# *Chapter 2*
# *Mechanisms for MSEs to Control Environmental Impact*

**Contents**



***Businesses have two main options for dealing with the environmental problems they generate: pollution control and cleaner production (CP). Pollution control deals with problems after they are created. CP examines and improves production processes to reduce problems before they happen—and can also benefit a firm's bottom line.***

The previous chapter illustrated both the importance of MSEs in development, and the range and severity of adverse environmental impacts that these enterprises can generate. This chapter focuses on two approaches to mitigating these impacts: pollution control and cleaner production. The chapter closes by briefly describing environmental management systems, which enterprises of any size can use to regularly assess and mitigate their adverse environmental impacts.

## Mitigation Approaches

An MSE (and the organizations assisting it) must find a strategy for controlling and/or mitigating each environmental problem it causes. The two main options available to any enterprise, including MSEs, are **pollution control** and **cleaner production** (CP). Pollution control is a strategy that addresses problems after they are created, while CP is an approach that examines and improves production processes to reduce pollution and other adverse impacts before they happen. Importantly, CP can also have financial benefits for the enterprises that implement it. These advantages typically point to CP as the preferred mitigation approach, although it may not solve all environmental problems.

### *Pollution Control*

Pollution control is a class of methods for controlling and/or capturing pollutants leaving a manufacturing facility before they can enter the environment. Because pollution control approaches are added on to the production process without directly affecting it, they are commonly referred to as "end-of-pipe" solutions. The most common approaches deal with the air, water and the waste leaving an enterprise:

- **Air pollution control technologies** can include filters and other devices that remove contaminants from smoke or exhaust.
- **Water control technologies** typically use a variety of methods to remove impurities from the **effluent** (water leaving the premises).
- **Incinerators** can be used to decrease the volume of solid waste (trash) created by a facility, but they themselves will usually require pollution control technologies to minimize the amount of contaminants they release into the air.
- **Disposal techniques** create a safer place to put hazardous waste (including contaminants captured using other pollution control techniques). The waste may be placed in landfills or wells specially designed to prevent escape of contaminants into the environment.

For example, to meet government regulations on water pollution, a facility may install an effluent treatment plant and arrange its production processes to discharge all liquid wastes into it. Depending upon the type of effluent, contaminants, requirements and ability to pay, the effluent treatment plant could use a variety of different methods to remove impurities. These include filtering, settling, stirring and evaporation. Impurities that are removed must then be appropriately disposed of, for example in a lined landfill, so that they do not enter the environment via a different pathway—such as washing away in the rain. The treatment plant needs to be operated and monitored carefully by a worker who must be trained to ensure that effluent leaving the plant meets all pollution control requirements. The output from the plant may also be monitored by regulatory agencies to ensure compliance.

### Problems with Pollution Control

Pollution control equipment was developed in the early days of environmental protection, when regulatory agencies first required companies to comply with pollution regulations. Such end-of-pipe devices can be effective at removing pollutants from waste streams, and may sometimes be the only way to mitigate an environmental problem—short of stopping the productive activity altogether. However, pollution control presents numerous disadvantages from both business and environmental perspectives, particularly for MSEs in developing countries. These include but are not limited to following:

- Pollution control typically only represents an added cost to businesses. Moreover, because pollution control strategies frequently offer economies of scale, they are relatively more burdensome for MSEs to adopt than they are for larger enterprises.[1] In many assistance situations,

[1] MSEs in some countries such as India have banded together to share the costs and technical expertise needed to operate effluent treatment plants, hoping to reap the benefits of economies of scale. However, such efforts have had mixed success and experienced numerous difficulties—such as problems ensuring fair play and finding cost-effective ways to transport effluent to a central location cost-effectively (Crow 1999). Hence, it is difficult to recommend such strategies without extremely careful consideration.

## Pollution Control

Pollution control approaches are "end-of-pipe" solutions added on to the production process. Pollution control can be necessary to mitigate environmental problems in some instances. However, over-reliance on pollution control is problematic from both an environmental and a financial perspective, for the following reasons:

- It represents an added cost to the business.
- Oversight is needed to ensure that MSEs install and use control equipment.
- Technical training is needed.
- It does not address issues of unsustainable use of resources.
- It cannot mitigate certain critical pollution problems, such as carbon dioxide emissions associated with global climate change.
- It does not get rid of pollution permanently; extracted contaminants must be disposed of and monitored.

the cost of a pollution control mitigation technology could substantially outweigh the initial amount of assistance sought by the MSE.

- Because of the added cost, most MSEs typically will not install or operate pollution control devices without oversight.
- Many pollution control devices require technical training and sophisticated operation to work properly, which places an additional burden on even well-meaning MSEs.
- Pollution control will not address concerns about unsustainable use of resources, such as wood burning that leads to deforestation.
- Pollution control cannot mitigate the critical pollution problem created by the release of carbon dioxide from burning fuel, which is a leading cause of global warming.
- Pollution control does not get rid of pollution permanently. Contaminants that are removed must be disposed of and monitored in proper facilities, which often do not exist in developing countries.

In the face of these problems, over the past 10–20 years businesses and environmentalists have developed an increasingly sophisticated alternative mitigation approach: cleaner production.

### *Cleaner Production*

Cleaner production (CP) is the preferred approach to mitigate adverse environmental impacts from MSEs. It represents a new way of thinking about success in business and environmental management. CP is:

- a **problem-solving strategy** that uses a set of analytic tools to improve the **efficiency** of production processes, improve profitability and reduce the risks to humans and the environment.
- a **business-focused approach** that can be seamlessly integrated into a business planning process, and that may boost creativity and innovation.
- **relevant to all** sizes of enterprise, from home-based to multinational.

CP is also commonly referred to as pollution prevention (as opposed to pollution control), waste minimization, green production or eco-efficiency.

#### Illustrations of CP Approaches and Benefits

Because it is easiest to gain an initial understanding of CP through examples of its application, we now present several stories of the successful implementation of CP by MSEs. These examples have been chosen to illustrate the range of possibilities for CP among enterprises of different size, capacity, and manufacturing subsectors. As you read, pay attention to all the different kinds of CP approaches used by enterprises to improve their business environmental performance. These approaches will be detailed and classified in the subsection that follows this one.

#### Mitigation Approaches

**Cleaner production** (CP) is the preferred approach for MSEs. CP is:

- A problem-solving approach that improves the efficiency of resource use
- Business focused, and can be integrated into MSE business practices and operations
- Relevant to all size of enterprises

## CP and Profitability

Many CP improvements require little or no initial investment and offer rapid payback. Examples include:

- Simple management techniques, such as the "First In, First Out" approach to storing perishables.
- Good housekeeping, such as keeping the workspace free from obstructions.
- Low-cost improvements, like replacing leaky values or recalibrating thermometers and pressure gauges.

*Example 1: Cleaner Production in Soap Production*[2]

Shivji and Sons Ltd., of Dar es Salaam, Tanzania, manufactures laundry soap. The company has a production capacity of five tons of bar soap per hour; it employs 45 permanent staff members and 20 seasonal workers.

A CP assessment revealed the following problems:

- The facility is powered by steam generated through diesel fuel combustion. The company was wasting steam through leaky valves and inefficient use.
- Improper unloading of shipments to the factory resulted in loss of 3,000 kilos of fat per year. The spilled fat was absorbed by the soil.

By replacing leaking valves and traps, halving the fat storage tank heating time, adjusting water use to minimize steam consumption during cooling, and recovering the spilled fat, the plant was able to realize an **annual return on investment of US $185,700**. An initial investment of US $830 was needed for the installation of the steam valves; no input or energy costs were required for recovering the spilled fat. The payback time for this project was two days. Consumption of industrial diesel oil was **reduced by 54 percent, saving 415,800 liters per year** and reducing plant air emissions.

*Example 2: Technology Change and Energy Efficiency in Cashew Nut Processing*[3]

Three cashew nut processors in Ghana had problems controlling the quality of their product. To process cashews, the raw nut is first steamed, then shelled, then dried in industrial dryers. The shells of the cashew nuts are used as fuel for steaming, but the dryers were being fueled by firewood harvested locally. Using firewood for fuel sometimes caused a problem for the businesses since the smell of the wood smoke would stay in the kernels, making the product unusable. Using firewood also made it difficult to regulate the temperature of the dryer. If the temperature were too hot, the kernels would burn, again resulting in waste product. Thus, the businesses wanted to find a new source of fuel to run their dryers.

The government in Ghana agreed to subsidize the use of propane gas as a fuel source as part of a program to reduce deforestation. For two of the businesses, the subsidized gas was **less expensive** to use than the fuelwood. For the third business, however, the fuelwood had been essentially free, since the staff harvested trees on site. Nevertheless, all three businesses opted to switch to propane to run their dryers. The most important criteria for this decision were the ability to control temperature and smoke. **Reducing waste cashews** resulted in higher profits, even for the business whose fuel costs increased with propane use.

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[2] UNIDO NCPC Case Studies, ICPIC

[3] Case study data collected by TechnoServe/Ghana and compiled by Tellus Institute (Tellus 2002). See sidebars in Part III, Chapter 3, for additional case studies.

*Example 3: Coffee Microenterprise in the Philippines*[4]

To improve its coffee-grinding process, a microenterprise switched from using plastic pails to using stainless steel bins to collect the ground coffee. The ground coffee particles had been sticking to the plastic pails, requiring washing to remove. The particles, however, did not adhere to the stainless steel, resulting in less lost product and lower water usage. The steel bins were also more durable than the plastic pails, which had required annual replacement.

The company **invested US $800** and realized an annual **return on investment of US $168** from recovering lost coffee grounds and avoiding the cost of replacing the plastic pails.

*Example 4: Cleaner Production in Woodworking*[5]

After being introduced to CP, a small carpentry shop in Brazil producing furniture components for the local market took another look at its wood scrap waste. After some investigation the owner learned that the waste could be reprocessed into new boards 2–4 meters in length using a process that cuts the scraps into triangles and then glues them together again (finger joint processing). After first outsourcing the work, the owner purchased a secondhand finger joint machine that his employees operate during slow periods.

This example of waste-to-product CP required an initial **investment of US $180**, provided an **annual return on investment of US $6,000**, and paid for itself in **10 days.**

## CP Strategies Overview

As the examples above illustrate, CP opportunities can be discovered using several approaches. These approaches can be arranged into nine categories, with many opportunities crossing the boundary between different categories.

1. ***Good housekeeping:*** *preventing leaks and spills, instituting preventive maintenance schedules, regularly checking equipment, and making sure employees follow official work procedures.* In Example 1, replacing leaky valves and traps represented good housekeeping.
2. ***Input substitution:*** *substituting one or more cheaper, safer, or more efficient inputs for an existing input*. Example 2's switch to propane fuel represents one type of input substitution, but replacement of input materials (such as chemicals) is also common.
3. ***Better process control:*** *changing working procedures, machine instructions, and process recordkeeping to increase throughput,* [6] *reduce waste, and/or improve product quality*. In Example 1, decreasing

[4] GTZ (2000a).

[5] GTZ (2000b).

[6] *Throughput* is output or production over a period of time.

the storage tank heating time and optimizing the use of water for cooling both demonstrate better process control.

4. ***Equipment modification:*** *changing the existing process equipment to increase throughput, reduce waste, and/or improve product quality*. In Example 3, switching to stainless steel bins for collecting coffee particles was an equipment modification that reduced waste and improved profitability.
5. ***Technology change:*** *replacing the existing technology or simply changing the order of process steps to increase throughput, reduce waste, and/or improve product quality*. Both the cashew processors in Example 2 and the carpenter in Example 4 used new technologies to take advantage of a CP opportunity.
6. ***Product modification****: changing the characteristics of a product to increase throughput, reduce waste, and/or improve product quality*. For instance, joining the parts of a product together with bolts instead of glue may make a product more durable and easier to repair.
7. ***Energy efficiency:*** *making changes in any aspect of business operations to reduce energy consumption or cost*. The soap producers in Example 1 increased energy efficiency by optimizing heating and cooling needs, while the nut processors in Example 2 increased energy efficiency by switching fuels.
8. ***On-site recovery and reuse:*** *capturing and reusing onsite materials that were previously wasted*. For instance, Example 1's soap producers captured previously wasted fats.
9. ***Waste-to-product:*** *identifying an end market and marketing a material formerly considered waste. This may involve changes in processing of original product or new processing steps to transform waste*. In Example 4, the small carpentry operation created a new, profitable product from its previously unused wood waste.

***CP can raise profits by reducing upfront costs of materials and energy, as well as costs for waste disposal. Using CP, an enterprise can also improve product quality, increase throughput, and avoid regulatory and compliance costs. Many CP improvements require little or no initial investment and offer rapid payback.***

### Why Is CP the Preferred Mitigation Strategy for MSEs?

Better environmental management translates into better overall management. Pollution can be thought of as a non-product output—material that the enterprise has paid for but for which it will receive no revenue in return. Controlling pollution at the "end of the pipe" requires an additional expenditure beyond the cost of the non-product output. This cost burden is difficult for MSEs to bear, as resources are limited and investment priorities are numerous. Cleaner production is more suitable than pollution control technologies for MSEs, because the benefits are more in tune with the realities of their competitive environment. Specific benefits include:

**Flexibility.** CP can be applied to any size business, from microenterprise to transnational corporation. Because it is a business-focused, profit-driven approach to pollution management, CP can be seamlessly integrated into a firm's planning process.

**Environmental benefits**. CP can reduce both pollution output and demand for natural resources (water, energy, raw materials, etc.) used as production inputs. By minimizing fuel use, CP can help reduce the emissions of

greenhouse gases like carbon dioxide, which contribute to global warming. By reducing the need for chemicals and other inputs, CP helps reduce environmental damage by suppliers. CP also reduces the need to rely upon technically sophisticated disposal methods to protect the environment.

**Health and safety benefits**. Typically, MSEs can mitigate their primary threats to health and safety at low cost—and improve productivity at the same time. Threats to workers' health and safety can also be sources of poor quality products. For example, in the food-processing sector, products can be contaminated and/or workers harmed by mishandled hazardous chemicals, pesticides, broken glass, scrap metals and trash. CP can help find alternatives to chemicals and pesticides, as well as identify sources of glass, metal and trash, which can be controlled through good housekeeping or proper management.

CP approaches can also help improve working conditions, which reduces the risk of accidents. For example, to reduce energy costs, a CP solution might be to improve natural lighting by painting the production area white and regularly cleaning windows. This type of improvement not only saves money by reducing the need for artificial lighting, but also reduces employee eyestrain, preventing mistakes and injuries and raising morale.

**Financial benefits**. CP can increase profitability by reducing upfront costs of input materials and energy, as well as costs for non-product outputs and waste disposal. Using CP, an enterprise can also improve product quality, increase throughput, and avoid regulatory and compliance costs. Additionally, many CP improvements require little or no initial investment and offer rapid payback.

Simple management techniques such as instituting a "First In, First Out" approach to stored perishable goods can reduce losses from spoilage. Good housekeeping procedures such as keeping the workspace free from obstructions can reduce the likelihood of accidents and spills. Low-cost improvements, like replacing leaky values or recalibrating thermometers and pressure gauges, can pay back their investment quickly and involve minimal interruption of production schedules.

**Risk Reduction**. CP can help reduce reliance on specific inputs, minimizing the risk of supply chain disruptions. For example, using renewable energy sources might be appealing because of the opportunity to bypass unreliable electricity supplies. Honing water conservation techniques may help businesses survive during droughts.

**Marketing Opportunities**. CP can help an enterprise establish new product lines or access new markets. The Brazilian carpenter described earlier was able to establish a completely new, profitable product line by applying the CP waste-to-product strategy. CP skills can help food-processing enterprises achieve HACCP[7] certification, allowing them access to the export markets of Europe and the United States. CP also improves company image in communities and among environmentally conscious customers, and may offer enterprises access to niche markets.

### CP: The Preferred Mitigation Strategy for MSEs

MSEs can benefit both financially and managerially from the introduction of CP into their operations. Specific benefits include:

- Flexibility in applying CP to different sized businesses
- Environmental benefits from reduction of natural resource use and lower carbon dioxide emissions
- Health and safety benefits for workers that improve productivity
- Financial benefits, from lower costs for materials and more efficient use of resources
- Risk reduction
- New marketing opportunities
- Enhancing the firm's management skills

[7] HACCP stands for Hazards Analysis Critical Control Points. It is a strategy for managing and guaranteeing the safety of food-processing systems.

**Management Enhancements**. CP can improve an MSE's management by:

- *Building decision skills*. The CP process identifies poor or inadequate accounting practices, allowing better, more consistent oversight of risk, short-term cash flow and product quality.
- *Improving management competence*. Like Total Quality Management, CP builds quality and efficiency into products, rather than repairing defects.
- *Enhancing profitability and competitiveness in the long run*. Improved management and quality, combined with cost savings, lay a solid foundation for economic sustainability of the enterprise (and for repayment of any loans).

***Like Total Quality Management, CP builds quality and efficiency into products, rather than repairing defects.***

Recognizing these advantages, as mentioned in the previous chapter, a major European bank, UBS, has begun to screen all loan applicants for energy efficiency and good resource management. UBS focuses on operational cost indicators that "reflect efficiency in financial terms."[8]

### Overcoming Challenges to the Adoption of CP by MSEs

Of course, implementing even the most enticing CP opportunity and reaping its benefits may be challenging for any enterprise, but particularly for MSEs. For instance, in India, Project DESIRE worked with 12 small-scale enterprises in the textile, pulp and paper, and pesticides industries and identified approximately 450 different CP options.[9] At the same time, however, the project identified a number of barriers inhibiting CP adoption, which can be grouped into four categories: systemic barriers, technical barriers, economic barriers, and attitudinal barriers. Understanding these barriers was critical to helping the enterprises implement over 46 percent of the CP opportunities within a 15-month timeframe—with a payback in all cases of less than six months.

The barriers to CP adoption can sometimes seem daunting, but BDS and credit providers already offer services that counter these barriers. The challenges that these providers might encounter in promoting CP are very similar to those encountered in promoting any new way of doing business, and may be less formidable than the challenges posed by "end of pipeline" pollution mitigation strategies. The table on the next page presents the kinds of barriers encountered in Project DESIRE and CP projects everywhere, and also gives suggestions for dealing with them—although it is expected that readers are experienced in overcoming such barriers in their own work.

[8] Hugenschmidt et al. 1999.

[9] Information on Project DESIRE outcomes adapted from Chandak 1994 and Pallen 1996.

**Table 1. Cleaner Production Barriers: Examples and remedies**

| Barrier Type | Barrier Examples | Suggested Approaches to Overcoming Barriers |
|---|---|---|
| Systemic | Poor recordkeeping and reporting<br>Ineffective management systems<br>Ad hoc production planning<br>High staff turnover<br>Seasonal variations, making high efficiency difficult | Business planning assistance and advice<br>Building management capacity<br>Technical assistance to improve recordkeeping and reporting capacity |
| Technical | Limited general technical ability<br>Limited access to technical information/success stories<br>Limited maintenance capabilities | Technical assistance<br>Networking with successful CP implementers<br>Focus on least technical CP approaches |
| Economic | Lack of financing for CP<br>Preference for least capital-intensive option even if it is not the best option<br>Poor investment planning, leading to partial implementation | Facilitate financing for CP<br>Give training in investment planning |
| Attitudinal | Lack of good housekeeping culture<br>Resistance to change<br>Risk aversion/fear of failure<br>Lack of employee input in decision-making | Leadership training<br>Technical assistance<br>Building management capacity<br>Employee training |

## Environmental Management Systems

Up to now, this chapter has focused upon approaches that help MSEs mitigate environmental problems at a single point in time. However, proper management of environmental responsibilities can require frequent attention. How can MSEs continue to mitigate both existing and new environmental problems over time?

An MSE can do so by setting up and operating an environmental management system (EMS). An EMS is a formal approach that an enterprise of any size can use to help it to *regularly* detect and assess environmental problems (and opportunities), develop and implement solutions, and monitor the results.

The most widely known environmental management system is ISO 14001, a complicated system typically used only by medium and large enterprises (see box next page). Readers should recognize that ISO 14001 is unlikely to be relevant or useful to the MSEs they work with. More generally, the paperwork and the formal allocation of environmental responsibilities that go with a standardized EMS are probably unnecessary for an MSE. More can be accomplished if the MSE will commit to monitoring its mitigation

### Making EMSs Work for Small Businesses

For MSEs, an environmental management system need not be fancy. An MSE can simply schedule a regular (e.g., annual) review of its processes to look for fresh CP opportunities. Even after many inefficiencies have been corrected, a careful look will detect new ways to avoid waste and pollution—and, often, avoid needless costs as well.

methods and regularly reassessing the situation, on a schedule that suits the situation. This type of EMS might be as simple as reviewing CP approaches once a year, during a seasonal lull in business, to identify new opportunities.

Research has shown that CP opportunities, like fruit, grow back. That is, even after an MSE has resolved numerous inefficiencies, new CP opportunities will present themselves. A primary goal of an EMS is continual improvement, and each individual enterprise must decide on the right mechanisms to meet that goal.

### ISO 14001: The Environmental Management System Standard

ISO 14001 is the most common EMS in the world today, having been adopted by thousands of businesses worldwide. This certifiable standard has detailed requirements for the following components of an EMS: policy, planning, implementation and operation, checking and corrective action, and management review.

Because setting up, operating and becoming officially certified as ISO 14001–compliant can represent a substantial investment, the vast majority of certified companies are large and medium enterprises. Furthermore, firms in the electronics and automotive sectors are the predominant ISO 14001 companies, because certification to ISO has been required by major purchasers, such as GM and Ford. The benefits of certifying to ISO 14001 are dubious for an MSE, unless doing so will give it access to a lucrative market opportunity that the MSE is well placed to take advantage of—such as becoming a supplier for GM.

Readers should also recognize that ISO 14001 certification does not necessarily prove a company has good environmental performance. It only indicates that the company has properly implemented the ISO 14001 environmental management system—which does not specify any particular performance levels. There is currently a lack of evidence showing that ISO 14001 companies have better environmental performance than similar companies that have not implemented ISO 14001.