One billion people live without safe drinking water, and 2.4 billion lack access to adequate sanitation. The human cost is widespread suffering and millions of avoidable deaths each year. How water management is addressed will determine whether we can reach the Millennium Development Goals.

Water is a basic component of all human activity - agricultural, industrial and our daily lives. Our economic and social well being depends on having adequate supplies of quality ground water. We have the technology and know-how to augment and conserve current water supplies and to increase efficiencies in current consumption practices. The challenge is to take concerted action now.

There is enough water if managed efficiently to meet human needs, both now and in the future - BUT unequal distribution, contamination and waste threaten supplies and pose a threat to sustainable development.

The United Nations declared 2003 to be the International Year of Freshwater. One of the targets under the UN Millennium Development Goals is to halve the proportion of people who live without safe drinking water by 2015. UNEP's water strategy is built on the principle of a fair share of water - for all users and for all uses, including the environment. UNEP offers competence with a number of tools - including assessments, policy options, technology transfer, capacity building, and awareness raising - to address water and sanitation issues and the global decline in freshwater availability and quality.
The Problem

Population growth, urban, domestic and industrial pollution, deforestation and inefficient use by agriculture have profound negative impacts on fresh water resources—both surface water as well as sub-soil water.

Globally, fresh water is used for three purposes: agriculture (75%), industry (20%) (including hydro and nuclear power generation) and domestic supply (5%). Irrigation—accounting for the bulk of agricultural use—is very wasteful. Often more than 70% of water used for irrigation never reaches the crops for which it was intended.

Industry uses less than agriculture but the level of pollution is higher. Most of the water is used for cooling and cleaning and although more than 80% of it is returned to its source it is often polluted with by-products and wastes from the manufacturing process.

Whether problems are due to limited water resources; inadequate public supplies or water treatment capacity, reducing the DEMAND for water can address a wide range of problems.

Prevention is key

For business...a waste once generated can cause various sorts of damage. Though it can be treated—there are (increasing) costs to consumers, industry and society as a whole.

For well-being...a cholera epidemic in 1991 cost the Peruvian economy $1 billion dollars in combined emergency health expenditures and lost revenue from exports and tourism. This figure is more than four times what Peru spent on water supply and sewerage between 1981 and 1988.

For survival...People without access to clean water or basic sanitation are almost invariably the poor. Their poverty denies them from meeting the basic necessities of clean water and sanitation. Poor people pay vastly more—between ten and a hundred times more—for water and sanitation services. Costs are not only financial, but also physical, whether it be queuing at a standpipe in a city slum, or walking for kilometres to collect water from a well. The poor also pay an enormous price in health. It is estimated that 80% of illness and death in the developing world is water-related. People with water-related diseases occupy half the world’s hospital beds. Lack of clean water or inadequate sanitation kills 1.7 million people a year, of which 90% are children.

Understanding Sustainable Consumption & Production

Sustainable Consumption & Production considers the entire life cycle of products, including:

- **product design** — meeting the needs using less materials (including water)
- **selection of raw materials** — choosing raw materials that have the least affect on the environment without compromising product or service quality and cost
- **production process** — modifying/optimising the manufacturing process or service delivery to reduce environmental impacts without affecting the quality of product or service
- **consumer use** — maximise the use and effectiveness of a product or service
- **beyond product life** — reusing and/or recycling used/discarded products
Cleaner Production is a proven strategy to increase efficiencies (thus reducing water use) and at the same time maintain water quality. It has been applied successfully in manufacturing companies and in water production facilities. It needs better understanding and adoption into everyday business practices.

Cleaner Production is the continuous effort to prevent pollution, thereby reducing the use of water, energy and material resources; and to minimise the generation of waste in the production process. Cleaner Production can help identify better water management practices that can conserve water, save money, improve efficiencies without hindering production processes, including:

- Reduced water demand: generally faster, cheaper, and easier than supply-side initiatives
- Savings in water and wastewater treatment: reduces costs and increases efficiency
- Reduced environmental impact: reduces pollution load and quantity of waste water
- Sustained water source quality: reduces contamination of water bodies

Consumers can use their purchasing power:
- Purchase fewer material goods.
- Demand and maintain a nutritious diet which is less meat-intensive.
- Select native plants and grasses for lawns and landscapes and rely on natural rainfall only.
- Install water-and energy-efficient appliances and fixtures.

### Slovak Recycled Paper Plant saves water

**Background:** The Kappa Štúrovo, jsc is the largest recycled paper processing plant in Slovakia. Located on the Danube, the company exports its products to southern and western Europe. The focus of the Cleaner Production efforts was on two areas of the process.

**Water use before:** Large volumes of fresh water were used due to outdated technologies, cleaning methods and equipment that did not allow greater water reuse. In addition, frequent changes of product (sometimes 3-5 times per shift) also resulted in excessive water use.

**Water use after:** A Cleaner Production assessment was carried out with the objective of reducing the pollution load and water consumption. Based on material balance and other information collected, problem areas were identified and ranked based on the urgency and size. Fifty-seven Cleaner Production measures were identified including:

- performing value analysis of products, to reduce the number of semi products to a reasonable level;
- training marketing department staff on properties of different products and their substitutes; and
- developing projects for the identification of new semi products and products which could be produced on the machine and new potential markets.

**Benefits Summary:** Thirty-three measures were implemented with financial benefits of about US $313,000. Water consumption on board production was reduced by 48%, or 1 761 000 m³/year.

For more information contact the Slovakia NCPC: kozempelova@scpc.sk
Water Availability Crisis Looms

Only one one-hundredth of 1% of the world’s total supply of water is considered easily accessible for human use. It has been estimated that by 2025, the majority of the Earth’s population will be in a situation of very low or catastrophically low water availability. Clearly, increasing the efficiency of water use is a global issue.

Water Situation in Costa Rica: In Costa Rica, agriculture accounts for 75% of the fresh water used. Nearly 91% of the water for industrial uses comes from underground sources. This water is used mostly by hotels, beverage industries and hospitals. There are 837,060 houses supplied with potable water, 81% of this water is taken from underground sources too.

The availability and quality of water in Costa Rica is being threatened by overexploitation, contamination, deforestation, growth of population, and changes in precipitation. Laws have been passed to regulate the situation, but enforcement and monitoring actions are not adequate.

Background: Asociación de Productores de Cervanteños is located in a rural area where vegetables and fruits are harvested. The enterprise has 32 employees and, depending on the season, they process pineapples, mangoes, peppers, and potatoes. The product is pasteurized and frozen for export.

Water use before: The water used in the manufacturing plant comes from a well located in the nearest mountain. The enterprise has 2 water holding tanks for storage. The water is treated with chlorine. The main activities which consume water are: washing tanks for the fruits and vegetables (4.0 m³/day), processing (7.9 m³/day), cleaning processes (4.4 m³/day), and Individual Quick Freezing (27.4 m³/day). The total daily amount of water to operate the manufacturing plant is 43.7 m³/day.

Water use after: The Cleaner Production Assessment led to identification of 47 improvement options out of which 4 were related to water management.

- Refurbishing an unused washing machine at the cost of $342 and using it instead of tanks for washing fruits and vegetables resulted in 50% reduction (from 4 m³/day to 2 m³/day) in water use. Annual monetary savings were $720 and a payback period of 6 months.
- Changing to a high-pressure water spout to clean the conveyors and processing tools required an investment of $54 resulted in reduction of water consumption of 1.5 m³/day and yielded monetary savings of $550 per year. Payback period was just 22 days.
- Fixing the thermostat of the Quick Freezing Machine with spare parts cost $555, but the company saved 27 m³/day of water used to unfreeze the machine, and saving $9,600 per year.
- Installing water sprayers in all the enterprise’s waterspouts cost $54.47 and saved 1.58 m³/day yielding a $560 annual saving.

Benefits Summary: The company made a one-time investment of about US $1,000 and saved about US $10,000 per year. The company saved 32.1 m³/day of water (24% of the total consumption). In addition, the employees became more conscious about environmental issues.

For more information contact the Costa Rica NCPC: cnpm@cicr.com or smusmanni@cicr.com
Saving WATER through Sustainable Consumption & Production

Raising Awareness can save water

Freshwater resources are unevenly distributed across the planet, which means that the interest in changing consumption and production patterns differ depending on how much water scarcity is part of day-to-day life in the local environment. One of the key obstacles for implementation of more sustainable water management is lack of awareness on how inefficient water consumption by some will have an impact on the ability to consume water by others. Simple measures to raise awareness and contribute to more sustainable water use include:

- Develop information for industry and government on sustainable water management.
- Promote informed use of water-saving technology.
- Push for land use ordinances that protect wetlands, aquifers, and watersheds.
- Ensure that local management boards monitor and enforce water protection strategies.

Indian Chemical Plant saves water

**Background:** Vam Organic Chemicals Limited manufactures and distributes industrial organic chemicals. The company's main products are vinyl acetate monomer, intermediates of vinyl acetate monomer, polyvinyl acetate pyridine and picoline, polyvinyl alcohol, and a range of adhesives. It is located on the banks of Upper Ganga Canal in Gajraula in the northern part of India.

**Water use before:** Molasses distillation is the basic production step. It is a water intensive industry consuming about 14500 m³/d of fresh water. The treated wastewater from the industry is then used for irrigation and for forestry development as per the specifications and guidance of regulatory authorities.

**Water use after:** The company initiated a Cleaner Production Programme with special emphasis on reduction of water use. The options leading to fresh water savings included:

- Optimization of the Anaerobic Bio-methanation plant of the distillery by adding effluent from Organic plant thereby eliminating dilution of spent wash from the distilleries by fresh water. Savings of 1365 m³/d of fresh water.
- Change in cooling water circuit from once through system to a closed loop system by installing a cooling tower. Savings of 550 m³/d of fresh water.
- Recycling sealing water of vacuum pump after allowing 10% bleeding and cooling by means of cooling tower in one location and chilled water heat exchanger in other location. Savings of 660 m³/d of fresh water.
- Replacing the fresh water used for dilution of molasses by the water from foam trap and yeast vessel jacket cooling water in the distillery. Savings of 250 m³/d of fresh water.
- Cleaning of fermenter by using spent lye from the distillery section as first wash and then rinsing by fresh water in place of washing by freshwater all together. Savings of 240 m³/d of fresh water.
- Reusing regeneration spent wash water for spraying on flyash and coal yard for dust control. Savings of 120 m³/d of fresh water.

**Benefits Summary:** The total fresh water consumption was reduced by 3250 m³/d (22%). As a result of these steps, the reduction in effluent generation was about 2700 m³/d. The time taken for the complete study and its implementation was about 18 months. The cost incurred for the above measures was US $64,400 approximately. Financial savings came from a reduction in pumping costs of fresh water, avoiding major capital investment for treatment; reduced handling and quantity of treated effluent for storage and subsequent use in irrigation. However, part of these savings was offset by pumping costs from the new recycling systems and from the closed loop systems. The net savings were about US $33,330/year.

For more information contact the India NCPC: ncpc@del2.vsnl.net.in
**Background:** The conventional highly alkaline boiling preparatory process of cotton is an example of one of the most negative environmental impacts of the dyeing process. However, using an alternative enzymatic process at lower temperature can reduce environmental impact through water and energy savings and bring quality benefits. Since early 2004, two Korean dyeing companies - Colorland and WS Dyetech Co. Ltd. - use recently developed bioscouring to produce cotton knits in dark colours.

**Water use before:** Traditional scouring of cotton fabrics leaves high levels of alkali in the fabric that must be neutralised before proceeding to dyeing. After scouring, two cycles of washing were carried out with acetic or formic acid added to the first wash water.

**Water use after:** Substitution of conventional highly alkaline scouring with mild alkaline enzymatic scouring eliminates the use of caustic soda completely. Neutralisation process is not needed and approximately, 8 to 10 tons of washing water is saved per ton fabric production.

**Benefits Summary:** Enzymatic scouring has been developed using Novozyme’s product, Scourzyme. After having achieved excellent results on cotton knits in pilot and plant trials that were carried out under a KNCPC-funded technology transfer project, a participating company decided to use enzymatic scouring for 30% of their production. 2,000 tons of cotton knits can be produced per year by the new technology and 16,000 tons of water can be saved per year.

**Description of Overall Financial Picture**
(based on 30% of the total yearly product - approximately 2,000 tons of cotton knits)

<table>
<thead>
<tr>
<th></th>
<th>Enzymatic Scouring</th>
<th>Alkaline Scouring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Costs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Investment</td>
<td>Not needed (the same facility is used)</td>
<td>Chemicals including Alkali: 93,352 USD</td>
</tr>
<tr>
<td>- Raw Materials</td>
<td>Chemicals including Enzyme: 117,190 USD</td>
<td></td>
</tr>
<tr>
<td><strong>Savings:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Water consumption</td>
<td>32,000 tons = 10,667 USD</td>
<td>48,000 tons = 16,000 USD</td>
</tr>
<tr>
<td>- Wastewater treatment plant operation: reduction of energy use such as steam and electricity</td>
<td>32,000 tons = 21,334 USD</td>
<td>48,000 tons = 32,000 USD</td>
</tr>
<tr>
<td></td>
<td>65,396 USD</td>
<td>82,350 USD</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td>Increase due to enzyme cost (US $23,838) is offset by savings (US $32,953) from water, waste water treatment and energy.</td>
<td></td>
</tr>
<tr>
<td><strong>Other Benefits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Product Quality</td>
<td>Softer touch</td>
<td>Non-specific scour</td>
</tr>
<tr>
<td>-</td>
<td>Higher fabric strength</td>
<td></td>
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<tr>
<td>-</td>
<td>Less weight reduction</td>
<td></td>
</tr>
<tr>
<td>- Employee health and safety</td>
<td>Enzymes: safer and easier handling</td>
<td>Alkali: harmful to skin</td>
</tr>
</tbody>
</table>

If this technology is spread to the 200 other dyeing companies in Korea, the total yearly water savings could be 3,200,000 tons. This measure would cost about US $ 1,066,667 per year but would be more than offset by waste water treatment savings totalling US $ 2,133,333 per year.

For more information contact the Korean NCPC: jaekim1@kitech.re.kr or jykang@kitech.re.kr
Saving WATER through Sustainable Consumption & Production

How Governments can start to make change

Governments play a key role in protecting the public trust in water. A key challenge governments face is that most freshwater ecosystems are not priced or valued in the marketplace, yet they are fundamental for human survival, functioning of social structures, and operation of the overall economy. In addition, groundwater is often insufficiently regulated, which causes detrimental effects on the ecosystem, the economy and human well-being.

Water pricing is an option to better control and regulate consumption. However, pricing alone is not a sufficient mechanism. Regulations, more efficient delivery mechanisms, and integrated water policy plans need to be developed and implemented to address water consumption in households, industry, agriculture, and the public sector. Players such as National Cleaner Production Centres can act as an intermediary between government and industry, and can thus be focal points for change towards more sustainable water use.

Water management is an example of an area where different actors of society need to work together to identify and implement optimal solutions. This type of cooperation is also evolving at the international level, for example, to avert or solve cross-border conflict due to water rights and access.

Ugandan fishing plant saves water

**Background:** Ngege Ltd is a fish-processing factory near Lake Victoria in Uganda, whose products include chilled and frozen fish. The fish is collected from landing sites and delivered to the factory in insulated trucks. At the factory fish is graded, filleted, skinned, trimmed, chilled or frozen depending on the customer’s order. It is then packed, labeled and exported. Under instructions from the Directorate of Water Development (DWD), the national institution responsible for monitoring the use and quality of water the company was required to improve its effluent management by installing an effluent treatment plant so that discharge wastewater met national effluent discharge standards (1999). The company opted to first adopt Cleaner Production to improve its environmental performance.

**Water use before:** Water is extensively used in fish processing for the cleaning of raw fish, the washing of equipment, floors, and transport trucks, and for making ice. Water consumption before applying Cleaner Production measures was 11.8 m³ per ton of raw fish.

**Water use after:** Cleaner Production measures such as waterless cleaning, reducing cistern water volumes, installing pressure guns on hose-pipes, and ensuring overall preventive maintenance, reduced water consumption to 8.2 m³ per ton of fish.

More Cleaner Production measures are being implemented to further improve the quality of effluent and reduce the consumption of water during the fish processing. However, availability of funds is a limiting factor in implementing some of the identified water-saving technologies, such as installing a more efficient ice-making machine.

**Benefits Summary:** The 30.5% reduction in water consumption saved the company US$ 6,338 per year. The reduced amount of effluent with lesser contamination has, for the time being, obviated the need for installing an effluent treatment plant.

For more information contact the Uganda CPC at: ucpc@ucpc.co.ug or pmwesigye@ucpc.co.ug
An existing network of organisations and experts are available and ready to help. The key is the motivation and the will to make a change.

The Cleaner Production Centre (CPC) network exists and can facilitate change.

Under the UNIDO/UNEP National Cleaner Production Centre Programme 24 centres have been established. Many additional centres supported bilaterally and nationally exist all over the world.

The purpose of an NCPC is to build local capacity to implement Cleaner Production in developing countries and economies in transition.

NCPC’s target primarily to transfer know-how and not to transfer only technology. The Centres, and the Cleaner Production assessors trained by them train and advise their clients on how to find the best solutions for their own specific problems.

The Global Network of National Cleaner Production Centres

Where to go for more information

Production and Consumption Branch
Division of Technology Industry & Economics
United Nations Environment Programme
Tel: 33 1 44 37 14 40
Fax: 33 1 44 37 14 74
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