CLEAN AND SUSTAINABLE PRODUCTION

ASEM SUCCESS WORKSHOP

June 5-7, 2002, Shangri-la’s Mactan Island Resort
Cebu, Philippines

ABSTRACTS
INTRODUCTION

"Clean and sustainable production technologies" was one out of four topics presented at the ASEM S&T Ministerial Conference in Beijing 1999. Preceding the ministerial conference, Malaysia, Korea, and Thailand on the Asian side and Denmark and Austria on the European side participated in the 1998/99 preparatory working group on "Clean and sustainable production technologies", Austria taking the lead.

As follow up of the S&T Ministerial Conference Austria agreed to build up an "ASEM Focal Point – Clean and Sustainable Production" in order to promote the scientific and technical exchange on sustainable development strategies in Asia and Europe. In 2000, The Austrian Ministry of Education, Science and Culture commissioned JOANNEUM RESEARCH /JOINTS to implement this Focal Point with the following long-term objectives: to create interest in an exchange of know-how between Asia and Europe concerning technologies and methods; to make European Good Environmental Practices known in Asia and vice-versa; to support the creation of an ASEM-wide network, to prepare future research programmes and projects focused on strengthening economic ties between Asia and Europe.

During the Pilot phase of this Focal point, the existing Good Environmental Practices Network (GEPnet) has been extended to ASEM countries, the "state of the art" in selected ASEM countries with regard to “Clean and Sustainable Production”(CSP) and preventive technologies has been identified, training material elaborated and methods for implementing sustainable regional development activities in selected ASEM countries have been compared.

Considering this previous engagement and in the aim to boost the ASEM S&T co-operation process, the European Commission (DG Research) assigned to JOANNEUM RESEARCH/JOINTS the task to organise the so-called “ASEM CP SUCCESS Workshop”. In cooperation with the "Asia-Pacific Roundtable on Clean Production " (Philippines), this workshop was held in Cebu/Philippines from June 5 – June 9, 2002 with more than 40 participants coming from Japan, Philippines, Singapore, Taiwan, China, Indonesia, Malaysia, Thailand, Korea, Viet Nam, Denmark, Portugal, Austria, Germany, the European Commission and the United Nations.

The aim of the workshop was to bring together experienced Asian and European research experts in the field of Clean and Sustainable Production (CSP) (entrepreneurs, civil servants, scientists, policy makers…). In a process of common discussion, strategies were to be formulated and possibilities for co-operation and networking identified for the future implementation of CSP policies on a bi-regional level ("Asia-Europe Think Tank on CSP").

As the main result of the Symposium, the Cebu Declaration on ASEM CSP Science and Technology Cooperation was approved.

The workshop was composed of plenary sessions, keynote presentations and thematic discussion working groups on Biotechnology, Dissemination Strategies, Energy, Innovation, EMS and Ecodesign. Necessary public and private framework conditions and policies for a successful introduction and dissemination of Clean and Sustainable Production systems have been identified for different thematic fields; Variable key elements of these framework conditions have been discussed as well as the specific European and the specific Asian context (if there is any) regarding dissemination chances and barriers, and actors have been identified for enhancing policies on CSP in the public and private field.
# CLEAN AND SUSTAINABLE PRODUCTION

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I. Introduction

The best approach to improve the environment is to prevent the generation of pollution rather than to find ways to clean it up after it has been generated. Biotechnology can be used to explore approaches to problem solving for cleaner production and sustainable environment.

Both biotechnology and the environment cover huge areas. Together, however, we can find ways to utilize the former to help find solutions to maintaining and improving the latter.

Before I discuss the benefits of biotechnology to the environment, let me first provide you with some basic principles of modern biotechnology.

II. Basic Principles

Biotechnology is nothing new. It is as old as civilization and has helped man in various ways.

DNA or deoxyribonucleic acid is a nucleic acid that contains the sugar deoxyribose and is found chiefly in the nucleus of a cell.

A gene is a length of DNA at a specific place on a chromosome. It is the natural unit of heredity.

Biotechnology is a set of scientific tools using living organisms (microorganisms, plant or animal) or their parts to produce useful products for medical, agricultural, industrial and environmental applications.

Genetic engineering or modern biotechnology, on the other hand, is one of the more advanced scientific techniques in biotechnology. It refers to all techniques that permit moving genes quickly from one organism to another, often from one species to another, to produce new or novel organisms.

A genetically modified organism or GMO is an organism that possesses a gene that has been transferred through genetic engineering.

III. Potential Benefits of Biotechnology to the Environment

One biotechnological approach that offers potential benefits to the environment is the use of genetically-modified (GM) or transgenic crops to produce more food.

1. Higher Yields through Use of GMOs Decrease Need to Convert Forests and Habitats into Farmlands

GM crops can significantly improve crop yields, so that more food can be grown on less land area, thus decreasing the need to convert forests and habitats into farmland. As shown in the table below, results of econometric research using 1997 data show, controlling for other factors, a statistically significant relationship between increased yields and increased adoption of herbicide-tolerant and insecticide-resistant crops, although in one case the effect is small.
Econometric Results on the Impact of Adopting Herbicide-Tolerant and Insect Resistant Crops

<table>
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<th>Herbicide-tolerant soybeans</th>
<th>Herbicide-tolerant cotton</th>
<th>Bt cotton</th>
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<tbody>
<tr>
<td>Change in yields</td>
<td>small increase(^2)</td>
<td>increase(^3)</td>
</tr>
</tbody>
</table>

\(^2\) Small increase is less than 1% change for a 10% change in adoption.
\(^3\) Increase is more than 1% change but less than 5% change for a 10% change in adoption.

- Increases in the adoption of herbicide-tolerant cotton are estimated to have led to significant increases in yields.
- Increases in the adoption of Bt cotton are estimated to have led to significant increase in yields.
- Increases in the adoption of herbicide-tolerant soybeans are estimated to have led to significant (but relatively small) increases in yields.

2. Reduced Soil Tillage

Agriculture as practiced now leads to erosion. Tillage causes huge losses of topsoil to the seas. Plants with herbicide tolerance may lead to environmental benefits by facilitating a shift to conservation tillage practices. Specifically, these crops may allow farmers to eliminate pre-emergent herbicides that are incorporated into the soil and rely on post-emergent herbicides, such as glyphosate. The shift to post-emergent control of weeds may promote no-till and conservation tillage practices that can decrease soil erosion and water loss and increase organic matter.

3. Reduced Use of Chemical Pesticides

Chemical pesticides are unique substances. Designed to kill or damage living things, they are "perhaps the only toxic substances that are purposely applied to the environment".

a. Harmful effects of pesticides

It has been scientifically proven that pesticides cause a wide range of health problems. In her best-selling book Silent Spring, Rachel Carson not only described how these pesticides were contaminating the natural world, she also documented how these chemicals were accumulating in our bodies and causing various forms of cancer. Our Stolen Future by Theo Colborn, Dianne Dumanoski and John Peterson Myers provides a vivid account of emerging scientific research about how a wide range of man-made chemicals including pesticides disrupt delicate hormonal systems resulting in: low sperm counts, infertility, genital deformities, cancer of the breast and prostrate gland, neurological disorders in children, and reproductive problems.

A study conducted in the US by the Northwest Coalition for Alternatives to Pesticides shows the heavy usage of common pesticides with health hazards.

Use of Common Pesticides with Health Hazards
Consider pesticides that are carcinogenic. Epidemiological studies demonstrated associations between increased exposure to frequently used pesticides and an increased risk of cancer. As shown in the figure below, such pesticides promote the formation of the “bad estrogen”, 16-α-hydroxyestrone, which has been linked to breast cancer.

Use of Common Pesticides with Effect of Pesticides on “Good” and “Bad” Estrogen in Breast Cancer Cells

Pesticides have a variety of effects on reproduction. In exposed people, certain pesticides cause birth defects, miscarriages, and reduced fertility. Reproductive effects can occur in males, females, or both. Nine (9) of the most commonly used pesticides in the US have been discovered to have caused sperm abnormalities, reduced sperm count, dysfunctional male hormones, and damaged male reproductive organs. On the other hand, seventeen (17) of these most commonly used pesticides have caused decreased pregnancies, a reduction in the number of living offspring, and reduced birth weights.

Pesticides cause special problems for children. Relative to their size, they consume more food and drink more water than adults, and both of these are at risk to pesticide contamination. Their behavior – crawling, playing outdoors, and putting things in their mouths – expose them to contaminants. A study by the US National Research Council estimates that everyday, over a
hundred thousand two-year olds consume more than their government’s “acceptable levels” of a common group of neurotoxic pesticides.

Pesticides are particularly hazardous for farmers. The US Environmental Protection Agency estimates that between 10 to 20 thousand pesticide-related illnesses and injuries occur among farmers every year; the same agencies believes that these numbers are underestimates of the true statistics. Certain localized studies have shown that the use of phenoxy herbicides and organophosphate insecticides is associated with an increased risk of lymphoma, leukemia, brain cancer, and testicular and prostrate cancer among the rural population.

Data gathered in China on poisonings due to pesticides is shown below:

<table>
<thead>
<tr>
<th>Variety of Cotton</th>
<th>Insecticide Load (kg/ha)</th>
<th>Insecticide Poisonings Reported (% of farmers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only Bt</td>
<td>10.3</td>
<td>4.7</td>
</tr>
<tr>
<td>Bt + Non-Bt</td>
<td>29.4</td>
<td>10.8</td>
</tr>
<tr>
<td>Only Non-Bt</td>
<td>57.8</td>
<td>22.2</td>
</tr>
</tbody>
</table>

Pesticides often contaminate food. The widespread use of pesticides in agriculture means that pesticides are frequently found on a variety of common foods. A recent study by the US Department of Agriculture shows that 67% of fresh fruits and vegetable samples tested were contaminated by at least one (1) pesticide. Worse, certain crops are contaminated even more frequently and at higher dosages. This has been discovered in certain fruits, grains and cereals.

Pesticides contaminate water and air. The US Geological Survey (USGS) found that all samples analyzed from their major rivers were contaminated by at least one (1) pesticide. Smaller bodies of water were almost as frequently contaminated: 99% of urban streams and 92% of rural streams; 50% of wells in the urban areas and 60% of wells in the rural areas. The same bleak picture is seen in air. The USGS found in its national monitoring study that the insecticide diazinon contaminates almost 90% of the samples tested, while the insecticide chlorpyrifos almost 70%. The two most common herbicide contaminants were 2,4-D (in almost 60% of the samples) and trifluralin (in almost 50% of the samples).

IV. POTENTIAL OF BIOTECHNOLOGY TO CONTRIBUTE TO CLEANER PRODUCTION

**Biocatalysis** - More efficient processes catalyzed by enzymes or microorganisms

**Use of Renewable Feedstocks** – Biomass as a source of renewable energy and chemicals

**Abatement** – Limiting the spread of pollution through biologically mediated processes

**Remediation** - Biologically mediated clean-up and restoration of existing
Advanced molecular biology techniques can be used to improve the catalytic function of enzymes. Metabolic engineering can also be used to design animal, plant and micro-organism cells so that steps for the production of a particular chemical occurs efficiently within the mini reactor – the cell.

Examples:
- Production of succinic acid from glucose. Succinic acid is the raw material for other chemicals with a combined market of US $1 billion.
- Production of a high-performance polyester from glucose. The resulting polymer can be recycled back into the monomer so that it can be recycled almost indefinitely.
- Production of biodegradable plastic.
- Bioleaching and bio-oxidation in the mining industry to replace high temperature processes such as roasting and smelting.

Biotechnology has the potential to help reduce fossil fuel consumption through production of ethanol and methanol. The Royal Dutch Shell Group predicts that by the middle of the 21st century, biomass will supply 30% of the global market for energy and chemicals. This is estimated to be an renewable annual feedstock market of US $ 150 billion.

Biotechnology can help minimize pollution through utilization of novel processes. For example, microbial processes have been developed to remove sulfur from petroleum. Compared to the conventional process, the biological process uses less energy. In the agricultural sector, use of biofertilizers, e.g., nitrogen fixing bacteria, reduce the need for additional chemical fertilizer. Enzymes have been used for a variety of processes which result in performance of the desired function with less environmental impact, e.g., lipases and proteases added to detergents to clean clothes in cold water instead of hot water and enzyme additives to increase digestibility of feeds.

Wastes can be converted into useful products through biotechnology. Waste organic matter can and has been converted to methane and the methane utilized as an energy source. This has been demonstrated to work at Maya Farms here in the Philippines.

V. Reasons for Low Acceptance of Agri-Biotechnology in Europe
- Little difficulty in meeting its food requirements.
- Relatively lower confidence in regulatory agencies as compared to the U.S.A.
- Strong environmental lobby favoring organic and traditional farming.

VI. Other Challenges to Industrial Biotechnology for Cleaner Production
- Novel processes often require high capital expenditure and development costs which can outweigh reductions in product costs.
- The traditional education of personnel in the supply chain, i.e., chemists, engineers, and plant managers does not include biological processes. Retraining and reorientation in biotechnology may be needed.
- Biotechnology development companies are mostly small and have difficulty attracting investments.
VII. Addressing the Challenge

There is need for sustained support for strategic research in university, government and industrial laboratories.

There is need for measures to support technology transfer, industrial innovation and skills development in biotechnology.

There must be commitment by the stakeholders to biotechnology demonstration, performance assessment and process validation.

There is need for increased awareness of all stakeholders on the potential of biotechnology to contribute to cleaner production and environmental sustainability.

There is need for leadership in both the government and private sectors in the promotion of biotechnology and provision of direct investments.

VIII. The Final Hurdle

When there is resistance to and low acceptance of biotechnology in some sectors, there is need to clarify science-based arguments on the pros and cons of this new technology. Biotechnology advocates tend to emphasize the advantages of the technology. People who are against biotechnology tend to emphasize their fears. Science-based discussions are needed to obtain the pulse of the middle ground. Only when consensus is obtained regarding the acceptability of biotechnology can policies and enabling mechanisms proceed with speed and confidence.

Ben Peczon can be contacted at:

E-mail address : bdpeczon@unilab.com.ph
Tel. No. : (63-2) - 637-9146
Fax No. : (63-2) - 635-7465
EMAS standards for the Eco-Audit and Management Scheme. It is a voluntary scheme for industry introduced by European Commission (EC) in 1993. EMAS is a regulation of the EC and open to countries in the European Union and the European Free Trade Association.

To participate in EMAS, a company must adopt an environmental policy, review environmental performance at site in question, develop an environmental management system (EMS) and develop an action plan based on the review findings, audit the system and publish a statement of performance of the site. A qualified third party checks the system and the statement to see if they meet EMAS requirements.

Companies which are successful in meeting EMAS requirements are improving environmental performance on a continuous process, complying with government regulations, practicing pollution prevention principles, publishing environmental performance information to the public, and have full support and commitment from the top management.

In general, companies which have an EMS certified to the ISO 14001 standard can meet the EMAS requirements. The main difference is that EMAS has a strong focus on provision of information to the public, communication and environmental performance. The revision process of EMAS involved different representatives from industry to government to environmental organizations and took place in year 2000.

Dr. Shen-yann Chiu and Mr. Raymond Leung can be contacted at:

E-mail address :  chius@ema.org.tw;  raymond@ema.org.tw
From the industrial organisation to the innovative organisation: innovation as driving force of sustainable development

By: Eurico Neves
Printinova Lda / University of Porto/Portugal

It’s a curious thing that in a world that its changing so fast, when we think about “industrial success” we still think large scale, we still think big, well established and traditional. But in a society where sustainable development as become the only valid road to progress, the real success cases are not represented by big industries anymore. Success today is not measured in size, but in attitude. Paraphrasing Father Brown, the father-detective created by G.K. Chesterton: “There are big companies that make us feel small, but the real big companies are those that make us feel great”. And those that make us feel great are the ones that use innovation as the driving force of their sustainable development.

The “gurus” of today’s economy have “diagnosed” an illness which affects companies unable to survive and innovate: “strong short-sightedness of its managers”, as the incapacity to see clearly at a distance and to previously define the most correct strategies for the leading companies. When we speak about the lack of innovation, we are surely dealing with a sight problem, but personally I think that above diagnose can often be wrong. Even though one has 20-20 vision, it’s still very difficult to look at the future and “see” innovations. What we may see, at best, are the innovative solutions that others, more dynamic and attentive than we are, have used to solve their problems in a due time – and such solutions may very well not serve for our problems. And even if they do, we'll always be late. Real innovations, those that will contribute to our development and give us real advantages, are often not those we just can make out on the horizon, but those in front of us and that we don’t even notice. It’s for this reason that the sight problem of the managers, which implies a lack of innovation in their businesses, it’s mostly a problem of tired eyes – the incapacity to see what surrounds them. The incapacity, for instance, to realise that innovation lies on the people with whom they work every day – may they be employees, clients or suppliers – or in the processes and markets they constantly manage.

Innovation in People & Partnerships:

In the knowledge era where we live, many of the industrial companies are still beginning to learn about Human Resources management. At last? No, too late.
It is still common to hear today that a company's human resources constitute a “fundamental strategic factor”. But the management of human resources it's not really a strategy – its a simple defensive tactic.

Nicholas Negroponte in his office at the Media Lab of MIT says, in his famous book “Being Digital”, that within 25 years the best employer of the world will be “self”. That will certainly be a change from the current status. And like Gary Hamel has said, “It’s a big mistake saying that change must originate from the top. Never did the monarchs establish a Republic”. Change is a revolutionary process. A process that has certainly already started and that according to Negroponte, will be almost completed in 25 years. By then, each republican will be the king of his own reign.

And what is the position of traditional industrial companies today regarding this? Well most are even not aware of it and do nothing – one of the biggest industrial groups in Portugal, for instance, with over 5,000 employees has only 2 people working in Human Resources – while the most alert try to fight it as hard as they can. The current function of human resources in most companies nowadays is just to delay the “self” revolution – to produce the best arguments in favour of the maintenance of the monarchy. Not an easy task, one must agree.

But there are innovative companies as well – and in those the Human Resources function is that of influencing the revolutionary spirit inside each republican in order to call for its
entrepreneurship potential, and make it fight for our cause. Those who act this way know that the only way to survive in the “self” economy is to create a network of alliances between small and big reigns. This is what the good old kings did (for this reason they resisted for a long time). For each successful war sacrifice required to his warriors, they would confer some land and some privileges. In today’s business wars one must do the same, and in this way to gain a strategic partner, a supplier, a client or, more than that, a pair.

Organisations that follow such a strategy are those that have learned to grow as “stars” instead of “pies”. A “pie-type” company just adds new layers in its growth, always keeping the decision power in its centre, and thus being further pushed away from its clients with any new layer. A “star” company, on the contrary, opens a new angle for each new market opportunity, investing in people and making them partners.

Some companies are using this strategy with success and growing fast and in a sustainable way. Others, unfortunately continue on their way, trying to control their “kalashnikovs” armed republicans with just a carrot and a stick. Good luck to them.

**Innovation in Processes & Relationships**

Another of he most important worries of industrial managers today is about process improvement, and in particular about about quality.

One of the best innovators in Portugal, the poet, painter and novelist (amongst other things) *Almada Negreiros*, once said: “Eternity do exist, but not so slow”. As far as quality is concerned, the quality professionals are also rapidly concluding that: “Quality must exist, but not so slow” and not has it has been managed until now.

The chimera of quality, in which all the companies launched themselves, brings us today to care so much about details that even a company as Xerox takes no less than 6 months to implement quality methodologies in new products. At the rate things are moving today, the new product can be outdated by then. As we perfectly know, in today’s instantaneous economy the markets no longer wait. This is a reality in strong contrast with the situation of the 40’s, from when the ISO 9000 norms date.

Quality, originally considered as a strategic weapon of small, innovative companies in order to attack the fiefs of the most important business colossus, has now turned into an heavy defence armour. In the name of innovation, it’s time to take quality from the interior of the companies and place it in the front line, that is, to use it where it’s more important, in the battles against competition, in the direct relationship with the clients and mainly in the place occupied by the company in the world, in particular in the social and environmental domains. The quality of a company cannot be measured according to the way the work is done inside the company, how people class files or open projects. In this sense companies have gone too far and now it’s time to stop. The quality of an innovative company must be measured according to its relationship with the outside world, namely its attitude towards the environment and the social position it occupies. The quality of the products has already been guaranteed to the customers, now they want quality of life. And organisations should start thinking about giving it to them, by targeting their innovation and process improvement effort at things that really matter as environmental or social aspects.

*It’s the end of the (industrial) world as we know it – and I feel fine*

The industrial world as we knew it for many years and that was characterized by traditional organisation systems, rigid hierarchies, few partnerships, focused exclusively on internal process improvement and with poor concern for environmental and social aspects - in few words, without innovation – is ending. It’s time to change from industrial organisations to innovative organisations.

The temptation of innovation has lied permanently with industrial managers, but the fear of risk, the fear of change, the fear of instability – in short, the fear of living – has prevented many from taking it. But now is definitely the time to follow Oscar Wilde’s advice: “I can resist anything, except temptation” and follow the innovation as the only one leading to sustainable development.
Eurico Neves can be contacted at:
Printinova Lda
Rua Afonso Cordeiro, 877, sala 201, 4450-007 Matosinhos, Portugal
Tel.: +351 22 9396350; Fax: +351 22 9396351;
e-mail: eurico.neves@printinova.pt
Dissemination of Clean and Sustainable Production

By: Prof. Hans Schnitzer
Joanneum Research, Austria

**Marketing strategy for CSP in Europe**

The application of clean production technologies has faced wide application mainly in large companies. They have the knowledge and manpower to drive innovation and efficiency within their own resources and the money to hire consultants and to promote research. The dissemination of Clean and Sustainable Production towards small and medium sized enterprises all around Europe and to third party countries on the other hand is a task for intermediates. So it is a matter of fact that information and marketing activities have to be planned in a way that the message comes via the intermediates to the end-users which are mostly SMEs.

The authors would like to remark that efforts have to be done in both directions. First of all activities towards motivation of ‘intermediates’ to join idea are necessary. Secondly strategies towards information transfer to the final consumer (which are definitely SMEs) have to be applied.

The authors also assume that if awareness in SMEs towards CSP is high the motivation for intermediates to provide the requested information increases. So the problem will be tackled from both sides – top down and bottom up.

For the purpose of developing appropriate strategies we would like to use a concept which is well known in marketing called the ‘diffusion of innovation’. This concept helps to understand mechanisms of dissemination and acceptance of innovations and gives valuable hints towards an effective information transfer.

The potential consumers can be divided into 5 groups which are illustrated in figure 1 and described in the following paragraphs.

- **Innovators (2-3%)**
  Members of this group are generally easily persuaded to adopt new ideas. They are eager to take some risk and have usually the resources necessary to take this risk.
- **Early adopters (13-14%)**
The members of this group are also open to new ideas but tend to be closer to the ‘mainstream’. Though they are open for innovation they are more risk averse. This is also one reason why this group is more respected by the majority of the population, a fact which helps in further diffusion. As this group is often considered to hold an informal leadership it is a very important group in the concept of innovation diffusion.

- Early majority (~34%)
The members of this group are usually well informed but risk averse, so they wait until the effectiveness of new technologies is proven by others. Nevertheless this group is afraid of being left behind the competitors. The adoption of innovations by the early majority often coincides with a dramatic increase of adoption generally.

- Late majority (~34%)
The members of this group are traditionally sceptical of change. Usually they wait with adoption of innovations until change is necessary and certain pressure is given to do so.

- Laggards (~16%)
The members of this group are more oriented to the past and do usually not have proper communication capabilities. They are somehow isolated and therefore more interested in maintaining status quo.

The percentage in brackets indicate the distribution of the single groups. For our purpose only the order of magnitude is of interest and not exact figures.

Generally experience proved that after exceeding an adoption rate of 10-15% the rate is increasing rapidly even without additional marketing activities. On the other side experience proved that an adoption rate of 100% is almost impossible.

Therefore marketing strategies have to be developed which focus more on the ‘innovators’ and ‘early adopters’ in order to gain momentum for the whole system. So the development of marketing strategies relies on the basic attitudes of the above described groups. The following paragraphs outline how the ‘innovators’, the ‘early adopters’ and the ‘early majority’ should be approached in the further dissemination of GEP. It has to be mentioned that.

**Communication strategy for innovators**

As already mentioned above this group tends to be very open to innovation. Though the authors are aware of the fact that this group is from its number rather small the ‘innovators’ are considered as a very important group for further progress of dissemination. These ‘innovators’ should be used as kind of crystallisation nucleus for further dissemination.

- Direct personal contact
In this area mainly those companies should be contacted who conducted already activities in the field of Cleaner Production in previous programmes (PREPARE projects in various countries, PRISMA in Netherlands, ECOPROFIT in Austria, etc.). These projects involved on the one side quite a lot of consultants, industry representatives, authorities, etc. who could now serve as valuable multiplicators. These actors are well known and to some extent already partners of the “CP-roundtables” in Asia and Europe. The near future should be used to contact those organisations which did not to date but are well known from previous project reports. On the other hand there were numerous companies who already proved the effectiveness of CSP. These companies should be contacted and motivated to join and contribute to its development actively by providing know-how and expertise.

- Mailing to well known companies
As there are already existing networks of companies these companies should be invited to join and support the network with their expertise and experience.

- Advertisement in specialist periodicals
In order to motivate ‘innovators’ to join also the way via specialist periodicals seems promising. Therefore the group should articles in management journals and general technical journals.

- Presentation at conferences and trade fairs
It is a matter of fact that ‘innovators’ are curious to learn about new technologies. Therefore they attend conferences, meetings and trade fairs presenting innovative technologies. These events will be utilised in future to introduce the CSP activities of ASEM.
Communication strategy for ‘early adopters’

As already mentioned this group consists of companies which are eager to implement new technologies as soon the risk is assessable. Therefore they need instruments different to the above mentioned for the ‘innovators’. The instruments which will be used for the ‘early adopters’ can be described as follows:

- Advertisement in journals
  Whilst the ‘innovators’ will be approached more in general journals (management, economy, technology) the ‘early adopters’ will be approached in specific journals. The strategy will be to describe success stories in different branches in close connection to the information system where this information can be obtained.
  Therefore those journals will have to be identified which have the highest credit as reliable information sources. This investigation will have to be done on both levels on national as well as international level.
- Communication via consultants-networks
  It was already mentioned above that CSP-ASEM should and will utilise existing initiatives to promote the dissemination of clean and sustainable techniques. Several opportunities were already identified. The identification of new ones will be matter of a marketing offensive.
- Communication via supporting organisations
  It was already mentioned that the ‘early adopters’ are open for new technologies but try to minimise the risk connected to implementation. One possibility to reduce risk is to apply for funding.
  Therefore funding organisations were also identified as important intermediates so that a special focus will be set on the involvement of these organisations.
  In further course these organisations should transport the knowledge about CSP respectively information sources to the companies they are dealing with.

Communication strategy for ‘early majority’

Though traditionally well informed the members of this group can not decide to implement innovative technologies before they are proven to be successful.

In this case the authors assume that sector organisations and local authorities will play an important role as they have access to a multitude of companies. Definitely there is also a need for training for the authority and sector organisation representatives.

- Communication via branch organisations
  In a previous step those branch organisations will have to be identified which are already active in the field of preventive environmental protection. For those organisations not familiar with the approach special seminars, papers and contributions to sector specific meetings will be provided.
  After this the sector organisations should transport the information about CSP to their members.
- Communication via authorities (e.g. licensing procedures)
  After the implementation of the above mentioned training course the representatives of local and regional authorities should transport the know-how to the companies.

Communication strategy for ‘late majority’

The ‘late majority’ is no target group for the initial phase of offensive marketing. The authors start from the assumption that this group can be reached by the multiplication effect after motivating the groups 1-3.

Those which are not attracted by the success of the multiplication phase will have to be approached with a new marketing mix to be defined after the evaluation of phase 1.

Communication strategy for ‘laggards’

It was already stated above that the team does not assume to cover a range of 100%. As the network idea is carried by the idea of active participation and these companies are traditionally reluctant the authors do not count them as target group.

Generally it can be stated that the marketing activities planned for the years will attract mainly the companies belonging to the groups 1 (innovators) – 3 (early majority). The authors expect that a critical mass can be reached which make ASEM-CSP in future to a self carrying system.

Prof. Dr. Hans Schnitzer can be contacted at:
Dissemination of Cleaner Production in Asia

By: Dr. Olivia la O’ Castillo
Asia Pacific Roundtable for Cleaner Production (APRCP), Philippines

COUNTRY APPROACHES TO CP *

Upward diffusion: Ratification of the UNEP International Declaration on CP; Adoption of national CP policies; Development of national CP action plans; Partnerships with industry peak bodies and non environment, industry and technology agencies and; Establishment of national CP funds (or more generic sustainable development funds - ‘green funds’).

Downward diffusion: Involvement of local governments, municipal authorities, and non-governmental organizations; Partnerships with industry and business; Launching of waste minimization circles (or CP clubs) and; Establishment of local/regional CP support centers.

Lateral diffusion into new sectors: CP introduced at the municipal level; CP applied to service sectors, such as tourism, and applied to primary production, such as mining, minerals processing, agriculture and fisheries; Industrial parks designed on the CP concept; CP applied in the design of buildings and; CP introduced in new production, such as fruit production and manufacturing of building materials.

Lateral diffusion into new tools applied to promote CP: Environmental and sustainability reporting; Eco-labeling; Environmental Management Accounting; Education at primary, secondary, and tertiary levels; Financial incentives; ISO 14000 certification; Technical assistance etc.

CP Initiatives at a National Level*

At the national level, several countries, including Australia, China, India and Thailand, have signed the UNEP - launched International Declaration on Cleaner Production as a framework for adopting national policies and programmes on CP. For example, CP has been recognized as the preferred environmental strategy for environmental management in China’s 9th National Five-year plan, in Indonesia’s Cleaner Production Strategic Plan, in Korea’s Environmental Policy, and in Sri Lanka’s National Environment Action Plan.

So far only a few countries (e.g. China and Vietnam) have adopted some kind of national CP legislation. However, in many countries (Australia, Malaysia, Philippines etc) several policies and acts (environmentally oriented but also related to industrial development and natural resource use) have been adjusted to include as a central element the preventive approach to resource management, which in many cases is synonymous with CP.

Several countries, including Indonesia, Philippines, Thailand and Vietnam have developed national action plans where concrete actions and goals are outlined for implementation over the next few years. Several countries have also established national CP centers (China, India, Sri Lanka, South Korea and Thailand) or launched national CP Roundtable organizations, for example in India and the Philippines.

CP Initiatives on Local Level*

• The institutional capacity, which usually is first initiated at the national level, has gradually been strengthened at the local level too. In India and China regional (local) CP centers have been established and in other countries, e.g. in Australia, tailor-made training programmes for local government environmental health officers have been developed. In addition technically qualified “Key resource persons” have been selected in each sub-region in individual states in India to undergo further training so as to be able to better support CP activities at the local level.
In some countries the civil society has, through various NGOs, taken on a prominent role in promoting CP. This includes efforts by community-level groups, e.g. in the Philippines, to identify conditions that will make local business decision-makers change their behavior and to adopt CP, and to increase awareness about CP among various stakeholders by gathering them in small strategic groups and assisting them in defining goals and objectives for their operations.

Partnerships between industry associations and environmental authorities have been launched at state level in several countries including Australia, Japan and Malaysia. Research organizations on energy efficiency or technology development have been engaged in India, Sri Lanka and Thailand and local CP centers have been established in China, India and Korea. Local NGOs have joined hands with the authorities in Nepal and New Zealand to promote CP, and in Indonesia, Environmental Counseling Groups have been established for specific industries to facilitate the sharing of CP information.

**CP Initiatives in New Areas**

Traditionally, CP has primarily targeted the manufacturing industry sector, as defined by UNEP, however, the formal definition of CP allows a much wider area of CP application, to other sectors as well as to products and services:

"Cleaner Production is a continuous application of an integrated preventive environmental strategy to processes, products and services to improve eco-efficiency and reduce risks to humans and the environment."

Although most CP efforts in the region still target the manufacturing sector, some examples of expansion of CP application to other area are notable. One of the most significant examples is the application of CP to the tourism sector (Cambodia, Indonesia, Thailand and Vietnam). This is not a small step as this sector is the largest and fastest growing business sector in the world and constitutes a major income earner in many countries of the region. Several demonstration projects have been undertaken at hotels and resorts and a number of manuals and handbooks on CP in the tourism sector have been published. CP is also an integrated part of the requirements of some hotel labeling programs, such as Green Leaf Thailand. The expansion of CP into the tourism sector also presents an opportunity for small developing island states in the region - where tourism is a major segment of business - to join the international CP family. Other sectors where CP has been applied for the first time in the region include fruit production (New Zealand), design of buildings (Korea and Thailand) carpet industry (Nepal) and mining and minerals processing (Australia).

A new approach, which in a sense also represents a new application of CP, is the implementation of CP in a whole industrial park. There are obvious advantages to applying CP to an industrial park or industrial zone, as the companies operating in such an area often have common waste and wastewater treatment facilities and also are guided by common regulations for how to operate in the area.
CP Policy
- Innovation and Industrial Policies
- Environmental Policies at National Level
- Environmental Policies at Local Level w/ emphasis on permit system
- Trade policies on CP
- Educational policies on CP
- Tax system on CP
- Technology on CP

Action Program
- Management Improvements
- Good Housekeeping
- Substitution of Toxic
- Process Modification
- Internal Reuse of Waste
- Change in Product and Process design

Barriers / Obstacles
- Conceptual Barriers
  - Lack of importance given to environment
  - Resistance to change
  - Poor environmental standards in organization and government
- Organizational Barriers
  - System of organization including policy framework and organization,
  - no integration as regards water, air, land, etc.
- Knowledge Based Barriers
  - Lack of knowledge in CP
  - How to access knowledge on CP
- Technical Barriers
  - Technology approaches, assessment, installations, tools, input materials, process and products with technical obstacles - at the stage of technology developed during demos and dissemination
- Economic Barriers
  - Vested interest
  - Shortage of investment funds
  - Incomplete or incorrect allocation of cost
  - Pricing policy that subsidize the use of resources such as energy and water.

Future Vision*
- Increased Government Involvement
- Enhanced Industry Leadership
- Financing of CP
- CP and Climate Change
- CP and Agriculture
- CP Partnership

Recommendations*
• Adoption of National Strategic Action Plans for CP
• Improve Outreach to SMEs
• Strengthen Legislation and Incentives
• Support for Adoption of Cleaner Technologies Increase Awareness of CP in Financing Institution
• Improve Transparency
• Continued CP Promotion and Networking
• Expanded Focus of CP

**Long Term Financing and Technical Assistance**

• CP assessment
• CP training and well-designed demo project
• Long term commitment to finance and CP programs (giving high priority)
• Giving technical support
• Revolving funds for SMEs – use to finance a CP audit and select beneficial options and companies can pay the funds on savings achieved.

* Source: UNEP/APRCP/TEI CP7 Status Report

**Dr. Olivia la O’Castillo can be contacted at:**

E-mail address : aprcp@info.com.ph
The Role of Energy in Sustainable Production

By: John Kryger
DTI, Denmark

Introduction

The role of energy in sustainable production is to minimise the use of energy, and to maximise the use of renewable energy sources in energy production and for private use.

One of the paradoxes of energy use and pricing is that in the richer part of the world, energy is expensive due to direct taxation (except in the USA) – in less developed countries energy is cheaper and many times subsidised to enable a higher living standard. This paradox leads to more efficient use of energy in the countries that can afford to use a lot of energy, and low efficient use of energy in the countries that have limited economic resources. Also most low-income countries are importing a very high percentage of their energy resources.

All scientists agree, that the use of energy is one of the major problems for a sustainable future. Energy is used in many different links of the product chain, from extraction of raw materials through the production processes, transportation, utilisation of products, and the final incineration or reuse of the products.

Energy is also used for heating/cooling of houses, transportation of people and the massive use of electricity in our daily life.

This presentation will concentrate on practical examples of sustainable energy use in industry as well as in private households. These examples will focus on the creative use of alternative energy sources. The presentation is limited to the use of already known and near future alternative energy systems – and the question why we are not using these systems more efficient. The presentation will not cover efficient pumps, ventilation and electrical motors – as well as clean coal technologies, even though they are examples of cleaner technologies of great benefit to enterprises and in the establishment of new power plants.

Through these examples, the presentation will challenge the following:

The northern countries are facing problems of cold winters and less sun – but stable and sometimes strong wind. The southern and equatorial countries are facing problems of the hot climate and a lot of sunshine. The wind can vary very much from region to region. The utilisations of solar energy systems are widely used in countries with low solar potential – and in most equatorial countries solar systems are under utilised.

Industry are not utilising the potential in alternative energy systems in all parts of the world – and hereby not taking the energy problem seriously.

The challenge for the R&D society is to facilitate sustainable energy use in all aspects of society.

Below is a brief presentation of the areas from which the selection of practical examples for the presentation will be taken.
Energy Power Plants

Many power plants are using alternative energy sources as supplement to conventional fuels. Use of wind energy, biomass and biogas systems is in operation worldwide. Energy production from waste incineration is one of the main energy sources in Denmark – leading to other environmental problems to be dealt with. Mixing coal and biomass is just introduced – increasing the flexibility in production. (Picture: Power plant with wind energy)

Decentralised energy production on smaller power plants can integrate the use of alternative energy sources efficiently. In most developing countries alternative sources in power plants are not utilised. In many cases these power plants are using heavy oil – imported – and efficiency is low. (Picture: Rural power plant in Brazil – conventional)

Private Energy Consumption

Use of alternative energy sources – 0-energy sources – for daily energy consumption:

Extended use of Solar Energy for electricity production as well as hot water. In near future solar Photovoltaic systems can be produced to prices that can compete with normal electricity production systems. (Picture: PV system installed at a hotel)
Solar Water heaters are today competitive on the northern European market – and widely used as supplement to the conventional heating systems. (Picture: SWH in private houses)

For Air-conditioning it is difficult to use alternative energy sources. Insulation Solar heat resistant windows and natural ventilation are existing options today. The future will bring alternative energy sources into the market. Changing the attitude to air-conditioning would save 35% of the global energy consumption used for air-conditioning. It is not necessary, healthy and pleasant to run the air-conditioning system on 18-20 degrees Celsius when the outside temperature is above forty. Insulating houses is not only to keep the heat inside – it can also keep the temperature down. (Picture: Opposite situation: Solar Wall for heating purposes – hangar at airport)

Industry Energy Consumption

The use of alternative energy sources for industrial purposes is not widely in operation. A few biogas systems are in operation – but extensive use of solar and wind energy are not in place.

Use of Solar Heaters in textile, food and other hot water/steam using industrial sector can minimise the use of non-replaceable energy sources.

Increased use of solar PV systems for pumps and all low energy systems are options available – but not used!

(Picture: A combined PV and SWH system at the Olympic Pool in Atlanta. The technology for larger scale energy systems is existing, but only used in “show-cases”)
In developing countries a few combined systems are in operation. These systems are all funded by grants from donor programmes – and not established on sustainable economic conditions.  
(Picture: A combined PV and heat exchange system at a high school in India)

The utilisation of biomass for energy production is well known in both Asia and Europe. The research in better utilisation of biomass as an energy resource is taking up speed in Europe, while the interest for these technologies are less interesting in Asia – even though the local production of biomass is extensive in Asia.

Conclusion

The use of alternative energy is most widely used in developed countries. Austria, and Australia is some of the leading countries in commercial solar systems – both PV and SWH systems.

In Denmark 20% of the total energy production is wind energy – and SWH are widely used at private houses and a few SWH systems are in use at enterprises (dairies).

The way governments are estimating the prices on energy are setting the scene for the competition among the various energy sources. By subsidising specific energy sources – the alternative energy sources – the market will change. Savings on import of oil can be to establish energy power plants based on wind and sun. The running costs of these are limited to the repair and maintenance costs – there are no costs for fuels and transportation of it.

In the future – if we mean sustainable energy consumption seriously – there is a need to reconsider pricing of conventional energy sources – and increase of alternative energy.

This presentation has not dealt with the research in new generation of alternative energy sources. This will new window of opportunities, minimise the energy and increase the utilisation of alternative energy worldwide.

Dr. John Kryger can be contacted at:

E-mail: john.kryger@teknologisk.dk

In Nepal the entire oil and gasoline consumption is transported by road from India and mainly utilised for electricity production and transportation.