adidas

Guide to Best Environmental Practice

Guide to Best Environmental Practice

adidas

Guide to Best Environmental Practice

Further SoE - Contact person:

Frank Henke -
Social & Environmental Affairs HQ

Evelyn Ulrich -
Social & Environmental Affairs EMEA

William Anderson -
Social & Environmental Affairs Asia

Gregg Nebel -
Social & Environmental Affairs Americas

Project Work:

INTECHNICA GmbH
Environmental and management consultants

Ostendstraße 181
D-90482 Nürnberg

10.2005

Preface

The traditional response to environmental problems created by industry has been regulatory driven "end-of-the-pipe" remediation. This approach has had limited success. Pollution control technology does not bring about lasting change. It is a short-term technical fix which is often costly to implement.

New approaches have now emerged which require industry to move beyond simple regulatory compliance in favour of finding more "sustainable" solutions. As a result, many businesses have come to realise that efforts directed at energy efficiency, waste reduction and pollution prevention, make economic sense – they save money. In short, these measures are both good for the environment and good for business.

To reflect this thinking, adidas has revised and updated the "Environmental Requirements" in our Standards of Engagement (SOE). The Environmental Requirements now place greater emphasis on making long term improvements through the adoption of environmental management and sustainable business practices. The full text of the standard is as follows:

Business partners should aim for progressive improvement in their environmental performance, not only in their own operations but also in their operations with partners, suppliers and subcontractors. This includes: integrating principles of sustainability into business decisions, responsible use of natural resources, adoption of cleaner production and pollution prevention measures, and designing and developing products, materials and technologies according to the principles of sustainability.

The section "Environmental Requirements" of the SOE is not intended to provide practical help on the realisation of standards in a working environment. This is dealt with in the "Guide to Best Environmental Practice" which is designed to complement the adidas "Guidelines on Health, Safety and Environment" and the "Guidelines on Employment Standards".

We encourage you to read and use the "Guide to Best Environmental Practice" to enhance your knowledge and understanding of sustainable business practices. The Guide shows how to address environmental issues in a systematic way and how to obtain economic benefits by taking a pro-active stance in the management of resources, processes and wastes.
The "Guide to Best Environmental Practice" cannot give a complete overview of all feasible environmental best practice activities and standards, but it does describe important starting points from which the environmental impact of factory operations can be reduced significantly, and the benefits to be gained. As our business partners, you are encouraged to obtain further information by consulting the internet sites and organisations listed in "Useful Websites" at end of the Guide.
In some cases the Guide uses environment or management-specific expressions, which are to be explained to the reader. These explanations can be found in a glossary at the end of the Guide.

This document is intended solely as guidance to help partner companies comply with adidas' Standards of Engagement (SOE). The guidance is not a substitute for locally published laws and regulations on Occupational Health, Safety and Environmental Protection. It is the responsibility of the manufacturing partner to engage qualified and competent professionals to advise on factory-specific HSE issues.

adidas reserves the right to update these Guidelines, without prior notice, to reflect changes in the way we implement the SOE, or to clarify and update text. If you wish to check whether adidas has revised this document or obtain additional copies, please contact the SOE-representatives in your region.

The contents of this guideline reflect our approach to the implementation of the Standards of Engagement as of: August 2002.

Introduction

Scope of the Guideline

In a production setting, industrial activities can affect the environment in different ways. The most important environmental impacts on site are shown in the following illustration. Recommendations for improving the environmental impact described are given in the chapters 1 to 6 of this Guide, since improvement in environmental performance is not only a technical issue. Chapter 7 discusses ways of developing appropriate management systems. Chapter 8 provides a summary of useful sources of further information.

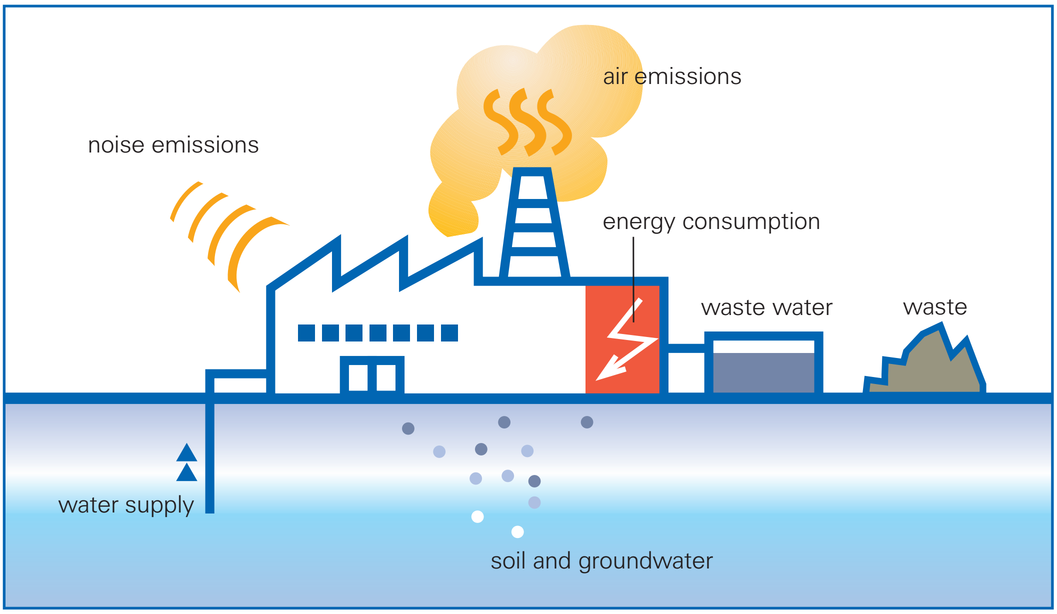


Table of Content

	Item	Version
1	Building	1/2002
2	Energy	1/2002
3	Waste	1/2002
4	Water	1/2002
5	Emissions	1/2002
6	Soil and Ground Water	1/2002
7	Systematise Activities	1/2002
8	Useful Websites	1/2002
	Glossary	1/2002

1 Building

Conventional design and construction methods produce buildings that can have a negative impact on the environment, as well as the occupants' health and on productivity. These buildings are expensive to operate and contribute to excessive resource consumption, waste generation, and pollution. Ideally, green building concepts are applied throughout the whole building, over its entire life span – from initial site planning through to operations and maintenance. The objective is to design, construct and operate an aesthetic building which meets all the occupants' needs while performing at optimum levels of efficiency (increasing environmental performance **and** reducing operational costs). A "green" building design must address many factors, including air quality, energy efficiency, and the application of green materials. To help reduce environmental impacts, a set of guidelines is listed below to facilitate the development of "green" buildings.

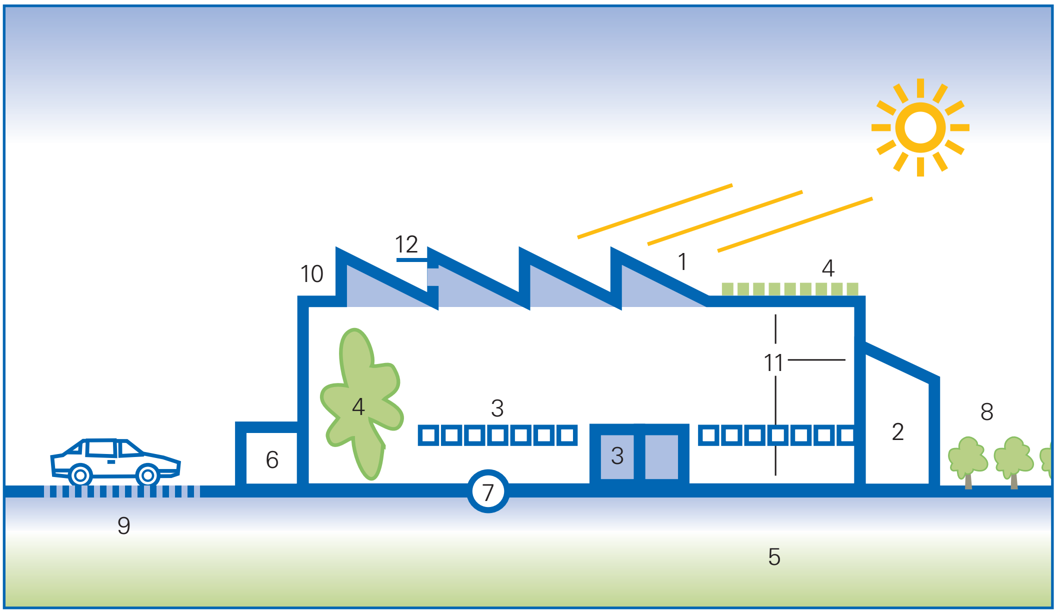
How improvements can be made	dyeing, finishing [1]	knitting, weaving	garment manufacturing	footwear manufacturing
Siting				
when choosing your building land, consider economic operation (e.g. passive solar design and the use of natural lighting) as well as logistical connections to reduce transport, its emissions and costs	✔	✔	✔	✔
protect and retain existing landscaping and natural features	✔	✔	✔	✔
when buying land for enlargement of the site, consider past land contamination (see also chapter on Soil and Groundwater)	✔	✔	✔	✔
Building Work				
if a reconstruction of the building is planned, discuss this as early as possible with designers, construction contractors and other companies involved to explore project options collaboratively, for example, how to supply compressed air; include recovery of heat or cold, etc. (see diagram: Eco Friendly Industrial Building)	✔	✔	✔	✔
if a completely new building is planned, consider the use of geothermal energy exchange (precooling in hot season; preheating in cold season)	✔	✔	✔	✔
avoid environmental problems during the period of building work by making appropriate waste disposal arrangements and supplying sufficient waste containers	✔	✔	✔	✔
Efficiency of the Building				
the efficiency of energy consumption can be optimised significantly by using shed roofs (see explanation below)	✔	✔	✔	✔

1 Building

How improvements can be made	dyeing, finishing [1]	knitting, weaving	garment manufacturing	footwear manufacturing
optimise insulation of walls, floors and ceilings to reduce energy consumption for cooling and heating; replace windows which are not good insulators (this is important for existing as well as for new buildings)	✔	✔	✔	✔
optimise lighting (see detailed explanation in Chapter 2: Energy)	✔	✔	✔	✔
transfer positioning of infrastructural units to provide economic operation (e.g. cooling towers and air intake of compressors on the shady side of the building)	✔	✔	✔	✔
separate waste water and clean surface water flows	✔			
reduce freshwater consumption and waste water levels by using rainwater for garden irrigation, technical uses or as water for toilet flushing	✔	✔	✔	✔
Materials				
select sustainable construction/building materials and products (e.g. reused and recycled building materials, zero or low emission paints, zero or low toxicity adhesives, paints, or preservatives, sustainably harvested materials, and products with high re-cyclability, durability and longevity)	✔	✔	✔	✔
reuse and recycle construction and demolition materials (e.g. use inert demolition material as a foundation for parking area)	✔	✔	✔	✔
External Areas				
select plants that have lower water and pesticide needs, and which generate fewer plant trimmings	✔	✔	✔	✔
green facades and roofs display the ecological awareness of a company in a pleasant way; in addition to the aesthetic value, green roofs and facades have a positive effect on the heat insulation of a building and can promote soundproofing	✔	✔	✔	✔
use cheap and water permeable pebbles, sand, turf, turf bricks and turf paving for entry roads, parking spaces and footpaths to avoid negative effects on ground water balance	✔	✔	✔	✔

[1] The ticks in the columns which are shown in the blue boxes of each chapter indicate the area of application (i.e. dyeing & finishing, knitting & weaving, garment production, footwear manufacturing) **and** *highlight the environmental relevance of each recommendation for the respective industry or manufacturing stage.*

The Eco Friendly Industrial Building



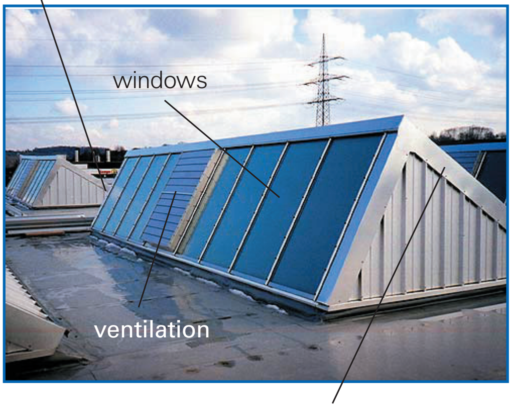
1. Sunny side of the shed roof for solar energy use
2. Sunny side with glass surfaces and adequate sun protection and ventilation
3. Close-fitting doors and windows
4. Green facades and roof
5. Ground free from past land contamination
6. Cooling tower on shady side
7. Air intake for geothermal energy exchange of incoming air and intake of compressor air on shady side
8. Low maintenance plants and shrubs (water and pesticide demand)
9. Parking spaces, footpaths, entry roads, etc. designed to absorb surface water (e.g. grid stones)
10. Windows on shady side of shed roof for even supply of light and good ventilation
11. High efficiency wall and ceiling insulation throughout the building
12. Windows on roof opening to allow ventilation of hot air at night and which can be closed during the day

1 Building

The Advantages of the Shed Roof

The steep part of the shed roof (60-90°) is on the shady side and provides even supply of light and good ventilation inside the building

Even and natural supply of light without direct sunlight provides a safe and economic working environment

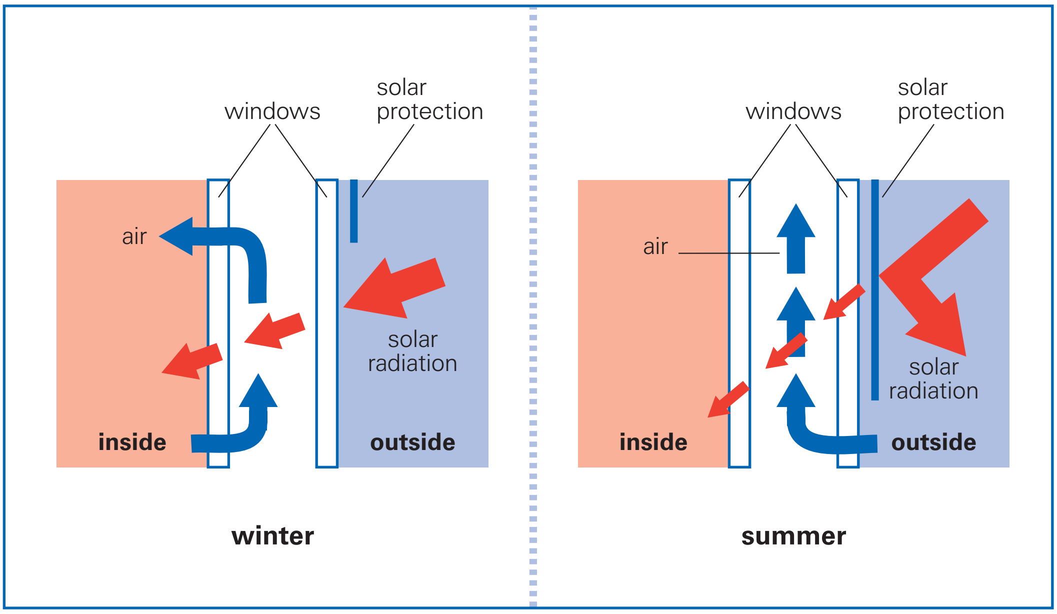


The flat part of the shed roof (~30°) on the sunny side can be used for the installation of solar panels

Adequate Solar Protection and Ventilation of Glass Surfaces

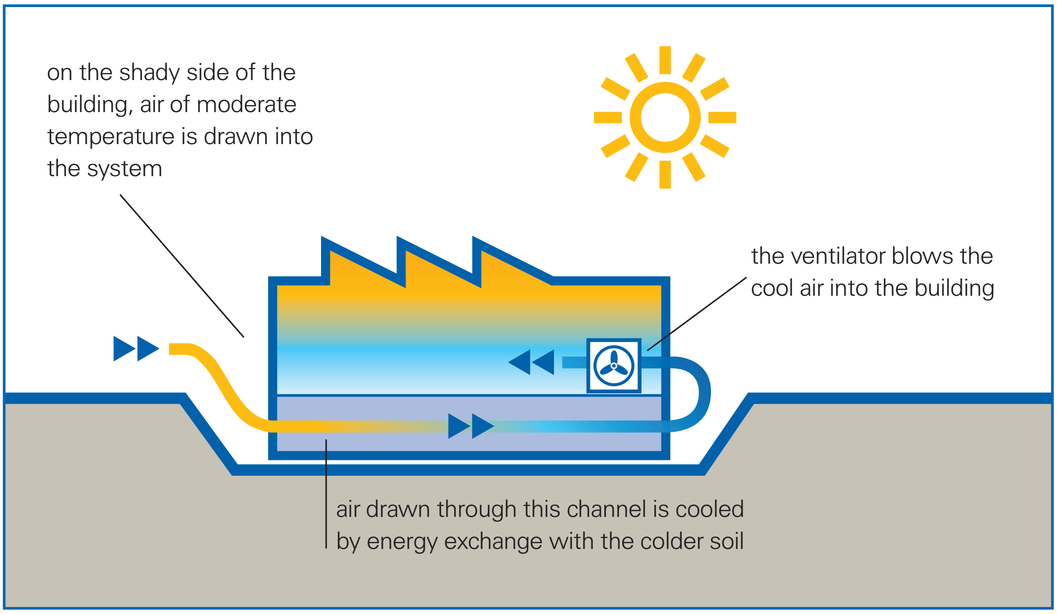
In winter, solar radiation passes through the windows and heats the air which circulates inside the building.

In summer solar radiation is largely blocked by solar protection. Warm air between the two windows is transferred outside the building.



Explanation of Geothermal Energy Exchange

The use of geothermal energy exchange is highly recommended for newly constructed buildings, where the ground has to be excavated for the foundations. In the case of an existing building, expenditure for the installation might be too high to make the project economically viable.



2 Energy

Energy consumption is a crucial factor which impacts on operational costs as well as the environment. Usually, pay-back periods for investments in techniques and technologies to help reduce energy consumption are very short.

However, it is not only investment in modern and efficient machinery that improves the environmental performance of a factory and helps reduce operational costs, but also proper maintenance of facilities and effective organisation of the operational process.

How improvements can be made	dyeing, finishing [1]	knitting, weaving	garment manufacturing	footwear manufacturing
turn off machines which are not actually in use	✔	✔	✔	✔
regularly maintain all installations (heating, ventilation, air-conditioning and dust or VOC extraction)	✔	✔	✔	✔
optimise insulation where heating or cooling processes are located	✔	✔	✔	✔
optimise light (see following explanation)	✔	✔	✔	✔
increase the air-conditioning setting and switch off when factory is unoccupied (it is not necessary to refrigerate the factory and/or offices 24 hours a day)	✔	✔	✔	✔
if your current supplier provides off-peak rates, try to use night current wherever possible (see following explanation)	✔	✔	✔	✔
optimise your air-compression system (see following explanation)	✔	✔	✔	✔
install blind current compensation and peak current control systems (see following explanation)	✔	✔	✔	✔
use co-generation to optimise yields of current and heat or cold (see following explanation)	✔	✔	✔	✔
perform heat exchange where possible, e.g. in thermo-fixing processes at the tenter dryer (see following explanation)	✔			
equip your steam generation with energy recovery systems (see following explanation)	✔			
use renewable energy where applicable (see following explanation)	✔	✔	✔	✔

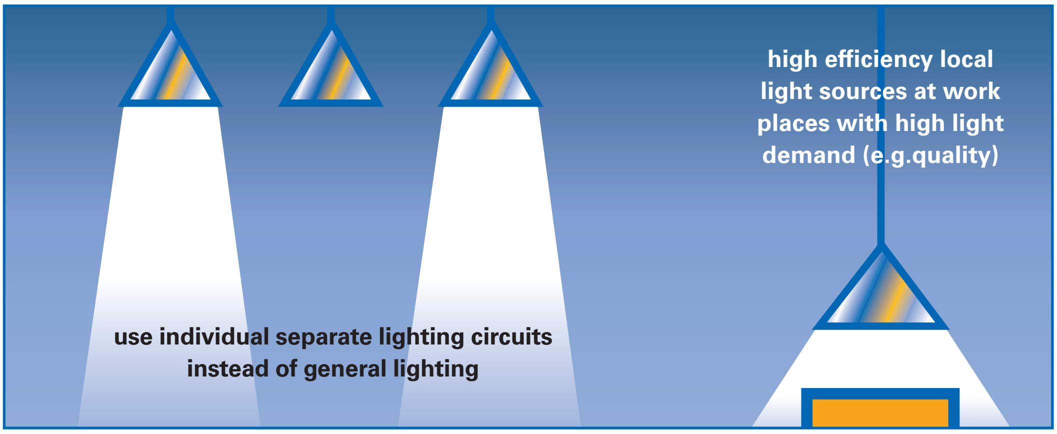
[1] *The ticks in the columns which are shown in the blue boxes of each chapter indicate the area of application (i.e. dyeing & finishing, knitting & weaving, garment production, footwear manufacturing)* **and** *highlight the environmental relevance of each recommendation for the respective industry or manufacturing stage.*

Lighting

Adequate and functional lighting is essential for the safe and efficient use of any workplace. Excessive use of lights or over-illumination of work areas can be detrimental to the health and the well-being of workers. It also wastes energy. Very often well planned lighting systems can save large amounts of money.

Potential for Improvement:

- ensure adequate light intensity (detailed recommendations for lighting are described in Chapter 10 of the HSE Guidelines)
- use lamps with high light efficiency (e.g. fluorescent lamps with electronic pre-switching device)
- use lamps with reflectors
- install lighting circuits in production areas which can be switched on or off individually
- where it makes sense, provide light dimmers (modern systems reduce energy consumption; older systems only reduce light intensity)
- use daylight where possible (windows, light domes, etc.)
- use motion sensors in low frequented areas
- use high efficiency local light sources in workplaces where demand for lighting is high



Use of Night Current

In many countries, power companies offer cheap "off-peak" electricity rates. This presents an opportunity to save money, if a factory is able to shift its power consumption to those off-peak hours. This may not be practical where the bulk of production takes place during the daytime. Nevertheless, there may be opportunities for reducing costs by using off-peak electricity for electrical cooling or heating units.

2 Energy

Air Compression Systems

Compressed air is the most expensive energy carrier and its usage should be avoided or reduced wherever possible. There are various ways of doing this:

- prevent leakage (one single leakage of 0.1 cm costs ~ US $150 a year)
- set the nominal pressure in the supply system as low as justifiable (in most cases 6 bar is enough; each additional bar costs approx. 10% more)
- introduce heat exchange for compressors, e.g. to preheat process water in textile refining (only 4–6% of the input energy for compressed air production is used for compression; 94% appears as waste heat).

Example:
A factory can save energy for air compression only by regular maintenance (leakage prevention) without any investment. In the case of a production level of 16 million m³ p.a., a cost saving potential of US $4,400 p.a. results from each percentage reduction in leakage.

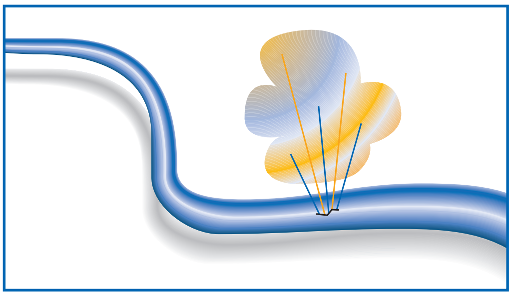
>> Tip:
You can check your leakage loss very easily by measuring the power consumption of the compressors at times when the production machines are not running (e.g. at weekends).

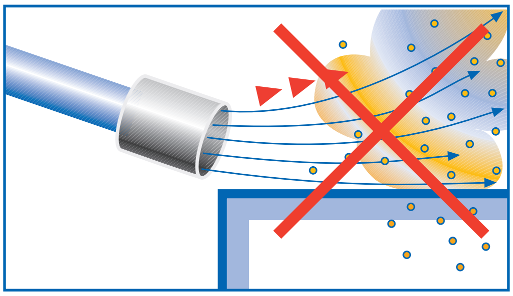
Example:
If your compressors run for 2 hours during a measured period of 24 hours to keep the selected pressure constant, the supply system has an energy loss of 8.3%.

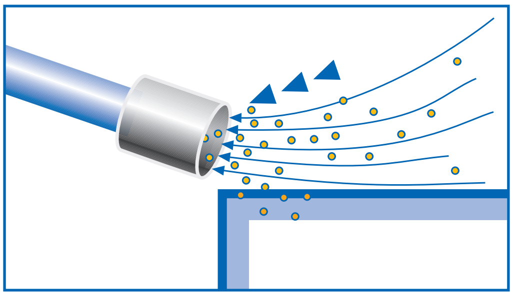
! Please note:
Avoid cleaning machinery with compressed air. It may seem easier for the employees, but

1. it is inefficient, as dust is not removed, merely circulated
2. it is extremely expensive (remember the low energy efficiency of 4-6%)

It is much cheaper and more efficient to remove dust from components or machinery by means of suction.





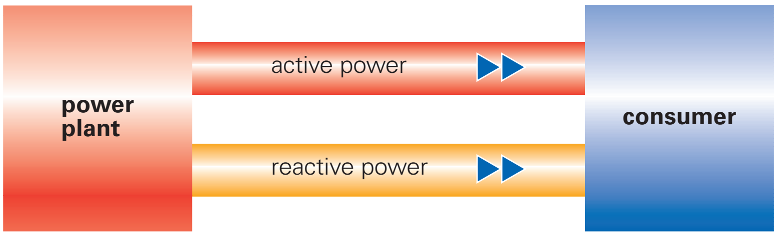


2 Energy

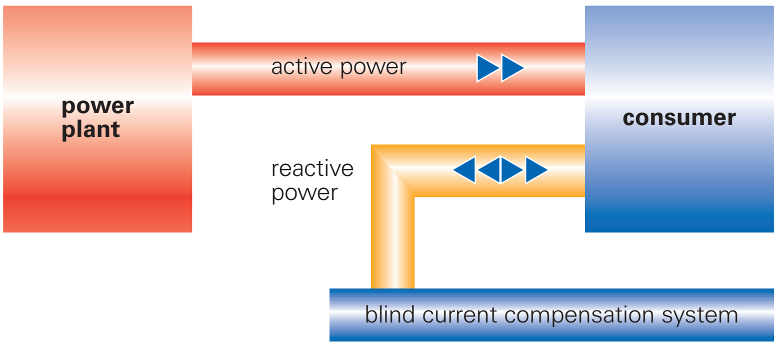
Blind Current Compensation

Because of electromagnetic effects, the consumption of electricity leads to energy losses. These losses are through so-called "blind currents." Where motors with high rates of energy consumption are used, blind current compensation can be a very useful way to save money.

In blind current compensation systems, capacitors buffer the reactive power and return it as useful active power to the system.



Without Blind Current Compensation



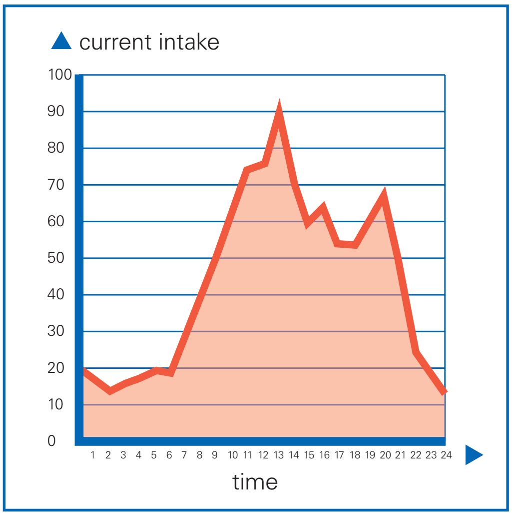
With a Blind Current Compensation System Installed

Peak Current Control Systems

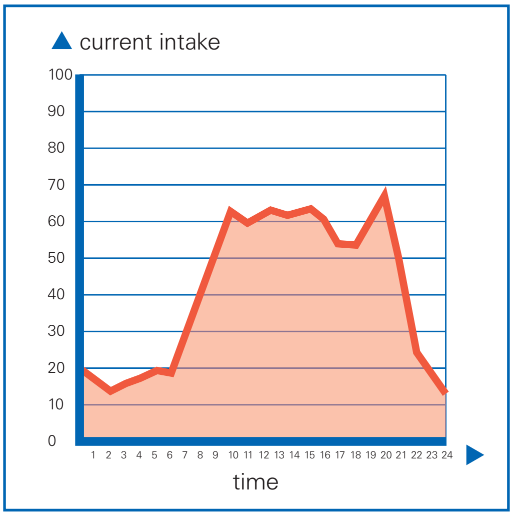
For power supply companies, the higher the peak of energy consumption, the higher the electricity bill. The use of Peak Current Control Systems helps to reduce electricity costs by shifting the time for electricity consumption.

To achieve a more constant rate of energy consumption and to avoid peaks, a computer permanently monitors the actual load. If, in case of a high load, a machine is switched on, the computer simultaneously switches off non-essential equipment, such as cooling systems or compressors, without adversely affecting the factory´s operations.

The following pictures show the energy consumption with, and without, a Peak Current Control System in place.



Without Peak Current Control System



With Peak Current Control System Installed

Co-generation

Co-generation, which means the simultaneous generation of current and heat, can lead to significant savings of energy consumption. It is profitable in factories, where both current and heat are required **(e.g. in dyeing houses)**.The decision for a co-generation system can lead to various benefits, depending on the specific conditions of the factory and local legal requirements. Co-generation systems:

- are available even for very small applications (the smallest devices produce 3 kW electrical power and 5 kW of thermal power and cost about US $2,500) but also can be used for a demand of 1000 kW and more
- lead to higher reliability of energy supply (in countries with low reliability in the public supply grid, loss of production can be very costly)

- can help to avoid peak currents (subject to the contract with the local energy supplier, exceeding peak current can be extremely expensive. With an intelligent control system, co-generation units are switched on if consumption reaches the level of peak current)
- typically, the investment pays for itself in about 4 or 5 years, but can differ in some cases (e.g. in countries with high electricity prices or in cases of low infrastructure with high supply set up costs)

A very efficient application of co-generation – especially if facilities are operated which require a high cooling demand – is the combination of co-generation with an absorption cooling system (instead of heat production).

To create 280 kW of cooling load, the absorption cooling unit consumes 424 kW heat. If the heat is derived from a co-generation system, the factory has to spend 770 kW of primary energy (fuel oil, for example). In addition to the cooling load, the factory acquires 254 kW of electricity, which can be used to run production machinery.

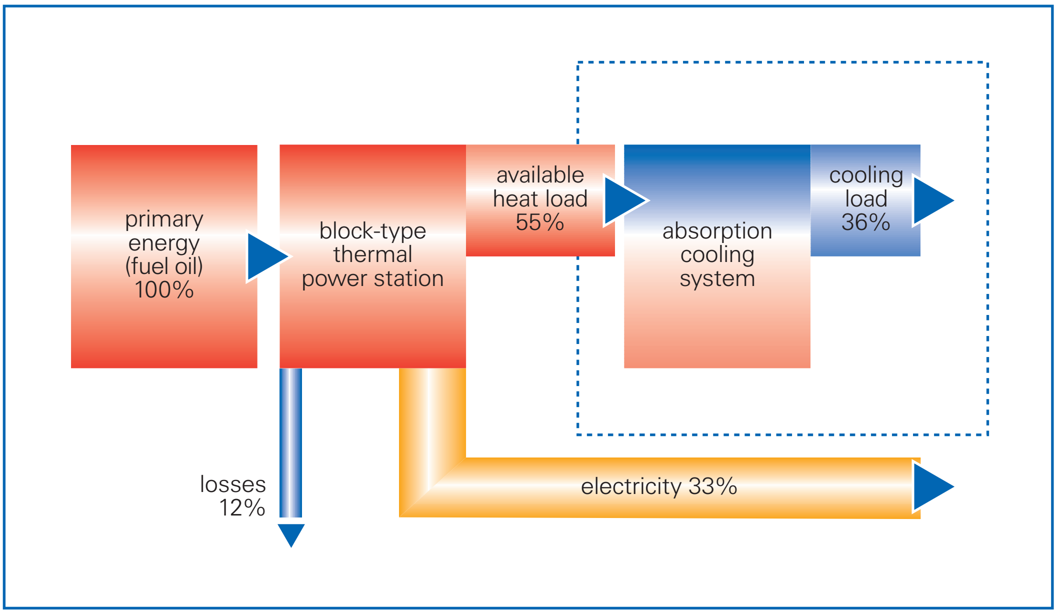


Fig. 2.1: Principle of co-generation in combination with an absorption cooling system.

Example:

For a factory located in the Philippines, a conventional cooling system with 280 kW cooling load (6,000 h/a) incurs electricity costs of US $46,500 per year. In the case of co-generation combined with absorption cooling, the same cooling load produces fuel costs of US $90,800 but also generates electricity to the value of US $157,000. This means that the system makes a contribution of US $66,200 per annum. Compared to a conventional cooling system, co-generation with absorption cooling saves US $112,700 per annum. As a result of this, the investment pays for itself after 4 years and 1 month.

Heat Exchange

A heat exchanger uses excessive energy from an outgoing medium (typically air, water or thermal oil) to provide heat for production processes. A typical example where heat exchange can make significant savings in energy and costs is the recovery in the tenter dryer process in fabric manufacturing. In addition to the effect on energy savings, throughput can also be improved. Excess waste gas which normally pollutes the air is condensed and can be removed as liquid waste.

Example:

In the case of a tenter dryer consuming 80 m³/h of natural gas and 6,000 working hours per year, a two-step heat exchange can save between 120,000 and 192,000 m³ of natural gas per year. Based on costs of US $0.25/m³ for natural gas, this corresponds to savings of between US $30,000 to 48,000 per tenter dryer.

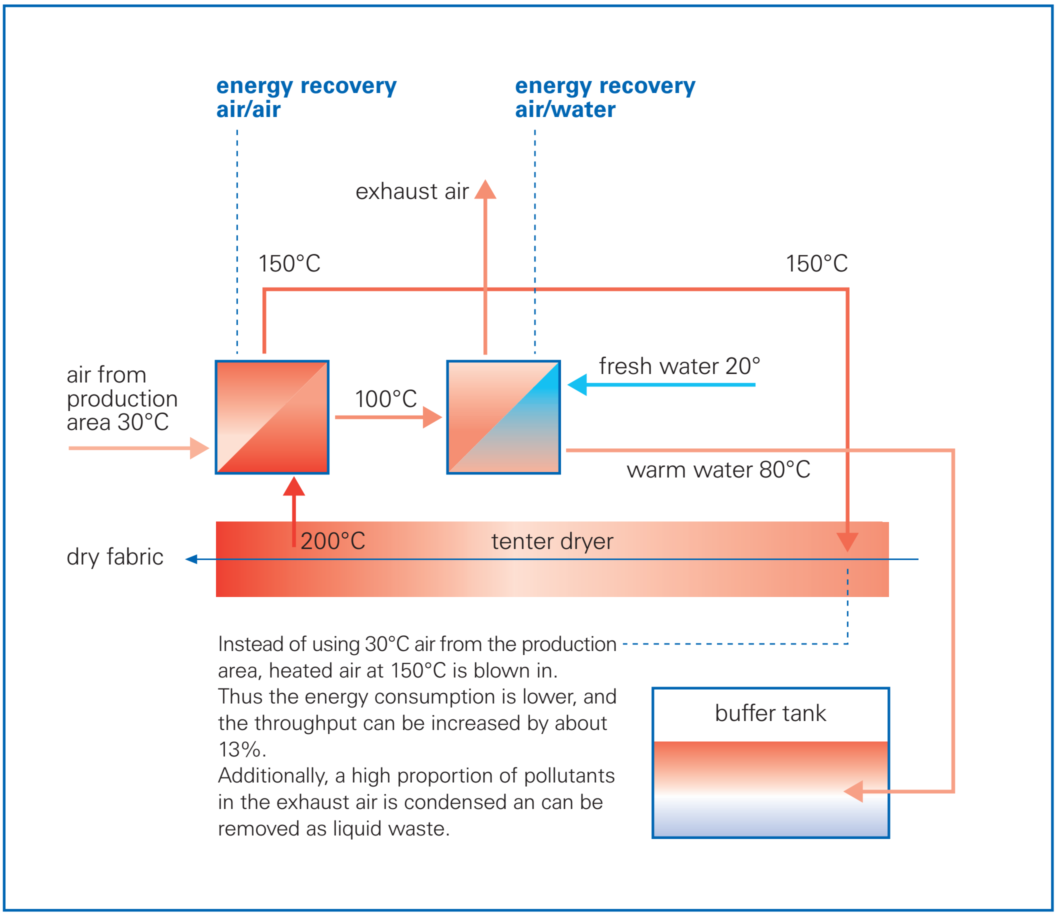


Fig. 2.2: Two-step heat recovery system at the tenter dryer of a fabric manufacturer

Heat exchange can also be performed very simply at the compressor station. Excess warm air can be used in winter time to preheat the building. In summer time the air escapes over the roof.

Steam Generation with Energy Recovery

Steam – water in its gaseous state – contains much more energy than water itself. Thus generating steam for use in the factory means a lot of money spent on heating. Conventional steam systems lose steam from 3 main sources:

- from the feed water tank (1-3% loss)
- from the blow down system (1-3% loss)
- from the condensate reflux (10-20% loss)

In all these areas, recovery systems can be used which transfer the energy directly back into the steam system, e.g. to pre-heat replenishment water or feed water. In simple terms, the recovery system consists of a heat exchanger combined with adequate piping and an intelligent control system which manages excessive heat production and heat demand. Since these systems work without moving parts, maintenance is not very time consuming and does not influence return on investment calculations.

! Please note:
The steam recovery systems illustrated here are somewhat different to conventional hot water recovery methods in steam systems, which are also widely used.

in winter
flap is open to blow warm air into the area
in summer
flap is closed to remove the warm air out through the roof

air outlet for excess compressor heat

Fig. 2.3: Heat recovery system at the compressor station

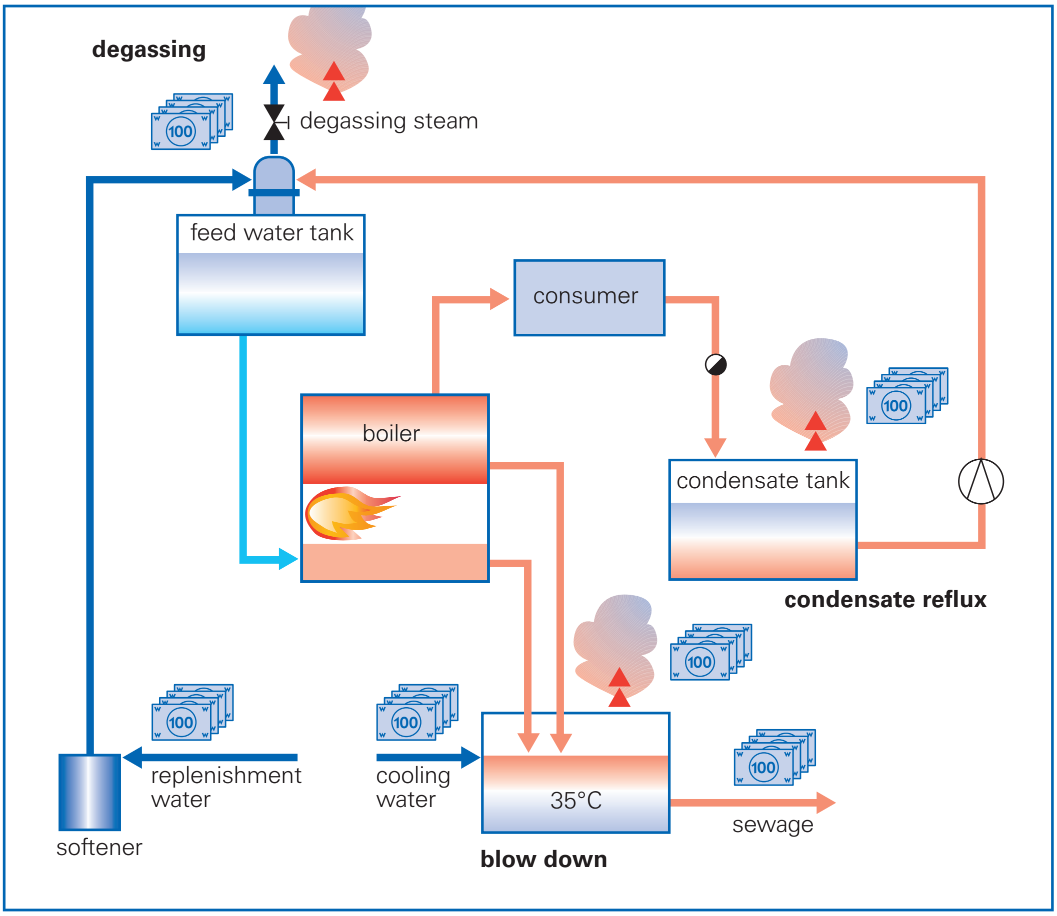


Fig. 2.4: Energy losses in a conventional steam system

Example:
A factory which produces about 70,000,000 lbs. steam per annum in a conventional steam system without recovery has yearly steam costs of around US $875,000.The introduction of a recovery system can potentially save around US $85,000 per year. In contrast to this, the cost of the recovery system is US $24,000. Thus the installation is amortised in 3-4 months.

Renewable Energy

A well balanced equilibrium of carbon dioxide (CO_2) has developed in our atmosphere over millions of years, giving us our temperate climate.

Man's use of fossil energy sources (such as coal, fuel oil or natural gas) disturbs this equilibrium and leads to a global increase in temperature; the so-called "greenhouse" effect.

One way of reducing the concentration of carbon dioxide in the atmosphere is to use renewable energy sources. This can be achieved in two different ways:

- use of energy which does not emit carbon dioxide (e.g. wind or water power, solar energy)
- use of energy which consumes the same amount of carbon dioxide during its development as is emitted during the energy use (e.g. fast growing plants)

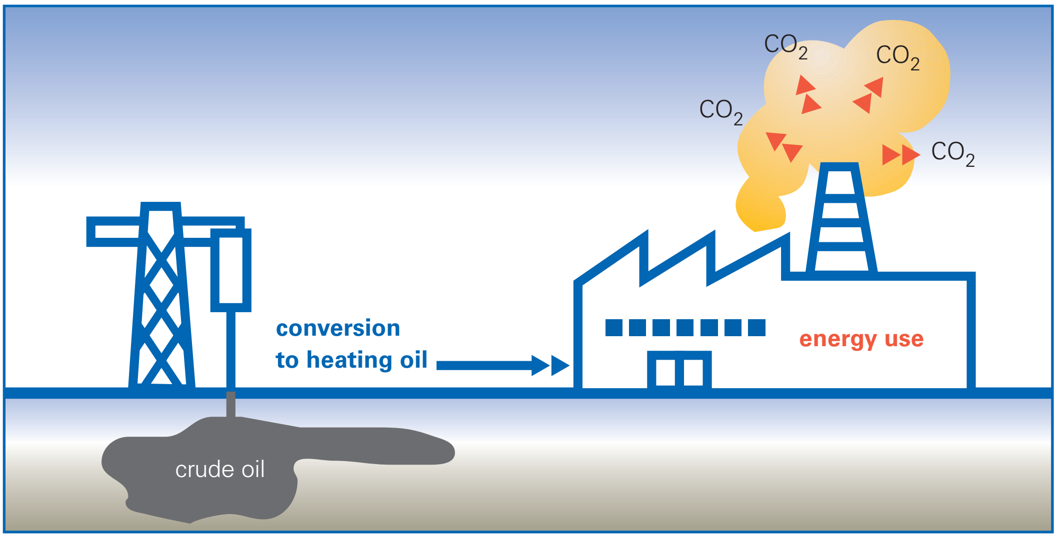


Fig. 2.5: The increase of the greenhouse effect by using non-renewable energy

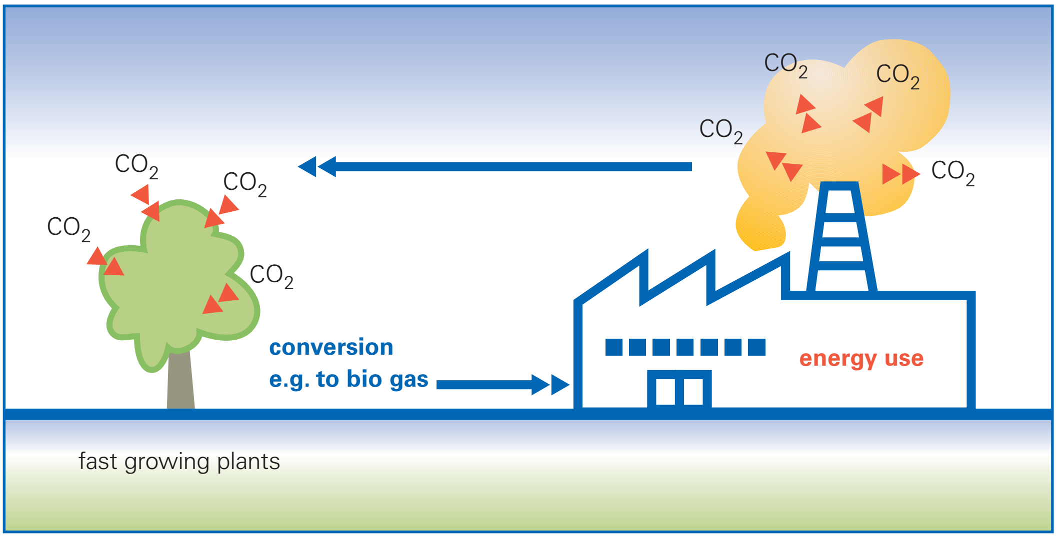


Fig. 2.6: CO_2 neutral energy use (equilibrium of CO_2 emission and CO_2 consumption)

! Please note:
The potential for using renewable energy depends on local conditions and available infrastructure. The use of wind, water and solar energy is closely allied to the general location and physical setting of the site.

3 Waste

In the HSE Guidelines, Chapter 12 explains in detail how to collect, store and remove different waste streams in an eco-friendly way. Following good waste management practices reduces costs. However, waste is much more than just discarded solid material.

Waste is purchased raw material that is treated with energy and water, processed by employees and subsequently not sold as product

"Waste minimisation" is a systematic approach to minimising the production of waste at its source. By assessing the processes used in a factory, a company can usually identify ways to reduce the amount of waste it produces. Alternatively, there may be ways to put unavoidable waste to good use through recycling. Finally, a company may have to consider treating its waste to make it less harmful to people and the environment. **Remember, disposal should be considered only as the last resort.**

Packaging Waste

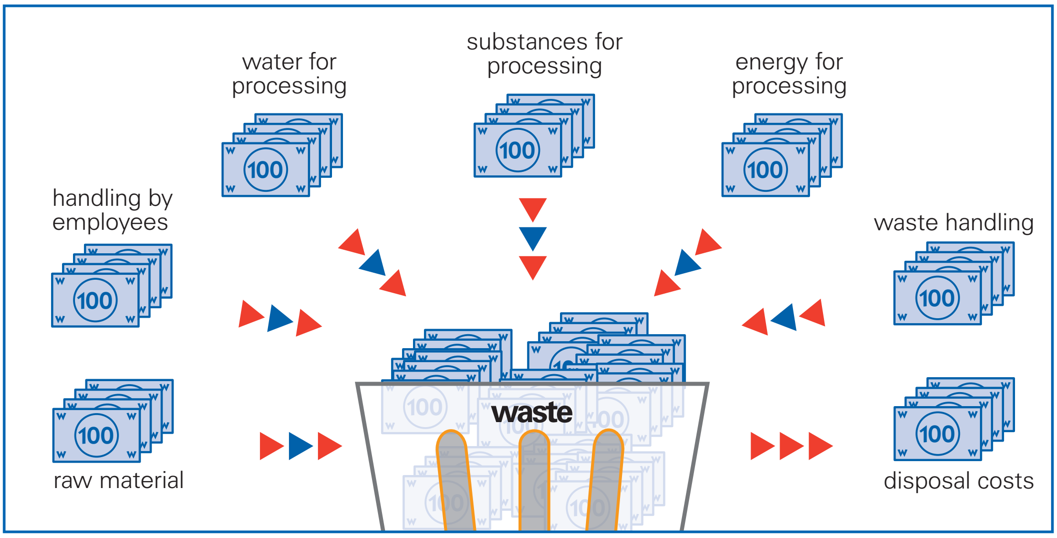
Inappropriate choice of product packaging can also adversely affect the environment. Weight and volume, in particular, determine transportation methods and the cost of subsequent disposal. adidas recognises this and therefore issues clear and mandatory requirements to factories regarding the kind of packaging that should be used.

How improvements can be made **Observe the basic principles of waste management "to avoid", "to reduce" and "to recycle". Therefore:**	dyeing, finishing [1]	knitting, weaving	garment manufacturing	footwear manufacturing
consider the recommendations of waste collection, storage and removal as described in chapter 12 of the HSE Guidelines	✔	✔	✔	✔
train your employees to recognise faults and to make the right decisions (e.g. in the case of repairable and irreparable faults)	✔	✔	✔	✔
educate and motivate your employees regularly in waste avoidance and proper waste separation (if necessary provide information in the form of an illustrated booklet)	✔	✔	✔	✔
co-operate with reliable waste disposal companies (check credentials)	✔	✔	✔	✔
keep records to prove that waste disposal was performed in an proper manner	✔	✔	✔	✔
record quantities and types of waste to get a picture of your hazards, costs and potential savings	✔	✔	✔	✔
produce typical values covering your waste production in order to plan what steps you need to take for improvement	✔	✔	✔	✔

[1] *The ticks in the columns which are shown in the blue boxes of each chapter indicate the area of application (i.e. dyeing & finishing, knitting & weaving, garment production, footwear manufacturing)* **and** *highlight the environmental relevance of each recommendation for the respective industry or manufacturing stage.*

The Costs of Waste

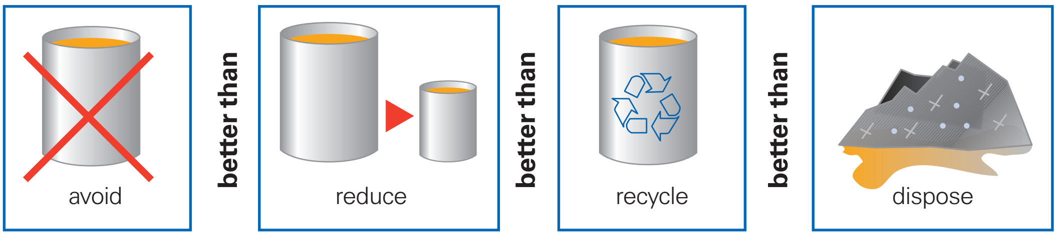
The cost of disposal is not the only cost incurred when a factory generates waste (see illustration). In one UK government analysis, it was shown that if all the costs were considered, they could account for more than 4% of a factory's annual turnover. By adopting intelligent waste minimisation programmes, savings of at least 1% of turnover can be achieved. Calculate your turnover and see what saving potentials you have.



Avoid – Reduce – Recycle

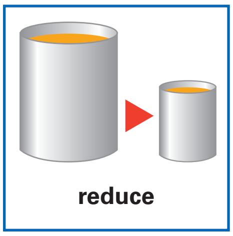
The basic principle of waste management is to avoid or reduce the consumption of raw materials and the amount of residue requiring disposal. By doing so, the raw materials consumed by a process can be reduced, as can the volume of waste being disposed of. Residues which cannot be avoided or reduced, should be used either materially or as a form of energy. Where material and energy usage are of equal value, the more eco-friendly use should take precedence.

There is enormous potential for improving a factory's waste management arrangements. Each factory has to find its own specific solutions. The following examples give some idea of how to avoid, reduce and recycle:



3 Waste

- avoid waste arising from non-productive preparation and finishing processes by not working with small quantities
- avoid hazardous waste by purchasing auxiliary agents which do not contain hazardous chemicals, e.g. banned solvents (look at the agent supplier's chemical safety data sheet)
- avoid waste in your canteen by using re-useable articles
- before authorising a re-cut, examine the faulty panels to find out why the problem occurred; this can help to avoid a repeat of the same problem
- keep fabrics/yarn/trimmings covered whenever possible to avoid contamination
- keep fabrics/yarn/trimmings segregated and clearly labelled in separate areas of the warehouse (mix-ups, e.g. the accidental use of yarn of the same colour but different quality can lead to wasted materials)
- fit appropriate tensioning equipment to the spreading table to avoid over-stretching (which can ruin large quantities of fabric) or incorrect sizing
- insert batch papers between batch lays to avoid accidental mixing of different but similar batches of garment panels; coloured or numbered batch papers also minimise confusion
- in the case of sizing mistakes, try to "size down" or "size up" the batch of garments (e.g. garments can be sized down from "medium" to "small" and still be acceptable for the customer)



- reduce amount of sewage sludge by performing proper water extraction (e.g. by use of selective flocculation chemicals or by using filter presses)
- reduce the volume of flush by simple storage so that water is removed under gravity (no energy costs)
- plan production to ensure maximum material utilisation
- use the minimum amount of material for testing and only test when absolutely necessary
- keep to customer's requirements and specifications to reduce reject levels (be aware of your capabilities and stay within them)
- use computerised layout planning systems (CAD-systems) in cutting to optimise the mix of garment pieces and sizes (can lead to a yield of more than 90%)

Example:
A factory located in Europe installed a system for complete automation of the cutting process. The cutting waste was reduced from 20% to an average of 12%. This represents a saving of about US $150,000 p.a. for waste disposal. The return on investment was estimated to be 3 years (the investment was around US $450,000). In actual fact, the investment paid for itself even sooner as a result of cost savings from the reduction in raw material and energy usage.

- examine all fabric carefully for quality faults when it is "spread" and "laid" (parts with printing and weaving errors can thus be removed early, thereby minimising financial loss)
- ask your machinists to return all partly used reels of thread at the end of each batch/shift; store them in a thread cabinet and reallocate them as necessary. Do not allow new reels to be used when partly used ones are available (it may be necessary to keep the thread cabinet locked and allow only supervisors to dispense thread)

Example:
A large garment manufacturer has reduced its consumption of thread by 14% since the introduction of thread-saving practices, resulting in a saving of around US $300,000 p.a.

- be aware of the value of trimmings, especially in the case of ribbon, lace and elastic (although more trimmings make life easier for the machinists, extra trimmings produce high costs. It may be useful to supply the operator with pre-cut lengths to avoid careless over-use)

Example:
Until recently, a large garment manufacturer located in the UK ordered more trimmings than were strictly required for production with a view to making life easier for the operators. Most of these "extra" trimmings ended up on the floor with the sweepings. By tightening up their allocation and use, the consumption of trimming was reduced by 7% with an associated saving of about US $500,000 p.a.

- install a humidity control system in the knitting room; optimum humidity can reduce yarn breakage and thus reduce faults in the knitting process
- in finishing, photoelectric controllers ("magic eye" sensors) minimise overspray of dyes or other finishing materials (roller coating instead of spray coating completely avoids overspraying)

Example:
By introducing a rotary spraying system on one of its finishing machines, a European factory reduced its waste spray from between 40–60% to 20–40%. Cost savings of US $40,000 p.a. were achieved. The cost of the new system (US $6,000) was paid back in less than 2 months.

recycle/reuse

- reuse residual printing paste as thickening agent in black colour (internal material recycling)
- reuse thread reels (internal material recycling)
- give used solvents to a disposal company which will re-distil the solvents (external material recycling)
- use waste with a high calorific value as substitute fuel in a power station (but only where the waste is incinerated under controlled conditions)
- reuse large plastic bags internally (e.g. to transport garment panels or to collect fabric, yarn and paper waste)
- arrange with your suppliers to return waste fabric, yarn and thread for recycling

Example:

A large garment manufacturer used to dispose of all its waste in the general waste skip – filling up to 3 skips/day. The fabric waste is now separated from the packaging and general waste and a compactor has been installed at each of the cutting sites. Fabric and packaging waste is recycled. The number of skips for general waste could be reduced. Company-wide savings of US $90,000 p.a. were achieved.

- ensure proper separation of waste streams

>>Tip:

A garment manufacturer located in Europe installed ultraviolet light sources which help to separate polyester from cotton. By doing so, a better price was received for the separated residues.

- do not consider redundant stock as waste – try to find alternative customers
- if possible, reuse batch papers
- where possible, reuse fabric roll tubes, e.g. to rewind remnants; alternatively return fabric roll tubes to the supplier for reuse
- ask your supplier about returning elastic reels and thread reels
- store damaged cardboard boxes, fabric roll centres/tubes, etc. and sell them to a local paper and cardboard recycler
- store plastic centres/tubes, reels, bags and sheeting (don't forget the cutting table) and sell them to a local plastics recycler
- avoid using valuable wool waste for machine cleaning, etc. (wool panels are worth approximately US $1.50 per kg when sold on; equivalent cotton rags from a merchant cost only US $0.30 per kg)

4 Water

Historically, water supply and effluent disposal costs have been an insignificant element in total operating costs, and managers have rightly focused on other priorities. This situation is now changing. Water is becoming a scarce resource in relation to demand, and water supply and effluent disposal costs have risen and will continue to rise. Polluter and user-pay principles are becoming a reality.

How improvements can be made	dyeing, finishing [1]	knitting, weaving	garment manufacturing	footwear manufacturing
begin your water saving activities with an initial input/output check which considers quantity assessment, origin, whereabouts, materials and additives, and distinguishes between drinking and service water (see following explanation)	✔	✔	✔	✔
install additional water meters to ensure quick remedial action in case of water wastage (savings are achieved mostly by monitoring and being able to measure and compare)	✔	✔	✔	✔
for comparative evaluation of water consumption and waste water generation, use indicators or metrics like the specific water consumption per kg or m^2 of product (see following explanation)	✔	✔	✔	✔
minimise water, soap and energy consumption by washing in counter current principle (see following explanation)	✔			
avoid excessive after-treatment (e.g. after reactive dyeing)	✔	✔	✔	✔
reduce your water consumption by optimising the general water supply network and the use of general water (see following explanation)	✔			
try to create water cycles wherever possible (e.g. cooling water)	✔			
if you plan new installations consider the introduction of a division of water currents which are differently contaminated (see following explanation)	✔			
if waste water is discharged into a public sewage system, documentation should prove that compliance with the TLVs is assured	✔			

[1] *The ticks in the columns which are shown in the blue boxes of each chapter indicate the area of application (i.e. dyeing & finishing, knitting & weaving, garment production, footwear manufacturing)* **and** *highlight the environmental relevance of each recommendation for the respective industry or manufacturing stage.*

A number of companies have already responded to these challenges. They have reviewed the way they operate and have turned the various "pressures" created by increased water usage and waste water disposal costs into opportunities. As a result, they have become more profitable and competitive.

Input/Output Check

A prerequisite for improvements and water management savings is a systematic investigation of the actual water situation (input and output). Therefore a detailed analysis of the individual water currents is essential. Begin with a simple data collection exercise using the record sheet shown below.

To obtain data, recent water bills can be as helpful as on-site meter readings (e.g. in the case of a ground water supply).

>>Tip:
Establish whether or not rainfall is discharged with the trade effluent. If it is, unnecessary disposal costs can be incurred. A rainfall of 1 m/year draining from a 100,000 m^2 site leads to an effluent volume of 100,000 m^3. Considerable costs can be incurred without proper storm water management.

Based on the input/output data, it is possible to plan for reducing or even ceasing the treatment of water.

Record Sheet

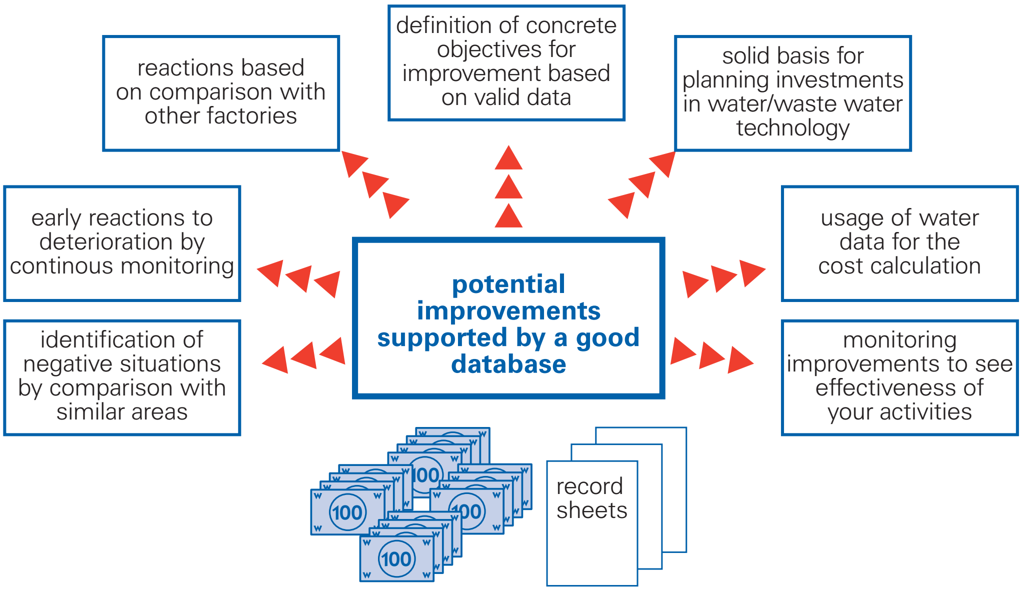
Input

	Total			Area			
	[m^3/a]	1	2	3	4	5	6
Drinking Water							
Service Water							
Costs (in $)							

Output

	Total			Area			
	[m^3/a]	1	2	3	4	5	6
Production Waste Water							
Cooling Water							
Washroom Water							
Rainfall Water							
Costs (in $)							

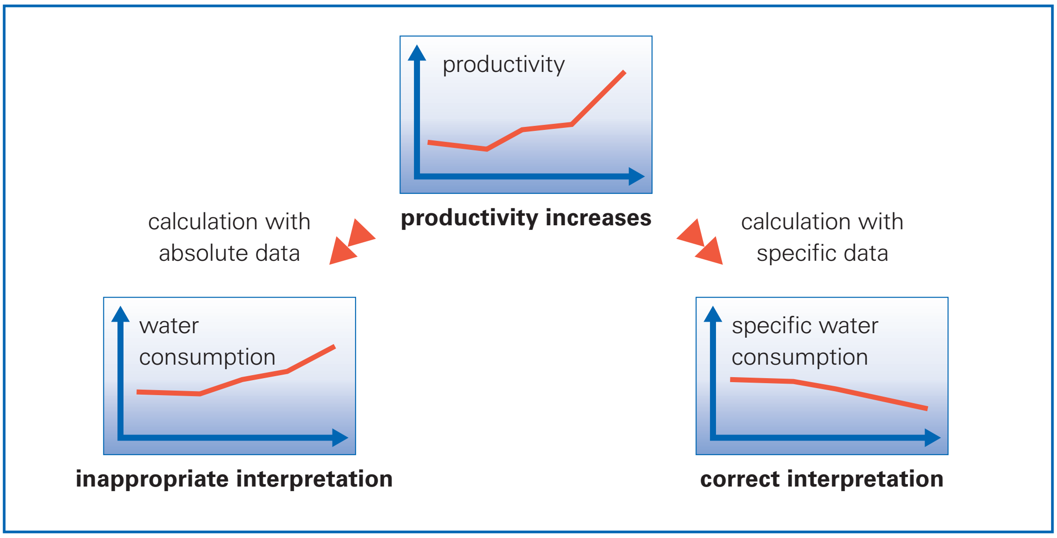
Tab. 4.1: Record sheet for gathering input/output data



Establish Indicators

In order to interpret the input/output data collected correctly, it is necessary to normalise this data against changing patterns of production. This requires the data to be converted from absolute numbers into consumption or discharge figures per unit of production.

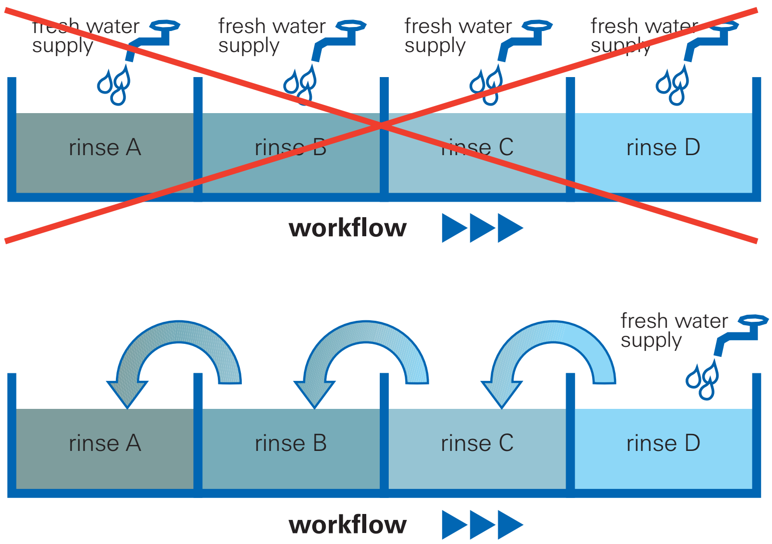
Example of a factory with increased productivity and improved water saving technology:



4 Water

Counter Current Principle for Washing Processes

The counter current principle can be applied to save significant amounts of water and chemicals in the washing process. The product is initially rinsed in "dirty" water and then in progressively cleaner water. Concurrently, the rinse water moves progressively from the last rinse towards the first rinse.



General Water Saving Measures

Overview Sheet for General Water-saving Measures	applied	possible	not advisable
Saving armatures			
Self-closing water valves or sensor tabs for hand washing			
Use of trigger grips (ensures that water is switched off when the hose is not in use)			
Fast-closing and magnet valves			
Optimisation of conduction pressure			
Regular leakage control			
Effective decalcification measures			
Recording names of individuals using separate water meters			
Use of process water from inshore waters (e.g. wells)			
Rainwater for watering gardens and toilet flushing			
Recycling of cooling water			
Other			

There are numerous possibilities for saving water. The overview sheet (see previous page) shows a selection of possible measures. It is not always technical measures which save water. It can often be organisational measures that enable savings to be made at no cost.

People are often unaware of the cost of seemingly insignificant leakages. But water loss can be substantial, especially if multiplied over the whole site (how many potentially leaking taps do you have on your site?). Remember too, that leaks continue for 24 hours a day, seven days a week and 52 weeks a year.

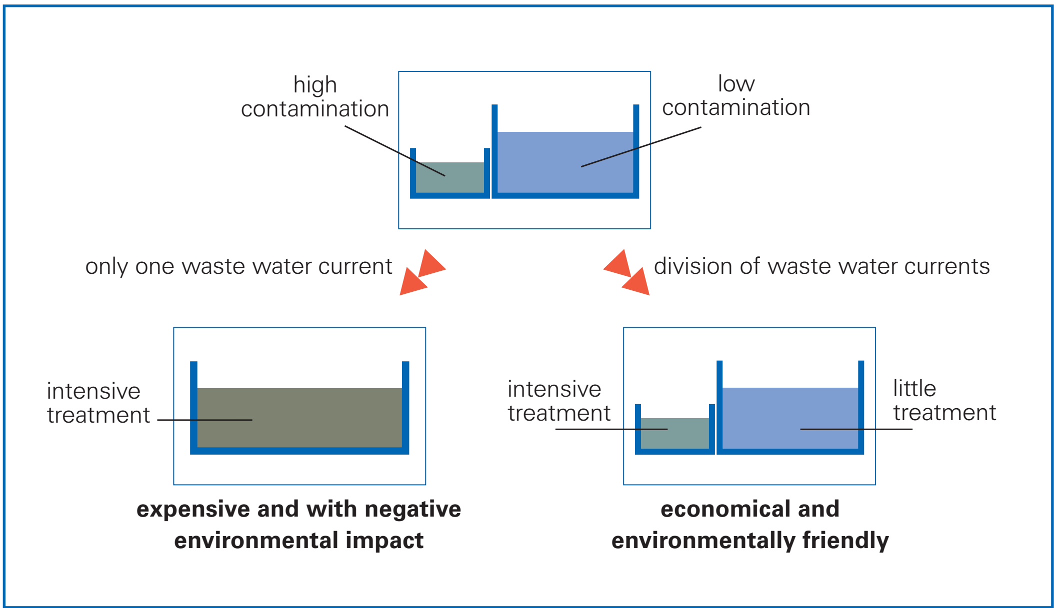
Example:
One single worn-out valve in a toilet bowl loses up to 200 litres of water per day and 73,300 litres per annum. Multiply this with your costs for water supply and discharge to get the saving potential for one single toilet bowl.

Example:
A European cloth finisher saves approximately US $8,000 p.a. by recycling cooling water from its solvent-scouring plant for use in wet processing. Apart from reducing water and effluent costs, recycling also achieves energy savings as a result of the pre-heated water and the reduction on borehole pumps.

! Please note:
If you use rain or surface water in your system, take hygiene regulations and water quality into account by separating these flows from drinking water.

Separate Clean and Dirty Water

The costs of treating waste water at a site are directly linked to the standard of treatment required, the method of treatment applied, and the volume of waste water collected. To reduce treatment costs, follow the principle of separating clean and dirty water flows. Highly contaminated water (which may come from a few, specific sources) should be collected and treated separately from less contaminated water, such as storm water runoff. In this way, treatment costs and environmental repercussions will be reduced.



A good water management system divides waste water into 3 different stages. Highly contaminated water is treated or disposed of as waste, medium-contamination water can be discharged into a municipal sewage treatment plant and low-contamination flows can be recycled internally. Since this division into 3 different flows requires a clearly separated piping system, it is usually introduced for new or reconstructed buildings.

Contamination	Examples	Further methods
high contamination	residual washing effluent residual padding effluent residual printing paste concentrated de-sizing effluent	waste water treatment waste water treatment disposal as waste disposal as waste
medium contamination	washing and soaping baths from bleaching and dyeing processes with COD between 300 and 1,500mg O_2/l	discharge to a municipal sewage treatment plant (without own treatment)
low contamination	washing water with COD < 300mg O_2/l	internal recycling

Water Treatment Options

Many possibilities are available for waste water treatment. It is therefore important for each factory to find solutions which best match its specific operating conditions and local discharge requirements. The following checklist can be used to compare treatment options.

Waste water treatment	applied	possible	not advisable
Gravitational Separation			
Anaerobic Fixed Bed Rotary Reactors with Anaerobic Biofilters			
Oxidation with Ozone			
Nanofiltration			
Reverse Osmosis			
Precipitation, Flocculation, Flotation			
Other....................			

5 Emissions

Process-related emissions, such as the pollutants given off by burning fuel, the use of organic solvents or noise from mechanical equipment, can affect a factory in two ways:

- when they occur in the workplace, they present occupational health and safety concerns;
- when they are released outside, they become an environmental issue.

Along the supply chain many different chemicals at various stages are introduced into the product.

Very often, this leads to the problem that the refiner, as the last link in the chain, has no information concerning the "chemistry" of the material. Consequently he is forced to perform excessive treatment, which is cost intensive and affects the environment. Furthermore, he is unable to run his air cleaning systems efficiently.

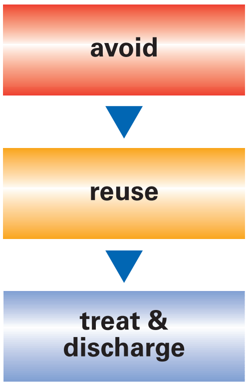
The problem could be significantly improved by an open information policy on the part of all suppliers in the supply chain.

How improvements can be made	dyeing, finishing [1]	knitting, weaving	garment manufacturing	footwear manufacturing
Air emissions:				
the principle: AVOID >> REUSE >> DISPOSE, as known in waste management, also helps to minimise negative effects and saves money on air pollution control	✔	✔	✔	✔
introduce a product passport to avoid excessive use of chemicals (e.g. for washing)	✔			
clean outgoing air as thoroughly as possible (e.g. charcoal cleaning against VOC emissions; cyclones against dust emissions)	✔	✔	✔	✔
use low emission products to avoid expensive end-of-pipe cleaning techniques and to minimise air pollution	✔	✔	✔	✔
take recommendations in the HSE Guidelines (Ch. 14) into account	✔	✔	✔	✔
Noise emissions:				
take steps to reduce noise directly at source	✔	✔	✔	✔
encase or encapsulate noisy machines and equipment	✔	✔	✔	✔
screen noisy areas with walls or ramparts	✔	✔	✔	✔
use sound-proofing materials for the coating of ceilings or walls	✔	✔	✔	✔
try to influence noise by modifying physical data (e.g. speed)	✔	✔	✔	✔
locate noise-intensive machines together if possible	✔	✔	✔	✔
"flag" noisy areas with signs and ensure that the workers wear ear plugs in these areas (see HSE Guidelines)	✔	✔	✔	✔

[1] The ticks in the columns which are shown in the blue boxes of each chapter indicate the area of application (i.e. dyeing & finishing, knitting & weaving, garment production, footwear manufacturing) **and** *highlight the environmental relevance of each recommendation for the respective industry or manufacturing stage.*

Air Emissions:

To limit air pollution, steps similar to those used for waste management can be applied, namely:



The lower the volume of emissions, the less costly the treatment or remediation of the air pollutants. Building on this principle, a choice must be made between primary avoidance measures and secondary exhaust treatment and purification measures.

Primary Measures

Air purification using "End-of-Pipe" technology is usually cost intensive with recurrent operating/maintenance costs. A more effective measure is to use technologies and processes which release the least amounts of air-pollutants. An example would be the use of textile finishes with the lowest content of volatile organic compounds (e.g. low emission preparations).

>> Tip:
Read the Material Safety Data Sheets (MSDS) of your finishing chemicals to get information about the hazardous potential in your finishing processes. Compare the MSDSs of different suppliers to estimate which is the more eco-friendly alternative.

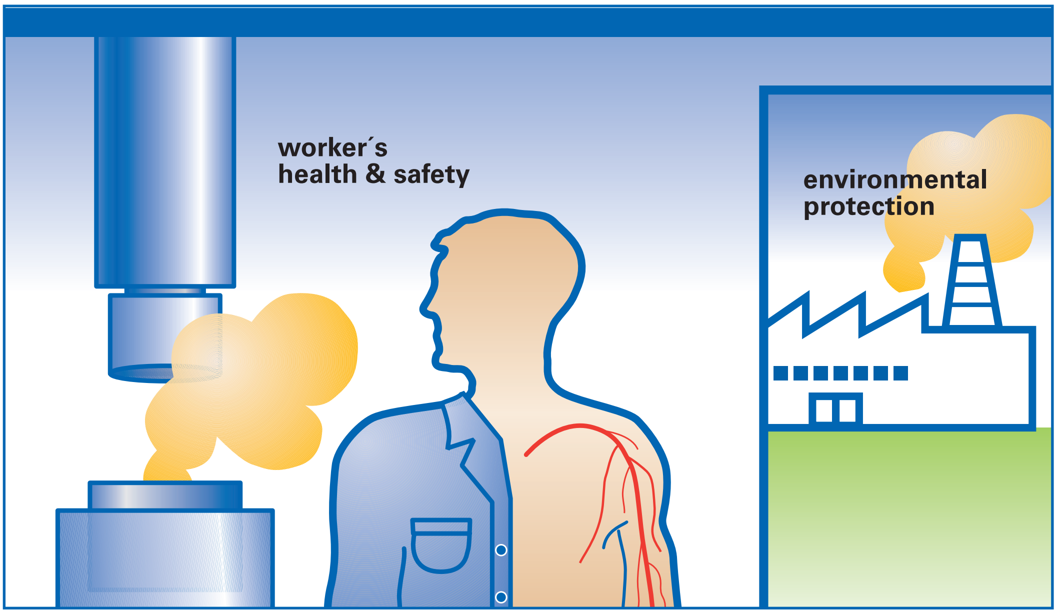
! Please note:
The following limitations should be noted:

- products which have been dyed using chlorine-containing accelerators, cannot be treated thermally (drying or thermo-fixing)
- products pre-cleaned with perchloroethylene must not be handled by the tenter dryer
- the residue of preparations for products to be refined should not exceed 0.3 weight percent (e.g. ensure by thorough pre-washing)

You should be aware that each single emission (also the very small ones) in your factory increases air pollution and costs money (loss of resources). Thus, these small and non cost-intensive measures should be performed wherever possible.

>> Tip:
Containers with dyes and cleaning agents such as tins, cans and barrels should only be opened when in use and then immediately closed. Hand pumps and dispensers allow regulated dosing in small amounts.

When dealing with air emissions, health and safety issues and environmental concerns are often closely linked. Thus primary measures in pollution control safeguard both the workers and the environment. In terms of workers´ health, the TLVs listed in Chapter 7 of the HSE Guideline should be strictly followed. Please ensure that none of your chosen chemicals contain banned substances.



Secondary Measures

Only after all possible primary measures have been taken, secondary measures should be adopted. Although end-of-pipe technology is usually very cost intensive, it may be required if local standards and legal requirements are to be met. Since each factory will have its own specific conditions and requirements, no standard recommendations can be made for the selection of the most suitable secondary treatment system. The following list gives some idea of possible options:

- air cleaners (pollutants are washed out from the exhaust air)
- electric filters (pollutants are removed by electrostatic effects)
- combined air cleaners/electric filters
- thermal after-burning systems (pollutants are pre-heated and then burned off at high temperatures to ensure that reaction products are safe)
- regenerative after-burning systems (similar to thermal after-burning, but more effective pre-heating)
- local exhaust systems close to the source of emission to minimise volumetric flow rate

6 Soil & Groundwater

Ground contamination is caused by toxic and hazardous materials coming into contact with the soil. These contaminates may then work their way down through the soil and pollute ground water and surface waters.

Soil and ground water contamination can be a serious threat to humans, flora and fauna. Prolonged exposure or the ingestion of toxic substances can lead to poisoning, long-term illness and even death.

Once the ground has become contaminated it can be very difficult to predict where pollutants may spread. The movement of contaminates will be influenced by the geological structure of the ground, by rain water flushing through the soil, the chemical properties of the contaminants themselves and the way in which they are broken down. In Europe and North America especially, legal and financial liabilities are the most important incentives for avoidance of soil contamination. Where remediation of contaminated soil or ground water is required, a company may be faced with extremely high costs.

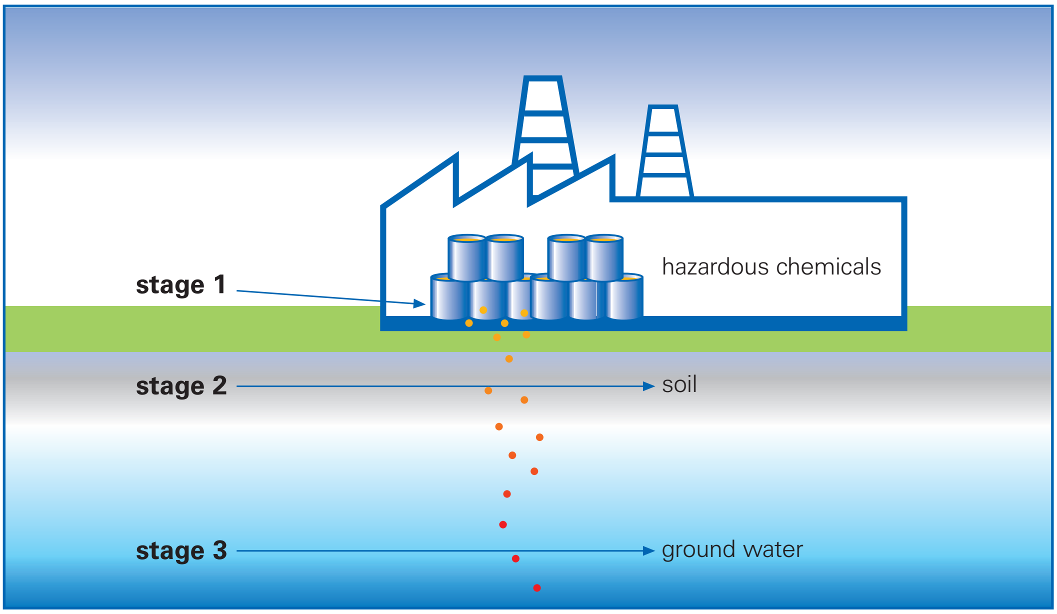
How improvements can be made	dyeing, finishing [1]	knitting, weaving	garment manufacturing	footwear manufacturing
Avoid future contamination:				
▪ meet the requirements of adidas´ HSE Guidelines (Chapter 5 describes in detail the requirements for storage of hazardous chemicals; Chapter 6 deals with the use and handling of hazardous chemicals outside the storage areas in the production process)	✔	✔	✔	✔
▪ regularly check equipment (installations, vessels, etc.) for leakage or other damage and repair immediately if required	✔	✔	✔	✔
In the case of potentially existing contaminated sites:				
▪ perform an assessment in the form of a historical search	✔	✔	✔	✔
▶ when was the site acquired?				
▶ what expansions/changes have occurred since the site was acquired?				
▶ has there been any known contamination of the site?				
▶ has a contaminated land survey of the site ever been undertaken?				
▶ where is waste discharged from, what is discharged, and where does it go?				

6 Soil & Groundwater

How improvements can be made	dyeing, finishing [1]	knitting, weaving	garment manufacturing	footwear manufacturing
estimate hazard	✔	✔	✔	✔
▶ take samples from the affected media (ground, ground air, ground water)				
in the case of a confirmed contamination: investigate remediation or clean up	✔	✔	✔	✔
▶ develop a remediation plan				
▶ address ecological requirements as well as technical and economic possibilities				
▶ decide the type and scope of the measures to be adopted				
plan remediation or clean up	✔	✔	✔	✔
▶ draw up a remediation plan as the contractual basis for the companies involved				
perform remediation	✔	✔	✔	✔
▶ try to achieve the stated remediation target, adhering to the set time and cost plan				

[1] *The ticks in the columns which are shown in the blue boxes of each chapter indicate the area of application (i.e. dyeing & finishing, knitting & weaving, garment production, footwear manufacturing)* **and** *highlight the environmental relevance of each recommendation for the respective industry or manufacturing stage.*

>>Tip:
The investigation and remediation of ground contaminates requires scientific and engineering expertise. Retain a qualified consultant to advise on each step in the assessment and in the clean-up.



Stages of Contamination

The following example shows the stages of contamination where there has been poor storage of chemicals.

Stage 1:

- Over time, the floor beneath the chemicals becomes contaminated
- Installations in the room are affected
- Building fabric is affected, or is discoloured

  $ Stage 1 is very **easy to avoid**, e.g. by using secondary containment (see Chapter 5 of the HSE Guidelines).

Stage 2:

- the chemicals reach the soil
- the extent of the contamination becomes difficult to estimate, it may not be visible or accessible

  $$ In stage 2, remediation could require the excavation of soil around the contamination source. Many cubic metres have to be disposed of as chemical waste. At stage 2 the cleanup becomes **expensive**.

Stage 3:

- ground water is contaminated
- once in the ground water, the contamination spreads out into a much larger area

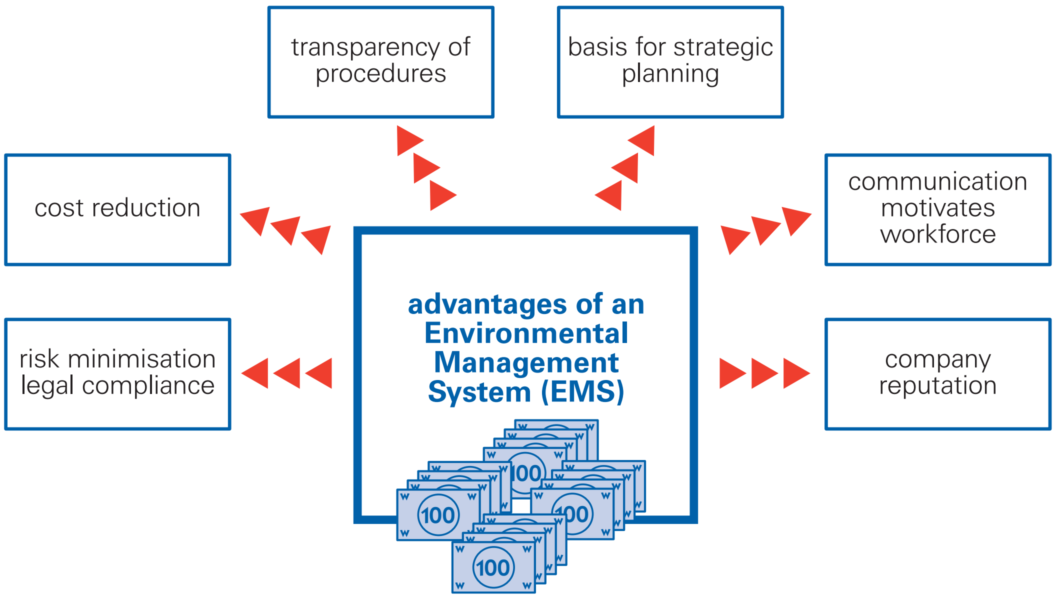
  $$$ Ground water is affected. Remediation is **extremely expensive** and can take many years. It could even bankrupt the business.

7 Systematise Activities

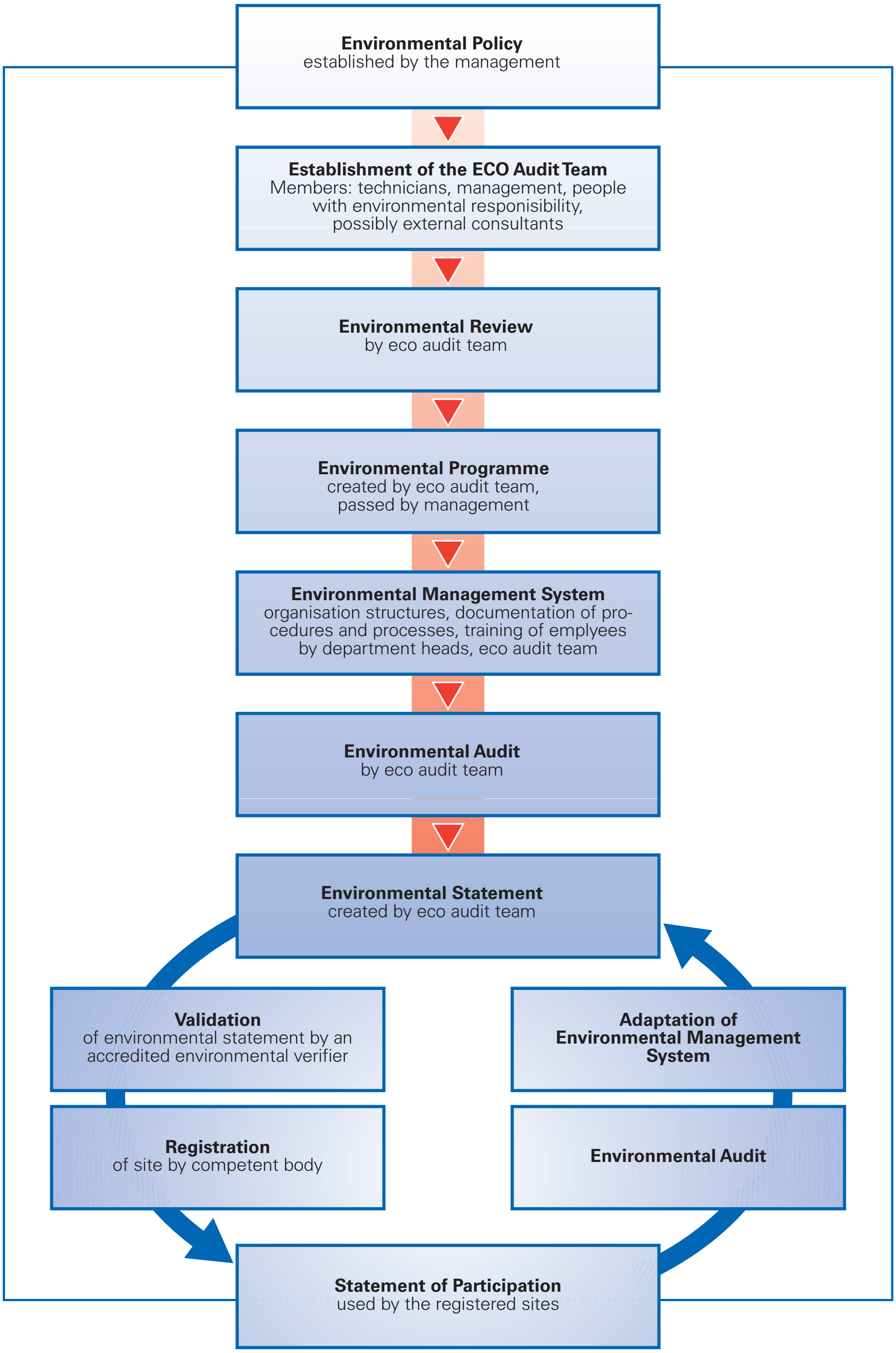
For a long time, environmental protection has been considered a technological and cost-intensive problem. However, it has since been recognised that cost-saving in environmental protection is mainly brought about by a combination of technical and organisational measures. To achieve this, the management of environmental issues has to be co-ordinated and prioritised. Responsibilities have to be fixed and procedures that describe key activities have to be established.

At the highest level, all these measures are combined in a documented Environmental Management System (EMS) that can be certified according to European EMAS or worldwide ISO 14001 standards. It is very important that all employees are committed to the EMS that has been established. Otherwise, it will be difficult to implement the system. It has been proven that only a well implemented EMS can lead to real economic and strategic improvements.

The illustration on the next page shows the process of setting up an EMS according to the European EMAS standard. Usually, establishing the process takes between 9 months and a year.



7 Systematise Activities



Environmental Policy

The environmental policy should be established by the management. It should be appropriate to the nature, scale and environmental impact of its activities, products or services. It should at least include a commitment to:

- continuous improvement and prevention of pollution
- compliance with relevant environmental legislation and regulations
- compliance with good management practices

4. Environmental Policy of the Global Technology Centre, Scheinfeld

Principles of sustainability
The adidas principles of sustainability which apply to operations worldwide provide us with a yardstick for assessing our own progress in the areas of social and environmental responsibility. They have been adopted as the environmental policy to be appllied at the Scheinfeld site:

Statutory requirements
We adhere to social and environmental laws, directives and guidelines while continually improving upon our own contribution to a sustainable society.

Management
We aim to:

- analyse and assess the social and environmental impact of our products, technologies and procedures already at the design and development stages;
- specify clear objectives, draw up an action plan and monitor our progress;
- publish the relevant results.

Relationships with suppliers and customers
We expect the activities of our suppliers to be compatible with our SOE. We work in partnership with them to improve work place conditions. We encourage our business partners to take a proactive stance on the social and environmental impact of their own activities.

Support
We support social and environmental projects and develop partnerships with businesses and organisations whose direct and indirect output contributes to a sustainable society.

Dialogue with our stakeholders
We aim to communicate with all stakeholders in an atmosphere of mutual trust and respect. We provide them with appropriate information related to the social and environmental performance of the group on a regular basis.

Establishment of Eco Audit Team/ Training

The Eco Audit Team should consist of representatives from all operational areas of the factory together with a member of senior management. People with different roles and experience will have different ideas and skills to help improve the environmental situation.

Composition of Environmental Team

- senior management representative
- the technical manager
- the quality/environmental manager
- a site services representative (if applicable)
- shift supervisors/operators
- workers representatives

Although it is important that all employees are included in the EMS, it is not necessary that they understand the whole system. Some parts of the workforce will need more information than others, depending on the level of responsibility. Therefore it is useful to provide different training sessions.

Basic Information:

A general training session should:

- highlight the company´s commitment to environmental management
- explain why the EMS is being adopted
- describe what the company hopes to achieve from implementing EMS
- describe the different steps for implementing EMS
- introduce the company´s environmental policy

Specific Information:

Some employees who are expected to manage particular parts of the EMS and explain them to others need more training. This could be:

- detailed information about specific parts of the EMS
- an introduction to environmental legislation
- an introduction to EMS documentation
- detailed technical information on environmentally relevant installations and machinery

Environmental Review

In order to get started, it is important to be aware of all environmental effects under normal and abnormal operating conditions (prepare a list of environmental effects). Furthermore, it has to be clear which environmental legislation is valid for the site (draw up a list of all environmental regulations with their actual requirements).

Environmental Effects

Regular Conditions

Energy consumption	e.g.	electrical supply for machinery heating oil for drying or thermo-fixation processes natural gas for heating process water electrical supply for lighting
Consumption of raw material	e.g.	use of cotton use of rubber
Water consumption	e.g.	process water for dyeing (borehole) domestic water (mains)

Environmental Effects

Regular Conditions		
Chemicals	e.g.	purchase storage use disposal
Emissions to atmosphere	e.g.	dust fumes VOC, NO_X, SO_X, CO, CO_2 from heating installation
Discharges to water	e.g.	effluents from washing effluents from cooling effluents from bleaching
Solid waste	e.g.	process waste (off-cuts, fibres, etc.) hazardous waste (e.g. machine oil, dyes, etc.) packaging waste (plastics, cardboard, paper, etc.)
Noise, odour, visual impact, vibration	e.g.	noise from machinery vibrations from machinery

Abnormal Conditions		
Fire	e.g.	air emissions contaminated tempering water
Soil contamination	e.g.	leakage of vessels or tanks spillage at filling devices
Water contamination	e.g.	accidental damage

All environmental effects are checked during an environmental audit to see that they comply with the established legal requirements. Deficits are noted during an inspection of the site. This Best Practice Guide and the HSE Guidelines are useful tools to identify critical issues. Following the audit, a written report is produced which includes further areas for improvement.

Legal Requirements

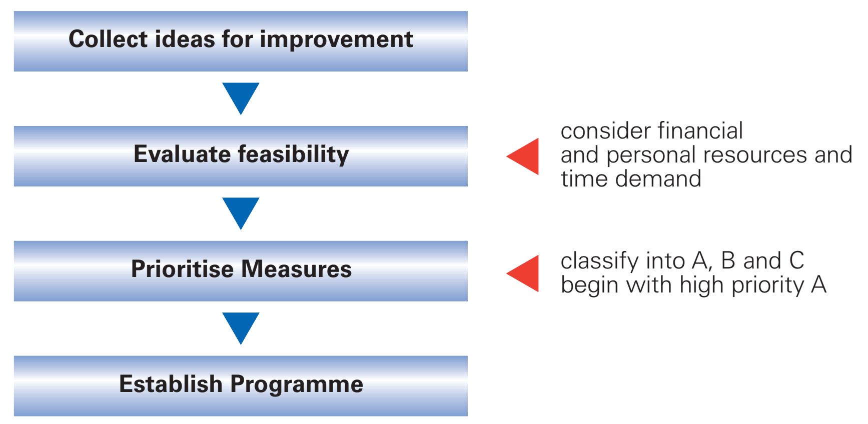
Regulation	Specific Requirement (examples)
Air Quality Standard CO limit, dust limit	VOC limit, NO_X limit, SO_X limit
Control of noise	max. dB(A) value of ... at ...
Waste regulations	control of disposal of chemical waste requirements to recycling
Waste water regulations	limits for specific parameters in waste water waste water treatment plant requirements limits on mass flow for waste water

Environmental Programme

The environmental programme is the driving force for continuous improvement. It should be established, documented and continuously maintained. Wherever possible, the objectives should be quantified. For each activity, a person responsible, a time limit and the necessary resources should be defined. The following aspects should be considered:

- compliance with own environmental policy
- legal requirements
- significant environmental aspects
- technological options
- financial, operational and economic requirements
- views of interested parties

The following steps should be taken to establish the environmental programme:



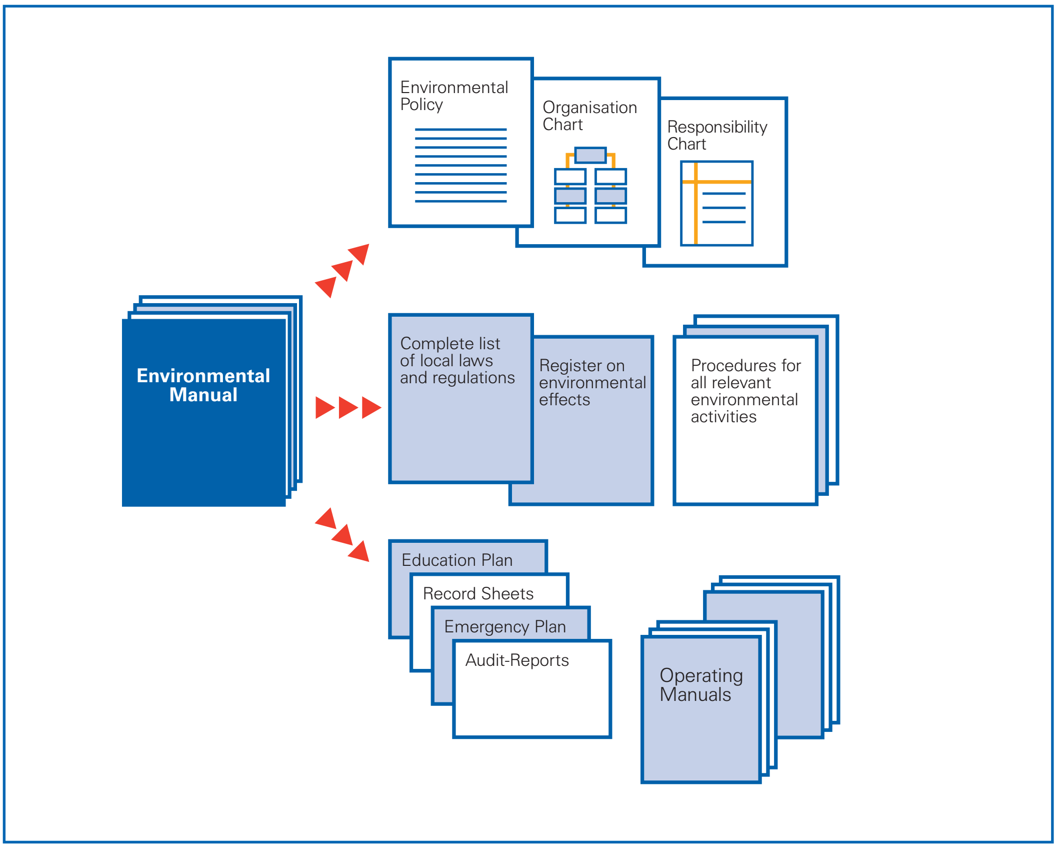
Example of an environmental programme:

Issue	Target	Measure	Responsibility	Resources	Deadline	Status	Target permanently achieved?
high Cr(III) values in effluent of tannery	Cr(III) < 0.10 mg/l	revision of dosage system	technical manager	US $XXX	Oct. 2002	not started	no
use of banned chemical toluene	identify replacement chemical	process review testing	technical manager	manpower	Sept 2002	done	yes

Environmental Management System (EMS)

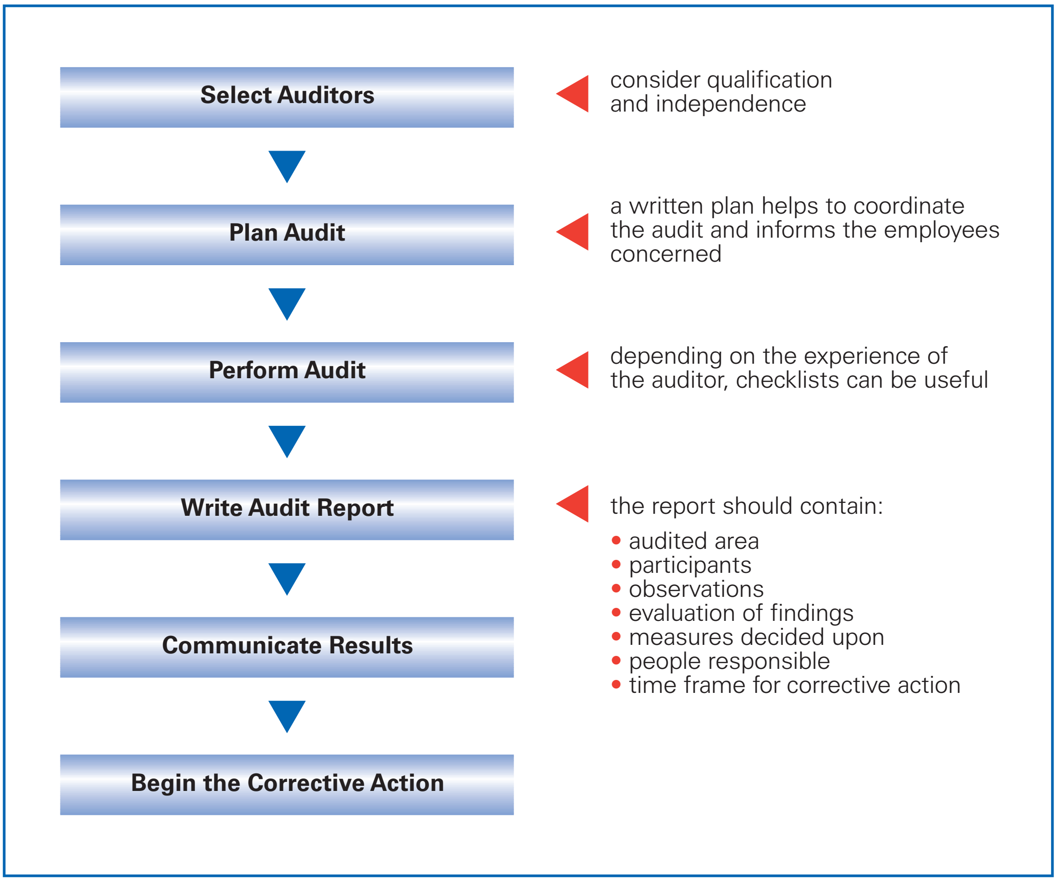
An EMS systemises the activities of practical environmental protection by means of relevant steering and controlling mechanisms. In this way, not only material and energy flows and improved practices are achieved, but also a reduction in risk liabilities and the enforcement of legal compliance. An EMS therefore supports the three principles of Integration, Co-operation and Communication. A factory based EMS may also form part of an integrated product policy. Enabling products and services to be improved on a permanent basis over the entire life cycle of the product.

An EMS bundles all relevant information concerning environmental activities into a series of environment policies and procedures, which include checks and feedback mechanisms. However, policies and procedures will not in themselves lead to environmental improvements. Vigilance and effort are required from a well-trained and motivated workforce, from the manager to the "man at the machine."



Environmental Audit

Environmental audits help to identify the actual status of the EMS and are the basis for corrective action to achieve continuous improvement. The following steps should be taken:



Environmental Statement

The environmental statement describes in a brief form the environmental activities of the company. It can be regarded as a kind of image booklet for the public and interested parties. Today, many companies use the internet to communicate their environmental statement. The following illustration shows some suitable elements of such an environmental statement.

Introduction	
Company Profile	
Milestones	describes the history of important environmental success
Environmental Policy	
Management System	describes the organisational structure and key responsibilities
Environmental Impact	direct environmental impact describes the effects which are closely related to the activities on site indirect impact also includes effects of the product along its life cycle together with activities of key suppliers
Data and Facts	is an input/output description of environmental data (water, waste-water, emissions, waste etc.)
Environmental Programme	describes the key activities planned and documented key activities which have to comply with the environmental policy

8 Useful Web Sites

Address	Host
bsr.org	Business for Social Responsibility
ceres.org	Centre for Environmentally Responsible Economies
eea.eu.int	The European Environment Agency
epa.gov/	US Environmental Protection Agency
Energy-efficiency.gov.uk	UK Government environmental protection site
greenbiz.com	Green Business Network
greenbuilder.com	Sustainable Sources
iso14000.net	Essential Technologies Inc. and GETF
oecd.org/env	Organisation for Economic Co-operation and Development
riet.org	Regional Institute of Environmental Technologies
rmi.org	Rocky Mountain Institute
sustainability.co.uk	SustainAbility Ltd.
sustainable.doe.gov	US Department of Energy
sustainable.org	Sustainable Communities Network
sustainablebusiness.com	Global Environment & Technology Foundation (GETF) site
unep.org	United Nations Environment Programme
worldwatch.org	Worldwatch Institute

9 Glossary

Term	Explanation
Anaerobic fixed bed rotary reactors	is a reactor to clean waste water under anaerobic conditions.
Decalcification measures	prevent calcification in water piping systems. It can be distinguished between chemical decalcification (e.g. de-ionising) and physical decalcification (e.g. based on magnetic effects).
Blind current compensation	If current is used for machinery where magnetic effects are involved (e.g. motors), so called blind currents appear, which reduce the efficiency of energy use. With the help of blind current compensation equipment, this loss can be avoided.
Calorific value	represents the energy content of a material which can be used in incineration.
Carbon dioxide (CO_2)	is a gas which contributes to the greenhouse effect. Carbon dioxide is the final product of each incineration of organic material and thus cannot be avoided by end-of-pipe cleaning of exhaust gas.
Co-generation	means the simultaneous generation of current and heat in one plant. Compared with separated generation of current and heat, the efficiency of energy use is much higher for co-generation systems.
dB(A)	is the scale to measure the quantity of noise in A weighting.
Degassing	is the process of pressure release in the feed water tank of steam systems. The pressure release is accompanied by a plume – a typical indication of large energy loss in a steam system.
Eco... (as prefix)	derives from ecology and means the protection of man and wildlife against harmful and inconvenient impact with the aim of ensuring sustainable viability.
EMAS	is the abbreviation of **E**nvironmental **M**anagement and **A**udit **S**cheme. It is the European system to certify environmental management systems.
Environmental impact	effects caused by industrial activity, which affects the environment.
Environmental Management System (EMS)	Bundles all environmental activity in a transparent documentation to avoid hazardous incidents and to reduce negative environmental impact.
Flocculation	is a separation method in waste water treatment. With the help of flocculation agents, the precipitation of the pollutant is accelerated.
Flotation	is a separation method in waste water treatment. With the help of flotation agents, the pollutant is transferred into foam, swimming on the surface and can be separated by skimming.
Greenhouse effect	The solar energy which arrives on the earth' s surface and the release of energy (infra-red radiation) from the earth into space is a well balanced and sensitive equilibrium. Some gases like carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_x) or CFC absorb this infra-red radiation. This leads to an increase in the atmosphere' s temperature, called the greenhouse effect.

Term	Explanation
ISO 14001	is an International Standard for environmental management systems.
Nanofiltration	is a filtration technique to separate very small particles from water.
Night current	Power plants produce current by night as well as during the day. Since by night, the demand is much lower, off-peak rates are offered for night current. Machinery with tolerance concerning the consumption time (e.g. heating or cooling aggregates) can use night current to save money.
Ozone oxidation	is a method to clean waste water with the help of ozone (very often in combination with UV-light).
p.a.	per annum, i.e. each year
Passive solar design	means the use of solar energy without separate installation of collector systems. In many cases only the intelligent alignment of buildings or the extension of a glass front leads to the use of solar energy and thus saves resources.
Peak current control system	These systems limit peaks in energy consumption. Since the rates for current depend on the peak rates, it is very expensive to have high peaks. Peak current control systems control the actual consumption of current. If the consumption gets in the region of the peak range, defined consumers (e.g. cooling aggregates) are switched off for a short time to avoid a peak consumption.
Reverse Osmosis	is a technique to separate very small particles from waste water.
Sustainability/ Sustainable Development	Most simply, the idea of sustainability, or ecological design, is to ensure that our actions and decisions today do not inhibit the opportunities of future generations.
Volatile organic compounds (VOC)	is a parameter to express load of solvents in air. Any organic compound that can be volatile under normal conditions contributes to the VOC value. Since VOC does not consider the chemistry of the volatile compounds, the VOC value cannot be used to assess the toxicity of the solvent loaded air.
Waste	An official definition of waste is: "Waste is any unavoidable material resulting from an industrial operation for which there is no economic demand and which must be disposed of." This definition, however, does not consider sufficiently the economic effects as driving force in waste management. Thus we recommend using the following definition: "Waste is purchased raw material that is treated with energy and water, processed by employees and subsequently not sold as product!"