

1 Teacher's notes – Volume 1 – CP Basics

Volume 1 – Introduction to cleaner production – is the starting volume of the UNIDO Cleaner Production Toolkit. It introduces the topic and the ideas of cleaner production and provides various examples. It is designed for trainers who teach consultants or trainers.

The teacher's notes provide comments on **training activities (workshops)** and **company work**.

The background material can be used as described below.

Use of the background material "Introduction to cleaner production"	
Material	Comment
Textbook	The textbook provides the basic background information. The trainer should be familiar with the subject before starting the training or workshop. The textbook itself can be distributed as training material to the participants.
Examples	<p>The examples illustrate typical benefits and results of CP activities:</p> <ul style="list-style-type: none"> - Painting process: The two Sankey diagrams of a painting process (before and after) demonstrate the efficiency of CP. Experience has shown that the participants remember these graphs well because they visualize the CP philosophy. - Anodizing company: A typical example for good housekeeping in cleaner production. Prior to substantial investments the simple solutions and "low hanging fruits" should be analysed. The reduction of the drag-out by means of good housekeeping with no or low investment leads to very effective results, because the reduction is applied to the source. - Ultrafiltration system: This example demonstrates how materials can be reused by applying a rather modern clean technology (such as the use of an ultrafiltration unit) coupled with low investment costs and a short amortization period.
Exercises	<p>The exercises support the knowledge transfer to the participants. These exercises are designed for group work in a training course, but can also be used as individual exercises:</p> <ul style="list-style-type: none"> - Fun Factory: This interactive exercise is designed for group work in a training course/workshop. Several groups can work on it at the same time. - Two mini-case studies: These two case studies should be discussed and solved by small groups of two (max. three) persons. The didactical objective of the first example with the sludge dryer is that the participants understand the difference between CP and end-of-pipe. In many cases the participants classify this option as CP. For the second mini-case study it is important to stress that the suggested option is better than the previous solution. But many better, more effective and creative options can be found by looking for additional CP strategies. - Analyse your own waste streams: If companies participate in the workshop, Worksheet 1-7 "Our environmental situation" and Worksheet 1-8 "Quantification of goals" can be used (for print-out versions, please refer to the worksheet section of Volume 1). During the presentation of the company to the other participants, the "weather report" and the expected goals of the CP projects can be discussed.

Use of the background material "Introduction to cleaner production"	
Material	Comment
Slides	The slides can be used for an introductory presentation on cleaner production. They provide an overview of the aspects of the CP methodology and include areas such as material flow analysis, energy, team and controlling. The slides can be completed by own charts, project experience, etc.
Worksheets	<p>The worksheets are used for the first data collection in the company. As an example, they have been completed with the case study of a brewery.</p> <p>The following worksheets are included:</p> <ul style="list-style-type: none"> • <i>Main products/services</i> (Worksheet 1-1); • <i>Main raw and process materials</i> (Worksheet 1-2) listing the top 20 input data; • <i>Energy data</i> (Worksheet 1-3); • <i>Main types of waste and emissions</i> (Worksheet 1-4) listing the top 20 output/waste data. From the didactical point of view, the disposal costs but also the purchasing costs of waste, the so-called economic loss of raw materials, should be analysed. • <i>Prevention of waste and emissions</i> (Worksheet 1-5) designed as an idea checklist (for the respective background information, please refer to the textbook); • <i>Possibilities of minimizing waste in our company</i> (Worksheet 1-6) designed to document all recently implemented, ongoing or planned CP activities in a company; • <i>Our environmental situation</i> (Worksheet 1-7); • <i>Quantification of goals</i> (Worksheet 1-8). <p>The worksheets can also be opened as <i>doc.files</i>.</p>
Checklists	The checklists help the trainer to prepare the training course or workshop and to start the company work.
Questions	<p>The questions check the participants' understanding of the information covered during the training course or workshop. Most of the information is included in the textbook, therefore links to the textbook are provided. The trainer can decide if and how he checks the participants' knowledge and if he wishes to use these questions.</p> <p>In addition, the questions can be used as a quick self-check for the trainer.</p>

Training course/workshop

The participants of a workshop or training course on the "Introduction to cleaner production" are consultants or trainers.

The following table shows an example schedule of a one-day workshop which is designed as part of a series of workshops. This schedule has proved to be efficient with different target groups.

The second table comprises the suggested materials, learning objectives and success indicators for the different teaching units.

Example schedule for a training course/workshop "Introduction to CP"				
Topic	Content	Time	Min.	Method
Welcome		9.00	15	
	Welcome of participants		5	All
	Programme of the day, organizational matters		10	All, flipchart
Introduction to CP		9.15	75	
	Elements of a CP project, principles of CP, CP versus end-of-pipe		75	Presentation by an expert, using an overhead projector or beamer (partly slides)
Group work		10.30	10	
	Assess your personal environmental situation at project start, think about possible goals		10	Individual work by each participant, worksheets (Exercise 3)
Coffee break		10.40	20	
Introduction of participants		11.00	75	
	Why are you here? How are you feeling? What is your function in the company?		15	Single point questions on flipchart
	Presentation of products, major production processes, environmental problems, expectations of a CP project		60	Presentation of each participant/company
Lunch		12.15	75	
Strategies for CP		13.30	60	
	CP strategies Examples for the strategies (also from the participants)		60	Presentation of expert, discussion (Slides, transparencies, etc.
Exercises		14.30	30	
	Mini case studies (Exercise 2)		15	Group work and plenary discussion
			15	
Break		15.00	20	
Fun Factory		15.20	70	
	Interactive game: Fun Factory (Exercise 1)		10	Introduction (flipchart)
			50	Group work
			10	Plenary discussion
Discussion, continuation		16.30	30	
	Discussion of the topic of the day, summary of major aspects, continuation of work, explanation of training material and worksheets, homework, organizational matters		30	Plenary discussion
End		17.00		

Explanation of the topics of the training course	
Topic	Materials/learning objectives/success indicators
Introduction to CP	<p><i>Material:</i></p> <ul style="list-style-type: none"> - Some transparencies from the slides in Volume 1 and additional own transparencies; - Textbook of volume 1 and also textbooks from the following volumes (such as material flow analysis, energy, team, etc.). <p><i>Learning objectives:</i></p> <ul style="list-style-type: none"> - Make the participants familiar with the concept of CP; - Motivate the participants to see the benefits of CP also for their work; - Provide an overview of all the aspects covered in a CP audit. <p><i>Success indicator:</i></p> <ul style="list-style-type: none"> - Participants have an overview of the steps in a CP audit and the discussion shows that they are interested in this subject and motivated.
Group work	<p><i>Material:</i></p> <ul style="list-style-type: none"> - Two worksheets of volume 1. <p><i>Learning objectives:</i></p> <ul style="list-style-type: none"> - Consider the environmental situation of a company in different areas; - Quantification of goals and expectations of CP; - The "weather report" should break the ice during the introduction of the participants. <p><i>Success indicators:</i></p> <ul style="list-style-type: none"> - The participants can draw up an environmental profile of the problems in their companies (although subjective and not quantitative; if all aspects are classified sunshine or rain, the result cannot be considered good); - In the following the trainer can show where and how the CP project can help (water, waste, energy, raw material, motivation, etc.).
Strategies for CP	<p><i>Material:</i></p> <ul style="list-style-type: none"> - Textbook, slides and examples of volume 1; - Own examples. <p><i>Learning objective:</i></p> <ul style="list-style-type: none"> - Understanding the different strategies such as product change, good housekeeping, change of raw material, technological modification, internal and external recycling. <p><i>Success indicator:</i></p> <ul style="list-style-type: none"> - After the introduction to the principal CP strategies and the examples from many different sectors, the participants have now a clearer picture of what CP is and how companies can benefit from it.
Exercises	<p><i>Material:</i></p> <ul style="list-style-type: none"> - Two mini case studies from the exercise section of Volume 1. <p><i>Learning objective:</i></p> <ul style="list-style-type: none"> - Apply the knowledge of CP strategies to small examples. <p><i>Success indicators:</i></p> <ul style="list-style-type: none"> - Intensive discussions in small groups and plenary; - Tip: allow many different opinions and discuss them before giving a solution.
Fun Factory	<p><i>Material:</i></p> <ul style="list-style-type: none"> - Exercise 1 from the exercise section of Volume 1, flipchart, Play-Doh and tools. <p><i>Learning objectives:</i></p> <ul style="list-style-type: none"> - Simulate a production process and the usual production problems and think of/discuss CP options; - Experience the combination of production and CP in a funny and creative group work. <p><i>Success indicators:</i></p> <ul style="list-style-type: none"> - The participants recognize CP options; - The participants can convert this production and CP simulation into practical measures.

Company work

Before starting to apply the CP-methodology in a company, several aspects should be considered. After the first information or after a training workshop (example described above) the collection of data starts. The proposed worksheets provide help and orientation for the first steps.

In general, the following comments can be useful:

Start-up of company work	
	Comments on data collection/data analysis
	<ul style="list-style-type: none"> - The data collection should not be too detailed – stick to the major (e.g. top 10 or 20) materials, but do not neglect important data. - Do not focus too much on special problems or areas at the beginning - While analysing the input and output data, check their consistency. Check for instance, whether the input of incoming water equals more or less the different water output streams (assuming that water is an important material flow). - Look for and check any existing documentation system in the company. - Elaborate CP strategies and CP options with the textbook, the exercises and worksheets. - At the beginning, concentrate on the CP methodology, do not focus too much on sector specific know-how – this may even be counterproductive at the beginning. - Keep also in mind that a more detailed analysis will be carried out later on, e.g. the material flow or energy analysis.
	First company visit
	<ul style="list-style-type: none"> - If possible, try to have a short meeting with the top management to discuss the environmental policy and any existing or future strategy of the company. - During the site visit follow the flow of production. - Check data consistency (see above). - Get an overview of the process steps that show significant inefficiencies. - Use the typical CP questions why, why, why (why has this become waste, why is it not possible to reuse/minimize, etc.). - Especially at the beginning, point out the so-called "low hanging fruits". - Cross-check any information you get from the company by observing the working procedures and by asking employees about their work, their problems and ideas for improvement. - A number of CP options are not only found directly in the production process but also in the way the production process is embedded in the auxiliary equipment and machineries. Therefore, after the production process, take a close look at: <ul style="list-style-type: none"> - The fresh water and wastewater management/treatment; - Boiler house, steam system, compressed-air system; - Cooling and freezing units (especially their integration into the whole energy system); - Maintenance programmes; - Air emissions (such as use of solvents, painting processes, etc.); - Waste management; - Existing legal problems; - Storage of raw materials, hazardous waste and products. - Find out where solid waste is stored and how it is removed from the company. Look into waste collecting containers. - Watch out for contamination of ground and soil (e.g. by oil, etc.).