EU-REI
Creating a Resource Efficient India

Circular Economy and Resource Efficiency in the Indian Context

Trainer Manual

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Before you start

About this trainer manual

The purpose of this trainer manual is support trainers in the implementation of the *Training Programme on Circular Economy and Resource Efficiency in the Indian Context*. This training programme primarily targets central and state government officials from concerned Indian ministries as well as selected representatives from training institutions, administrative training colleges, state authorities (including SPCBs, planning department, industry etc.), urban local bodies, civil society representatives and the private sector (including industrial associations).

As part the modular training programme, the participants will be guided by qualified trainers and look into the following aspects of Circular Economy (CE) and Resource Efficiency (RE):

- Module 1 - Introductory session
- Module 2 - Foundation of RE and CE in the international context
- Module 3 - Towards RE and CE through sectoral strategies in India
- Module 4 - Tools, standards and indicators for RE and CE
    - 4a Material Flow Analysis
    - 4b Lifecycle Assessment
    - 4c Standards
    - 4d Indicators
    - 4e Public Procurement
    - 4f Circular Business Models
    - 4g Funding
- Module 5 - Evaluation and Feedback

Module 1 is a short introductory module to the course, while module 5 focuses on training evaluation and planning the next steps beyond the implementation of the training. Modules 2, 3 and 4 contain information on various topics as well as case studies and exercises.

How to use this manual

The training manual provides you with guidance on how to structure and implement the modular training programme. For this purpose, it contains suggestions about the overall sequence of the training as well as separate lesson plans for each training module. Each lesson plan indicates the envisaged learning objectives, the materials needed as well as a proposed moderation plan for the respective training module. The moderation plans outline the proposed sequence of session elements, indicate the suggested mode of delivery, the estimated time required as well as the materials needed. Since the training modules build on each other, it is advisable to implement the modules in the order as given. However, module 4 consists of various sub-modules, which can be selected based on relevance/target audience and can be taught independently from one another.

The delivery of each module is based on a mix of presentations, exercises, interactive discussions and case studies. The presentations, in form of PowerPoint slides, and handouts for the exercises and case studies are available separately. For the different exercises and case studies, you will find further trainer guidance notes in the respective modules.

The participants of the training receive a participants‘ handbook that contains all slides of the training together with explanatory notes. The explanatory note tally with the key messages of the respective slides used in the presentations.

Where to find what

List of Figures

List of Abbreviations

Term/Abbreviation	Definition/Full-form
BIS	Bureau of Indian Standards
BSI	Federal Office for Information Security, Germany (Deutsches Bundesamt für Sicherheit in der Informationstechnik)
CBM	Circular Business Model
CE	Circular Economy
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardization
CPP	Circular Public Procurement Sets a special focus on goods and services, which contribute to slowing, narrowing or closing loops within supply chains whilst minimizing environmental impacts and waste.
C&D	Construction and Demolition
CO_2	Carbon Dioxide
DMC	Domestic material consumption Macro indicator: Direct material input - exports
EEE	Electrical and Electronic Equipment
EIB	European Investment Bank
EPR[1]	Extended Producer Responsibility Environmental policy approach in which a producer's responsibility for a product is extended to the waste stage of that product's life-cycle. In practice, EPR involves producers taking responsibility for the management of products after becoming waste, including: collection; pre-treatment, e.g. sorting, dismantling or de-pollution; (preparation for) reuse; recovery (including recycling and energy recovery) or final disposal. EPR systems can allow producers to exercise their responsibility either by providing the financial resources required and/or by taking over the operational aspects of the process from municipalities. They assume the responsibility voluntarily or mandatorily; EPR systems can be implemented individually or collectively.
EU-REI	European Union - Resource Efficiency Initiative
GHG	Greenhouse Gas
GPP	Green Public Procurement Public authorities seek to procure goods and services with a reduced environmental impact throughout their entire lifecycle.

[1] http://www.basel.int/Portals/4/download.aspx?d=UNEP-CHW-OEWG.11-INF-7.English.pdf

G20	Group of Twenty (international forum for the governments and central bank governors)
IPR[2]	Individual Producer Responsibility Each individual producer is responsible for the collection and disposal of waste originating from his own products.
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standards Organisation
Life cycle	Consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal.[3]
LCA	Lifecycle Assessment Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle.[4]
MCI	Material Circularity Indicator developed by the Ellen MacArthur Foundations and measures circularity of materials flows on the business and product level The MCI consists of three variables • the mass of virgin raw material inputs (V); • the mass of waste going to landfill or energy recovery (W); and the product's longevity and use intensity, reflected by a utility factor (X).
MeitY	Ministry of Electronics and Information Technology
MFA	Material Flow Analysis a systematic assessment of the flows and stocks of materials within a system defined in space and time.
MOEF&CC	Ministry of Environment, Forest and Climate Chang
PP	Public Procurement
PRO[5]	Producer Responsibility Organisation Collective entity set up by producers or through legislation, which becomes responsible for meeting the waste collection- and disposal obligations of the individual producers.
Product system	Complete set of steps that are involved in the production, use, and disposal of a product or service throughout its life cycle. The LCA of a product system evaluates the resource consumption and by-product or waste emissions incurred by each process or phase of the life cycle.[6]
SCP	Sustainable consumption and production The use of goods and services that responds to basic needs and bring a better

[2] http://www.basel.int/Portals/4/download.aspx?d=UNEP-CHW-OEWG.11-INF-7.English.pdf
[3] ISO 2006
[4] ISO 2006
[5] http://www.basel.int/Portals/4/download.aspx?d=UNEP-CHW-OEWG.11-INF-7.English.pdf
[6] https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/2012_LED_Lifecycle_Report.pdf

	quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations. It is increasingly recognized that efficiency gains and technological advances in products and their associated production processes alone will not be sufficient to bring global impacts to a sustainable level; changes will also be required to consumer lifestyles, including the ways in which consumers choose and use products and services.[7]
SDG	Sustainable Development Goals

[7] https://www.lifecycleinitiative.org/resources/life-cycle-terminology-2/

Context of training programme

This training programme was developed as part of the European Union's Resource Efficiency Initiative (EU-REI) in India, which aims to support India in the implementation of the United Nations Global Sustainable Consumption and Production (SCP) agenda by way of adapting international standards and best practices for resource efficiency (RE) and circular economy (CE). The project works towards creating a dialogue on the need for resource efficient approaches in India among key stakeholders and provides support to the Resource Efficiency Cell (RE Cell) at the Ministry of Environment, Forest and Climate Change (MoEF&CC) in strengthening technological, scientific and management capacities related to RE and CE.

In July 2019, MoEF&CC has released the Draft National Resource Efficiency Policy, which highlights the importance of awareness generation and enhancing competences as part of policy instruments to mainstream across selected focus sectors.

It is in this context that EU-REI supports the launch of a training programme on RE and CE with the objective to increase awareness and facilitate the uptake of these concepts amongst Indian stakeholders. The competence development programme primarily targets central and state government officials from concerned ministries as well as selected representatives from training institutions, administrative training colleges, state authorities (including SPCBs, planning department, industry etc.), urban local bodies, civil society representatives and the private sector (including industrial associations).

Overall learning objectives
Upon completion of the course, the participants will be enabled to ○ relate to the objectives, importance and opportunities associated with the concepts of RE and CE in India and the world; ○ reflect upon their own scope of responsibility for implementing RE and CE in relation to India's sectoral strategies; and ○ understand a range of different tools, which support the decision-making process for implementing RE and CE solutions.

Structure and design of the program

Target group and modular structure

The toolkit is designed as a support tool for trainer and experts who work in the field of RE and CE. It provides modules on different subjects in this field, including theoretical inputs, examples of case studies from various regions and subject areas, innovative aspects, practical exercises and group work, references and checklists.

A total of five modules have been developed:

1) Introductory session
2) Foundation of RE and CE in the international context
3) Towards RE and CE through sectoral strategies in India
4) Tools, standards and indicators for RE and CE
5) Summary, outlook and evaluation

The toolkit provides an array of training materials, which allow for multi-day trainings based on a recommended six-hour day. While the toolkit suggests a model training schedule, trainers are strongly encouraged to alter the schedule according to their own preferences and especially to the training needs of the target group. The RE & CE toolkit is designed for a wide range of target groups, which is also reflected in its modular structure.

Module 1 serves as an introduction to the activities and is relevant for participants from all stakeholder groups. The same applies for modules 2 & 3 where concepts and principles of RE & CE in the international and national context are presented. Module 4, which covers the application of various tools, indicators and standards, is divided into sub-modules, which can be selected according to the needs of specific target groups. Trainers can individually arrange the modules for each training in accordance with the respective group of participants. Suggestions for target groups and matching submodules are shown in the table below. Depending on the particular interest and background knowledge of the target audience, it is further recommended to combine some of the sub-modules discussing similar concepts, e.g. sub-modules on life cycle assessment and material flow analysis.

Finally, module 5 again is directed at all target groups and contains elements to summarize and evaluate the training activities. Trainers are not only encouraged to customise the submodules of module 4 according to the requirements of the participants but to choose the number of submodules with respect to their specific timeframe of available days for the training. A minimum of 2 days per training with 6 training hours per days are highly recommended. Details about the time required for each module can be found in the following chapters of this manual.

Target group	4a) MFA	4b) LCA	4c) Standards	4d) Indicators	4e) PP	4f) CBM	4f) Funding
Students[8]	x	x					
State-level policy-makers (e.g. SPCBs)			x	x	x		
Inter-ministerial decision-makers			x	x	x		
Producers (e.g. brand owners, importers)[9]	x	x				x	x
Dismantler, collectors, recyclers			x	x			x
ULBs	x	x			x		x
Tech park operators	x	x				x	x
Consultancies, Think tanks	x	x	x	x	x	x	x
RWAs	x	x			x		x

Feedback and evaluation

In this toolkit different modes of evaluation and feedback are suggested for the application during the training. Trainers are encouraged to select methods according to their preference and to the conditions of the training (e.g. number of training days). The proposed methods can be used to

- revise or refine the training design for future use or for the next training days;
- determine the success or failure of the training; and/or
- allow participants to reflect on their progress.

While the frequency and mode of evaluation can be selected in a customised fashion by trainers on an individual basis, techniques and feedback sessions should be conducted at well-defined points throughout the training and their general importance should not be underestimated. A number of feedback and evaluation techniques are listed in the table below. Further instructions and guidance materials can be found in the following sections of this manual.

[8] MBA/PHD
[9] As per definitions of existing waste management rules

Pre- and post-training assessment	
Aim	Documentation of change in Knowledge, Attitudes and Practises amongst the participants in the course of the training program.
How?	Questionnaires to be filled out in the beginning and end of the training (Module 1&5).
Recommended for	- Trainers interested in efficiency of training - Participants interested in their learning progress
Quiz	
Aim	Assessment of knowledge and competences developed during the training.
How?	Quiz accompanying or at the end of the training. Exercise sheets need to be developed by trainers according to the modules integrated in the training programme. Sheets can be handed to participants to be filled during the modules or for a final quiz during module 5. Results to be discussed in the group during module 5 to identify gaps of knowledge. This allows for the recommendation for further study material and for the adaptation of future trainings.
Recommended for	- Training with at least two submodules of module 4
Evaluation sheets	
Aim	Evaluation of content and methodology.
How?	Evaluation sheets at the end of the training (Module 5). Anonymous.
Recommended for	- Every training
Alignment of expectations	
Aim	Identify expectations of the participants and enable a comparison if those have been met. Allows for an interactive training evaluation that is equally beneficial for trainer and participants.
How?	Flipchart exercises at the beginning and the end of the training (Module 1&5).
Recommended for	- Every training
Group case study	
Aim	Comprehensive repetition of acquired skills as a group exercise. Additional skill development through the combination of different subject areas that were included in the training.
How?	Case study exercise for group (or smaller sub-groups) during module 5. To be developed by the trainer according to the chosen sub-modules.
Recommended for	- Multiple day trainings

Show of hands	
Aim	Reflect on the activities of a training day or module. Easy and quick method to gather feedback from participants. The method can be used at the end of a module, the end of a training day or right at the end of the training in general.
How?	Ask each participants to use their fingers to reflect on the past activities. ➢ Thumb – something good, enjoyable ➢ Index finger – something to point out (good or bad) ➢ Middle finger – something bad, not enjoyable ➢ Ring finger – something to treasure from the activity/day ➢ Little finger – something has been fallen short This method can be used after an exercise, module or training. It can be encouraging if the trainer starts with the exercise and share your point of view.
Recommended for	- All trainings and stakeholder groups
Card roulette	
Aim	Evaluate training methods and assessment of knowledge and skills of participants developed during the training. Recap of course content and evaluation of training methods gives trainer the option to get direct feedback and offers an interactive and sustainable opportunity to deepen the learning experience for the participants.
How?	Group exercise at the end of the training (Module 5). Take sample cards from exercise template, select cards according to the modules selected for the training and add cards with questions as needed. Print exercise template, cut out the cards and laminate them for multiple use. Please refer to description of module 5 for more detailed instructions. Content of questions on cards: ➢ Question N°1.1- N°1.16: Training evaluation ➢ Question N°2.1- N°2.5: Questions on Module 2 ➢ Question N°3.1- N°3.3: Questions on Module 3 ➢ etc.
Recommended for	- Multiple day trainings

Figure 1: Sample Card for evaluation method Card Roulette

Module overview

The following tables provides an overview of the different training modules and key points in each of the modules:

Module and Content	
1	**Welcome and introduction**
	• Outline of program curriculum • Introduction of participants • Assessment of expectations
2	**Foundation of RE and CE in the international context**
	• Introduction to lifecycle thinking • Introduction to resource efficiency and circular economy • Principles of circularity • Strategies in a circular economy • Conceptual considerations on RE and CE • RE and CE in the international context
3	**Towards RE and CE through sectoral strategies in India**
	• Introduction • RE and CE: challenges and opportunities in India • National progress on RE and CE • Key provisions and stakeholders of sectoral strategies
4	**Tools, standards and indicators for RE and CE**
	Customisable module on various tools, standards and indicators with focus on application
4a	**Material Flow Analysis (MFA)**
	• Introduction & recap • Salient features of MFA • Types and Steps of MFA • Material Flow Analysis of a Coffee Machine
4b	**Lifecycle Assessment (LCA)**
	• Lifecycle Assessment (LCA) • Types of LCAs • Defining steps in LCAs
4c	**Standards**
	• Standards • Standardisation bodies • Sectoral standards • Standards and the environment • Standards on RE and CE
4d	**Indicators**

	• RE and CE Indicators • Circularity Calculator
4e	**Public Procurement (PP)**
	• Public Procurement • Types of environmentally oriented Public Procurement • Principles of Public Procurement • Steps in the Public Procurement Process
4f	**Circular Business Models (CBM)**
	• Circular Business Models • Types of interventions in a circular business model • Value dimensions of a circular business model • Circular Business Model Case studies
4g	**Funding**
	• RE & CE financing in the EU • Focal areas of RE and CE funding • Assessment of financing options • Funding challenges • Selecting possible funding areas • Assessing funding options
5	**Summary, outlook and evaluation**
	• Workshop evaluation • Assessment of learning progress • Additional sources of information

Sample timetable for the training programme

This table provides an exemplary timetable for the delivery of a training programme in form of full-day training programmes distributed over three days, with six hours of effective training time each day. In this example the basic modules were accompanied by the optional modules 4a-d. Since this may not necessarily be a suitable approach for all target groups, please consider organising the training in a different time format, if necessary, for example several half-day morning or afternoon sessions, or even shorter sessions spread out over several days, each dealing with one module.

Day	Slot	Time	Content	Learning Objectives	Delivery Method(s)
Day 1	**Module 1:**	**Introductory Session**			
	09:30 am - 10:10 am	40’	Welcome and introduction to the curriculum and the topic	• Understand the structure of the course; • Know each other by name and their diverse professional backgrounds; • Articulate their expectations regarding the technical contents of the course; • Relate to the intended learning outcomes of the course; and • Familiarise themselves with the participants handbook.	• Presentation • Group exercises
	Module 2:	**Foundation of RE and CE in the international context**			
	10:10 am - 11:10 am	60’	Session 1 (Step 1-3) • Introduction to lifecycle thinking • Introduction to lifecycle thinking II • Introduction to resource efficiency and circular economy	• Explain the rationale of RE and CE; • Summarize the principles of lifecycle thinking.	• Presentation • Open brainstorming • Video
	11:00 am - 11:30 am	*20’*	*Coffee Break*		
	11:30 am - 12:30 pm	60’	Session 2 (Step 4-6) • Principles of circularity • Strategies in a circular economy • Conceptual considerations on	• Differentiate conceptual implications of RE and CE; and • Contextualise RE and CE to international debates.	• Presentation • Open brainstorming • Group discussion

			RE and CE • RE and CE in the international context		
	12:30 pm - 01:30 pm	*60'*	*Lunch*		
	Module 3:	**Towards RE and CE through sectoral strategies in India**			
	01:30 pm - 02:30 pm	90'	Session 1 (Step 1-3) • Introduction • RE and CE: challenges and opportunities in India • National progress on RE and CE	• Contextualize challenges and opportunities of RE and CE in India; • Outline the existing policy context along the entire lifecycle; and • Capture the key elements of the RE strategy and four sectoral strategy papers.	• Presentation • Video • Exercises
	02:30 pm - 02:50 pm	*20'*	*Coffee Break*		
	02:50 pm - 04:05 pm	75'	Session 2 (Step 4) • Key provisions and stakeholders of sectoral strategies	• Map out the stakeholders involved in the implementation of sectoral strategies at the national level.	• Presentation • Exercises
	04:05 pm - 04:20 pm	15'	Wrap up, evaluation and feedback		
Day 2	**Tools, standards and indicators for RE and CE**				
	Module 4a:	**Material Flow Analysis (MFA)**			
	09:00 am - 10:10 am	70'	Session 1 (Step 1-3) • Introduction & recap • Salient features of MFA • Types and Steps of MFA	• Relate to salient features of MFA as a decision-making support tool; and • Define the steps of MFA.	• Presentation • Brainstorming • Exercise
	10:10 am - 10:30 am	*20'*	*Coffee Break*		
	10:30 am - 12:05 pm	95'	Session 2 (Step 4) • Material Flow Analysis of a Coffee Machine	• Describe and illustrate techniques of analysing and documenting material flows.	• Presentation • Exercise
	12:05 pm - 01:00 pm	*55'*	*Lunch*		
	Module 4b:	**Lifecycle Assessments**			

	01:00 pm - 02:10 pm	70’	Session 1 (Step 1- 3) • Introduction & recap • Lifecycle Assessments • Defining steps in LCA	• Relate to the concept and terminology of life cycle assessments (LCA); and • Define the steps of a life cycle assessment.	• Presentation • Video • Brainstorming • Exercise
	02:10 pm - 02:30 pm	*20’*	*Coffee Break*		
	02:30 pm - 03:45 pm (03:55 pm)	75- 85’	Session 2 (Step 4) • LCA of Insulation materials • Wrap up	• Interpret the results of life cycle assessments.	• Presentation • Brainstorming • Exercise
	03: 45pm – 04:00 pm	15’	Wrap up, evaluation and feedback		
Day 3	Tools, standards and indicators for RE and CE				
	Module 4c:	**Standards**			
	09:30 am - 10:20 am	50’	Session 1 (Step 1-4) • Introduction & recap • Discussing standards • Standardisation bodies • Sectoral Standards	• Relate to the relevance of standards, their disadvantages and benefits and to their role within sectoral strategies.	• Presentation • Exercise
	10:20 am - 10:40 am	*20’*	*Coffee Break*		
	10:40 am - 11:40 am	60’	Session 2 (Step 4-8) • Standards and the Environment • Environmental Checklist • Standards on RE and CE • Wrap up	• Outline levels on which standardization takes place in India and at international level; and • Understand opportunities for lifecycle considerations when developing standards.	• Presentation • Exercise
	11:40 am - 12:40 pm	*60’*	*Lunch*		
	Module 4d:	**Indicators**			
	12:40 pm - 02:15 pm	95’	Session 1	• Relate to the purpose of indicators and explain	• Presentation • Brainstorming

		• Introduction & recap • RE and CE Indicators • Circularity Calculator	SMART-principle; • Outline difference between quantitative and qualitative indicators as well as macro-, meso- and micro-level application; and • Recall the terminology of resource use indicators and possible data sources to determine material flows.	• Small group exercise
02:15 pm -02:35 pm	*20'*	*Coffee Break*		
Module 5:	**Evaluation and Feedback**			
02:35 pm – 03:35 pm	60'	Introduction & recap Exercises	• Recall key concepts, background information, tools and standards presented throughout the course; and • Assess one's learning progress and further learning needs.	• Quiz • Post- assessment • Card Roulette
03:35 pm – 03:45 pm	*10'*	*Coffee Break*		
03:45 pm – 04:10 pm	25'	Exercise Training Conclusion	• Identify and use additional sources of information and reference.	• Evaluation sheets • Alignment of expectations • Exercise • Show of hands

Some thoughts about effective training delivery

How to enhance learning retention

Experience shows that that the positive impact of training, expressed in terms of retention of training content, and the likely application of lessons also depend on the way the training is being delivered.

Learning experiences that mainly rely on lectures result in a very low level of learning impact, whereas the impact increases with the level of active involvement of the participants. This is why all modules of this training programme contain at small, interactive exercises.

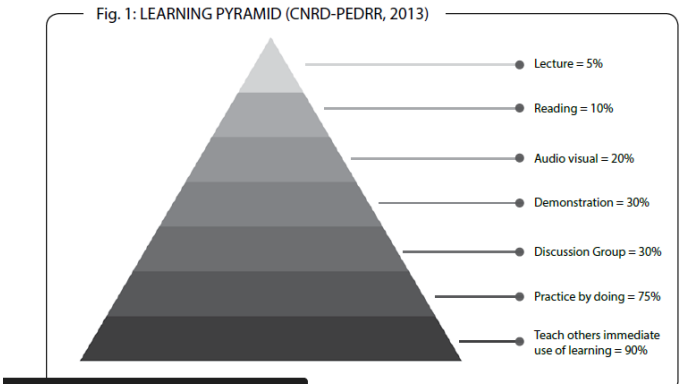


Figure 2: Learning Pyramid[10]

In the context of exercises, it would be important to remember that the role of the trainer is to provide all the help participants need, e.g. by giving examples, demonstrations, using multimodality approach etc. The core idea for trainers is to prompt the trainees without stealing their opportunity to discover the answer by thinking through the lesson or exercise on their own.

Key steps to facilitating exercises

1	Locate participants in the workshop programme (Where are we?)
2	Give input (if necessary and foreseen in the moderation plan)
3	Explain objective, task and time of the exercise
4	Ensure that participants have understood the explanation
5	Observe and monitor working groups
6	Moderate presentation of results (different options) ☐ Presentation by each group (it may take too long if there are many groups); ☐ Info market: It is important to give instructions/questions to the participants to enable them to evaluate the results of the info market; or ☐ Evaluation in groups of two: Group A evaluates Group B, then vice versa. It is important to give instructions to the participants so that they have criteria for the evaluation of results.
7	Process the exercise – evaluation and generalization in the plenary

It is essential to prepare evaluation/processing questions on the basis of the objectives established for this exercise. Some questions may already be found in previous moderation plans so that the facilitator does not always have to think of new questions. However, these questions have to be adapted to the results that shall be achieved.

Variety is the spice of life

Without changes in the training, the participant will lose interest and attention. Variations, either in

[10] https://postconflict.unep.ch/publications/Afghanistan/TEACHPackage_EnvCitizenship_Web.pdf

the delivery methodology (for example varying between presentations and exercises) or in using different media such as videos as part of the training delivery, enrich the learning experience for the participants. This will also make sure that the learning experience appeals to the different learning styles of participants. Some may prefer learning by listening, others by seeing and others by doing. Keeping this in mind, the lesson plans of the different modules are structured in order to ensure such variation.

However, it is important to keep the participants‘ interest in focus. This means that to leave sufficient room for questions and discussion during and after every session. However, this still means to pay attention, that questions and discussion stays within an acceptable timeframe and avoid “monologues” (from side of the trainer and the participants). If time does not allow concluding the discussion, one can always refer to the additional resources or later modules if the topic can be found there.

Most of the sessions include lectures that have been included to give the participants the necessary background knowledge to achieve learning objectives of the toolkit. These different knowledge input elements are built similarly on the basis of the following structure:

- **Introduction*:*** Defining the objective of the session, outlining the content and motivating the audience (up to 20%);
- **Body*:*** Covering essential information, providing examples and room for discussions and clarification (around 70%);
- **Conclusion*:*** summarizing and giving a concluding statement, stimulating further thoughts and creating a transmission to following sessions (around 10%).

Each knowledge input element has a specific message; the content focuses on specific and relevant facts. It is up to the trainer to enliven the delivery of these elements. Participants should be encouraged to raise questions and raise points for discussions during the sessions. In case of lectures, it can be useful to ask the participants to make notes and wait until the lecture is finished.

Furthermore, it is advisable to create an atmosphere of a mutually satisfying experience for the entire group. This involves that isolated one-on-one dialogues with specific individuals. Over-responding should be avoided, and the trainer should maintain control of the session at all points. Interruptions or aggressive attitudes should be avoided. When answering questions, the trainer should follow some guidelines:

- ☐ Presume questions (think about the most likely questions and prepare your answer, refer to the lecture or additional resource to underline your argument);
- ☐ Understand the questions (ensure the whole group has the right understanding;(repeat it if needed, paraphrasing can be of help);
- ☐ Give planned-out answers;
- ☐ Honesty (if you don`t have the answer to a question, say so and prepare the answer for the next day; and
- ☐ Keep control (try to involve the audience if a comprehensive question was raised, remind the questioner and the audience of the goal of the presentation).

To deepen the comprehension, application and analysis of certain topics, these short lectures are combined with diverse and interactive elements approaches.

In order to implement the proposed techniques and methods effectively, the group of participants should not be too large. A group size of 15-20 persons is recommended for optimal training success, the suggested maximum is a group size of 25 persons.

Leading discussion and brainstorming

Discussion and brainstorming in groups and plenum are some of the envisaged methods included into the session plans.

A well-structured discussion bears great advantages for the participants and the trainer alike. It allows for the participants to get involved and actively take part in the learning experience and therefore retain knowledge in a more sustainable way. By tapping into the knowledge and experience of a learning group, the group serves as a resource by itself. The trainer has the chance

to find out about the knowledge and opinions of the participants on a certain topic. This way it can be avoided to lecture participants about a subject they are already familiar with. Successfully leading a discussion can be a challenge for the trainers, since this requires more skills than just delivering a straight lecture. Though an effective instrument in enhancing mutual learning, it requires usually more time as well as structuring to cover the same number of subjects.

Here some practical aspects for consideration when leading a discussion:

- ☐ Not more than 25 people should be in a group. Sub-groups can help create a more fruitful environment;
- ☐ Seating arrangement can promote discussion; sitting in rows should be avoided;
- ☐ The level of knowledge should be more or less equal and at least some background information should be given beforehand;
- ☐ The energy level of the participants should be considered. Early mornings or right after lunch can affect the level of participation;
- ☐ Preparing questions to cover the key points that should be considered can help to structure discussion sessions and to accomplish the set training objective;
- ☐ The trainer should state the objective and expectations beforehand, including the timeframe as well as visualise these in order to keep the discussion focused.

Though there are a variety of brainstorming techniques for groups, the general idea is to collect as many ideas as possible on a certain topic in a sort time. All participants are encouraged to actively participate and to share their ideas with others. As in case of discussion, there are some basic aspects that are important to consider for the trainer:

- Clear and open questions need to be written down beforehand;
- Take notes of the comments and make sure that learners` comments are written down in the way they were formulated. If necessary, ask how longer comments should be written down (if the comments are reworded without being asked, the learners may feel patronized and demotivated).

To make a brainstorming effective, four core rules need to be considered by all participants:

Rule 1	Nobody judges any of the ideas; all ideas are valid
Rule 2	All ideas are welcome, even if they seem wild and unconventional
Rule 3	Quantity is the objective => the more the better
Rule 4	Already existing ideas can be the seed for new ideas

Selecting and setting-up the training room

The physical arrangement of the training room has an important influence on the effectiveness of group work and participation. Just as there is no right way to facilitate meetings, there is no right way to arrange a room that works for all meetings. However, there are certain room arrangement models that positively affect participation. These are shown in the examples on the right-hand side.

Training and workshops work well with U-shapes or “island” or “cabaret” settings. For conferences with very limited interaction between participants, a cinema setting would be more suitable. As you can see, there are also certain room arrangement models that are not recommended at all.

Ideal is the situation where the room can be changed. Small tables that are readily moveable are ideal.

Important also to make sure that the room is large enough to accommodate the expected number of participants as well as the desired room arrangement model.

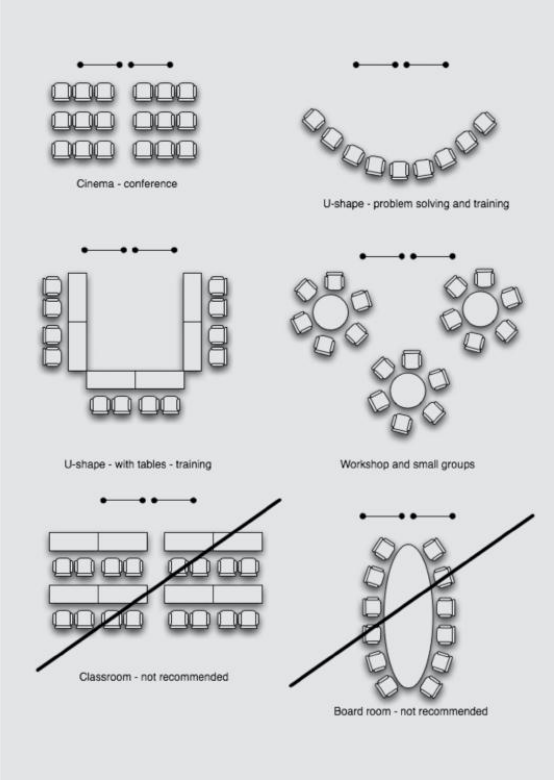


Figure 3: Training Room Set- up[11]

For further information on effective training delivery, check some of the numerous trainer guidebook or online resources; for example:

- Gary Kroehnert; Basic training of trainers, A Handbook for New Trainers, Tata McGraw-Hill;
- Bruce Klatt, The Ultimate Training Workshop Handbook, Tata McGraw-Hill.

[11] https://www.adelphi.de/de/publikation/emwater-trainer%E2%80%99s-toolkit

Modules

Module 1 – Introductory session

Module 1: Introductory Session	
Learning objectives ("After completion of this module, participants will be able to…")	**Delivery method(s)**
• Understand the structure of the course; • Know each other by name and their diverse professional backgrounds; • Articulate their expectations regarding the technical contents of the course; • Relate to the intended learning outcomes of the course; and • Familiarise themselves with the participants handbook.	• Presentation • Exercises • Pre-training assessment

Duration	Resources required
40 min *+ 15 min (optional)*	• Projector • Laptop • Slide deck: Module 1 • Blank flipcharts • Pens and markers • Prepared flipcharts (see figure below) • Name tags • Printed training schedule (one per person) • List of attendants (day one) • Pre-training assessment forms

Step	Time (in min)	Subject	Mode of delivery	Tools & resources

Step	Time (in min)	Subject	Mode of delivery	Tools & resources
1	5	**Welcome remarks** • Welcome trainees, advice on policies of building, location of the lavatories, safety rules and to switch off phones; • Hand out attendance sheet and ask for signatures; • Ask participants to write their names on name tags and tape them on their outer clothing; and • Show course overview and briefly explain rationale of modules.	Presentation	• List of attendants • Slide deck: Module 1 • Laptop • Projector • Name tags • Markers/pens

2	15	**Introduction round**
		• Introduce yourself and give some background information, use flipchart template to indicate guiding questions;
		• Exercise 1.1: Introduction round
		  ○ Ask participants to form 4 groups; and
		  ○ To introduce themselves to the group and to state their experience with RE/ CE, their professional background and their motivation to join the training;
		  ○ Focus should be on their professional background and/or the group of stakeholder they represent. This will influence the further structure of the training.
			Group exercise	• Slide deck: Module 1
				• one prepared flipchart (see template below)

3	20	**Alignment of expectations**
		• Exercise 1.2: Expectations
		  ○ Ask participants to return to the four groups; and
		  ○ To think what they expect from this training, and what they would not like to get into;
		  ○ Use flipcharts to document feedback from audience (save flipchart for exercise on last training day).
		• Present slides on expected learning outcomes:
		  ○ Briefly explain intended learning outcomes and document any expectations which cannot be met for potential follow-up after training;
		  ○ Explain the variety of teaching methods that will be applied;
			Presentation
			Group exercise
				• Slide deck: Module 1
				• One prepared flipchart (see template below)
				• Two meta cards per person
				• Printed schedules (one per person)
				• Marker/pens

Step	Time (in min)	Subject	Mode of delivery	Tools & resources
		○ Propose ground rules for the training (e.g. preventing disturbance by mobile phones, participation, Q&A); and ○ Hand out prints of schedule. • Refer to the participants handbook as guiding document trough the training with all lecture slides, additional information and space for notes.		
4	15 *(optional)*	**Assessing learning progress** *(optional)* • Present slide on assessment of learning progress and briefly explain assessment mode • Exercise 1.3: Pre-Training Assessment ○ Show slide with exercise description; ○ Distribute pre-training assessment sheets; ○ Ask participants to individually fill out sheets; and ○ Review assessment sheets and refer to modules where the points will be covered in more details in course of the training.	Exercise	• Slide deck: Module 1 • Pre-training assessment forms • Pens

Examples of flipcharts for introductory session

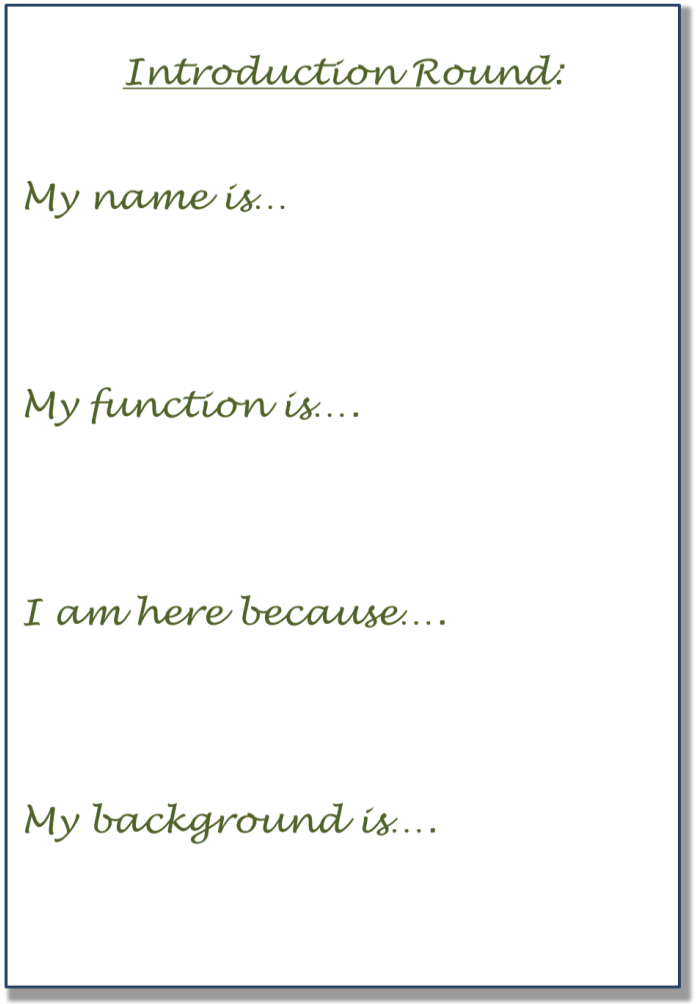


Figure 4: Flipchart template for exercise 1.1

Figure 5: Flipchart template for exercise 1.2

Module 2 - Foundation of RE and CE in the international context

Module 2: Foundation of RE and CE in the international context	
Learning objectives ("After completion of this module, participants will be able to…")	**Delivery Method(s)**
• Explain the rationale of RE and CE; • Summarize the principles of lifecycle thinking; • Differentiate conceptual implications of RE and CE; and • Contextualise RE and CE to international debates.	• Presentation • Exercise • Brainstorming • Video • Group discussion

Duration	Resources required
120 minutes	• Projector • Laptop • Speaker system (for videos) • Slide deck: Module 2 • Blank flipcharts • Pens and markers • Worksheets; exercise 2.1 • Worksheets; exercise 2.2

Reference materials

- http://reports.weforum.org/toward-the-circular-economy-accelerating-the-scale-up-across-globl-supply-chains/from-linear-to-circular-accelerating-a-proven-concept/
- https://www.ellenmacarthurfoundation.org/circular-economy/infographic
- https://www.ellenmacarthurfoundation.org/circular-economy/concept
- https://ec.europa.eu/environment/circular-economy/pdf/circular_economy_MoU_EN.pdf
- https://cdn.website-editor.net/1d19b3c8e4ec4cea997a5b973b37c28c/dms3rep/multi/tablet/Africa+Case+Study+Map+10.4.19.jpg
- https://www.resourceefficient.eu/sites/easme/files/Circular%20Policy%20Action%20Brief.pdf

- Videos:
  - https://www.youtube.com/watch?v=4wQ2Jm6i9F0
  - https://www.youtube.com/watch?v=zCRKvDyyHmI&feature=emb_title

Step	Time (in min)	Subject	Methodology	Tools & Resources

1	20	**Introduction to lifecycle thinking**
		• Locate participants in the course
		• Exercise 2.1: Open brainstorming
		  ○ Start module with an open brainstorming session;
		  ○ Ask participants to provide a brief definition for a) Resource Efficiency (RE) and b) Circular Economy (CE); and
		  ○ To draw out their understanding of RE and CE.
		• Show video to introduction to lifecycle thinking (03:21 min); and
		• Explain lifecycle stages, impact categories and areas of application of lifecycle thinking.
			Presentation
			Brainstorming
			Video
				• Slide deck: Module 2
				• Projector
				• Speaker system
				• Flip chart paper
				• Marker

2	20	**Introduction to lifecycle thinking (II)**
		• Exercise 2.2: Brainstorming on flipchart
		  ○ Ask participants to form 4 groups, and o discuss how lifecycle thinking interlinks with the concepts of RE and CE; and
		  ○ Note feedback from participants on flipchart.
			Exercise
			Brainstorming
				• Slide deck: Module 2
				• Projector
				• Poster with inscription (see figure below)
				• Marker

3	15	**Introduction to resource efficiency and circular economy** • Present conceptual considerations on resource efficiency; • Let participants brainstorm social, environmental and economic benefits of RE; • Play introductory video (03:48 min); • Provide definition of CE and illustrate the operating logic of today's linear economy; and • Ask participants if they can give examples for biological and technical cycles.	Presentation Video	• Slide deck: Module 2 • Speaker system

4	15	**Principles of circularity** • Provide step-wise explanation of butterfly diagram as interactive lecture; and • Group discussion: Ask participants if the can name examples, e.g. products for technical and biological cycles.	Interactive Presentation Group discussion	• Slide deck: Module 2
5	15	**Strategies in a circular economy** • Introduce strategies for achieving circularity and highlight the two relevant dimensions: time and material throughput (corresponding to length and thickness of arrows); • Illustrate the different strategies using the example of a mobile phone; • Ask participants for examples for each strategy.	Presentation	• Slide deck: Module 2
6	15	**Conceptual considerations on RE and CE** • Present slides on conceptual implications on RE and CE; • Explain concepts of efficiency and effectiveness; and • Highlight that RE and CE are two sides of the same coin, but have different Foci.	Presentation	• Slide deck: Module 2

7	20	**RE and CE in the international context**
		• Exercise 2.3: Open brainstorming
		  ○ Ask participants to brainstorm on the following questions, facilitate discussion in the group (10 min)
		  ▪ What are the global environmental drivers which necessitate RE and CE?
		  ▪ What international (multilateral) initiatives and agreements are you familiar with?
		  ▪ To what extent do they relate to the concepts of RE and CE?
		  ▪ How do India and other countries/regions contribute to the fulfilment of these initiatives?
		• Highlight the role of RE and CE in multilateral agreements/initiatives by
		  ○ outlining the international drivers for RE and CE; and
		  ○ briefly explaining G20 Resource Efficiency Dialogue, the Paris Agreement and the Agenda 2030.
		• Show map of international CE initiatives and explain the illustrated policies and initiatives
		  ○ Highlight the role of RE and CE in multilateral agreements/initiatives; and
		  ○ emphasize the importance of national policies and practices on the subject and point out that during the next hours and days the situation in India and the support tools that are available for implementation will be discussed.
		• Briefly explain G20 Resource Efficiency Dialogue;
		• Highlight elements of the Paris Agreement and why RE and CE are important contributors to mitigate GHG emissions;
		• Outline the elements of the Agenda 2030
		  ○ Ask participants if they are familiar with the concept of the Sustainable Development Goals (SDGs);
		  ○ Ask one of the participants to briefly explain the concept; add or correct facts that were missing or incorrect;
		  ○ Ask participants what they think where CE practices make a direct contribution to achieve the SDG (let them name examples) ask participants which of the SDGs are relevant in the context of RE and CE; and
		  ○ Explain the SGDs that can directly or indirectly benefit from RE and CE principles.
		• Describe how the explained concepts are embedded in an international context using the example of the SGDs;
		• Wrap up module by elaborating on take-home messages.
			Interactive presentation
			Open brainstorming
				• Slide deck: Module 2

Example of flipcharts for brainstorming activity on life cycle thinking

Figure 6: Flipchart template for exercise 2.2

Module 3 - Towards RE and CE through sectoral strategies in India

Module 3: Towards RE and CE through sectoral strategies in India	
Learning objectives ("After completion of this module, participants will be able to…")	**Delivery Method(s)**
• Contextualize challenges and opportunities of RE and CE in India; • Outline the existing policy context along the entire lifecycle; • Capture the key elements of the RE strategy and four sectoral strategy papers; and • Map out the stakeholders involved in the implementation of sectoral strategies at the national level.	• Presentation • Video • Exercise

Duration	Resources required
130 min	• Laptop • Projector • Speaker system (for videos) • Slide deck: Module 3 • Worksheets, exercise 3.1 (one per participant) • Worksheet, exercise 3.2 (at least one per group) • Blank flipcharts • Pens and markers

References

- https://www.footprintnetwork.org/2015/09/23/eight-countries-meet-two-key-conditions-sustainable-development-united-nations-adopts-sustainable-development-goals/
- https://www.asef.org/images/docs/SustainableDevelopmentGoalsandIndicatorsSmallPlanetPart1.pdf
- https://s3.amazonaws.com/sustainabledevelopment.report/2019/2019_sustainable_development_report.pdf
- http://www.eu-rei.com/pdf/publication/Strategy%20on%20Resource%20Efficiency.pdf
- http://www.eu-rei.com/pdf/publication/Enhancing%20Resource%20Efficiency%20through%20Extended%20Producer%20Responsibility.pdf
- http://www.eu-rei.com/pdf/publication/Fostering%20Resource%20Efficiency%20in%20the%20Indian%20Building%20and%20Construction%20Sector.pdf
- http://www.eu-rei.com/pdf/publication/NA_EU_Status%20Paper%20&%20Way%20Forward_Jan%202019.pdf
- http://www.eu-rei.com/pdf/publication/NA_MoHUA_Strategy%20on%20RE%20in%20C&D%20Sector_Jan%202019.pdf

- http://www.eu-rei.com/pdf/publication/NA_MeitY_RE%20Strategy%20in%20EEE%20Sector_Jan%202019.pdf
- https://www.eu-rei.com/pdf/publication/NA_MoS_Strategy%20on%20RE%20in%20Steel%20Sector_Jan%202019.pdf
- http://www.eu-rei.com/pdf/publication/NA_MoM_Strategy%20on%20RE%20in%20Aluminium%20Sector_Jan%202019.pdf
- http://www.eu-rei.com/pdf/publication/NA_EU_Status%20Paper%20&%20Way%20Forward_Jan%202019.pdf
- https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Circular-economy-in-India_5-Dec_2016.pdf
- https://www2.mmu.ac.uk/media/mmuacuk/content/documents/bit/Stakeholder-analysis-toolkit-v3.pdf

Step	Time (in min)	Subject	Methodology	Tools & Resources
1	5	**Introduction** • Briefly explain how this session links with the previous one; and • Present initial slides of presentation 1 (objectives, outline of session).	Presentation	• Laptop • Projector • Slide deck: Module 3

2	30	**RE and CE: Challenges and opportunities in India**
		• Exercise 3.1: Video analysis
		  ○ Distribute the worksheet to the participants;
		  ○ Ask the participants to watch the video and make notes with respect to the questions on the worksheet
		  ▪ Opportunities for the Indian economy;
		  ▪ Challenges of current resource use in India;
		  ▪ Key sectors for increasing RE; and
		  ▪ Potentials for increasing RE in across these sectors.
		  ○ Show the video on RE to the participants (05:00 min);
		  ○ Ask for quick feedback from participants whether they have understood everything and answer any immediate questions raised;
		  ○ Review the questions on the worksheets and ask participants to explain what they have noted;
		  ○ Add any aspects that may not have been mentioned by the participants; and
		  ○ Emphasize that those are only limited aspects of RE and CE in India and just selected sectors and point out, that these aspects and sectors and additional ones will be discussed during this module.
		• Go through the slides and explain the implications of increasing material demand and dependence on critical raw materials; outline benefits of CE.
			Exercise
			Video
			Presentation
				• Speaker system
				• Slide deck: Module 3
				• Worksheet: exercise 3.1 (one per participant)
				• Pens

3	20	**National progress on RE and CE** ● Show graph on bio-capacity and Human Development Index; highlight path towards sustainable development quadrant; ● Conclude topic by encouraging participants to assess their own footprint by using the link indicated on the slide; ● Outline India's performance on SDGs; emphasize the lack of information on SDG 12 (SCP); ● Present Indian policies and programmes along the lifecycle stages ○ Highlight and outline the key strategy documents, including Strategy on resource Efficiency and the four sectoral strategy documents, eventually also referring to state level strategy documents e.g. Telangana E-waste Strategy; ○ Recall concepts of lifecycle thinking from the previous modules; ○ Go through the slides and explain the national laws and initiatives for each stage of the lifecycle; ○ Emphasize the needs for action of each stage; and ○ Explain the latest developments, as MeitY with NITI Aayog developed several strategy papers and reports, in cooperation with EU- REI and mention the sectoral assessment studies.	Presentation	• Slide deck: Module 3
4	75	**Strategies on RE and CE across selected sectors in India** ● Exercise 3.2: Identifying key stakeholders of India's Resource Efficiency Policy ○ Ask participants to form 4 groups, introduce task and worksheets; ○ Explain stakeholder mapping methodology using slides; ○ Provide some examples of stakeholders in the Indian sectors; ○ Give participants 40 minutes to work on the exercise and advise them to indicate their findings on the prepared posters; ○ Ask one representative of each group to present their findings in front of the group, encourage the group to give remarks/ ask questions; and ○ Add or give remarks if important aspects have been neglected, ask the groups for details if you have the feeling that certain aspects have not been understood completely. ● Conclude module by summarising main take-away messages.	Exercise	• Slide deck: Module 3 • Worksheet: exercise 3.2 (min. four copies) • Four Posters with inscription (see figure below) • Pens and marker

Solution sheets for exercises of module 3

Exercise 3.1: Video on Resource Efficiency in India

Required time: 5 minutes

Introduction

Watch the video and take notes on the following aspects about resource efficiency in India:

Challenges in current resource use in India:

- Significant increase in consumption and production needs constant material flow
- Per capita material usage increased 2.5 times since the 1980s
- Comparatively low rate of resource efficiency
- Finite resources can lead to an economic crisis
- While only 3% of resource is imported, the major share of some critical materials are imported (such as phosphate, cobalt and nickel)
- This makes India vulnerable to supply shocks
- High rate of extraction of domestic resources could lead to depletion of resources and towards an increasing dependency on supply from other countries (and therefore on unstable global market prices)
- Careless exploitation of critical natural resources can further have negative social and environmental implications (like increased GHG emissions)

Opportunities for the Indian economy:

- India economy is vast in diversity of sectors, sizes and resource footprints

Key sectors for resource efficiency in India:

- Automobile industry
- Construction industry

Potentials for increasing RE in across these sectors:

- Optimization of **production processes**
- **Reuse** of demolition debris (reduces needs for new materials)

Figure 7: Solution sheet for exercise 3.1

Example for flipchart for module 3

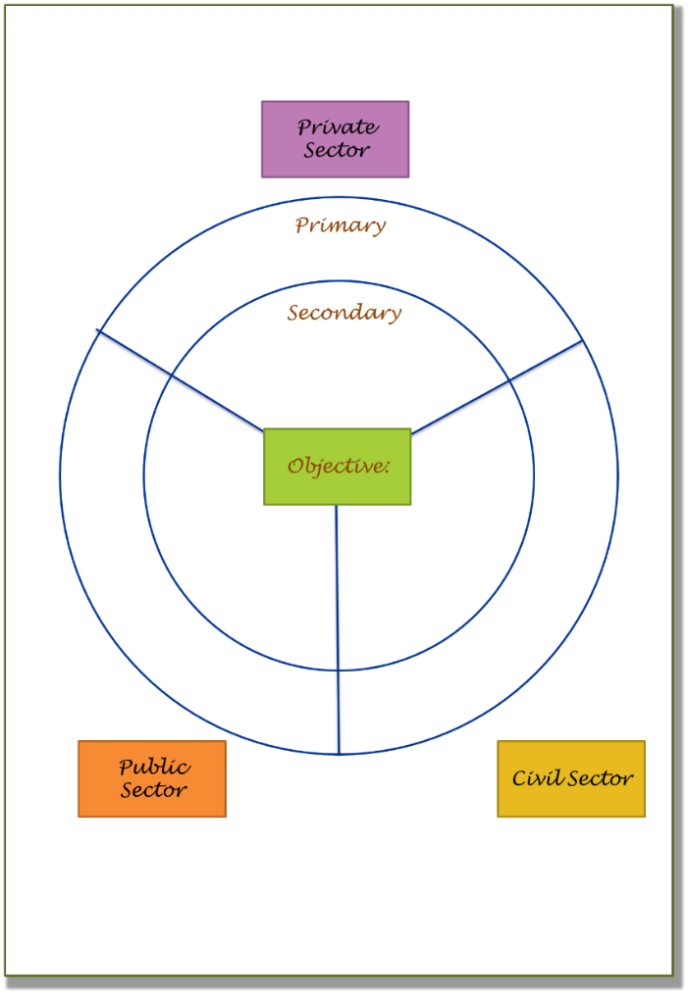


Figure 8: Flipchart template for exercise 3.2

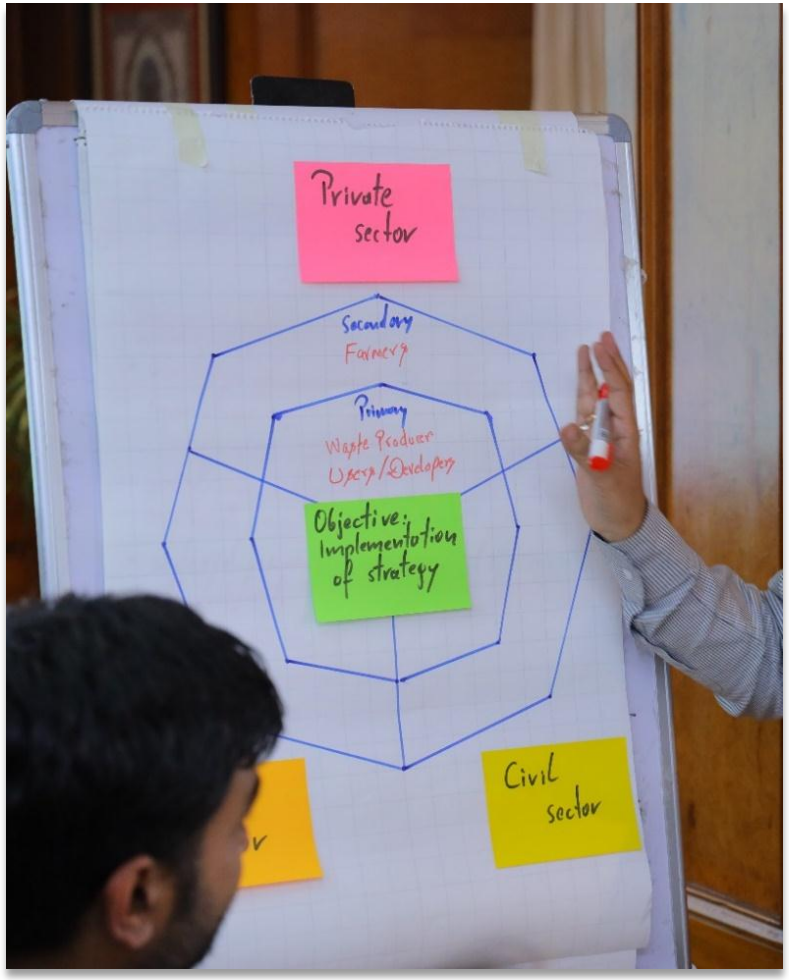


Figure 9: Example for exercise 3.2

Module 4a - Tools, standards and indicators for RE and CE – Material Flow Analysis

Module 4a: Material Flow Analysis	
Learning objectives: ("After completion of this module, participants will be able to…")	**Delivery Method(s)**
• Relate to salient features of MFA as a decision-making support tool; • Define the steps of MFA; and • Describe and illustrate techniques of analysing and documenting material flows. It is recommended to combine this module with module 4b on LCA.	• Presentation • Brainstorming • Exercise

Duration	Resources needed
165 min	• Projector • Slide deck: Module 4a • Blank flipcharts • Worksheets, exercise 4a.1 (one per participant) • Worksheets, exercise 4a.2 (one per participant) • Worksheets, exercise 4a.3 (one per participant) • Pens and markers

References

- https://publik.tuwien.ac.at/files/PubDat_188894.pdf
- https://thecitywasteproject.files.wordpress.com/2013/03/practical_handbook-of-material-flow-analysis.pdf
- https://iges.or.jp/en/publication_documents/pub/issue/en/3891/3RFS_010_web.pdf
- http://www.npcindia.org.in/wp-content/uploads/2017/05/MFCA-Leaflet.pdf)
- https://www.oecd.org/environment/indicators-modelling-outlooks/MFA-Guide.pdf
- https://www.ifu.com/en/
- https://seea.un.org/sites/seea.un.org/files/global_material_flow_accounting_manual_final_draft.pdf
- https://ocw.mit.edu/courses/engineering-systems-division/esd-123j-systems-perspectives-on-industrial-ecology-spring-2006/lecture-notes/lec14.pdf

Step	Time in min	Subject	Methodology	Tools & Resources
1	10	**Introduction & recap** • Welcome group to module; • *Optional: if this is the second day the training workshop, start with a recap of day one as well as allow time for clarifying questions or giving explanations on questions raise at end of day one);* • Locate the group within the programme of the day and the next session (refer to prints of schedule/flip chart with schedule for the day); • *Optional: Ask participants about their assignment from the day before, leave some room for questions and discussions; and* • Launch into subjects by asking participants if they know any material cycles (e.g. nutrient cycle, hydrological cycle).	Presentation	• Slide deck: Module 4a • *Schedule for day 2*

2	30	**Salient features of MFA**
		• Present definition and rationale of MFA:
		  ○ Use illustration to explain the aspects of the definition; and
		  ○ Ask participants if the can name flows and stocks of materials and defined systems.
		• Explain objectives of MFA.
		• Brainstorming: Use MFA of the human metabolism to explain the aspects and terminology of MFA.
		• Exercise 4a.1:
		  ○ Hand out exercise sheet and explain the exercise;
		  ○ Ask participants after 5-10 min to finalize the exercise and let participants read out the completed text; and
		  ○ Leave room for discussions and questions and ensure that everyone understood all the terms.
			Presentation
			Brainstorming
			Exercise
				• Slide deck: Module 4a
				• Worksheet: exercise 4a.1
				• Pens

3	30	**Types and Steps of MFA** • Explain types of MFA, respective ISO, levels of MFA and Sankey diagrams; and • Outline steps in elaborating MFA.	Presentation Exercise	• Slide deck: Module 4a • Worksheet: exercise 4a.2 • Pens

		• Exercise 4a.2: Present case study Sainest Tubes to illustrate main steps in MFA
		  ○ Ask participants to form groups, hand out exercise sheets and explain the exercise;
		  ○ Ask the groups to discuss their results with the group;
		  ○ Show slides with solutions and discuss gaps and/or additions from the worksheets of the participants; and
		  ○ Ensure that everybody fully understood the steps of MFA.
		• Highlight advantages and disadvantages of MFA.		

4	90	**Material Flow Analysis of a Coffee Machine**
		• Exercise 4a.3:
		  ○ Ask participants to return to their groups, hand out exercise sheets and explain the exercise;
		  ○ Check in with the participants while they are working on the exercise and ensure all tasks are understood and all groups make progress;
		  ○ Discuss results and illustration with the group, use lecture slides as examples (task 1);
		  ○ Group presentation of the results using flipcharts (task 2); and
		  ○ Group discussion (task 3).
			Presentation
			Exercise
				• Slide deck: Module 4a
				• Worksheet: Exercise 4a.3
				• Blank flipcharts
				• Marker & Pens

5	5	**Close session** • Summarise key points; and • Provide time for questions and comments.	Presentation	• Slide deck: Module 4a

Solution sheets for exercises of module 4a

Exercise 4a.1: Terminology of material flow analysis

Task

Please read the cloze text passage below and place the appropriate word in the gap from the choices below.

Material Flow Analysis (MFA) is the study of physical **flows** or **fluxes** of **materials** into, through and out of a given **system**. It is based on methodically organised accounts in physical units, and uses the **principle of mass balancing** to analyse the relationships between material flows (including energy), human activities and environmental changes. Material flows can be analysed at various **temporal** and **spatial** scales depending on the issue of concern and on the objects of interest of the study. The analysis can be applied to the global or the national economy, an industry, an enterprise, a city or a river basin.

An MFA gives a complete and consistent set of information about all **flows** and **stocks** of a particular **material** within a **system.** It connects the sources, the pathways and the intermediate and final sink of a material. Through balancing **inputs** and **outputs**, the flows of wastes and environmental loadings become visible, and their **sources** can be identified. The **depletion** or **accumulation** of material stocks is identified to either take countermeasures or to promote further **utilization**.

System (2x) Depletion
Sources Stocks Materials
Utilization
Spatial
Flows (2x) Output
Inputs Principle of mass balancing
Material
Accumulation Flux
Temporal

Figure 10: Solution sheet for exercise 4a.1

Table 1: Case study Sainest Tubes

SAINEST TUBES PVT. LTD.

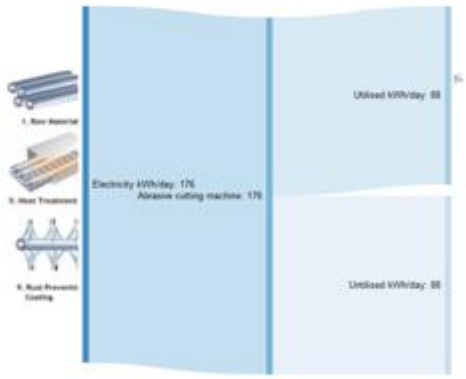
Observation	Solution	Investments (INR)	Savings (INR/year)
Process scrap due to insufficient gripping	Additional vertical pneumatic cylinder is attached for sufficient gripping	1,000	6,58,944
The abrasive cutting machine was running when not loaded	Switch off machine when idle	2,400	1,10,160
Insufficient cooling of annealed material, which reduces the furnace loading capacity	An additional cooling zone was introduced, so loading could be increased by 50%	35,000	78,00,000
6 Men @ unloading at blast furnace	Introduced pneumatic cylinder & 3 Men used for unloading	50,000	4,50,000

Step 1: Problem definition
High production costs due to process ineffciencies

Step 2: System definition
Process:
- Abrasive cutting

Flows in cutting process:
- Electricity consumption (kWh/day)

Step 3: Definition of material flows and stocks
Input data:
- Power of abrasive cutting machine = 22,032 kW
- Electricity price = 5 INR/kWh
- Abrasive cutting machine running for 8 hrs/day
- Abrasive cutting machine running idle for 4 hrs/day



Step 4: Interpretation and illustration
Calculation of savings:
- Turning off abrasive cutting machine while idle results in savings of 22,032 kW * 4 hrs/day * 5 INR/hr = 440,64 INR/day
- 440,64 INR/day * 250 working days in India = savings of 1,10,160 INR/year

Figure 3: Exercise template

Figure 11: Solution sheet for exercise 4a.2

Material flows and stocks

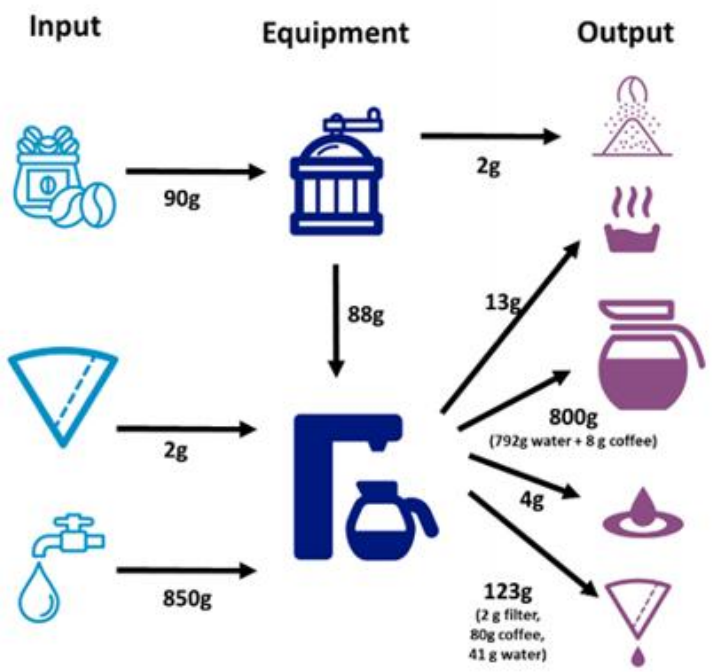
Table 3: Input and output data

Equipment	Coffee grinder, coffee machine including pot.
Balance period	One brew as representative period comprising all relevant activities and materials in usual amounts.
Process steps	"coffee making", including coffee grinding, brewing and drinking.
Input	
• Coffee beans	90 grams
• Water	850 grams
• Dry filter	2 grams
Input ∑	942 grams
Product output	
• Water	792 grams
• Coffee extract	8 grams
Product output ∑	800 grams
Non-product output	
Residual coffee powder (grinding)	2 grams
Coffee grounds	
• Filter	2 grams
• Coffee	80 grams
• Water	41 grams
Residual water in coffee machine	4 grams
Evaporated water	13 grams
Non-product output ∑	65 grams
Output ∑	**942 grams**

Figure 12: Solution sheet for exercise 4a.3 (Part 1)

Process flow

Template chart A: overview (trainer notes)



Template Chart B: overview (trainer notes)

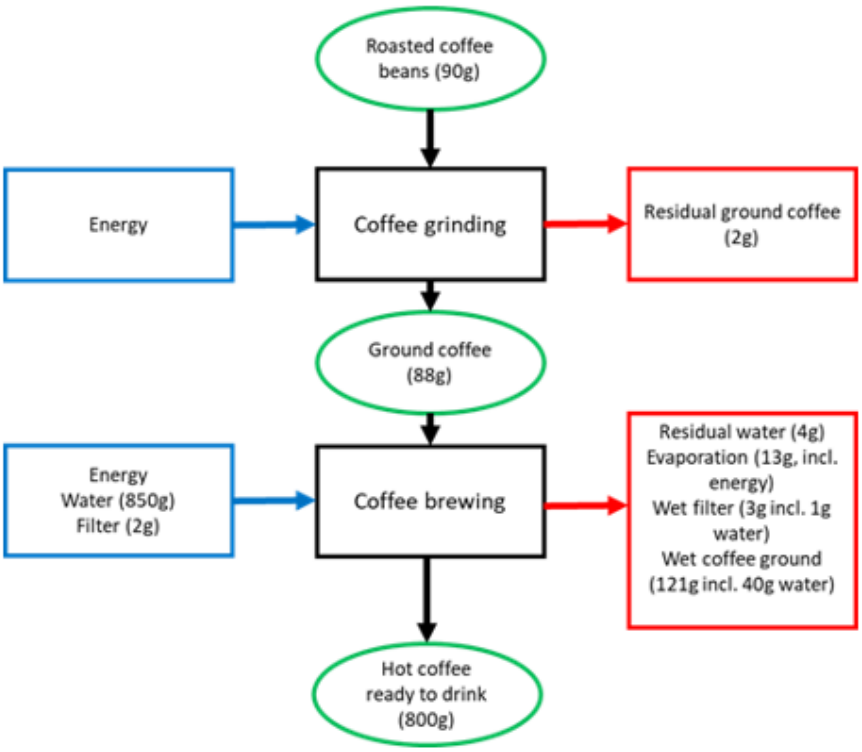
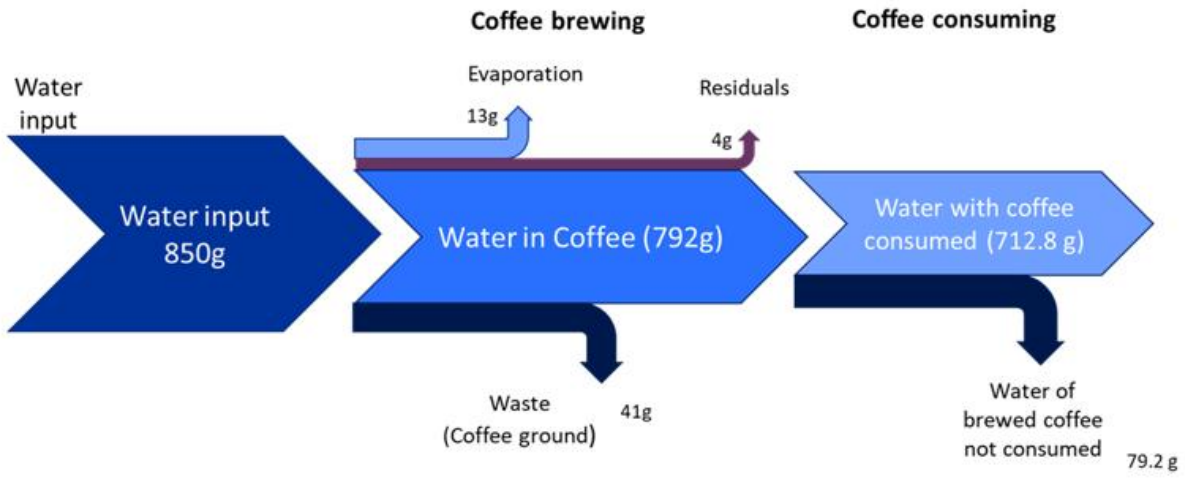


Figure 13: Solution sheet for exercise 4a.3 (Part 1; Visualisation)

Process flow – Sankey diagram

Template chart C: Water efficiency (trainer notes)



Process flow – Sankey diagram

Template chart D: Material efficiency for coffee (trainer notes)

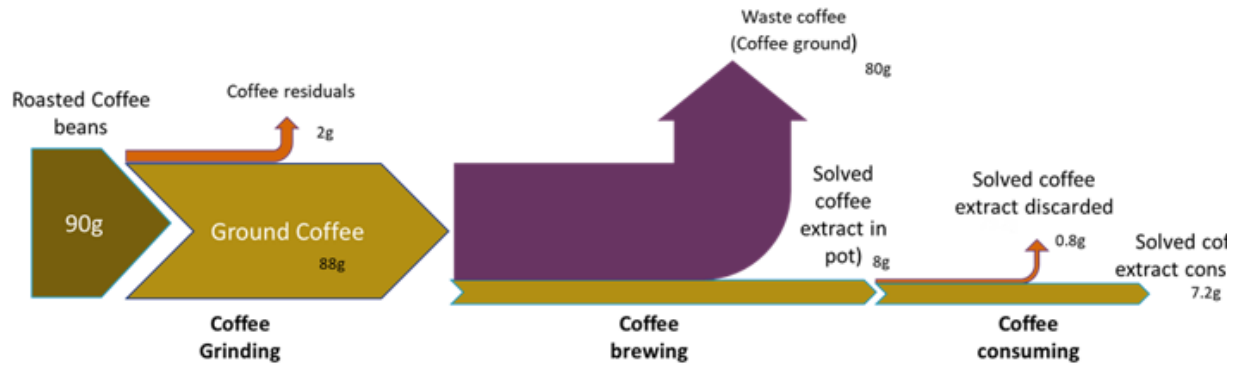


Figure 14: Solution sheet for exercise 4a.3 (Part 1; Sankey visualisation)

Measures for process optimization and impacts on lifecycle

Table 4: Exercise template (trainer notes)

Measures	Impacts in lifecycle
Good housekeeping • Improved material utilization; • Grinding of larger quantities; • Define recipes; • Define indicators; • Train operators; • Provide quality control.	Drinking remaining coffee may reduce overall consumption (impact on nervousness/coffee addiction may increase)
Technology modifications • Use a new (closed) coffee machine to reduce losses due to evaporation and waste heat; • Grinder producing less residues (complete emptying); • Finer grinding; • Use bigger filters; • Use espresso machine as completely different technology; • Buy ground coffee.	New coffee machine may reduce energy consumption, however, energy required for production of new machine may exceed savings depending on operational life of the same
Substitution of raw and process materials • No paper filter (goldfilter); • Possibility of using pre-ground coffee; • Soluble coffee.	Using soluble coffee can eliminate energy consumption at the office almost entirely (only kettle needed) but outsources the same to the production process (i.e. extraction, drying and processing at unknown efficiencies)
Reduce, reuse, recycle • Composting of ground coffee and filters; • Reuse coffee grounds for a low-quality cup of coffee; • Reuse coffee grounds as pesticide (e.g. against potato beetle).	Reuse spent coffee grounds for low-grade coffee can increase overall energy and water consumption as demand for high quality is not fulfilled and additional coffee with fresh grounds will be brewed
Product modifications • Turkish coffee; • Stronger, weaker coffee; • Coffee sweets, coffee pills; • Instant coffee; • Caffeine pills.	Turkish coffee may increase private use of toothpaste to remove coffee grounds stuck between teeth
Other organisational measures • Time-travel diagram to optimize coffee quantities.	Can provide indications as to when coffee is consumed ("coffee-rush-hour") and inform type of technology modifications require (e.g. automatic kill-switch of coffee machine to reduce energy consumption)

Figure 15: Solution sheet for exercise 4a.3 (Part 3)

Module 4b - Tools, standards and indicators for RE and CE – Lifecycle Assessment

Module 4b: Lifecycle Assessments	
Learning objectives: ("After completion of this module, participants will be able to…")	**Delivery Method(s)**
• Relate to the concept and terminology of life cycle assessments (LCA); • Define the steps of a life cycle assessment; • Interpret the results of life cycle assessments.	• Presentation • Video • Brainstorming • Exercise

Duration	Resources needed
Up to 150 min	• Projector • Laptop • Speaker system (for videos) • Slide deck: Module 4b • Pens and markers • Prepared flipcharts • Worksheet, exercise 4b.1 (at least one per group of 3-4 participants) • Worksheet, exercise 4b.2 Part I (one per participant) • Worksheet, exercise 4b.2 Part II (at least one per group of 4-5 participants)

References

- https://www.scribd.com/document/438834744/LCA-Report-15-05-2018
- https://www.springer.com/gp/book/978940177608
- https://link.springer.com/chapter/10.1007/978-94-017-7610-3_2
- Video: https://www.youtube.com/watch?v=BiSYoeqb_VY

Step	Time in min	Subject	Methodology	Tools & Resources
1	5	**Introduction & recap**	Presentation	• Laptop • Projector

		• Welcome group to module; • Locate the group within the programme; • Launch into subjects by asking participants about their previous experience with Life Cycle Assessments; and • Explain purpose and structure of this session.		• Slide deck: Module 4b
2	30	**Lifecycle Assessments** • Video ○ Show video on introduction to lifecycle assessments (06:03 min). • Present lifecycle stages and impacts; • Explain rationale of LCAs, including differences between singular, comparative, attributional and consequential LCAs; • Further elaborate on terminology of LCA.	Presentation Video	• Speaker system • Slide deck: Module 4b

3	30	**Defining steps in LCA**
		• Exercise 4b.1: Defining steps in LCA
		  ○ Ask participants to form of 2 - 3 persons;
		  ○ Encourage participants to define steps 1-4 of a fictional LCA to compare two mobile phones; and
		  ○ To think of examples in each step and try to be as specific as possible
		  ○ Present solutions to exercise.
		• Summarize advantages and disadvantages of LCA.
			Presentation
			Brainstorming
			Exercise
				• Slide deck: Module 4b
				• Worksheets: Exercise 4b.1 (one per group)
				• Pens

4	70- 80	**LCA of Insulation materials**
		• Exercise 4b.2: LCA of Insulation materials
		  ○ Hand out exercise sheets (Exercise 4b.2_LCA insulation_Part I) and ask participants to work on the task individually;
		  ○ Explain the tasks and leave room for questions;
		  ○ Give participants 30 min to work on the tasks;
		  ○ After 30 min check if everyone finished the tasks;
		  ○ Encourage participants to share their solutions and present the solution slides; and
		  ○ Leave 15 min for further discussion on the subject using the guiding questions provided.
		• *(Optional) Depending on the level of knowledge and of active participation of participant and speed of progress, there are two options to choose from how to conduct the second part of the exercise. Please note that the respective slides need to be (de)activated in the presentation)*
		• a) Group discussion (20 min)
		  ○ Show slide with guiding questions for group discussion and slide with background information; and
		  ○ Encourage participants to share their point of view and lead discussion.
		• b) Group work (30 min)
		  ○ Ask participants to form groups of 4-5 people and hand out exercise sheets (Exercise 4b.2_LCA insulation_Part II);
		  ○ Explain the tasks and give participants 20 min to work on it; and
		  ○ Encourage participants to share their findings with the entire group, add/correct aspects that were missing or incorrect, show slides with solutions.
			Exercise	• Slide deck: Module 4b
				• Pens
				• Worksheets: Exercise 4b.1 Pat I (one per participant)
				<u>Or</u>
				• Worksheets: Exercise 4b.1 Part II (one per group)

5	5	**Wrap up** • Summarise key points; and • Provide time for questions and comments.	Presentation	• Slide deck: Module 4b

Solution sheets for exercises of module 4b

Step 1: Goal definition and scoping

- „targetting two new high-end smartphones by Sony (models Z3 and Z5) with accessories but without network usage"
- „funtctional unit is set to life time usage (3 years) for a representative usage scenario"
- „All life cycle stages and processes are included in [...] except reconoditioning mobile phone for reuse"
- „the environemtal life cycle assessment indicators are chosen as presented in Table 1"

ELCIA indicators as recommended by ILCD	Unit
Global Warming Potential **(GWP)**	CO_2-eq.
Ozone Depletion Potential **(ODP)**	CFC-11-eq.
Human Toxicity Cancer potential effects **(HumToxCan)**	CTUh
Human Toxicity non-Cancer potential effects **(HumTox)**	CTUh
Particulate Matter (2.5 µm) **(PM)**	G
Photo-Oxidant Creation Potential **(POCP)**	NMVOC-eq.

Step 2: Lifecycle inventory analysis

Raw materials acquisition:

- Primary materials, packaging materials for parts and final delivery, virgin and recycled inputs

Production:

- Parts production, packaging and transportation, assembly, ICT manufacturer support abilities, distribution

Use:

- Smartphone energy consumption based on Sony Data, associated use of networks

End of life:

- Open to explore different scenarios in this section (e.g. 90 % recycled, 10% virgin materials, or 20% recycled materials and 80% virgin materials)

Based on another study: Liebmann, A., 2015 ICT Waste Handling: Regional and Global End-of-Life Treatment Scenarios for ICT Equipment

Step 3: Lifecycle impact assessment

Results of impact category „global warming potential (GWP)":

- Total GWP of the device based on functional unit (3 years) for model Z5 is 57 kg CO_2-eq and for model Z3 is 50 kg CO_2-eq
- Production stage of dominates GWP
- End of life stage can be carbon-negative if contents are recycled or plastic is incinerated and substitutes fossil fuels

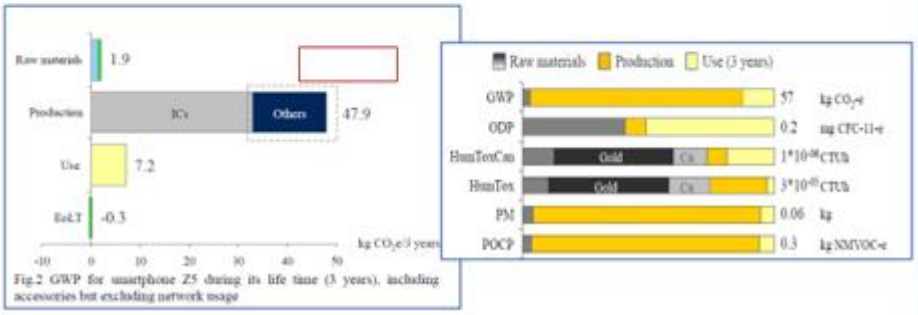


Fig.2 GWP for smartphone Z5 during its life time (3 years), including accessories but excluding network usage

Figure 16: Solution sheets for exercise 4b.1 (1/2)

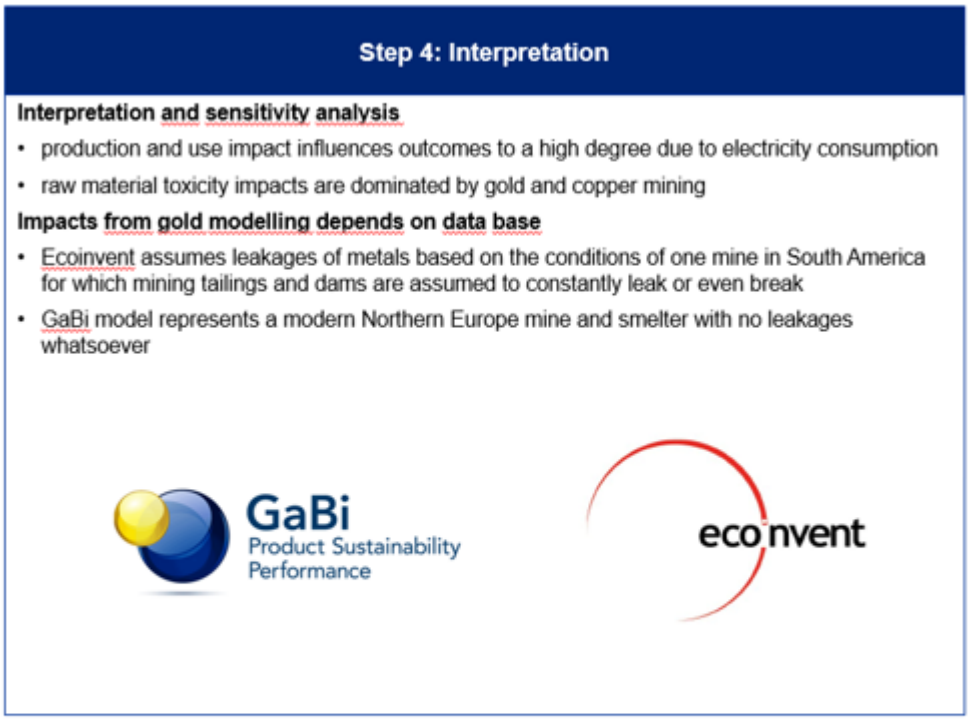


Figure 17: Solution sheets for exercise 4b.1 (2/2)

Worksheet 1

Task 1: Compare the insulation material based on their ***functionality*** (according to the actual amounts of material that must be installed to achieve the thermal resistance of 1m²K/W).

1. Best functionality: ..... **(Stone wool)**
2. Medium functionality: ..... **(Flax)**
3. Lowest functionality: ..... **(Paper wool)**

Note: only very small differences. All materials perform well with respect to their insulation properties.

Task 2: Rank the different product systems with respect to their different impacts levels (whereby 1= best, 2=medium, 3=worst, n/a= no information available). Use the information provided in table 2 and note your findings in the table below:

Table 4: Ranking of the three insulation materials with respect to different impacts

Impact category	Unit	Stone wool	Flax	Paper wool
Global warming potential	g CO_2-equivalent	2	3	1
Acidification	g SO_2-equivalent	2	3	1
Nutrient enrichment	g NO_3^-equivalent	2	3	1
Generation of solid waste	g non-hazardous waste	2	3	1
Generation of hazardous waste	g hazardous waste	2	1	3
Energy consumption				
Fossil fuels (incl. Feedstock)	MJ	2	3	1
Renewable fuels (incl. Feedstock)	MJ	1	2	3
Electricity	MJ	1	3	2
Total energy consumption	MJ	1	3	2
Water consumption	g water	2	3	1
Health aspects				
Carcinogenicity	Animal evidence	1	n/a	3
Lung fibrosis (inhalation)	Animal evidence	1	3	3
Lung disease (non-malignant)	Human evidence	1	3	n/a
Cancer (IARC)	Human evidence	3	n/a	n/a

Advantages of ranking system:

- provides good overview
- easy to read
- no professional knowledge needed

Disadvantages aspects of ranking system:

- provides only general picture
- differences between materials might be marginal and therefore insignificant
- impact categories might be of varying relevance depending on your intention and the scope of your study/product

Figure 18: Solution sheets for exercise 4b.2 (Worksheet 1)

Worksheet 2

Task 3: Identify which materials have the largest and which the smallest global warming potential. Indicate your findings by labelling the x-axis on the figure below:

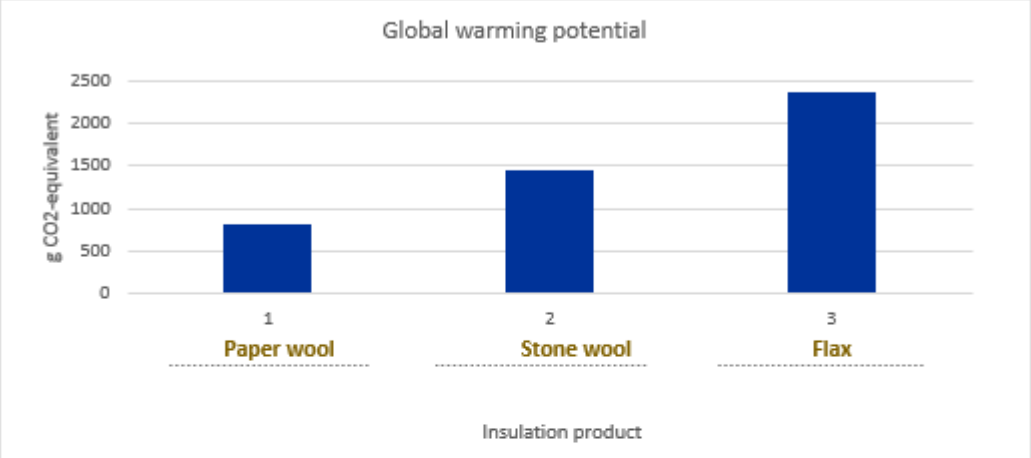


Figure 1: Global warming potential of the individual insulation products

Figure 19: Solution sheets for exercise 4b.2 (Worksheet 2)

Worksheet 3

Task 4: Analyse the provided information and discuss possible reasons for the high impact potential of flax. Identify lifecycle stages that have particular high impact.

- The global warming potential differs by almost factor 3 between the least contributing material (paper wool) and the most contributing (flax).
- It may be somewhat surprising that flax insulation, which in principle is based on a renewable resource, has the largest contribution.
- A number of reasons for this:
    - Large-scale agricultural production of flax requires artificial fertilizer; whose production is relatively energy intensive (causing emissions of carbon dioxide)
    - Production of fertilizer further emissions occur: dinitrogen oxide (N_2O) (a strong greenhouse gas)
        - Evaporation of N_2O of the fields
    - Binder and flame retarding materials added use relatively large amounts of fossil fuels for their production
    - Production process itself also contributes through emissions from its energy consumption. The energy is used to melt the binder materials before mixing with the flax raw material.
- Contribution to global warming potential of stone wool:
    - Main contribution for stone wool insulation comes from the production process where fossil fuels are used for production of energy.
    - Production of stone raw materials is not very demanding in terms of energy consumption and there are no other emissions during their production that have a global warming potential.
    - Binder materials are only used in very small amounts and besides emissions from energy consumption, there are no other known emissions that contribute to global warming in significant amounts.
- Contribution to global warming potential of paper wool:
    - Although the raw material for paper wool, old newsprint, primarily is based on renewable resources, its production still demands an input of fossil fuels and causes accordingly emissions of carbon dioxide, which is the main contributor (more than 55%) in this system.
    - Other significant sources are production of aluminum hydroxide and the final production, each contributing with 10-15%.

Figure 20: Solution sheets for exercise 4b.2 (Worksheet 3)

Module 4c - Tools, standards and indicators for RE and CE – Standards

Module 4c: Standards	
Learning objectives: ("After completion of this module, participants will be able to…")	**Delivery Method(s)**
• Relate to the relevance of standards, their disadvantages and benefits and to their role within sectoral strategies; • Outline levels on which standardization takes place in India and at international level; • Understand opportunities for lifecycle considerations when developing standards.	• Presentation • Exercises • Brainstorming

Duration	Resources needed
110 min	• Projector • Laptop • Slide deck: Module 4c • Blank flipcharts • Pens and markers • Prepared flipcharts • Worksheets, exercise 4c.1 (at least one per group of 2-3 participants) • Worksheets, exercise 4c.2 (at least one per group of 2-3 participants)

References

- https://www.weeelabex.org/
- https://www.cenelec.eu/
- https://publications.jrc.ec.europa.eu/repository/bitstream/JRC110326/efficiency_trends_2017__final_lr.pdf
- https://boss.cen.eu/ref/CEN_4.pdf
- https://www.cen.eu/Pages/default.aspx
- https://www.ds.dk/media/px5jhney/a-world-built-on-standards.pdf
- https://www.iso.org/standards.html
- https://bis.gov.in/

Step	Time in min	Subject	Methodology	Tools & Resources
1	5	**Introduction & recap** • Welcome group to module; • Locate the group within the programme; • Launch into subjects by asking participants about their previous experience with Life Cycle Assessments; • Explain purpose and structure of this session; and • Launch into subjects by asking participants about their understanding of standards.	Presentation	• Laptop • Projector • Slide deck: Module 4c

2	30	**Discussing standards**
		• Provide and discuss the definition of standards on the example of a notebook;
		• Explain 4 major categories of EU typology of standards;
		• Discuss five-step process of standard development and nomenclature;
		• Exercise 4c.1: Discussing Standards
		  ○ Ask participants to form groups pf 2-3 people and discuss the following questions:
		  ▪ What are the general advantages and disadvantages of standards from an economic point of view?
		  ▪ How are standards relevant in the context of RE and CE?
		  ○ Hand out exercise sheets and ask participants to use them to indicate findings;
		  ○ Use prepared poster to summarize findings of the groups; and
		  ○ Discuss findings and advantages and disadvantages of standards.
			Presentation
			Exercise
			Brainstorming
				• Slide deck: Module 4
				• Pens
				• Worksheet: Exercise 4c.1 (one per group)
				• Prepared flipcharts (see figure below)

3	10	**Standardisation bodies** • Discuss the 3 levels of standardization in India; • Go into detail about the role of the Bureau of Indian Standards (BIS) and sector-specific bodies; and • Give an overview about international trade obligations.	Presentation	• Slide deck: Module 4c

4	5	**Sectoral Standards** • Present the national strategy and international standards in the Aluminium sector; • Present the national strategy and international standards in the Steel sector: • Present the national strategy and international standards in the C&D sector; and • Present the national strategy and international standards in the EEE sector.	Presentation	• Slide deck: Module 4c
5	5	**Standards and the Environment** • Provide the steps of the EUs New Approach; and • Shortly discuss the role of CEN/EHD.	Presentation	• Slide deck: Module 4c

6	40	**Environmental Checklist**
		• **Exercise 4c.2: Environmental checklist**
		  ○ Handout worksheets;
		  ○ Explain exercise, ask participants to form groups of 2-3 people and analyse the background text;
		  ○ Take 10 minutes to discuss the solution with the participants.
			Exercise	• Slide deck: Module 4c
				• Worksheets: Exercise 4c.2 (one per group)

7	10	**Standards on RE and CE** • Show standards on energy-related products; • Provide the WEEE related standards; • Explain the role of BSI and the Framework for implementing the principles of the circular economy in organizations; and • Present information on CE standardization at the international level.	Presentation	• Slide deck: Module 4c
8	5	**Wrap up** • Summarise key points; and • Provide time for questions and comments.	Presentation	• Slide deck: Module 4c

Solution sheets for exercises of module 4c

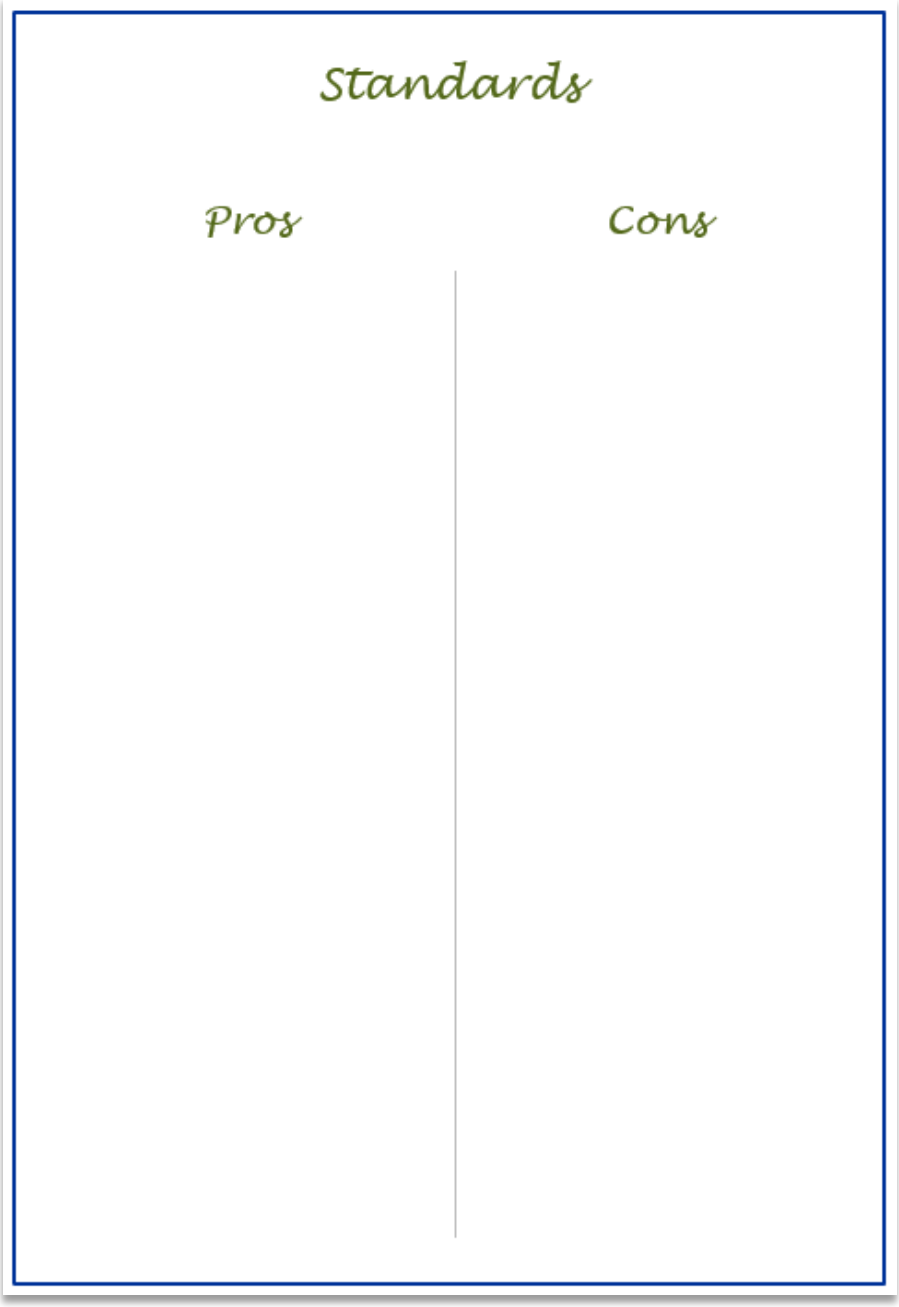


Figure 21: Flipchart template for exercise 4c.1

Exercise 4c.1: Discussing Standards

Estimated time requirement: 20 minutes

Introduction

Standards are an essential part of modern everyday life. They generally be defined as documents, established by consensus and approved by a recognized body, that provide rules, guidelines or characteristics for activities or their results for common and repeated use. Standards aim at the achievement of the optimum degree of order in a given context, for example with regard to resource use in manufacturing consumer products. From an economic point of view, standards offer a wide range of general advantages but can also create disadvantages if used improperly.

Structure of exercise

Please form groups of 2-3 people and discuss the general advantages and disadvantages of standards from an economic point of view. Use the table below to capture your findings.

Advantages	Disadvantages
• Standardised production enables economies of scale, thus bringing down the cost per product • Standards can ensure high quality of products and services, thereby creating added value for customers • Standards allow companies to sell uniform products on the global market place and capture global market segments • Since standards are developed by experts and practitioners, they capture knowledge and lessons learnt by them • Standards are integral to protecting consumers by ensuring product safety • Standards fulfil an important gateway function by indicating compliance and good practice	• Standards can compromise the uniqueness of products and services • Standards can create market barriers and inhibit free trade of goods and services • Standards can create additional costs by potentially over-regulating technical aspects in the production or product development process • Setting up verification processes for testing the compliance with standards requires a functioning eco-system and requires monetary resources • Standards can be difficult to understand for laymen due to their often technical nature and bulky language

How are standards relevant to RE and CE? Please provide a brief written answer.

Standards can help increase resource efficiency in the production process by minimising waste and providing guidance on manufacturing techniques. In a broader sense, standards can ensure product interoperability of products or services, for example by requiring power supplies to be standardised so that they work with a number of electrical appliances. In addition, standards can facilitate innovation towards RE and CE in the market place, e.g. by driving the need for more recyclable materials, lightweight constructions and repairable goods.

Figure 22: Solution sheet for exercise 4c.1

Table 1: EU Environmental Checklist

Technical working group: RECE-2025	Title of standard: CEN - EN 771-1: Specification for masonry units - Part 1: Clay bricks	Date of last modification of the environmental checklist: Date of training

Environmental issue	Stages of the lifecycle										All stages
	Acquisition		Production		Use			End-of-Life			
	Raw materials and energy	Pre-manu-factured materials & components	Production	Packaging	Use	Maintenance and repair	Use of additional products	Reuse/ Material and Energy Resovery	Incineration without energy recovery	Final disposal	Transportation
Inputs											
Materials	0.15 m³										
Water	0.38 l		0.08 l + 0.026 l								
Energy	0.01 kWh	0.01 kWh	0.015 kWh + 0.012 kWh					1.45 kWh		14.88 kWh	0.002 kWh + 4.03 kWh
Land					0.05 m²			0.0007 m²		0.0717 m²	
Outputs											
Emissions to air	0.06 kg $CO_{2\text{-eq}}$	0.02 kg $CO_{2\text{-eq}}$	0.03 kg $CO_{2\text{-eq}}$ + 0.16 kg $CO_{2\text{-eq}}$					0.34 kg $CO_{2\text{-eq}}$		2.34 kg $CO_{2\text{-eq}}$	0.004 kg $CO_{2\text{-eq}}$ + 0.84 kg $CO_{2\text{-eq}}$
Discharges to water											
Discharges to soil											
Waste											
Noise, vibration, radiation, heat											
Other relevant aspects											
Risk to the environ-ment from accidents or unintended use	Health and safety during mining operations		Health and safety during milling and drying operations		Structural stability			Health and safety during demolition			
Customer information			Recycled content		Insulation factor						

Comments: Based on LCA results of clay bricks, the following classes could be included in standard CEN - EN 771-1: 1) use of secondary raw materials during production; 2) lightweight construction to reduce required amount of material during production; 3) consumer information on thermal insulation value for reference during use phase.

NOTE 1 The stage of packaging refers to the primary packaging of the manufactured product. Secondary or tertiary packaging for transportation, occurring at some or all stages of the lifecycle, is included in the stage of transportation.

NOTE 2 Transportation can be dealt with as being a part of all stages (see checklist) or as separate sub-stage. To accommodate specific issues relating to product transportation and packaging, new columns can be included and/or comments can be added.

Figure 23: Solution sheet for exercise 4c.2

Module 4d - Tools, standards and indicators for RE and CE – Indicators

Module 4d: Indicators	
Learning objectives: ("After completion of this module, participants will be able to…")	**Delivery Method(s)**
• Relate to the purpose of indicators and explain SMART-principle; • Outline difference between quantitative and qualitative indicators as well as macro-, meso- and micro-level application; and • Recall the terminology of resource use indicators and possible data sources to determine material flows.	• Presentation • Exercises

Duration	Resources needed
Up to 100 min	• Projector • Laptop • Slide deck: Module 4d • Blank flipcharts • Pens and markers • Worksheet, exercise 4d.1 (at least one per group of 2-3 participants) • Worksheet, exercise 4d.2 (at least one per group of 2-3 participants)

References

- https://matthewatkin.actioncoach.co.uk/2018/07/09/the-importance-of-kpis/
- https://iges.or.jp/en/publication_documents/pub/issue/en/3891/3RFS_010_web.pdf
- https://www.oecd.org/environment/indicators-modelling-outlooks/MFA-Guide.pdf
- https://www.boell.de/sites/default/files/201207_green_economies_around_the_world.pdf
- https://www.ellenmacarthurfoundation.org/assets/downloads/insight/Circularity-Indicators_Project-Overview_May2015.pdf
- https://www.ellenmacarthurfoundation.org/resources/apply/measuring-circularity
- https://iris.unive.it/retrieve/handle/10278/3688992/104510/Int_J_Sustainable_Eng_06_2017.pdf
- https://ec.europa.eu/eurostat/documents/1798247/6191533/3-Economy-wide-material-flow-accounts...-A-methodological-guide-2001-edition.pdf/

Step	Time in min	Subject	Methodology	Tools & Resources
1	5	**Introduction & recap** • Welcome group to module; • Locate the group within the programme; • Launch into subjects by asking participants about their previous experience with Life Cycle Assessments; • Explain purpose and structure of this session; and • Launch into subjects by asking participants what they understand as indicators.	Presentation	• Laptop • Projector Slide deck: Module 4d
2	10	**Relevance of indicators & SMART** • Highlight importance of indicators; • Explain SMART-principle; • Outline difference between quantitative and qualitative indicators as well as macro-, meso- and micro-level application; and • Give example: material flows of Japan.	Presentation	• Slide deck: Module 4d

3	20	**Allocating macro-level resource use indicators**
		• Exercise 4d.1: Allocating macro-level resource use indicators
		  ○ Ask participants to form groups of 2-3;
		  ○ Let them review the definitions and examples of macro-level indicators on RE;
		  ○ Ask them to assign each indicator to the corresponding slots (1-6) on the flowchart;
		  ○ They should match provided options for data sources to the categories ‘material input’/ ‘material output’ and name two additional options for data sources; and
		  ○ Present solutions to exercise.
			Presentation
			Exercise
				• Slide deck: Module 4d
				• Worksheets: Exercise 4d.1
				• Pens

4	25	**Using indicators and Circularity Tools** • Establishing and using indicators; • Conduct exercise on macro-level RE indicator by using worksheet and flow chart; and • Present Material Circularity Indicator (MCI) and Circularity Calculator.	Presentation	• Slide deck: Module 4d

5	30	**Applying a circularity calculator**
		• Exercise 4d.2: Applying a circularity calculator
		  ○ Ask participants to build groups of 2-3 persons;
		  ○ Hand out exercise sheets (Exercise 4d.2);
		  ○ Explain the tasks and leave room for questions;
		  ○ Give participants 30 min to work on the tasks, afterwards check if everyone finished the tasks;
		  ○ Encourage participants to share their solutions of task 1 and present the solution slides;
		  ○ Leave room for discussion and questions;
		  ○ Next, ask one representative of each group to post one sticky note per question with their results of the discussion of task 2 on the prepared flipchart paper;
		  ○ Analyse the results, start an open discussion with the participants about their thoughts and opinions about the method (max. 15 min); and
		  ○ The focus here is on enabling participants to develop their own understanding of the indicator.
			Presentation
			Exercise
				• Slide deck: Module 4d
				• Worksheets: Exercise 4d.2
				• Flipchart
				• Pens

6	5	**Wrap up** • Summarise key points; and • Provide time for questions and comments.	Presentation	• Slide deck: Module 4d

Solution sheets for exercises of module 4d

Worksheet 1

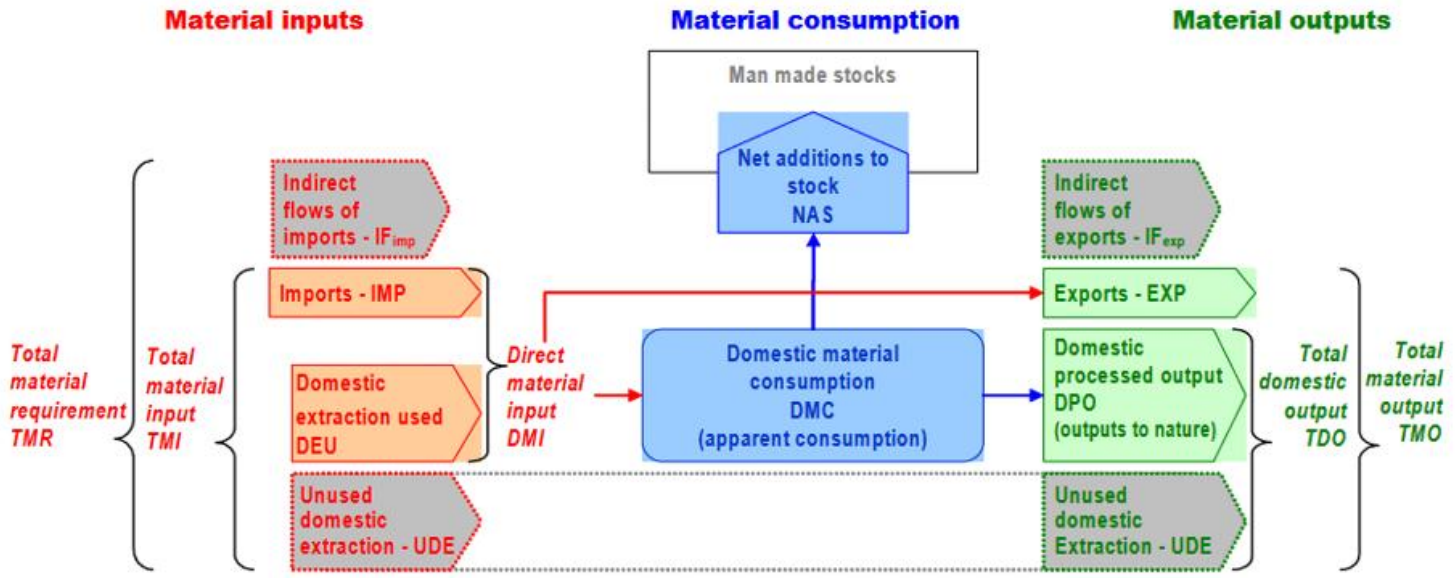


Figure 2: Exercise template for allocation of resource use indicators (source: https://www.oecd.org/environment/indicators-modelling-outlooks/MFA-Guide.pdf (adapted))

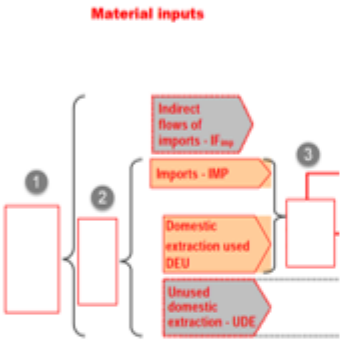
- See also https://www.oecd.org/environment/indicators-modelling-outlooks/MFA-Guide.pdf, p. 19

Figure 24: Solution sheet for exercise 4d.1 (worksheet 1)

Worksheet 2

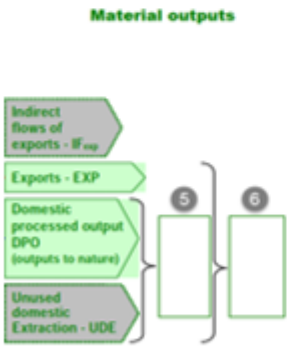
Data Sources

Agricultural statistics (cereals, vegetables etc. produced)	Environmental accounts for air emissions	Energy statistics and balances (extraction of fuels)
Energy statistics (emission inventories)	Forestry statistics (timber harvested)	Agricultural statistics for fertilizer use



Data Sources for Material Input:

1. Forestry statistics (timber harvested)
2. Energy statistics and balances (extraction of fuels)
3. Agricultural statistics (cereals, vegetables etc. produced)
4. Statistics for foreign trade (imports)
5. Statistics for foreign trade (imports)



Data Sources for Material Output:

1. Environmental accounts for air emissions
2. Agricultural statistics for fertilizer use
3. Energy statistics (emission inventories)
4. Statistics for foreign trade (exports)
5. Environmental statistics for waste water and solid waste disposal

- See also https://ec.europa.eu/eurostat/documents/1798247/6191533/3-Economy-wide-material-flow-accounts...-A-methodological-guide-2001-edition.pdf/ p. 47

Figure 25: Solution sheet for exercise 4d.1 (worksheet 2)

Worksheet 1

Table 3: Exercise template

Lifecycle stage	#	Max score	Score of "Chug'n'Chuck" capsules	Score of "KeepCap" capsules
Design	1	20	0	15
	2	2	2	0
	3	5	3	5
Production	4	10	5	0
	5	15	7	0
Commercialization	6	5	0	3
	7	10	0	7
	8	10	0	0
In use	9	15	0	5
	10	5	0	5
	11	10	0	10
	12	5	0	5
End of life	13	15	15	0
	14	10	5	10
	15	10	5	7
SUM			42/152	72/152

Figure 26: Solution sheet for exercise 4d.2 (worksheet 1)

Strengths and Limitations of the Circularity Indicator:

- Does the methodology capture all necessary circularity aspects and if not, which aspects are missing?
- Are the weightings (max scores) adequate or how should they be changed?
- Which of the criteria did you find most difficult to assess and why?

Strengths and Limitations of the Circularity Indicator:

- Does the methodology capture all necessary circularity aspects and if not, which aspects are missing?
  - Several possible answers
  - Example for missing aspect: transport of products
  - Efficiency of methodology heavily depending on data availability
- Are the weightings (max scores) adequate or how should they be changed?
  - Several possible answers
  - For example:
    - #2: relative parameter, max. score should be higher for products that require long- distance transport
    - #14: End- of life management more relevant for products with hazardous components. Max. score should be increased for such products
- Which of the criteria did you find most difficult to assess and why?
  - Several possible answers
  - For example #3: assessment of criteria depending on cooperation of producer

Figure 27: Flipchart template for exercise of module 4d.2 (with solutions)

Module 4e - Tools, standards and indicators for RE and CE – Public Procurement

Module 4e: Public Procurement	
Learning objectives: ("After completion of this module, participants will be able to…")	**Delivery Method(s)**
• Understand the importance of clearly defined criteria in the evaluation of tender proposals; • Assess the importance of green public procurement in the Indian context with regards to sustainable development; • Define different types of environmentally-oriented public procurement (GPP, SPP, CPP); and • Map out the four steps of public procurement and understand how green/sustainability/circular considerations can be included in them.	• Presentation • Video • Small group exercise • Case study

Duration	Resources needed
100 min	• Projector • Laptop • Speaker system (for video) • Slide deck: Module 4e • Worksheets, 4e.1 (at least one per group of 2-3 participants) • Worksheets, 4e.2 (at least one per group of 2-3 participants) • Case study

References

- https://ec.europa.eu/environment/gpp/pdf/CP_European_Commission_Brochure_webversion_small.pdf
- https://ec.europa.eu/environment/gpp/index_en.htm;
- https://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm
- https://www.greengrowthknowledge.org/sites/default/files/downloads/best-practices/UNEP_sampling_successes_green_public_procurement_case_studies.pdf

Step	Time in min	Subject	Methodology	Tools & Resources
1	5	**Introduction & recap** • Welcome group to module; • Locate the group within the programme; • Launch into subjects by asking participants about their previous experience with Life Cycle Assessments; • Explain purpose and structure of this session; and • Launch into subjects by asking participants if they have been engaged in Public Procurement previously.	Presentation	• Laptop • Projector • Slide deck: Module 4e
2	10	**Public Procurement** • Introduce the term Public Procurement and support it by giving quantitative examples in the case of India; • Show the video on GPP; and • Present the three types of environmentally oriented public procurement.	Presentation Video	• Slide deck: Module 4e • Video • Speaker •

3	5	**Steps of Public Procurement**
		• Explain the four steps of procurement
		  ○ subject matter and technical specifications;
		  ○ selection and exclusion criteria for tenderers;
		  ○ award criteria for evaluation; and
		  ○ contract performance clauses.
			Presentation	• Slide deck: Module 4e

4	20	**The Greenest Workshop**
		• Exercise 4e.1: The greenest workshop
		  ○ Form groups of 2-3;
		  ○ Let them Brainstorm on possible aspects for consideration under green public procurement by conducting Part 1, 2 and 3 of the exercise;
		  ○ Part 1: Think of goods and services required to organise this workshop.
		  ○ Part 2: Specify criteria for more procuring more environmentally friendly options.
		  ○ Part 3: Classify these options in accordance with GGP, SPP and/or CPP.
			Presentation
			Exercise
				• Slide deck: Module 4e
				• Worksheet: Exercise 4e.1
				• Pens

5	5	**GPP Case study on green textbooks** • Case example: Procurement of „green“ textbooks in China; • Contrast the adaptation of the printing industry against the material and energy savings as well as pollution reduction.	Presentation Case study	• Slide deck: Module 4e

6	50	**Greening tenders**
		• Exercise 4e.2: Greening tenders
		  ○ Form groups of 2-3;
		  ○ Distribute sample tender document to groups;
		  ○ Ask groups to review the tender and identify possible areas where GPP RE and CE aspects could be included;
		  ○ Part 1: Write down products or services that need to be procured to construct the girls' hostel at Madras IIT.
		  ○ Part 2: Specify how sustainability improvements could be included in the tender example.
			Presentation
			Exercise
				• Slide deck: Module 4e
				• Worksheet: Exercise 4e.2
				• Pens

7	5	**Wrap up** • Summarise key points; and • Provide time for questions and comments.	Presentation	• Slide deck: Module 4e

Solution sheets for exercises of module 4e

Table 2: Exercise template

Part 1: Products/services	Part 2: Criteria	Part 3: Classification
Flipcharts	- made from recycled paper	- CPP
Text markers	- water soluble - low content of volatile organic compounds (VOCs)	- GPP - GPP
Projector	- energy-saving - made from conflict-free minerals	- GPP - SPP
Snacks	- fair trade - organic	- SPP - GPP
Print-outs	- made from recycled paper - duplex print	- CPP - GPP/CPP

Figure 28: Solution sheet for exercise 4e.1

Table 2: Exercise template part 1

Products	Services
- Construction material - Insulation material - Cables, wiring - Elevator - Doors, windows, light bulbs, etc. - ...	- Planning of design, architecture, energy concept, etc. - Prepare construction site - Construction of the building - Lighting concept - Electricity and water supply - Maintenance of the building - ...

Figure 29: Solution sheet for exercise 4e.2 (part 1)

Table 3: Exercise template part 2

	Tender specification	Sustainability improvements in tender specification
Definition of the contract tender (object of the contract)	Scope of work: Planning & construction of New Girls Hostel (G+8) by replacing rear wing of Sarayu Hostel at IIT Madras Tenderer: IIT Madras Engineering Unit Validity of the tender: Three months Time Period for completion: 12 months Date and time of submission of tender: 27.02.2020 at 3:00 PM Date of opening of the tender document: 28.02.2020 at 3:10 PM	*Planning & construction of zero energy/energy efficient girls hostel at IIT Madras* *Planning & construction of green girls hostel at IIT Madras designed for deconstruction in 15 years from completion of building*
Minimum requirements	- The building work shall be carried out complying in all respects with the requirements of relevant by-laws of the local body under the jurisdiction of which the work is to be executed or as directed by the Engineer-in-Charge and nothing extra will be paid on this account. - The contractor shall comply with all legal orders and directions of the local or public authority or municipality and abide by them. - Sample of all materials, fixtures etc., shall be approved in advance from the Engineer-in-Charge before taking up the respective work. - The contractor shall produce all the materials in advance so that there is sufficient time for testing and approving the materials and clearance of the same before their use in work.	*Building must comply with criteria the Indian Green Building Council (IGBC) silver/gold/platinum/etc. rating* *Building must comply with criteria of highest Green Rating for Integrated Habitat Assessment (GRIHA) rating*
Selection and exclusion criteria	- The applications will be evaluated for conformity to the eligibility criteria. - Misleading or false representation or deliberately suppressed the information in the forms, statements and enclosures required in the application for eligibility.	*Present sustainable architecture & design concept under consideration of passive architecture, site preservation, etc.* *Present impact assessment of site selection and planning under consideration of soil erosion, preservation of plants & trees, proximity to local transport, etc.*

Figure 30: Solution sheet for exercise 4e.2 (part 2; 1/2)

	- Record of poor performance such as, slow progress of work, abandoning of work, not properly completing the contract, or financial failures/weaknesses etc.	*Present water conservation & energy efficiency* *Present building materials and resources concept under consideration of sustainable building materials, handling of waste materials during construction, etc.* *Present indoor environment concept under consideration of fresh air ventilation, daylighting, low-emitting materials, etc.*
Estimated costs	- Up to Rs. 78.00 Lakhs	*The offer with the lowest emissions/most energy efficient/resource efficient concept is allocated up to 10% of total points, while the others are allocated points proportionally.* *Allow for estimation of lifecycle costs*
Other contractual provisions and approaches	- Child labour is strictly prohibited. - Movement of labour should be restricted to the areas where work is carried out. Workers should be made to confine themselves to the work areas and should not wander into nearby areas/buildings/forests. - The work should be executed during day time only. If the work is required to be carried out in the night, necessary permission of the Engineer-in-Charge shall be obtained. The contractor will make his own arrangement for lighting the area and no extra amount for carrying out the work during night is payable. To the extent possible engaging women labour in the night shift should be avoided. - Water for construction shall be arranged by the contractor. The contractor will not be allowed to use any of the water resources available within the campus nor will be permitted to dig any bore well inside the campus.	*Contractor is responsible for any unforeseen maintenance cost (e.g. replacement of materials. etc.) in the first 20 years after construction of the building.*

Figure 31: Solution sheet for exercise 4e.2 (part 2; 2/2)

Module 4f - Tools, standards and indicators for RE and CE – Circular Business Models

Module 4f: Circular Business Models	
Learning objectives: ("After completion of this module, participants will be able to…")	**Delivery Method(s)**
• Understand the definition of a business model and its components; • Outline how the abstract concept of circular economy can be implemented and create value through circular business models; • Identify potential intervention points to create a circular business model; • Apply the Business Model Canvas to create and redesign business models.	• Presentation • Case study • Exercise • Video

Duration	Resources needed
130 min	• Projector • Laptop • Speaker system (for video) • Slide deck: Module 4f • Worksheet, 4f.1 (at least one per group of 3-5 participants) • Worksheet, 4f.2 (at least one per group of 2-3 participants) • Pens and marker

References

- https://www.youtube.com/watch?v=QoAOzMTLP5s#action=share
- https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf

Step	Time in min	Subject	Methodology	Tools & Resources
1	5	**Introduction & recap** • Welcome group to module; • Locate the group within the programme; • Launch into subjects by asking participants about their previous experience with Life Cycle Assessments;	Presentation	• Laptop • Projector • Slide deck: Module 4f

		• Explain purpose and structure of this session; and • Launch into subjects by asking participants if they have heard of Circular Business Models or worked on a Business Model Canvas.		
2	5	**Business Models** • Introduce the definition, function and elements of a Business Model; • Present and discuss the example of an off-grid solar energy business model; and • Show business model canvas video (02:19 min).	Presentation	• Slide deck: Module 4f
3	10	**Circular Business Models** • Introduce the term Circular Business Model; • Explain structure of circular business model canvas by relating back to the interventions and elements referred to before; • Explain the four intervention points of circular business models; and • Discuss examples of Circular Business Model which implemented different intervention points.	Presentation	• Slide deck: Module 4f

4	60	**Freshwatching**
		• Exercise 4f.1: Freshwatching
		  ○ Form groups of 3-5 people;
		  ○ Introduce Tomato business model and explain exercise 4f.1;
		  ○ Give groups time for Brainstorming circular interventions and discuss their potential impact on other business model segments; and
		  ○ Let groups Share ideas & discuss potential solutions with all groups.
			Presentation
			Case study
			Exercise
				• Slide deck: Module 4f
				• Worksheet: Exercise 4f.1
				• Pens
				• Case study

5	20	**Value dimensions and Canvas of Circular Business Models** • Explain value dimensions of a circular business models; • Introduce Circular Business Model Canvas; and • Introduce case study on Bharat Earth Moving Equipment.	Presentation Case study	• Slide deck: Module 4f • Case study

6	30	**Circular business model canvas**
		• Exercise 4f.2: Circular business model canvas
		  ○ Form groups of 2-3 people;
		  ○ Let groups analyse the case study of Bharat Earth Moving Equipment Pvt. Ltd. and fill in the three marked up cells in the business model canvas;
		  ○ Put the case study in policy Indian context by discussing the guiding questions with all groups.
			Presentation
			Case study
			Exercise
				• Slide deck: Module 4f
				• Worksheet: Exercise 4f.2
				• Pens

7	5	**Wrap up** • Summarise key points; and • Provide time for questions and comments.	Presentation	• Slide deck: Module 4f

Solution sheets for exercises of module 4f

Table 2: Exercise template

Offer		**Circular intervention possibilities**
Value proposition	• Online ordering, payment and table booking service • Deliver food from the restaurant of your choice to your home or any other place • Subscription/premium programme in selected cities offering promotions and complimentary food • Information about restaurants, menus, ratings, etc. • Promotions for restaurants, etc.	• Sell recyclable / biodegradable / reusable packaging to partner restaurants • Provide pick-up service for used packaging either for recycling or reuse • Provide more information about serving sizes of individual restaurants to reduce food waste • Add a section where restaurants can offer food that is about to expire at a cheaper price, e.g. fresh baked bread (similar to too good to go app) • Offer to restaurants to promote more about the way how they do business, e.g. sourcing of organic food, measures against food waste, etc.
Customer segments	• Users who look for restaurants of various cuisines and who like to try new restaurants • Users who prefer home delivery or eating out • Restaurants who want to advertise their services • Restaurants who do not have their own delivery service	• Target environmentally aware consumers that do not order food frequently because of waste it produces • Offer preferential treatment to restaurants using organic food, use biodegradable packaging, etc.
Relationships customers/partners	• Partnerships and close network of restaurants • Customers • (Delivery) staff	• Partner with packaging providers • Use close connection to customers (e.g. subscription customers) to offer take-back/reuse scheme of packaging
Value creation & delivery		
Key activities	• Creating and managing technology infrastructure • Coordination, order and payment platform for food • Managing logistics to process orders • Delivery	• Take over packaging of food • Offer own “Tomato” food that comes in reusable food containers

Key resources/capabilities	• Interactive technology platform • Big network & and good partnerships with restaurants • Large database of users • Subscription customers • Delivery personnel	• Change entire vehicle fleet to bicycles or electric motorized vehicles • Offer take-back service of packaging of subscription/all customers
Key partners	• Restaurants • Drivers	• Recycling companies • Packaging industries • Partner with organic food suppliers and promote use to restaurants • Partnership with organisations that provide leftover food to the poor
Channels	• Mobile application • Website	• Infrastructure to reuse food packaging • Build up packaging recycling infrastructure
Value capture		
Costs	• Technology setup & maintenance • Fixed costs (e.g. salaries, office rent, etc.) • Fuel expenditure • Vehicle fleet (bicycles & motorised vehicles) • Advertising/promotions	• Cost for new infrastructures
Revenue flows	• Restaurants pay commission • Customers pay premium • Advertising / marketing	• Offer discounts to customers who use their own cutlery, napkins, condiments, etc. • Offer discounts to restaurants that use biodegradable packaging • Increased premiums from restaurants that now save on packaging material

Part 1: Circular business models canvas – the case of Bharat Earth Moving Equipment

Circular Business Model Canvas BHARAT EARTH MOVING EQUIPMENT

Value Proposition	Collect & reintegrate (reduce primary materials)	First sale (with prolonged use)	Collect & reintegrate (organize take-back)	Additional sale of product or parts	Enable material recovery
Offer		Machines and services to develop infrastructure	Return of 'core'	Remanufactured machine	
Value Proposition		Low life-cycle costs, repair, and upgrade services	deposit in exchange of core	"like new machine" warranty	
Customer segments		Construction industries	Machine owners	After market	
Relationships customer/ partners		Close, e.g. maintenance and performance optimization	Close, e.g. performance optimization	Close	
Value Creation & Delivery					
Key activities		Material acquisition, manufacturing	on-site disassembling service	Quality checks, remanufacturing	
Key resources/ capabilities		Manufacturing technology, design for remanufacturing	Transport	Remanufacturing technology	
Key partners		Suppliers and dealers	Dealers for return	Remanufacturing tech. developers	
Channels		Dealers	Dealers	Dealers	
Value Capture					
Costs		Material costs, fix costs	Deposit, reverse logistics	Remanufacturing (tech. and labour)	
Revenue flows		Sale machines and services	None	Sales of machines and services	

Figure 32: Solution sheet for exercise 4f.2 (part 1)

RE and CE in the Indian Context – Task Sheet

Part 2: Policies supporting circular business models

Table 2: Policies supporting circular business models

Question	Notes
Which policies and legislations are relevant for which aspect of the circular business model?	Extended Producer Responsibility for End of Life Vehicles promote collection and recycling Tax reductions for repair/remanufacturing services create favourable conditions for prolonging lifetime
What policies and legislations exist in India today?	RE strategy on steel (provisions yet to be transposed into legislations) RE strategy on aluminium (provisions yet to be transposed into legislations)
What policies and legislations are needed in the future to support circular business models?	Tax on raw materials Tax breaks on repair/remanufacturing services

Figure 33: Solution sheet for exercise 4f.2 (part 2)

Module 4g - Tools, standards and indicators for RE and CE – Funding

Module 4h: Funding	
Learning objectives: ("After completion of this module, participants will be able to…")	**Delivery Method(s)**
• Recall possible areas for funding in RE and CE context; • Relate to available funding sources in India; • Assess rational and business case of RE & CE.	• Presentation • Video • Brainstorming • Group exercise • Exercise

Duration	Resources needed
160 – 175 min	• Projector • Laptop • Speaker system (for video) • Slide deck: Module 4g • Blank flipcharts • Pens and markers • Prepared flipchart (see templates below) • Worksheet, exercise 4g.1 (at least one per group of 2-3 participants) • Worksheet, exercise 4g.2 (one per participant)
References	

- https://www.eib.org/attachments/thematic/circular_economy_guide_en.pdf
- https://dea.gov.in/sites/default/files/Document%205Guidelines%20for%20determining%20eligibility%20of%20proposals%20for%20financial%20support%20to%20Public%20Private%20Partnerships%20in%20infrastructure%20under%20the%25.pdf
- https://inc42.com/buzz/startup-scheme-indian-government-startups/
- www.acmfn.com/wp-content/uploads/2019/12/India-report-FINAL-web.pdf
- www.acmfn.com/wp-content/uploads/2019/12/india-case-study.pdf
- www.seed.uno/enterprise-profiles?search_by_keyword_e=&e_search_by_countries%5B%5D=IN&art_state=1&cck=enterprise_profile&search=enterprises&task=search
- https://www.scienceandtheenergychallenge.nl/sites/default/files/workshops/attachments/NWO%20Sc4CE%20-%20Workshop%20Business%20Models%20-%20Paper%20on%20Circular%20Business%20Models.pdf

Step	Time in min	Subject	Methodology	Tools & Resources
1	5	**Introduction & recap** • Welcome group to module; • Locate the group within the programme; • Launch into subjects by asking participants about their previous experience with funding instruments; • Explain purpose and structure of this session; and • Launch into subjects by asking participants to share few experiences with getting access to funding.	Presentation	• Laptop • Projector • Slide deck: Module 4g

	35	**RE & CE financing**
		• Present latest news from EIB financing CE at 10 billion EUR (5 min);
		• Conceptual input on possible RE & CE interventions areas for funding (15 min), including video (2:41 min).
		Exercise 4g.1: Open Brainstorming (15 min)
		• Form groups of 2-3
		• Let groups discuss the following questions:
		  ○ Can you think of companies/ ventures operating in India that are investing in RE/CE?
		  ○ What funding area would you assign it to?
			Presentation
			Video
			Brainstorming
			Exercise
				• Slide deck: Module 4g
				• Speakers

		• Fill gaps with own input.		
3	55	• Conceptual input on funding instruments and challenges (15 min) • Group work (25 min): ○ Form two groups; ○ Organize group, introduce task and hand out flipchart paper with marker; ○ Guide groups during group work (10 min) – remind groups to visualize results; ○ Ask groups to briefly present their results (max 5 min per group); ○ Show slides and elaborate on points that have not been met be participants; and ○ Leave room for questions and discussion. • Overview of selected funding sources on RE & CE available in India (15 min).	Presentation Group work	• Slide deck: Module 4g • Prepared flipchart (illustration see below) • Markers
4	60- 75	**Funding challenges** • Exercise 4g.2: Group work ○ Organise groups, explain exercise and hand-out worksheets (5 min) and verify whether participants are familiar how to calculate indicators; if not, show optional slides on indicators (15 min); ○ Guide groups during group work (30 min) – remind groups to visualise results; ○ In plenum let groups briefly present their results (groups to also explain which case study chose and why) – max 5 min per group; ○ In plenum reflect on results and limitations of methods, also reflect on cost factors and implications when considering LCA aspects (20 min).	Exercise	• Slide deck: Module 4g • Worksheet: Exercise 4g.3 • Pens
5	5	**Wrap up** • Summarise key points; and • Provide time for questions and comments.	Presentation	• Laptop • Projector • Slide deck: Module 4g

Example for flipchart for module 4g

Funding Challenges -
Funding seeker perspective

Figure 34: Flipchart template for exercise 4g.2 (1/2)

Funding Challenges -
Financing institution
perspective

Figure 35: Example for exercise 4g.2 (2/2)

Solution sheets for exercises of module 4g

Worksheet - Case study 1:

Option 1:

Investment sum:	Rs.	150,000	
Usage of water before:	kl per year	1,188	
Usage of water after:	kl per year	950.4	
Price of water:	Rs. per kl	635	
Lifetime of measure:	yrs	3	
Annual savings:	Rs.	**150,876**	(1,188 – 950.4) x 635
Simple payback period	yrs	**0,99**	150,000 / 150,876
Return on investment (ROI)	%	**201.75**	((150,876 x 3) - 150,000) / 150,000) x 100

Option 2:

Investment sum:	Rs.	3,000,000	30 x Rs 100,000
Usage of water before:	kl per year	30,000	2,500 kl x 12
Usage of water after:	kl per year	28,000	
Price of water:	Rs. per kl	635	
Lifetime of measure:	yrs	4	
Annual savings:	Rs.	**1,270,000**	(30,000 – 28,000) x 635
Simple payback period:	yrs	**2.36**	3,000,000 / 1,270,000
Return on investment (ROI):	%	**69.3**	((1,270,000 x 4 - 3,000,000) / 3,000,000) x 100

Figure 36: Solution sheet for exercise 4g.3 - Case study 1

Worksheet - Case study 2:

Option 1:

Investment sum:	Rs.	100,000	
Usage of electricity before:	kWh per year	180,000	15,000 x 12
Usage of electricity after:	kWh per year	171,000	180,000 x 0,95
Price of electricity:	Rs per kWh	7.88	
Lifetime of the measure:	yrs	5	
Discount rate:	%	9	

NPV:

Year	Yearly savings (Rs.)	PVIF	Present value (Rs.)
1	(180,000 – 171,000) x 7.88 = 70,920	1/1,09^1=0.92	65,064.22
2	70,920	1/1,09^2=0.84	59,691.94
3	70,920	1/1,09^3=0.77	54,763.25
4	70,920	1/1,09^4 =0.71	50,241.52
5	70,920	1/1,09^5=0.65	46,093.13
Total	Rs. 354,600		Rs. 275,854.06
		Initial investment minus	- Rs. 100,000
NPV			**Rs. 175,854.06**

Figure 37: Solution sheet for exercise 4g.3 - Case study 2 (1/2)

Option 2:

Investment sum:	Rs.	900,000	300,000 x 3
Usage of diesel before:	ltr per year	60,000	5,000 x 12
Usage of diesel after:	ltr per year	57,000	60,000 x 0,95
Price of diesel:	Rs per ltr	50	
Lifetime of the measure:	yrs	5	
Discount rate:	%	9	
		900,000	300,000 x 3

NPV:

Year	Annual savings	PVIF	Present value (Rs.)
1	(60,000 – 57,000) x 50 = Rs. 150,000	1/1,09^1=0.92	137,614.68
2	Rs. 150,000	1/1,09^2=0.84	126,251.99
3	Rs. 150,000	1/1,09^3=0.77	115,827.52
4	Rs. 150,000	1/1,09^4 =0.71	106,263.78
5	Rs. 150,000	1/1,09^5=0.65	97,489.7
Total	Rs. 750,000		Rs. 583,447.67
		Initial investment minus	Rs. 900,000
NPV			**Rs. - 316,552.33**

Figure 38: Solution sheet for exercise 4g.3 - Case study 2 (2/2)

Worksheet - Case study 3:

Investment sum:	Rs.	550,000	
Usage of acid before:	ltr per year	70,000	
Usage of acid after:	ltr per year	58,100	70,000 x 0,83
Price of acid:	Rs. per litre	10	
Lifetime of the measure:	yrs	6	
Discount rate:	%	12	
Annual savings:	Rs	**119,000**	(70,000 – 58,100) x 10
Simple payback period:	yrs	**4.62**	550,000 / 119,000
Return on Investment (ROI):	%	**29.82**	(((119,000 x 6) - 550,000) / 550,000) x 100

NPV:

Year	Annual savings (Rs.)	PVIF	Present value (Rs.)
1	(70,000 – 58,100) x 10 = Rs. 119,000	1/1,12^1	106,250.00
2	Rs. 119,000	1/1,12^2	94,866.07
3	Rs. 119,000	1/1,12^3	84,701.85
4	Rs. 119,000	1/1,12^4	75,626.65
5	Rs. 119,000	1/1,12^5	67,523.80
6	Rs. 119,000	1/1,12^6	60,289.10
Total			489,257.47
		Initial investment minus	Rs. 550,000
NPV			**Rs. – 60,742.53**

Figure 39: Solution sheet for exercise 4g.3 - Case study 3

Module 5 – Evaluation and Feedback

Module 5: Evaluation and Feedback	
Learning objectives: ("After completion of this module, participants will be able to…")	**Delivery Method(s):**

• Recall key concepts, background information, tools and standards presented throughout the course;
• Assess one's learning progress and further learning needs; and
• Identify and use additional sources of information and reference.
Please note that the duration of the module and the resources required depend on the selected evaluation methods.
Select the evaluation methods and material according to the time available and to the advanced modules covered during the training
	• Presentation
	• Optional:
	  ○ Quiz
	  ○ Post- assessment
	  ○ Card Roulette
	  ○ Evaluation sheets
	  ○ Alignment of expectations
	  ○ Group case study
	  ○ Hand evaluation

Duration	Resources required:
Up to 85 min	• Projector • Laptop • Quiz sheets • Slide deck: Module 5 • Workshop evaluation forms (one per participant) • Flipcharts from day one (figure 5) • Prepared flipcharts • Sticky dots

References
n/a

Step	Time in min	Subject	Methodology	Tools & Resources
1	5	**Introduction & recap**	Presentation	• Slide deck: Module 5

		• Locate participants at the end of the training and present learning objectives		• Projector
2	30	**Card Roulette** Exercise 5.1: Card Roulette (Feedback Round) Present exercise 5.1 and explain the Card Roulette game the participants: • All participants standing or sitting in a circle would be optimal • Ask participants to draw out a card (including the trainer) • Everyone is asked to read out loud the question and to answer • If participants struggle, give hints or ask the group for support. Take care, that everyone at least has the chance to articulate themselves • Please note that the required time for this exercise is depending on the number of participants and should be extended if needed	Exercise	• Slide deck: Module 5 • Feedback cards (Printed, cut and preferably laminated)
3	20	**Post Training assessment & Evaluation** Exercise 5.2: Post Training assessment & evaluation • Present exercise 5.2 and explain the two parts of the post-evaluation form to the participants; • Briefly describe the purpose of pre- and post-assessment tests and their benefits to this programme; • Ask participants to read the forms and answer any upcoming questions. Afterwards encourage participants to fill out the forms to their best knowledge; • Please note that pre-training assessment is necessary to conduct the post-training assessment; • If the pre-training assessment has not been conducted, only use the evaluation form and adjust the slides accordingly.	Exercise	• Slide deck: Module 5 • Exercise sheets: Post- training assessment form (one per participant) • Exercise sheets: Evaluation form (one per participant) • Pens
4	20	**Dot voting** Exercise 5.3: Dot voting	Exercise	• Flipchart from first training day (Figure 5) • Prepared flipchart (see template

		• Place the flipchart from the first day and a new flipchart with the template for exercise 5.3 clearly visible in the room; • Ask participants to indicate their satisfaction towards the training with a dot along the line; • Summarize the results and ask if some participants want to share their thoughts with the group.		below) • Sticky dots
5	10	**Conclusion of Training** • Conclude the training by referring to the manual and the additional information that can be found in it.	Presentation	• Slide deck: Module 5

Example for exercise template for module 5

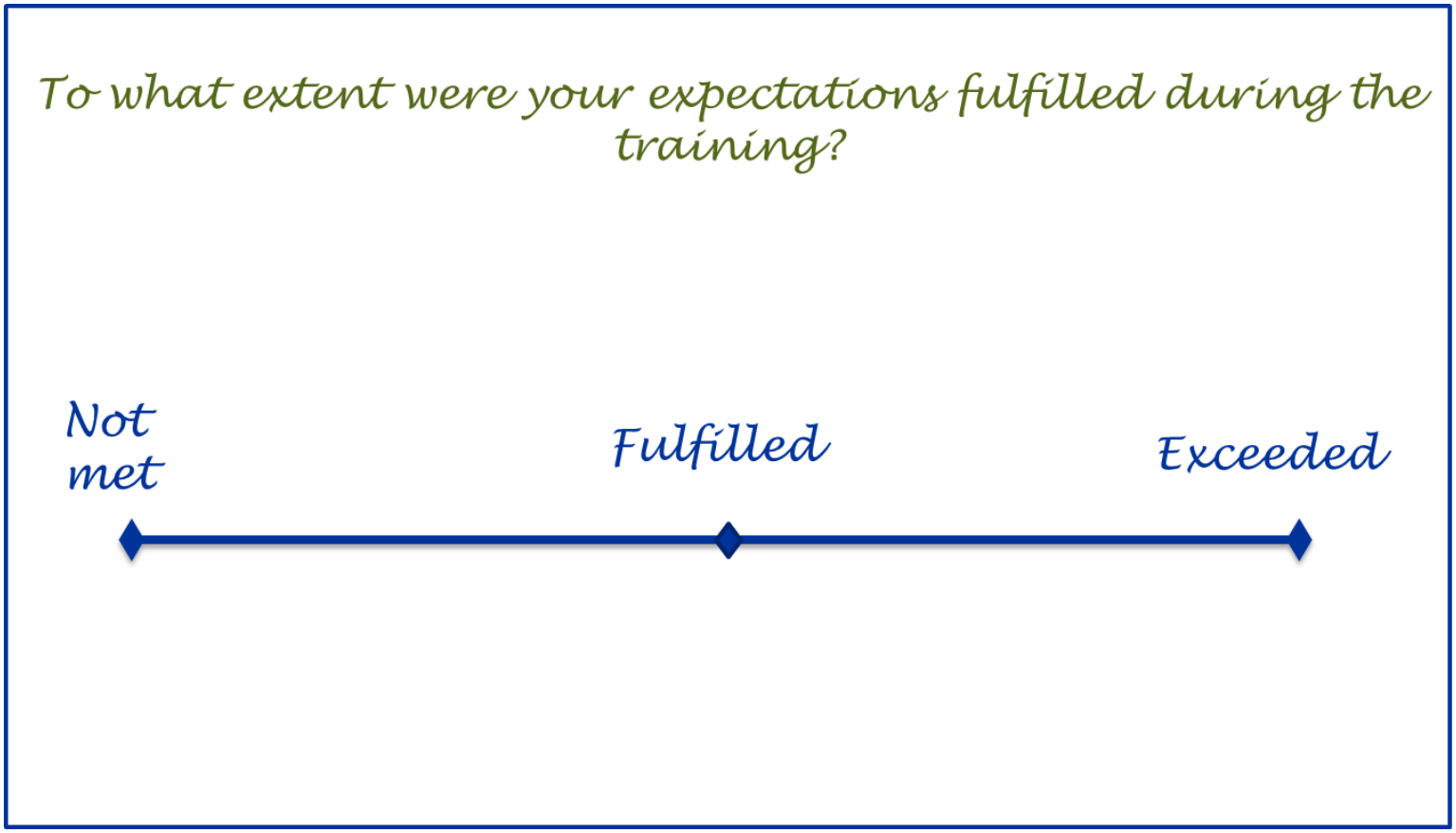


Figure 40: Flipchart template exercise 5