throughout supply chains, over all phases of the product or service life cycles must be considered. LCA data is a cornerstone of Sustainable Development Goal (SDG) 12 and the availability of a national LCA database is thus a key requirement for developing more scientific and holistic solutions to national sustainability problems.

The issue of developing an Indian life cycle assessment (LCA) database hosted by an Indian national organization has come up at several forums prior to the development of this roadmap. While need for Indian life cycle inventory (LCI) data has often been expressed by the local LCA community, so far no Indian organization has, on its own, taken initiatives to develop local datasets for LCA studies and make them available to the community. In October 2018, National Environmental Engineering Research Institute, Nagpur (CSIR-NEERI) and Confederation of Indian Industries (CII) were awarded the India component of a national LCA database roadmap development project. The project is funded by European Commission (EC) and commissioned by UN Environment and the Life Cycle Initiative. This project draws to a close in July 2019 and CSIR-NEERI has already initiated roadmap implementation activities by instituting an internal project in collaboration with Indian Institute of Petroleum, Dehradun (CSIR-IIP).

CSIR-NEERI is one of the premier national laboratories set up under the Council of Scientific & Industrial Research (CSIR), an autonomous body under the Ministry of Science & Technology, Government of India. CSIR-NEERI carried out the first LCA study in India in 1999 and an active LCA team is operating in its Cleaner Technology & Modelling Division (CTMD). Apex Indian

government organizations including the Ministry of Environment, Forests and Climate Change, (MoEFCC) and the National Green Tribunal (NGT) refer to CSIR-NEERI for expert advice on scientific and technical issues related to the environment. Environmental data available through CSIR-NEERI is always considered credible and trustworthy by Indian government agencies. Following the stakeholder consultations undertaken during the project and an assessment of organizational mandate, credibility, commitment to national interests, technical expertise and access to public funding, CSIR-NEERI is considered to be the most appropriate organization for hosting Indian national LCA data repository/database. Accordingly, this roadmap designates it as a potential focal point for national LCA data.

In summary, the roadmap developed under this project incorporates the following features:

- CSIR-NEERI will be the national agency taking the initiative to consolidate and host Indian LCA data in a standardized format, giving due consideration to easy access by potential data users and interoperability with global IT platforms
- The national working group (NDWG) formed by CSIR-NEERI to guide and contribute to the roadmap development activity under this project continues to operate, though there may be continuations, withdrawals or new inductions in its membership depending on member contributions to roadmap implementation activities.
- NDWG is constituted as an empowered group with membership open to organizations and individual experts who actively contribute to roadmap development and subsequent implementation activities. NDWG members are expected to guide and shape the roadmap development process by not only advising what other experts or other organizations should do, but also proposing how they themselves or their organizations are empowered and will contribute towards implementation activities.
- National LCA database development is being taken up in phases as under:
  - Development of a prototype of the data handling process including IT solution by CSIR-NEERI based on a new LCA study in collaboration with another CSIR laboratory, viz. Indian Institute of Petroleum, Dehradun (CSIR-IIP)
  - Extrapolation of the experience from prototype development into a database hosting and maintenance solution
- During the first phase consisting of prototype development, NDWG members will also continue to advise and support CSIR-NEERI in expanding the group and seeking opportunities for funding data related activities envisaged in the second phase.

## Introduction

This document is the final report for the India component of a project funded by the European Commission (EC) and commissioned by UN Environment and the Life Cycle Initiative for development of national life cycle assessment (LCA) database roadmaps in six countries, viz. Brazil, India, Sri Lanka, South Africa, Ecuador and Uganda. The project has been delivered by an international consortium led by theecoinvent Association and implemented by local partners in each of the six countries. The roadmaps are established by national project partners in the consortium in consultation with their respective national database working groups (NDWGs) and other stakeholders. The India component of the project was awarded to National Environmental Engineering Research Institute (CSIR-NEERI) and Confederation of Indian Industries (CII). This report provides an overview of activities already initiated and an outlook on how these will lead to the development of the Indian national LCA database over time.

## Background

The issue of developing an Indian LCA database hosted by an Indian national organization has come up at several forums prior to the development of this roadmap. While need for Indian life cycle inventory (LCI) data has often been expressed by the local LCA community, so far no Indian organization has taken the initiative on its own to develop local datasets for LCA studies and make them available to the community.

In 2015, under a project funded by the European Commission (EC) and commissioned by UN Environment, Federation of Indian Chambers of Commerce and Industry (FICCI) had undertaken a series of consultations with stakeholders to develop readiness for national LCA database. The consultations revealed that establishing a national LCA database was not seen as a priority by policy makers or by many Indian companies. Only a handful of companies were undertaking LCA studies, either as part of their global agenda on environmental sustainability, or to meet requirements of overseas buyers who specifically asked for LCA study results. Those undertaking the studies were using data that was available through the LCA software license often bundled with access to global database/s which occasionally included datasets of Indian products. There was no interest shown by any stakeholder to take on the responsibility of providing or securing financial resources for a national initiative to develop region-specific LCA datasets. A key recommendation from the consultations was that creating an Indian LCA database is not a priority issue deserving large-scale public funding in the near future. Therefore, until specific funding tied to Indian datasets development is not forthcoming, the best course of action will be to generate opportunities to answer policy questions and also develop data at the same time, including by collation of secondary data in format/s accessible by LCA tools. Following this recommendation, FICCI has been making efforts to find a partner to fund initial activities in this direction.

In 2016-18, under the LCI component of the Sustainable Recycling Industries (SRI) program, funded by the Swiss State Secretariat for Economic Affairs (SECO) and implemented by theecoinvent Association, multiple activities were undertaken to develop LCI datasets in five focus countries, including India. Activities in India included setting up a Regional LCA Centre at CII, local capacity building for developing LCA datasets by CII, actual data collection and development of LCI datasets by local experts from CII and FICCI, and capacity building on life cycle thinking and LCA by FICCI.

In March 2018, CSIR-NEERI hosted two capacity building workshops in partnership with FICCI. As part of its efforts to find a partner to fund initial activities for developing local LCA data, FICCI briefed CSIR-NEERI on the outcomes of the project undertaken in 2015. From the discussions, it was concluded that if a government institute with expertise in LCA can become a focal point for developing national datasets, it is more likely to attract potential users and providers of the data, especially from government, to join forces and scale up the effort. Since October 2018, CSIR-NEERI had the opportunity to lead the India component of the present roadmap development project, funded by the European Commission (EC) and commissioned by UN Environment and the Life Cycle Initiative, and has now emerged as the potential focal point for national LCA data. As part of the roadmap implementation activities, CSIR-NEERI is working towards development of a prototype of the data handling process and the IT solution through a new LCA study in collaboration with Indian Institute of Petroleum, Dehradun (CSIR-IIP).

CSIR-NEERI and CSIR-IIP are among the national laboratories set up under the Council of Scientific & Industrial Research (CSIR). CSIR is an autonomous body under the Ministry of Science & Technology, Government of India. CSIR provides scientific and industrial research and development to maximize economic, environmental and social benefit for the people of India. Figure 1 shows the network of laboratories operating under CSIR.

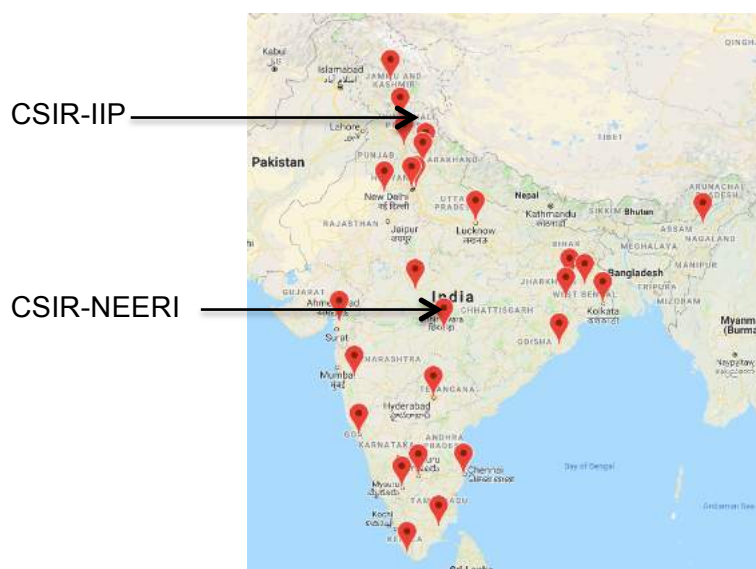


Figure 1: Network of CSIR Laboratories (Source: <https://www.csir.res.in/about-us/csir-network-map>)

## Need/motivation for Indian LCA database

Different stakeholder groups with an interest in LCA in India are at different levels of maturity in conducting LCAs and have different perceptions about the need for a national LCA database. Therefore an overarching understanding of the need for national LCA data has to be articulated in a way that all stakeholder groups can identify with it. The following paragraphs summarize this articulation and serves the purpose of aligning stakeholder perceptions.

Amidst intensifying global concerns over environmental issues, developing countries like India must respond to at least four different triggers for change:

- **Greening of global markets** implying pressure from trading partners to address environmental and social impacts of exports
- **Public health imperatives** to address environmental problems and deal with public concerns over pollution and poor waste management
- **Decoupling** of economic growth from resource use, efficient and sustainable use of resources in an era of increasing prices and looming shortages of exhaustible natural resources
- **Development of new products** to meet evolving needs and national priorities while also giving due consideration to improving sustainability performance

While different countries experience these triggers with varying intensity and try to fix resulting problems in one way or another, there is little clarity on how sustainable the fixes themselves are. Life cycle assessment (LCA) is among the best tools to assess and thereby support improvements of sustainability performance in a holistic manner. LCA compiles and examines inputs/outputs of materials/energy and associated environmental impacts of product/service systems throughout the life cycle from raw material extraction to end-of-life disposal. This kind of analysis helps avoid fixes that merely shift burdens and do not deliver net benefits. LCAs are “data hungry” as all flows from and to the environment, of all processes throughout supply chains, over all phases of the product or service life cycles must be considered. LCA data is a cornerstone of Sustainable Development Goal (SDG) 12 and the availability of a national LCA database is thus a key requirement for developing more scientific and holistic solutions to national sustainability problems.

## Target audience and intended use of roadmap report

The target audience for this roadmap report includes the Indian and global LCA communities and stakeholder groups interested in promoting and/or using LCA approaches for sustainability assessments in India. The roadmap report provides an overview of Indian LCA data already available in different databases, and explains modalities for (a) the development of new Indian datasets by an Indian governmental institute (b) initiation of dataset development in the near future by leading stakeholders, and (c) how the initial work is envisaged to be scaled up.

The roadmap report will be made available in public domain for comment, consultation and contribution for six months after the date of its formal release on July 5, 2019 and an updated version will be released on January 5, 2020 after taking into account the outcomes from initial implementation activities as well as comments and contributions received from the community.

## The roadmap establishment process

This roadmap has been developed by CSIR-NEERI with support from CII after conducting a baseline assessment of LCA activity in India and holding consultations with key stakeholders over the period October 2018 to June 2018. The following sections summarize the activities done during this period.

### Baseline assessment

A baseline assessment was conducted by circulating a questionnaire to individuals who have been active in the field of LCA in India. Their contacts were taken from the database of Indian LCA practitioners available with NEERI, CII, and the ecoinvent Association. The baseline assessment and stakeholder consultations (BASC) report of this project prepared in December 2018 provides details of the exercise. Key points from the BASC report are summarized below:

- As of now, 395 datasets from India covering agriculture, cement manufacturing, coal and lignite, iron and steel, plastics, power and energy, textiles, transport, construction materials, electronics and general components are available in the ecoinvent and Gabi databases.
- 58 specific organizations/individuals with complete contact details were identified as potential stakeholders for being invited to participate in a working group that could guide the roadmap development process. These consisted of eight public policy organizations, 21 private companies, four public sector companies, 11 academic/research institutes, seven consultants/vendors, and seven industry associations.

### Stakeholder mapping

Potential stakeholders identified above were contacted through phone, email, skype and face-to-face meetings to discuss their potential contribution as NDWG members. An assessment was undertaken with the objective of identifying stakeholder groups with at least one out of the Interest and Influence parameters<sup>1</sup> being indicated as 'High'. The analysis helped identify five key kinds of organizations as explained below:

1. **Government ministries and departments**, as of now do not use LCA studies to answer policy questions they are currently dealing with. Deeper engagement and practical work is required with specific agencies to demonstrate the value of LCA in evaluating solutions. In this process, LCI datasets can be developed that may also be available for other studies.

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<sup>1</sup> as applicable to stakeholder mapping

2. **Large corporates**, private as well as public, undertake LCAs for internal decision-making and to meet customer requirements. The background data they use is sourced from licensed tools and any additional data collected/generated through the LCAs is not available to the community. However, new collaboration opportunities may be possible with industry associations taking the lead by compiling data from several companies.
3. **Industry associations**, are interested in developing LCA datasets that may be available to the community, provided external funding is received to cover the costs of data collection and hosting the IT solution
4. **Government industrial research institutes**, engaged in new product development to meet national priorities may also need to assess environmental performance of the new products and can contribute LCA data while conducting such assessments.
5. **Academic community**, engaged in research on LCA topics can put in data collection effort and also use the data in further studies, though they rely mainly on free/low cost academic licenses. They can also provide expert advice for dataset development and hosting solutions
6. **Technical experts**, offering LCA tools and consultancy have hands-on experience and can provide expert advice for developing datasets, database hosting solutions as well as support implementation activities

## National Database Working Group (NDWG)

Building on the conclusions from the 2015 project undertaken by FICCI on developing readiness for Indian national LCA database, CSIR-NEERI has formed the working group to guide roadmap development with members who are empowered not only to guide roadmap development, but also to contribute in subsequent implementation activities. This implies that members are not expected to merely advise what others/other organizations should do, but also advise how they themselves/their organizations can contribute towards implementation of the roadmap.

Based on the stakeholder mapping as above and after eliciting their interest in joining such an empowered group, CSIR-NEERI invited representation from each stakeholder group. In line with the practice followed by the international consortium for this project, the group has been named National Database Working Group (NDWG). The group is chaired by CSIR-NEERI and co-chaired by CII. Membership of the group is open to individuals who actively contribute to roadmap development **and** implementation activities. The India NDWG is thus constituted as an active and empowered group consisting of following:

- Representatives from Indian government organizations concerned with key policy issues in sustainability and providing focused inputs on urgent policy matters that can benefit from Life Cycle knowledge
- Representatives from organizations that work with CSIR-NEERI in LCI data collection exercises during 2019. These include organizations of three types: corporates, industry associations, and autonomous institutes. Details of the exercise is worked out on case-to-case basis and agreed upon through mutual consultation.

- Academic researchers engaged in LCA studies contributing Indian LCI data sets for seeding a national Indian LCI database and support evaluation of solutions
- Technical experts supporting CSIR-NEERI in evaluating technical solutions for hosting Indian LCI data sets

Appendix A provides names of NDWG members on date.

## Roadmap for developing national LCA datasets

### Goal and objective

The roadmap developed under this project is intended to provide access to Indian LCA data, and it is expected that the availability of such data will promote the use of science-based tools such as LCA, for sustainability decision-making in India. The objective of the roadmap is to show the direction for making high quality, reliable, and consistent data available to the community for ongoing impact assessments

### Strategy and approach

As indicated in the BASC report, CSIR-NEERI carried out the first LCA study in India in 1999 and an active LCA team is operating in its Cleaner Technology & Modelling Division (CTMD). Apex Indian government organizations including the Ministry of Environment, Forests and Climate Change, (MoEFCC) and the National Green Tribunal (NGT) refer to CSIR-NEERI for expert advice on scientific and technical issues related to the environment. Environmental data available through CSIR-NEERI is always considered credible and trustworthy by Indian government agencies. Following the stakeholder consultations undertaken during the project and an assessment of organizational mandate, credibility, commitment to national interests, technical expertise and access to public funding, CSIR-NEERI is considered to be the most appropriate organization for hosting Indian national LCA data repository/database. Accordingly, this roadmap designates it as a potential focal point for national LCA data..

Going by the experience of LCA databases established or being established in other parts of the world, the development of a fully functional, standalone LCA database could take several years. As such, it is difficult to estimate the requirements for resources, timelines, and technical expertise of such a national database for India at this point in time. Further more, in today's era of global supply chains, a standalone national database is not likely to become commercially viable on its own. In India, the number of Indian organizations familiar with technicalities of LCA data and also convinced about business case and benefits of conducting LCA vis-à-vis the cost and effort involved, is quite limited. Therefore, it is uncertain as to which agency or agencies might be willing to consider providing large funds for setting up a national LCA database.

Considering the above, it is not yet clear whether developing a fully functional, standalone national database is the way to go, or only a repository of Indian datasets may be developed with the capability to make the data readily available for LCA studies through integration with other global databases and LCA software. In order to make well-informed recommendations on this issue, at least one practical exercise of the end-to-end process of collecting new data, accessing existing data, using LCA software, generating additional data, and developing prototype IT solution to host the data on a pilot scale is required. Any guidance for roadmap development needs to be based on practical experience of implementation on a pilot scale under Indian conditions. To ensure this, the national working group (NDWG) for this project to guide the roadmap development activity is formed as an active and empowered group open to members who actively contribute not only to roadmap development but also to roadmap implementation activities. NDWG members thus advise not only on what others/other organizations should do, but also how they/their organizations contribute towards roadmap implementation. The contributions could, for example, is in the form of joint projects/hands-on exercises with CSIR-NEERI and/or joint proposals for funding of projects through which Indian LCA datasets are developed and made available to the community. Figure 2 shows the governance structure for roadmap implementation activities illustrating the role of NDWG in guiding and contributing to roadmap development and implementation..

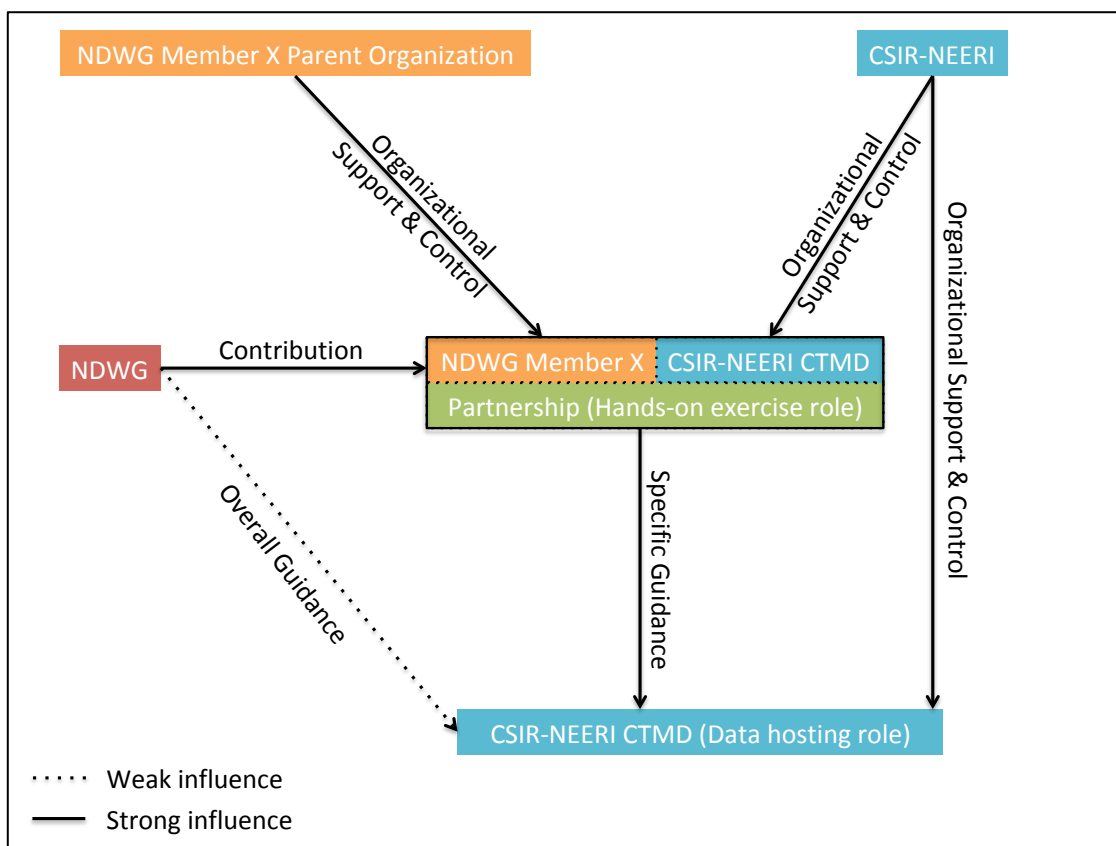


Figure 2: Governance structure for roadmap development and implementation

While this roadmap strives to maintain the momentum of activities initiated under this project, it does not yet conclude whether the target is a fully functional, standalone national database, or a repository of Indian datasets. Accordingly, the roadmap incorporates the following features:

- CSIR-NEERI will be the focal point for developing and consolidating Indian LCA data in a standardized format giving due consideration to global data interoperability needs
- NDWG will continue to perform its existing role beyond the closure of this project with new inductions, continuations or withdrawals in its membership, depending on member contributions to roadmap implementation activities.
- Each NDWG member taking up a joint project with CSIR-NEERI has the opportunity to shape the process for developing the Indian LCA data collection and hosting solution individually through their own joint project, and also collectively through periodic meetings and updates on projects by other members.
- LCA database development will be taken up in two phases: (i) development of a prototype of the data handling process including IT solution by CSIR-NEERI, using data from a new LCA study in collaboration with CSIR-IIP, another CSIR laboratory, and (ii) extrapolation of the experience from prototype development into a database hosting and maintenance solution
- In the first phase, the NDWG will also advise and support CSIR-NEERI in exploring and seeking opportunities for funding activities envisaged under the second phase.
- The roadmap is open for public consultations till January 05, 2020. Potential stakeholders interested in contributing to its implementation and/or further development are invited to contact CSIR-NEERI with an expression of interest which will be considered and decided upon by CSIR-NEERI in consultation with the NDWG.

## Implementation phases

The database development work will be undertaken in two phases:

1. **Prototype development:** In this phase, joint projects will be taken up by CSIR-NEERI with contributing NDWG members to go through the end-to-end process of collecting new data, accessing existing data, using LCA software, generating additional data, and developing prototype IT solution to host the data. As of now, one project has already been committed by CSIR-IIP to conduct LCA study on jet bio-fuel jointly with CSIR-NEERI for which resources will be raised by both partners internally. Other NDWG members, viz. Tata Steel, ISA, INSDAG, SABIC, Mahindra Automotives, and JNARDDC have also expressed interest in similar exercises based on the following initial ideas:
  - Tata Steel has proposed the development of new LCI datasets as relevant to the steel/ infrastructure sector subject to resolution of data confidentiality issues, specifically indicating that they could proceed with these discussions only in August 2019.
  - ISA and INSDAG have also shown interest in developing steel datasets subject to concurrence by their members after they have better understood the data requirements and the business case for undertaking such an exercise.

- SABIC has proposed development of LCI data to assess environmental impact of mixed plastics waste handling, and can support initial activities leading to the development of a full proposal. The earliest they could take this up is in July-August 2019.
  - Mahindra Automotive has expressed interest to work on a pilot, but need more time to decide the specific mode and areas of this activity. Subject to their internal approvals, they may be able to share data from their recent LCA studies.
  - TVS Lucas has indicated interest in data collection on: resource use for autopart manufacturing operations (mechanical/chemical), materials recycling (aluminium/steel/copper/plastics), environmental impact of power (grid/inhouse green power), and resource conservation concepts for plating, painting, phosphating, heat treatment, etc.
  - As part of the government's RE efficiency strategy for aluminium sector, JNARDDC has indicated interest in data on extraction, recycling, and waste disposal; and in assessment of environmental performance of primary and secondary production.
2. **Database development:** Experience and learning gained from the prototype development stage will be considered to take key decisions on establishing a national database.

In general, the national database will be developed considering global best practice and procedures adapted in an action research mode to suit contextual requirements. This means that initially when new datasets are developed as part of a joint LCA study by CSIR-IIP and CSIR-NEERI, the ambition will be to match global best practice, at the same time specific decisions on data collection mechanism, data representativeness, data quality and review requirements, data format and interoperability etc. will be taken in accordance with the study requirements and licensed tools already available with them from their existing work in the LCA space. Decisions on additional IT acquisitions for implementation of Phase 2 will be taken in line with the experience gained through the hands-on exercise/s, and after taking into account wider stakeholder needs.



The LCA study will enable IIP to assess and improve environmental performance of jet bio-fuel being produced in its operating plant. Eventually CSIR-IIP will be providing the technology to commercial organizations for setting up manufacturing plants in the country.

The prototype will enable NEERI to understand the end-to-end process of data collection, review and hosting and take key decisions on future hosting of national LCI datasets. The data repository prototype workstream will include design of standardized data collection templates in excel/word, guidance on data collection and review process, algorithms for conversion of excel/word data files to formats accessible by LCA software and interoperable according to requirements of the Global LCA Data Access (GLAD) network<sup>2</sup>, hosted by UN Environment, and IT solution to host the new datasets developed for this study.

The data collected for the LCA study will be of two kinds: inventory data which will be used for impact assessment, and the underlying metadata which will provide a structure for the data repository and enable interoperability with global platforms. The inventory data will be made available in format that can be accessed by the software to be used for the study. The metadata will be made available in format that is interoperable with GLAD. Access to the inventory data will be through data access policy to be decided during the course of prototype development. Free access to the metadata will be provided upon registration and authentication, and in accordance with the GLAD search engine protocols.

## Governance and management

Both CSIR-IIP and CSIR-NEERI being publicly funded, they will follow project governance and management mechanisms applicable to joint projects by Indian government research institutes. The raw data will be provided by CSIR-IIP and conversion to required format for enabling access by software tools will be undertaken by CSIR-NEERI. The new datasets developed under this project will be owned jointly by CSIR-NEERI and CSIR-IIP and access to the data will be available as per policy decided by data owners. As a matter of principle, the data will be available for other studies in the sector subject to specific terms and conditions on financials and data confidentiality requirements for data that is proprietary to CSIR-IIP.

In addition to the project governance and management mechanisms internal to CSIR-IIP and CSIR-NEERI, the NDWG will also provide advice on the overall data collection, review, access, and hosting solutions. Progress on prototype development through the CSIR-IIP and CSIR-NEERI project (and any other hands-on exercises related to LCA data that may be taken up later by CSIR-NEERI in partnership with other NDWG members) will be presented to NDWG for review and endorsement of key decisions on how the experience from the first phase should be interpreted and used while planning for the next phase.

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<sup>2</sup> <https://www.globalcadataaccess.org/>

## Human Resources

The team constituted for the first pilot exercise consists of eight members with expertise/ experience in following areas:

- Experience of conducting LCA studies
- Technical expertise in jet bio-fuel production process
- Sector expertise in upstream (supply chain), and downstream (customer use) requirements and practices
- IT expertise in developing databases and file converters
- Global perspective on Life Cycle Thinking, LCA software and databases

## Project activities and duration

Activity	Timeline after commencement of project		
	0-3 months	3-8 months	8-12 months
<b>Initiation:</b> Goal and Scope finalization	↔		
<b>Data collection:</b> Process Inventory, environmental inputs and outputs of biojet fuel		↔	
<b>Data storage and format conversion:</b> Development of prototype IT solution for data hosting and access		↔	
<b>Planning for Phase 2:</b> User requirements for IT solution to host new datasets, design of data collection modalities, allocation of resources for Phase 2		↔	
<b>LCA Study:</b> LCA Impact assessment, Hotspots identification, Uncertainty analysis of LCA results		↔	
<b>Report preparation:</b> Improvement analysis, Data compilation and report Preparation			↔

## Phase 2: Database development

Based on the experience gained in the prototype phase, key decisions on scope of the next phase for development and hosting of LCA dataset repository/database will be taken with guidance from the NDWG. Phase 2 is expected to commence six to eight months after the commencement of Phase 1 LCA study project.

### Stakeholder commitments

CSIR-NEERI is committed to use the experience gained from the prototype development work and scale it up into a nationally representative data repository/database over the next three to five years. General agreement on the role of CSIR-NEERI as the focal point for Indian LCA data and of NDWG members to guide the process through joint hands-on exercises has been obtained before sending formal invitations to them for joining the NDWG. By providing their consent to join, members signify their agreement with contributing to the roadmap development and implementation activities through projects or hands-on exercises jointly with CSIR-NEERI.

### Budget and resource constraints

As of now, the scale and speed at which the prototype will be developed into a nationally representative database cannot be anticipated and therefore no clear budgetary allocation has been made for Phase 2 of the roadmap implementation. CSIR-NEERI will be submitting proposals to various national and international funding agencies as part of its ongoing project development activities .

### Risk management

**Data quality** risks for data captured, its adequacy, reliability, usefulness/fitness for purpose – risk managed by following global standards and guidelines

**Stakeholder disinterest** could stall actual development of the database – risk contained by ensuring high quality stakeholder engagement throughout, following best practice, clearly defining ‘what-is-in-it-for-me’ for key stakeholders.

**Resource constraints** initial technical solution for a full fledged database may have to rely on expensive foreign expertise supplemented with local inputs – risk will be managed by budgeting for cost of developing local expertise.

## Demonstration of interoperability with GLAD

Parallel to the roadmap development process, CII has within the present project developed metadata descriptor files according to the requirements of the GLAD network for three coal-related and eight plastic-related datasets. These were validated against the GLAD requirements by ecoinvent and are currently awaiting final upload for connection and publication over GLAD.

### Selection of datasets

Datasets from the SRI-LCI project on coal mining and waste plastic recycling were selected by CII for this pilot study on connecting data to GLAD, as both sectors were felt to be important from the country perspective: coal, as a key fossil fuel input to energy utilities and many manufacturing processes; and plastic, due to the widespread use and the related environmental impacts. Coal is available in the current version of the ecoinvent database (v3.5); recycling of waste plastic is expected to be published as part of the database version 3.6. All these datasets have undergone rigorous review internally at ecoinvent and by external review teams according to the ecoinvent *Data Quality Guidelines*. The specific datasets used in the pilot connection are:

1. hard coal mine operation - IN
2. lignite mine operation - IN
3. hard coal preparation - IN
4. market for plastic granulate, unspecified, recycled - IN
5. market for waste plastic, consumer electronics, unsorted - IN
6. plastic flake production, consumer electronics, for recycling, by grinding/shredding, formal sector – IN
7. plastic flake production, consumer electronics, for recycling, by grinding/shredding, informal sector – IN
8. plastic granulate production, unspecified, recycled, formal sector – IN
9. plastic granulate production, unspecified, recycled, informal sector – IN
10. treatment of waste plastic, consumer electronics, dismantling, sorting and cleaning, formal sector – IN
11. treatment of waste plastic, consumer electronics, manual dismantling, sorting and cleaning, informal sector - IN

### The connection process

The main objective of GLAD is to ensure better data accessibility and interoperability of LCA data from different sources globally. To enable this, one of the key main functionalities of GLAD is the conversion function which uses the concept of metadata descriptors that “describe” each dataset has been introduced. Each metadata descriptor consists of a value, a goal for the value (what it should represent) and an assessment of the conformance of the value to the goal. The metadata provided for datasets in the ecoSpold2 format of the ecoinvent database is partially different from the metadata descriptors required for GLAD. This meant that, as part of

the process for the pilot connection of ecoinvent datasets to GLAD, about 25 new metadata descriptors had to be added to the information already existing in the datasets. Details about the connection process and metadata descriptors are available on the GLAD data provider page (<https://www.globalcadataaccess.org/become-a-dataset-provider>).

There are four methods to connect to GLAD:

1. A simple index file (this, however, only enables the central GLAD search to recognize the datasets but it will not establish a network between data provider node and the GLAD central server)
2. The LCA Collaboration Server
3. Soda4LCA
4. Setting up a direct connection with the GLAD API by the node

For purposes of this pilot, method #4 was used.

The experts at ecoinvent generated pre-filled JSON files, containing any metadata descriptors directly transferable from the information in the original datasets, and shared the same with CII. These JSON files were then edited manually by CII, using an online JSON editor, to include the 25 new metadata descriptors and their associated values. Recommended entries were provided for several of the new metadata descriptors by ecoinvent facilitating an , hence the revision process was quite uncomplicated.

The revised files, with the additional metadata descriptors were sent back to ecoinvent for connection to GLAD. These were then connected (on a trial basis) successfully to GLAD by ecoinvent using the GLAD API/web service established internally by ecoinvent for uploading/connecting the finalized JSON files. For this purpose, the GLAD test environment was used. The datasets will be made available through GLAD, however, upon completion of this project and in coordination with the GLAD administration in the second half of 2019.

## Conclusions and recommendations

CSIR-NEERI will be the focal point for LCA database development activity in India. Roadmap implementation activities are conceived as practical steps in action research mode rather than a theoretical exercise of creating a roadmap document. Demonstration of interoperability with GLAD in respect of existing datasets has been completed. First steps towards developing new interoperable datasets have already been taken by CSIR-NEERI and CSIR-IIP by agreeing to commission a joint project for new LCA study on jet bio-fuel and development of data hosting IT solution prototype. The data hosting solution is expected to be developed in the next six to eight months. Subsequently, the speed with which the prototype can be scaled up into a full fledged national database will depend on outcomes of a formal viability assessment and success of funding opportunities being explored.

## References and resources

CSIR website <https://www.csir.res.in/>

CSIR-NEERI website <http://neeri.res.in/>

CSIR- IIP website <https://www.iip.res.in/>

Report of consultations with key stakeholders on 'Readiness for development of Indian LCA database', Federation of Indian Chambers of Commerce and Industry, New Delhi, January 2016. <http://www.indialca.com/pdf/2016-indian-lca-database-project-report.pdf>

NITI Aayog pitches for transition to Resource Efficiency and Circular Economy as an Economic Paradigm for New India  
[https://eeas.europa.eu/delegations/india/57035/niti-aayog-pitches-transition-resource-efficiency-and-circular-economy-economic-paradigm-new\\_en](https://eeas.europa.eu/delegations/india/57035/niti-aayog-pitches-transition-resource-efficiency-and-circular-economy-economic-paradigm-new_en)

## Appendix A – NDWG members on date

	Prefix	Name	Organization	Organization Type
1	Sh	Ashok Menon	SABIC	Private Industry
2	Dr	Ramesh P	Lucas TVS	
3	Sh	Kumaraguru Rajasekar	Tata Steel	
4	Dr	N. Saravanan	Mahindra	
5	Sh	Sushim Banerjee	INSDAG	Industry Associations
6	Sh	Arnab Hazra	ISA	
7	Sh	Jitendra Kumar	NITI Aayog	Government agencies
8	Sh	Devendra Aggarwal	NGT	
9	Dr	Prashant Gargav	CPCB	
10	Dr	Puttewar	JNARDDC	Research Institutes
11	Dr	Jasvinder Singh	IIP	
12	Sh	Souvik Bhattacharya	TERI	
13	Prof	Vivek Kumar	IIT-D	Academic Institutes
14	Prof	Brajesh Dubey	IIT-K	
15	Prof	Suresh Jain	IIT-Tirupati	
16	Dr	Rambabu	RSM Advisory	Consultancy



If you would like to contribute to further development of the Indian LCA data roadmap, please communicate your interest to CSIR-NEERI. To communicate your interest or to request a copy of this report and provide your comments/suggestions on the current roadmap, please send email to [indianlca.db@neeri.res.in](mailto:indianlca.db@neeri.res.in)

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