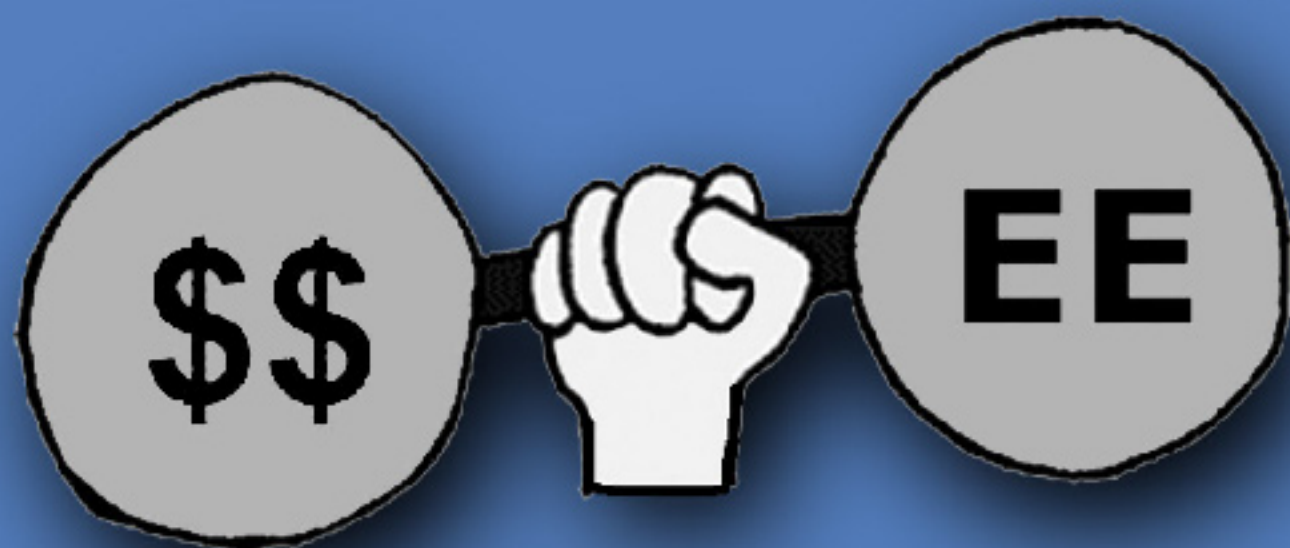


PART 2
HOW TO BECOME
ENERGY EFFICIENT



Part 2: How to become energy efficient

This part provides a 6-step methodology to help Asian companies improve energy efficiency, reduce costs and reduce greenhouse gas emissions, based on *real practice* experience in more than 40 Asian companies.

Part 2 is included in full in this hard copy Guide

Introduction

The “Company Energy Efficiency Methodology” (Methodology) has been developed for *Asian industrial companies* to help them *improve energy efficiency* through Cleaner Production.

Energy efficiency can help companies to:

- Reduce energy and production costs
- Improve environmental performance and reduce greenhouse gas emissions
- Reduce exposure to rising energy prices and energy shortages
- Win new customers who consider environment as an important selection criteria
- Improve productivity and product quality
- Improve reputation with customers, government and public
- Improve staff health, safety and morale
- Improve compliance with legislation and ISO 14001 targets

This Methodology has been developed because it:

- Is tailored to energy-intensive industrial companies in developing Asian countries, which in many ways are different from companies in industrialized and Western countries
- Focuses on energy, which is less visible than waste, water and raw materials
- Explains not only what should be done in theory, but also how it is done in practice because all companies are different. A focus is therefore given on how to overcome barriers such as time limitations and lack of data, and on practical company examples

This Methodology is based on:

- The Cleaner Production (CP) strategy: prevention of waste, systematic approach, integrated into business processes and aimed at continuous improvement
- Several existing CP and energy audit methodologies
- *Real practice* experience from energy assessments carried out as part of the GERIAP project in more than 40 Asian industrial companies

How to use the Methodology

Companies can improve their energy efficiency through a *6-step Cleaner Production approach* (see Figure 1). On the CD-ROM and website, you can click on each step to see the purpose, output and estimated time required for the step. You can also download all steps as a pdf file or download training materials.

Under each step there are several *tasks*. Each task describes what a company should do as a minimum. On the CD-ROM and website, arrows on the right provide more detailed information:

- Company examples that explain how the task was applied at different companies and lessons learnt (Appendix A)
- Worksheets to assist you in completing the task, and which are editable and printable (Appendix B) Remember: the ultimate purpose is to keep improving energy efficiency, and this methodology

can help companies do this. But the methodology should be applied flexibly and depending on the company's situation, because *each company is different*: country, sector, size, organizational structure, production processes, existing energy management systems, and so on.

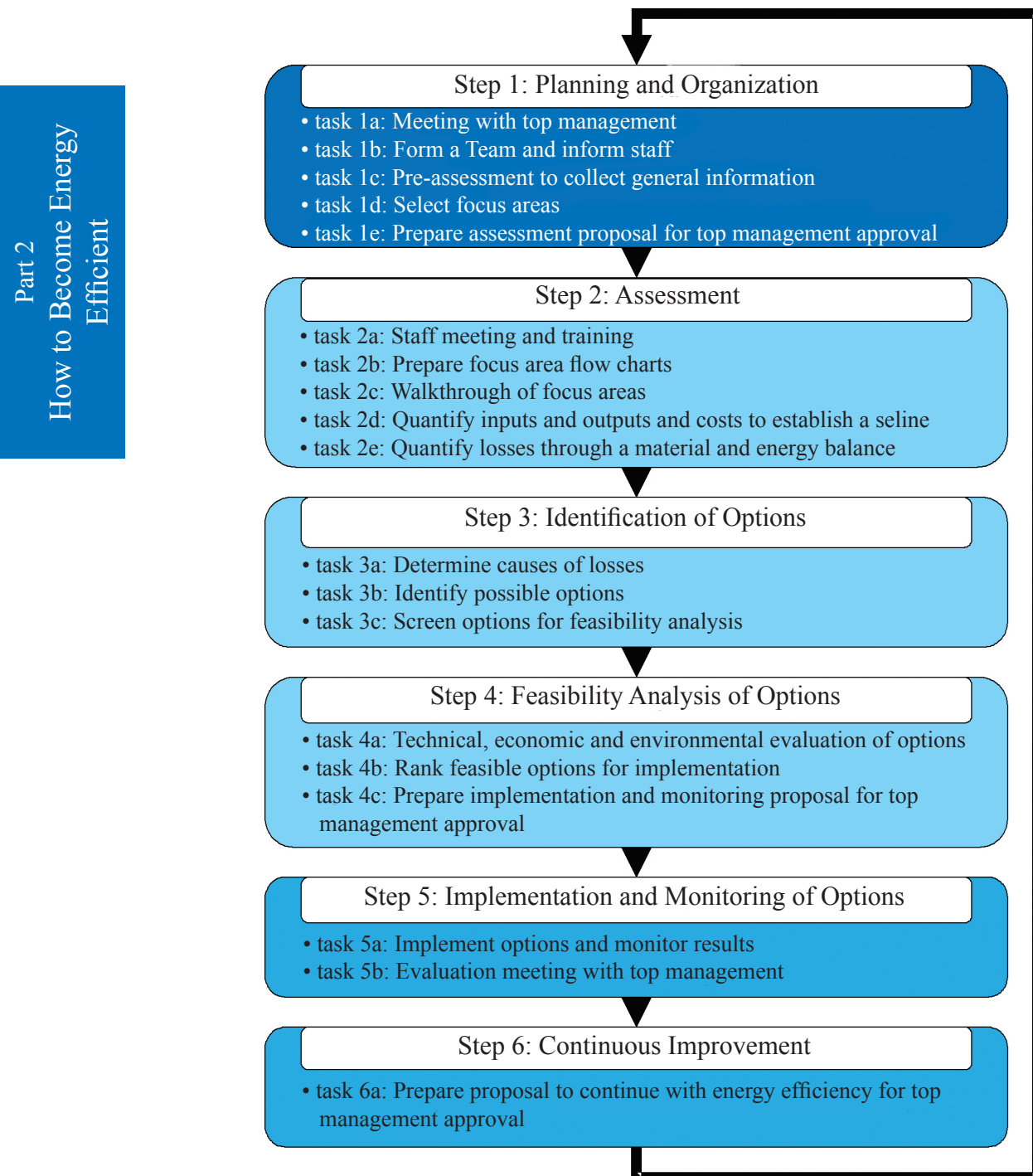


Figure 1: Company Energy Efficiency Methodology

Step 1 - Planning and Organization

The *purpose* of step 1 is to obtain top management commitment and plan and organize an energy assessment. Without an approved plan, there is no commitment!

The *output* of step 1 is therefore a written proposal with selected steps and tasks to improve the company's energy efficiency that is approved by top management. An approved plan will make steps 2 to 6 a lot easier!

Step 1 should take about 3 – 6 days. Tasks under step 1 and the estimated time needed include:*

- Task 1a: Meeting with top management (1-2 hours)
- Task 1b: Form a Team and inform staff (0.5-1 day)
- Task 1c: Pre-assessment to collect general information (1-3 days)
- Task 1d: Select focus areas (0.5-1 day)
- Task 1e: Prepare assessment proposal for top management approval (2-3 days)

*Note: the amount of time depends on, for example, the size of the plant, the number of people involved and the amount of information available.

How you start depends on who you are. If you are:

- **Top management** of a company interested in improving energy efficiency, then you should identify which managers and staff members are needed to get a project started, and ask them to attend a first meeting with you. You can also ask an external facilitator to attend the meeting
- **Middle management** (e.g. Production Manager, Environment Manager) and not part of top management, then you should request top management for a meeting and invite other managers and staff who are needed to get a project started to attend. You can also ask an external facilitator to attend the meeting
- **An external facilitator** (e.g. consultant, CP Centre, research institute) with an interest in getting the company to improve its energy efficiency, then you should request top management for a meeting (or ask a company manager to organize a meeting for you). You can also ask for company managers who are needed to get a project started to attend the meeting

1a. Meeting with top management

If you are top management, then the purpose of this first meeting is to get the commitment of company middle managers, staff and/or external facilitators to carry out a pre-assessment and write a proposal for a detailed energy assessment.

If you are a company middle manager or external facilitator then the purpose of this first meeting is to get top management's approval for a pre-assessment and writing of a proposal for a detailed energy assessment.

At this 1-2 hour meeting discuss the following:

- If and/or why top management is interested in improving the company's energy efficiency (see Worksheet 1 for a list of possible reasons)
- Any energy areas of interest or concern
- Where the company is right now with energy management (fill out the Energy Management Matrix in Worksheet 2)
- Other factors that will influence the approach to improving energy efficiency (see Worksheet 3)
- The amount of time needed to conduct a pre-assessment (normally 1-3 days) and write a proposal (normally 2-3 days) and deadlines
- Who should be in the Team and who from top management will be the main contact for the Team (see task 1b)

- How staff will be informed to ensure their assistance during the pre-assessment (see task 1b)

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples of companies that participated in the GERIAP project on how they addressed the meeting with top management.
- Worksheets (Worksheet 1, 2 and 3, See Appendix B)

1b. Form a Team and inform staff

A Team of 4 - 6 people should be formed. In practice, the Team is often formed at the meeting with top management.

The Team normally includes (but can be expanded when the focus areas have been selected):

- Someone who knows the main energy uses and environmental impacts of the company, e.g. the Environment Manager or Energy Manager
- Someone who knows the production process, e.g. the Head of Production
- Someone with access to general company information and energy cost data, e.g. the company's Accountant or Finance Manager
- A communications or training person, especially if management have identified staff training as one of their objectives
- A top management representative who normally is not part of the Team's day-to-day work

The company may decide to also include an external facilitator (consultant or service provider) in the Team for the pre-assessment and writing of the proposal, especially if he/she/they are needed for the assessment later.

The Team holds a half-day first meeting to agree on each member's roles (see Worksheet 4) how and when to carry out the pre-assessment (task 1c), select focus areas (task 1d), and write a proposal for management (task 1e).

In addition, the Team should inform staff about the pre-assessment, for example through a letter by top management, regular staff meetings or notice boards.

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples of companies that participated in the GERIAP project on how they addressed the Team formation and informing staff.
- Worksheets (Worksheet 4, See Appendix B)

1c. Pre-assessment to collect general information

The Team now carries out a pre-assessment at company level to collect and review general information, which normally takes between 1-3 days. The main purpose of the pre-assessment is to identify where the biggest areas for energy savings are (= potential focus areas in task 1d!) and writing a realistic proposal to top management (task 1e).

This information can be obtained through existing documentation and computer systems, interviews with staff, a walkthrough of the plant, and simple monitoring. Because staff were informed about the pre-assessment, they are more likely to cooperate!

Information collected should include:

- General company details, such as address, number of staff, working hours and production capacity (see Worksheet 5)
- Organization chart with the different departments and main functions
- General production flow chart for the whole company with the main inputs and outputs for each

- production step (see Worksheet 6)
- Production data for the past 3 years, preferably for each month (see Worksheet 7)
- Energy and other resource consumption data and costs for the past 3 years, preferably for each month and for each production step or department (see Worksheet 7)
- An inventory of major equipment, such as boilers, air compressors, motors (see Worksheet 8)
- Overview of information collected for each process step / for each department (see Worksheet 9)
- Company greenhouse gas (GHG) emissions (see GHG Indicator)

Note: the amount and quality of information available is most important for task 2d (quantifying inputs and outputs and costs for focus areas). If only limited information is available, then task 2d can only be carried out in less detail or more time is needed to measure and collect data.

See “Company examples” for examples of companies that participated in the GERIAP project on how they did the pre-assessment.

Information on the CD-ROM and website:

- Company examples (Appendix A)
- Worksheets (Worksheet 5, 6, 7, 8, 9, See Appendix B)
- GHG Indicator

1d. Select focus areas

Now it is time to select focus areas. A focus area can be:

- The entire plant
- A department, production line, or process step, such as the kiln or the packaging plant
- Specific (energy) equipment or resources, such as steam, compressed air, motors, or fans

The Team meets for a 1-4 hour brainstorm session to prepare a list of possible focus areas, and to choose focus areas based on for example (see Worksheet 10):

- Size of the plant
- Management’s areas of interest or concern
- High energy / resource consumption or costs
- Areas for which energy efficiency audits or project have not yet been carried out
- Expertise and knowledge of staff about a certain area
- Plans for construction or upgrading
- Available information for a certain area

Note: this information has already been collected as part of the management meeting and the pre-assessment!

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples of companies that participated in the GERIAP project on how they addressed the selection of focus areas.
- Worksheets (Worksheet 10, See Appendix B)

1e. Prepare assessment proposal for top management approval

It is important to obtain top management commitment because an energy assessment costs money and staff time and can interrupt the production process. This can only be achieved if there is a clear proposal for the energy assessment (step 2, 3 and 4 of the approach).

This proposal can be prepared within the company (e.g. the production manager, energy manager or an internal Team or committee) or by an external facilitator who has been involved in tasks 1a – 1d (e.g. by a consultant, a Cleaner Production Centre or other service provider).

The assessment proposal should include (see Worksheet 11):

- Objectives (i.e. agreed in the meeting with management)
- Scope (i.e. focus areas)
- Outputs (i.e. an proposal for implementation of feasible options to improve energy efficiency)
- Approach (i.e. the steps 2, 3 and 4 of the Methodology – how detailed each step and task should be depends on the company, because each company is different!)
- Team (i.e. who will take part in the assessment and the roles and responsibilities of each Team member)
- Time planning (i.e. how much time / man days is needed for each step and task, a timeframe with deadlines)
- Budget (i.e. how much money is needed for the assessment)

The proposal is then sent or presented to top management for comments and approval. In case of an external facilitator, consultant or service provider a contract is signed for assistance with the energy assessment.

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples of companies that participated in the GERIAP project on how they addressed the assessment proposal to top management.
- Worksheets (Worksheet 11, See Appendix B)

Step 2 - Assessment

The *purpose* of step 2 is to assess where energy is lost/wasted for the focus area(s).

The *output* of step 2 is an overview of how much energy is lost and how much money this costs for the focus area(s). Then it becomes easier to identify options to improve energy efficiency in step 3!

Tasks under step 2 and the estimated minimum time needed include:*

- Task 2a: Staff meeting and training (minimum 0.5 day for staff meeting only)
- Task 2b: Prepare focus area flow charts (minimum 2 hours per focus area)
- Task 2c: Walkthrough of focus areas (depending on the focus area, but minimum 0.5 day per focus area, excluding collection of detailed data for task 2d)
- Task 2d: Quantify inputs and outputs and costs to establish a baseline (time required depends on data available as determined during the pre-assessment, task 1c)
- Task 2e: Quantify losses through a material and energy balance (0.5 – 1 day per focus area provided that data were collected under task 2d)

* Note: the selection of tasks, time needed and who does what should already be included in the energy assessment proposal to top management that was prepared under task 1e. Although task 2b, 2d and 2e are described as separate tasks, it is possible to combine these, which will avoid repetition and save the Team time!

2a. Staff meeting and training

As a minimum the Team should organize a staff meeting to inform staff about the assessment and their roles and to get their support. Staff from the focus areas should attend this meeting, but preferably everyone from top management to production staff throughout the plant should get an introduction. Production staff are important because they are the ones who work in the focus area every day and understand the production processes best!

It is recommended that the Team and staff working in the focus areas receive training on CP and energy efficiency, how to carry out an assessment, and technical training on energy equipment, depending on whether

- The Team has sufficient knowledge and experience to carry out the energy assessment
- An objective of the energy assessment is to increase staff's knowledge and experience so that they can continue with energy assessments in the future (as indicated by top management under task 1a) or only to find quick energy efficiency options
- The company's Team or external consultants carry out the energy assessment

See Worksheet 12 for suggested training. *Note that this Guide includes training material for company staff!*

Other possible activities include hanging up posters, starting a slogan campaign, explanation at section/department meetings, and announcements through a letter from top management to staff or through a company newsletter.

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples of companies that participated in the GERIAP project on how they addressed the staff meeting and training.
- Worksheets (Worksheet 12, See Appendix B)

2b. Prepare focus area flow charts

The Team should prepare a focus area flow chart for each of the selected focus areas as follows (see Worksheet 13):

- List the different steps of the focus area and draw a box around each step
- List the most important inputs (resources) for each step on the left, such as energy (electricity, fuels), water, raw materials and chemicals
- List the most important outputs for each step on the right, such as solid wastes, heat, emissions, noise and wastewater
- List the intermediate and final products between the steps, such as clinker and cement

Add any information on units of measurement for inputs and outputs and quantities and costs that is already available. Otherwise this information can be gathered as part of the next tasks.

The focus area flow chart will look differently for a department or process step (e.g. kiln, boiler house) compared to specific energy uses (e.g. steam system, motors, fans).

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples of flow charts of focus areas for companies that participated in the GERIAP project.
- Worksheets (Worksheet 13, See Appendix B)

2c. Walkthrough of focus areas

The Team now conducts a detailed walkthrough of the focus areas, usually starting at the first step of the process flow chart and finishing at the last step. The purpose of the walkthrough is to:

- Better understand the focus area
- Get feedback from production staff about problems they have with procedures and operating equipment, and possible losses of energy and other materials
- Write down any visible losses of energy and materials such as steam and water leaks, damaged valves and pipelines, excess blow-down from the boiler, etc (see Worksheet 14 for more examples)
- Obtain information about quantities and costs for the inputs and outputs of each focus area step through interviews with staff, metering reports, or taking measurements (needed for task 2d)

The first walkthrough is done thoroughly. But in practice, the Team will visit the focus area several times to meet with production staff and gather more information on inputs and outputs (task 2d) and later to identify and investigate energy efficiency options (step 3 and step 4).

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples of companies that participated in the GERIAP project on how they addressed the walkthrough of focus areas.
- Worksheets (Worksheet 14, See Appendix B)

2d. Quantify inputs and outputs and costs to establish a baseline

A baseline is important because you can measure improvements after implementing options, and management will only be convinced to continue if you can show how much resources and money was saved.

To establish a baseline, for each input and output in the process flow chart collect the following information (see Worksheet 13):

- Quantities (e.g. tons of coal per day)
- Costs (e.g. \$ per ton of coal)
- Other characteristics (e.g. temperature of water going in and out of the boiler, pressure)

Ideally, you want quantity and cost information for 3 years, 12 months within one year, and the days within one month, so that you can observe trends.

The information can come from interviews with staff, readings of online meters, monitoring records, and by taking measurements with monitoring equipment (especially to verify data records!)

However, in practice it is not always possible to do all this because:

- Not all companies have this information readily available. For example, a company may only have electricity bills and an electricity meter for the plant but no breakdown for each equipment or department that uses electricity
- Monitoring equipment is not available at the plant
- There is limited time available to complete this task

The level of detail and how much time is needed to measure and collect data under this task should already be identified during the pre-assessment (task 1c). Possible solutions should also have been included in the proposal to management (task 1e).

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples of companies that participated in the GERIAP project on how they established a baseline.
- Worksheets (Worksheet 13, See Appendix B)

2e. Quantify losses through a material and energy balance

What goes into a process must come out somewhere else. Based on the process flow chart and quantified inputs and outputs prepared in the previous tasks, try to “balance” the inputs and outputs side.

Any inputs that do not come out as useful outputs (e.g. product, steam) are considered “losses”. These can include losses of energy (e.g. through heat, blow-down, flue gases, un-burnt materials), and losses of products and materials (e.g. water, chemicals, product rejects and off cuts).

Using the cost information (task 2d), calculate the costs of the losses. This will allow you to focus on options from a cost and resource point of view.

Completing a full and detailed material and energy balance could take a long time, especially if there is little data on inputs and outputs at the company. It is also more difficult to determine energy losses because energy is not as tangible as raw materials and wastes.

It is important to be practical and focus on quantifying at least the biggest and most expensive losses, because this will form the basis of identifying options for improvement.

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples of companies that participated in the GERIAP project on how they prepared a useful material and energy balance.
- Worksheets (Worksheet 13, See Appendix B)

Step 3 - Identification of Options

The *purpose* of step 3 is to identify opportunities to improve energy efficiency for the selected focus areas.

The *output* is a list of options that will be investigated on their feasibility in step 4.

Tasks under step 3 and the estimated time needed include:*

- Task 3a: Determine causes of losses (estimated 0.5 day per focus area)
- Task 3b: Identify possible options (estimated 0.5 day per focus area)
- Task 3c: Screen options for feasibility analysis (estimated 0.5 day)

* Note: the time needed and who does what should already be included in the proposal prepared under task 1e. Step 3 can take between 1 – 3 days depending on the number of focus areas, the number and type of losses and causes, the time available, the technical expertise of the Team members and if tasks 3a – 3c are carried out separately or together. For example a one-day workshop can be held where the Team first looks at the causes of losses, then identifies possible options and finally screens options for feasibility analysis.

3a. Determine causes of losses

Once we have identified the losses, it is important to answer the question: Why are these losses occurring?

The best way to analyze the causes is through a brainstorm session, which is a meeting with the Team and other staff from the focus areas to discuss the losses. One person can act as facilitator and make notes on a whiteboard so that everyone can follow the discussion.

It is important to continue asking “why” until you have found the real cause or “root cause” of the problem. A common problem with boilers is un-burnt ashes. Why? Because the air supply to the boiler is too low. Why? Because the meter gives a wrong reading of air supplied. Why? Because the meter has not been maintained properly. Why? Because boiler operators nor maintenance staff maintain the boiler. Why? Because the maintenance procedures do not specify who should maintain the boiler and how often. This is the root cause of your loss. And only now it is possible to come up with options to solve this problem permanently. In our example, increasing the air supply is a temporary solution (saving little energy in the short term), whereas changing maintenance procedures is a permanent solution (saving a lot of energy in the long term).

Worksheet 15, the Fishbone Diagram tool, and Company examples from companies that participated in the GERIAP project can help you find the causes for losses at your selected focus areas.

Information on the CD-ROM and website:

- Company examples (See Appendix A)
- Worksheets (Worksheet 15, (Appendix B))
- Fishbone Diagram

3b. Identify possible options

Once we know why losses occur, we can move to the next question: What can we do to solve it?

A brainstorm session with the Team and other staff from the focus areas is the best way to come up with possible options. Options can fall in the following categories:

- Good housekeeping
- Improved process management
- Production process / equipment modification
- New technology / equipment
- Input material substitution
- On-site reuse / recovery
- Production of useful by-product.
- Product modification

Click on “Option categories” for an explanation and examples for each category. You can also use Worksheet 15 to write down possible options.

There is no such thing as a “bad idea” so everyone should be encouraged to come up with as many possible options as possible! Sometimes hundreds of possible options are generated for one focus area alone.

Another source of possible options are the notes from the walkthrough of focus areas under task 2c (Worksheet 14) and the notes from the discussion with top management about energy management in the company under task 1a (Worksheet 2).

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples from companies that participated in the GERIAP project on how they identified possible options.
- Worksheets (Worksheet 15, See Appendix B)
- Option categories

3c. Screen options for feasibility analysis

The Team now needs to decide which possible options to investigate for feasibility. The easiest way to do the screening of options is by putting them in one of these categories:

- Options that can be implemented directly. They are technically simple and need little or no money to implement. For example, repairing leaks, changing an operating procedure, reducing excess air from the boiler.
- Options that require further analysis. These options are technically more complex or require a financial investment. For example, replacing a compressor, recovering heat from boiler blow-down, or replacing lime with alternative materials in cement production.
- Options that can be considered at a later stage. These options are probably difficult to investigate and implement, for example, because the costs are too high, they take too much time to investigate, or a plant upgrade is planned that will cover this option already.

The meeting with management under task 1a should also give you an indication of what screening criteria to apply!

Worksheet 15 can be used to categorize options, and look under “Company examples” to see what other companies have done.

Options that require further analysis will be investigated for their technical, financial and environmental feasibility as part of step 4. Options that can be implemented directly do not require a feasibility analysis, however, the technical, financial and environmental details will still need to be recorded.

Information on the CD-ROM and website:

- Company examples (See Appendix A)
- Worksheets (Worksheet 15, (Appendix B))

Step 4 - Feasibility analysis of options

The *purpose* of step 4 is to determine which options are technically, financially and environmentally feasible and in what order feasible options should be implemented.

The *output* of step 4 is a proposal that is approved by top management, with recommended options for implementation and how to do this, plus a list of options that require further investigation or which are not feasible.

Tasks under step 4 and the estimated time needed include:

- Task 4a: Technical, economic and environmental evaluation of options (time depends on the number and complexity of options investigated)*
- Task 4b: Rank feasible options for implementation (0.5-1 day)
- Task 4c: Prepare implementation and monitoring proposal for top management approval (2-3 days)

*If top management has given a maximum amount of time for the feasibility analysis, then the number and type of options selected for feasibility analysis should be adjusted accordingly.

4a. Technical, economic and environmental evaluation of options

The Team can now investigate which options are technically, economically and environmentally feasible. How this is done is described below. You can use Worksheet 16 to write down the results.

First of all, you must decide what tasks should be done for each option, i.e. what do you need to find out to know if an option is feasible? This should include (see “Feasibility analysis tools” for more details and examples):

- Technical feasibility: need for new equipment, space availability, impact on product quality, staff time required
- Economic feasibility: one-off investment costs, annual operating/ongoing costs, annual cost savings, payback period
- Environmental feasibility: impact on energy consumption and greenhouse gas emissions, but also look at water use, raw material use, solid waste, wastewater, other air emissions, noise, odours and dust.

Second, you need to identify other possible reasons for implementing the option. For example, if company emission levels are higher than legal limits then this may be a reason to implement an option even if the option is expensive.

Third, you need to think of possible barriers to implementing the option. For example, an option may have large savings and a short payback period, but investment capital is not available in the company. Lack of monitoring equipment may make monitoring of results difficult. Try to think of possible solutions too!

Also consider comments from top management on the reasons for energy efficiency, the current energy management practices and other factors of influence on improving energy efficiency (see Worksheet 1, 2 and 3). More

Information on the CD-ROM and website:

- Company examples (See Appendix A) for more examples of other reasons and barriers.
- Worksheets (Worksheet 16, See appendix B)

4b. Rank feasible options for implementation

Now that we know which options are feasible we want to know: which options should be implemented first, second, third, etc. Organize another Team meeting to give each option a rank:

- 1 - Options to be implemented in the short term, e.g. within one year
- 2 - Options recommended for implementation but in the longer term
- 3 - Option recommended for further investigation, or to be considered at a later stage
- Unfeasible options

The results of the technical, economical and environmental feasibility analysis and the other reasons and barriers are used as a basis to rank the options. In practice an open discussion amongst Team members is enough to compare and rank the options. However, you could also start by giving a “low”, “medium” or “high” score for the technical, economical and environmental feasibility and other reasons, and then decide on the ranking (see Worksheet 17).

For options recommended for implementation in the short term (rank 1), you should now decide (and include in Worksheet 16):

- What are the implementation and monitoring tasks
- Who will be responsible for coordinating and carrying out these tasks (including internal staff, and external suppliers and consultants)
- Completion dates
- How much staff time is required
- Other comments

This will help with preparing an implementation proposal.

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples from companies that participated in the GERIAP project on how they ranked feasible options for implementation.
- Worksheets (Worksheet 16, 17)

4c. Prepare implementation and monitoring proposal for top management approval

Top management’s support is again needed for the implementation and monitoring of feasible options in the short term. The Team should prepare a proposal for an Implementation and Monitoring Plan to top management (see Worksheet 18):

- An introduction
- Number of options identified, options investigated for feasibility, feasible options, options requiring further investigation, and unfeasible options
- Options recommended for implementation in the short term:

- Total estimated investment required, annual ongoing costs, annual savings and payback period
- Total estimated environmental benefits (energy, GHG emissions and resources/wastes)
- Most important other reasons for implementation
- Most persistent and difficult barriers and proposed solutions
- Table with list of options including technical, economical, environmental, reasons and barriers for each individual option
- Team (who will carry out the implementation and monitoring, including external facilitators/consultants)
- Communication of results to top management and staff
- Appendices with
 - Worksheets 16 for options recommended for implementation in the short term
 - Worksheet 17 with details and ranking of all options investigated

The proposal is then sent to top management for comments and approval. If an external facilitator, consultant or service provider is needed for the implementation and monitoring, a contract is signed.

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples from companies that participated in the GERIAP project on how they prepared this proposal to top management.
- Worksheets (Worksheet 18)

Step 5 - Implementation and monitoring of options

The *purpose* of step 5 is to implement feasible options in order of priority and monitor results and discuss findings with top management.

The *output* of step 5 is improved energy efficiency, reduced costs and reduced GHG emissions from implemented options, and agreement with top management about the next steps.

Tasks under step 5 and include:

- Task 5a: Implement options and monitor results*
- Task 5b: Evaluation meeting with top management (0.5 day)

*How much time this task takes depends on the number and complexity of options to be implemented. This decision will have been made when top management approved the Implementation and Monitoring Plan.

5a. Implement options and monitor results

The Team should carry out the Implementation and Monitoring Plan approved by top management.

Use Worksheet 16 to record the monitored results for each option. These should at least include:

- Economic results: one-off investment costs, annual operating/ongoing costs, annual cost savings, and payback period
- Environmental results: energy consumption and greenhouse gas emissions, and other environmental results (depends on each option, such as water use, raw material use, solid waste, wastewater, other air emissions, noise, odors and dust)
- Other results: e.g. any other benefits from the option (e.g. improved legal compliance, reduced injuries) and barriers encountered

In practice, the monitored results will often be slightly different from the feasibility analysis data.

Without monitoring it will be very difficult to convince management that energy efficiency projects are beneficial to the company. You need to proof especially the financial benefits of implemented options to get their support for future projects.

It is also important to communicate (interim) results throughout this phase to management and staff to:

- Show management that energy efficiency is good for business and gain their support for future projects
- Reward staff for their efforts in improving energy efficiency and encourage them to come up with new options

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples from companies that participated in the GERIAP project on how they implemented options and monitored results.
- Worksheets (Worksheet 16, See Appendix B)

5b. Evaluation meeting with top management

An evaluation meeting between the Team and top management is necessary to formally close the first round of energy efficiency projects. But a second purpose is to gain their commitment to continue with energy efficiency.

At this 2-4 hour meeting discuss the following:

- Results of the implemented options and how to communicate these internally and externally (see “Company examples” on how to do this)
- How to continue to improve the company’s energy efficiency by agreeing with top management
 - Additional options for implementation (ranked 2 under task 3b)
 - Additional options for further investigation (ranked 3 under task 3b)
 - New focus areas to carry out more assessments (e.g. based on the list of possible focus areas from task 1d)
- How to integrate energy management throughout the company’s systems by agreeing with top management actions needed under the six categories of the Energy Management Matrix (see Worksheet 3)
 - Policy and systems
 - Organization
 - Motivation
 - Information systems
 - Training and awareness
 - Investment

Therefore this evaluation meeting could also be used as a first meeting with top management (task 1a) as part of a new cycle.

Information on the CD-ROM and website:

- Company examples (See Appendix A) for examples from companies that participated in the GERIAP project on how they managed the evaluation meeting with top management.
- Worksheets (Worksheet 3, See Appendix B)

Step 6 - Continuous improvement

The *purpose* of step 6 is to ensure that the company *continues* with improving energy efficiency in a *systematic* way that is *integrated* in company processes (these are the key components of Cleaner Production)

The **output** of step 6 is continuation of implementing energy efficiency options and integration of energy management into company processes

Step 6 has only one task:

- Task 6a: Prepare a proposal to continue with energy efficiency for top management approval (2-3 days)

6a. Prepare a proposal to continue with energy efficiency for top management approval

The Team should now write a proposal based on what was agreed with top management at the evaluation meeting and seek top management approval.

Write this proposal by making use of

- Worksheet 11 - Assessment proposal (for the assessment of new selected focus areas and the feasibility analysis of the additional options selected for further investigation)
- Worksheet 18 - Implementation and monitoring proposal (for additional options selected for implementation and energy management improvement options)

Therefore writing this proposal is in fact a combination of preparing and assessment proposal (task 1e) and an implementation and monitoring proposal (task 3c) as part of a new cycle.

Energy management has been integrated into the Methodology, for example:

- The quality of the pre-assessment (task 1c) and assessment (step 2) depend largely on the quality of energy management systems
- Some of the identified options were aimed at improving energy management (task 3b)
- Many of the barriers for options are energy management barriers (task 4a)

For this reason, continuous improvement can only be achieved by effective energy management and integration of energy management into other company processes and systems (see the Energy Management Matrix in Worksheet 3). For example, energy management should be integrated into the same management system for environment, health and safety, quality, and risks.

With the experience the Team now has, they can focus even more on improving energy management in a second cycle of the Methodology.

Information on the CD-ROM

- Company examples (See Appendix A) for examples from companies that participated in the GERIAP project on how they work for a continuous improvement.
- Worksheets (Worksheet 3, 11 and 18, See Appendix B)

