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Environmentally Sound Technology diffusion seen by UNIDO

UNIDO's HOLISTIC AND SECTORAL CP STRATEGY

Open trade, international investment flows, information technology and global environmental concerns are the key elements of the current multilateral order. New integrated concepts have to be applied to ensure progressive and environmentally sound development based on private sector-led productivity gains in developing countries and countries with economies in transition. The holistic and sectoral Cleaner Production (CP) strategy of UNIDO aims at providing efficient technical support to those countries and at assisting them in facing the challenges of the 21st century.

The CP strategy has been developed based on the long-standing experience UNIDO has obtained in promoting CP and the reforms UNIDO has undergone during the last years. Since 1992, UNIDO has established National Cleaner Production Centres and Programmes in 30 developing countries and countries with economies in transition. In total the programme has raised over 30 million US$, more than 60% from the main donor countries Austria and Switzerland. Cooperation with other UN organizations, e.g. UNEP, ILO, has been and will continue to be a major element of UNIDO's Cleaner Production Programme.

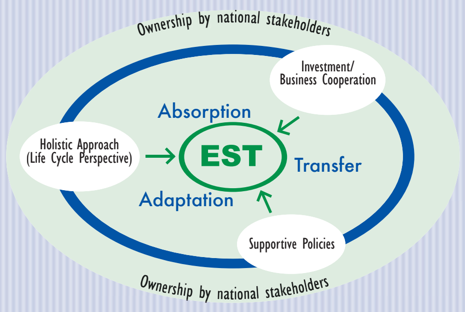
It concentrates on improving economy wide productivity in a sustainable manner and enabling developing countries and countries with economies in transition to expand their share in world trade and advance towards social improvement and poverty alleviation.

In order to reach the above mentioned goal, UNIDO's CP strategy focuses on the two areas of intervention where it has a competitive advantage:

- the diffusion of quality and productivity enhancing Environmentally Sound Technologies (ESTs) and
- market access through the fulfilment of the requirements of the international markets thanks to UNIDO's holistic and sectoral CP approach and a combination of CP and related elements (CP and quality, EMS, health and safety, labour and other issues).

EST diffusion

Integrating EST transfers in a broad perspective



THE DIFFUSION OF ENVIRONMENTALLY SOUND TECHNOLOGIES

The diffusion of ESTs is a key element for the improvement of productivity in a sustainable manner. It requires the integration of EST transfers in a broad perspective, integrating the following technical, financial and policy dimensions:

- **Life cycle perspective:** the extension of the traditional focus on the improvement of processes to the life cycle approach as developed in UNIDO's holistic and sectoral CP approach;
- **International business cooperation and investment promotion:** the effective transfer of ESTs requires the preparation of bankable investment projects, utilizing either the existing financial mechanisms or supporting the establishment of specific credit lines for EST;
- **Policy advice and technology dissemination:** the existence of incentives and supporting mechanisms is of crucial importance for the diffusion of ESTs. For these mechanisms to reach their maximum effectiveness, country specific Cleaner Production Programmes should be developed through participative mechanisms.

This also includes the integration of EST transfers at company level into a broader sectoral level and the elaboration of **national sector specific CP strategies** by the National Cleaner Production Centres.

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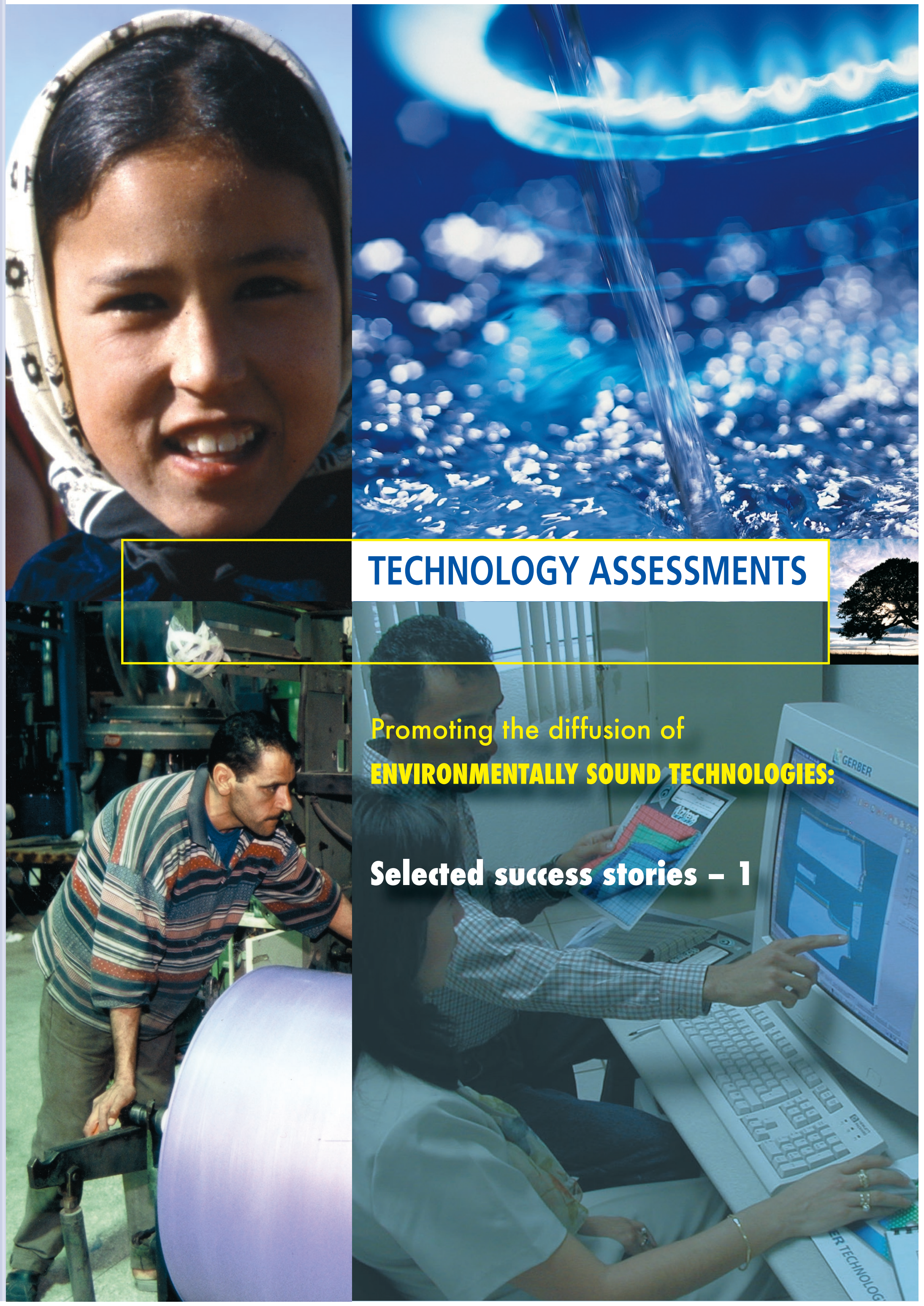
UNIDO CLEANER PRODUCTION PROGRAMME

one step ahead makes a difference



TECHNOLOGY ASSESSMENTS

Promoting the diffusion of
ENVIRONMENTALLY SOUND TECHNOLOGIES:

Selected success stories – 1

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
economy environment employment

Dir. princip.

RUSSIA
St. Petersburg
PULP AND PAPER SECTOR
Mr. A. Startsev

INTRODUCTION

Since its establishment in 2001, the North Western International Cleaner Production and Environmental Management Centre in St. Petersburg has been strongly involved in technology transfer projects, aiming both at reducing the environmental impact and improving the productivity of the involved companies.

The projects already completed by the Centre are covering the following sectors:
- Increase of energy efficiency (upgrading the technology of heating boilers, co-generators, pumps and valves);
- Automation of process monitoring;
- Treatment and reuse of liquid wastes (oil, chemicals and wastewater);
- Energy or material recovery from solid wastes;
- Pollution abatement with end of pipe technology (abatement of dust, nitric oxides and sulphur in the gaseous emissions from power plants, of COx in the emissions from vehicles).


The improved bleaching equipment.

TECHNOLOGY ASSESSMENT

The Centre recently concluded an Environmentally Sound Technology (EST) project in the pulp and paper sector, to implement a Total Chlorine Free (TCF) technology for pulp bleaching.

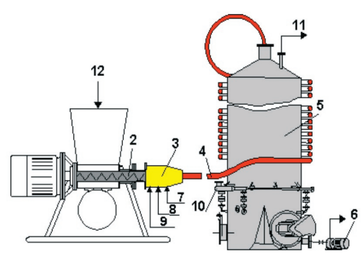
Usual approaches to the development of new technologies in this specific sector are typically based on the alteration of the chemistry of the process, replacing chlorine gas as bleaching agent by chlorine dioxide, oxygen, ozone, peroxides, etc. The new technology uses a different approach and further improves existing TCF technologies through a change in the physical conditions of the process. It consists in the combination of a specially designed thick stock pump and a mixing reactor of tubular type, which allows using gas instead of water as a transportation agent.

The basic size equipment requires an investment of 320,000 US$, with a payback period of 1.4 years. The technology change will lead to the following savings compared to currently used technologies (conventional process, Elemental Chlorine Free – ECF – and Total Chlorine Free – TCF –):

Per ton of product	Conventional process	Current ECF	Current TCF	Improved TCF
Water consumption	82	48	9,3	4,4
Energy consumption	4	3,9	4,2	1,9
Chlorine use	90	30	no use	no use
Net cost of pulp	290	245	300	220

DIFFUSION OF THE TECHNOLOGY

The same technology can be easily adjusted and implemented in different processes:
- Sugar industry, for sugar cane processing and transportation;
- Peat extraction;
- Processing and transportation of silt;
- Composting process of municipal solid wastes;
- Washing of fibrous semi-finished products.


Scheme of the physically improved TCF bleaching.

VIET NAM
METAL FINISHING SECTOR
Mr. Tran Van Nhan

INTRODUCTION

The Viet Nam National Cleaner Production Centre (NCPC) conducted the present study after a Cleaner Production (CP) in-plant assessment in a wire production company. As the implementation of the good housekeeping measures identified during the assessment phase could not realize the entire CP potential of the company, a technology assessment was then conducted. The implemented technology was compared to state of the art technologies, adapting benchmarks to local conditions. The final choice of the technology was based on the evaluation of its technical, economic and environmental feasibility.


The Viet Nam NCPC Team

TECHNOLOGY ASSESSMENT

The first purpose of the study was the complete redesign of the production line, focusing on the wire heat treatment. The state of the art technology was identified: batch annealing in an hydrogen atmosphere, which avoids the use of lead baths required for continuous annealing technologies.

The coating technology has then been compared to three different state of the art technologies (named A, B and C) and to the EU BAT report, itself based on a survey of European wire galvanizers. All alternatives have been referred to the actual production capacity of the plant. The results of the comparison show very different energy and material consumption rates per ton of product, as can be seen in the table below:

	EU BAT	Current	A	B	C
Method	Hot dip	Electroplating	Electroplating	Hot dip	Hot dip
Coating energy (kWh)	180 – 1,000	480 + 0.75 kg coal	450	194	288
Annealing energy (kWh)	n.a.	236	n.a.	419	241
Total energy (kWh)	n.a.	727	714	663	572
Water (l)	700 – 6,000	700	532	8,100	727
Acid (kg)	10 - 100	50	0.4 – 0.5	12.5	12
Zinc (kg)	15 - 150	Anode: 46 Electrolyte: ?	Anode: 25.2 Electrolyte: 9 l	50	50
Spent acid (l)	5 - 100	12	5	n.a.	n.a.
Investment	-	-	1,450,000	514,000	712,000
(US$ per 10,000 t/y)	-	-	4.9	2.5	2.9

The table shows that technology A performs better than technologies B and C regarding acid and water consumption, but it requires more energy.
From the overall comparison, the company selected technology C as the most suitable for the conditions in Viet Nam: the better environmental performance of A does not justify its preference over the least expensive option C.

BENEFITS

The change to technology C will bring the following environmental and productivity impacts. It should be noted that the calculated payback time of 2.9 years doesn't take into account the improved product quality (fulfilling international quality standards), which will allow the company to sell it at a higher price and get additional profit.

	Variation
CO_2 emissions	- 20 %
Acids use (depends on annealing gas)	- 50 to - 80 %
Water consumption	- 10 %
Production capacity	+ 20 %

COSTA RICA
AGRO-INDUSTRIAL SECTOR
Mr. Sergio Musmanni

INTRODUCTION

The National Cleaner Production Centre (NCPC) Costa Rica started working in the palm oil sector in 2000, with an integrated programme during which Cleaner Production (CP) in-plant assessments were conducted in several companies.

At that time the low worldwide prices for vegetable oil resulted in low investment capacity for the companies. A broader approach to this service was thus taken, looking for alternative higher value uses of the oil, with the purpose of decreasing the dependence of the farmers from the price variation of the vegetable oil. Several options were initially identified (production of solvents, lubricating oils and fine chemicals) and the Centre decided to focus on a product with high volume potential: biodiesel. A pre-feasibility study of the use of palm oil as a renewable alternative energy source started in 2001 and a feasibility study, funded by the Ministry of Science and Technology, followed in 2002.

TECHNOLOGY ASSESSMENT

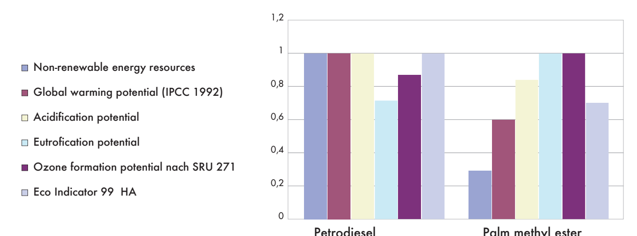
The reviewed technologies included several continuous flow and batch mode systems. The selected technology must accommodate to different raw material compositions with minor modifications to the operational settings and low effects on the final product. This will allow the system to use palm oil, fatty acids and refused oil, as well as other oils and fats available. It is important to have a modular solution to accommodate for potentially increasing demands.

The identified technology consists in a transesterification unit working in a batch mode. It includes catalyst preparation units, stirred jacketed reactor, phase separation vessels and control panels.

BENEFITS

The project will bring the following benefits:
- Social: improvement of the social conditions for palm oil farmers by granting higher stability to their operations;
- Environmental: switch from fossil to renewable energy source, resulting in
  - Significant reduction in the emissions of green house gases like CO_2 sulphur dioxide (acid rain), NMVOC (non methane volatile organic compounds), CO and particulate matter;
  - Zero net CO_2 emissions throughout the biogenic cycle as the palms grown in the plantations recover the combustion gases;
- Functional: The properties of biodiesel are such that the engines run smoother and the lubricating properties of the fuel are enhanced, resulting in better conditions for the engines.

The graph below shows the results of a Life Cycle Analysis comparison of petrodiesel with palm methyl ester, bringing to the fore the main environmental benefits of biodiesel namely the reduced use of non renewable resources and the decreased global warming potential.



Study performed on EMIS by S. Koch under the guidance of F. Dinkel from ETH Zurich

DIFFUSION OF THE TECHNOLOGY

The biggest barrier to the diffusion of this technology are the following:
- Investment costs: the construction of the foreseen 10,000 tons plant would require an investment of 4 million US$;
- Sensibility to raw material cost (86 %), crude palm oil and international diesel price.

Several conditions are thus requested to assure the viability of the project:
- Tax breaks and incentives. A tax free scheme for biodiesel could allow for the reallocation of 15 to 20 million US$ nationally, to be invested in rural areas of the country;
- Land scheme, in which a portion of the plantations is allocated to non-food uses and dedicated to renewable fuels on a normal basis;
- Glycerine sub-product selling for maximum resource use and economics.

This shows the importance of policy issues and the essential role of the involvement of various stakeholders, including national and local authorities, in the successful implementation of such a project. In the long term, additional chemical modifications leading to the production of other value-added products would be advisable.