

# RAC/CP

## ANNUAL TECHNICAL PUBLICATION

Mediterranean Enterprises and Sustainability • December 2004 • N.14

Regional Activity Centre  
for Cleaner Production  
(RAC/CP)

**CAPACITY BUILDING IN CLEANER PRODUCTION IN BOSNIA AND HERZEGOVINA.  
PART I - LAYING THE GROUNDWORK AND PROVIDING THE FRAMEWORK FOR  
CP IMPLEMENTATION**

**A DECISION-SUPPORT TOOL FOR THE SELECTION OF CLEAN TECHNOLOGIES  
IN SMES**

**NATIONAL STRATEGY FOR CLEANER PRODUCTION IN EGYPTIAN INDUSTRY**

**CLEANER PRODUCTION IN A STEAM AND CONDENSATE SYSTEM. A CASE  
STUDY IN AN ANIMAL FEED PRODUCTION PLANT**

**L'OPÉRATION ECOSIND : UNE OPPORTUNITÉ POUR AMÉLIORER LA GESTION  
DE L'ENVIRONNEMENT DES PME INDUSTRIELLES**

**INCENTIVES FOR THE ADOPTION OF CLEANER PRODUCTION**

**AN OVERVIEW OF THE LEGAL, INSTITUTIONAL AND PLANNING FRAMEWORKS IN  
THE MEDITERRANEAN ARAB COUNTRIES TO PROMOTE CLEANER PRODUCTION**



Regional Activity Centre  
for Cleaner Production



Ministry of the Environment  
Spain



Government of Catalonia  
Ministry of the Environment  
and Housing





**REGIONAL ACTIVITY CENTRE  
FOR CLEANER PRODUCTION  
(RAC/CP)**

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This is an annual technical publication  
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for Cleaner Production (RAC/CP).

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## Presentation

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As the fourth issue of *RAC/CP Annual Technical Publication – Mediterranean Enterprises and Sustainability* appears it encounters a new political momentum in the Government of Catalonia and its Ministry of the Environment and Housing. A new situation that has also implied a change of Management for the Regional Activity Centre for Cleaner Production (RAC/CP). Therefore, we wished to start this issue of the publication with an editorial including the vision of the new Minister for the Environment and Housing of environmental policies in Catalonia, as the framework for a new phase that is now beginning for the RAC/CP.

In addition, a new assessment has been made of the state of cleaner production in the Mediterranean countries. A second edition of the study giving an overview of the legal and policy framework for implementing CP at the national level, the agents involved in promoting CP, the programmes and action plans, along with the tools and activities for promoting and disseminating CP, was carried out and published in 2004 with the aid of the National Focal Points of the Regional Activity Centre for Cleaner Production (RAC/CP). In this regard, we have included an article presenting some findings of the study, notably concerning the Mediterranean Arab countries.

This fourth issue also presents projects and initiatives aimed at facilitating the introduction of best available techniques and cleaner production in small and medium-sized industries in general, and for the textile industry in particular. Moreover, it includes a case study on the application of cleaner production in a steam and condensate system to ensure its optimal operation in industrial activities.

Furthermore, two articles introduce the setting up of the general framework for the application of cleaner production at the national level. Finally, on this occasion the publication addresses not the obstacles but the incentives for introducing cleaner production in companies, backed up by a survey carried out with companies showing that the main motivators for CP application are still economics and legislation.

In this time of new opportunities that is beginning for the RAC/CP, we would like to sincerely thank the authors of the current issue for their fidelity and valuable contributions to the publication, and would like to encourage individuals, institutions, organisations and companies to participate in this project that aims to exchange technical experiences and knowledge to advance towards a better-quality Mediterranean Region.

## Présentation

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La quatrième édition de *RAC/CP Annual Technical Publication – Mediterranean Enterprises and Sustainability*, la publication technique annuelle du CAR/PP, s'inscrit dans un nouvel élan politique du Gouvernement catalan et de son Ministère de l'environnement et du logement. Une nouvelle situation qui a également supposé un changement au sein de la direction du Centre d'activités régionales pour la production propre (CAR/PP). C'est pourquoi nous souhaitons débiter cette édition par la publication d'un éditorial où figure la vision du nouveau ministre catalan de l'environnement et du logement, ce qui donne un cadre à cette nouvelle étape dans laquelle rentre le CAR/PP.

En outre, une nouvelle évaluation de l'état de la production plus propre dans les pays méditerranéens a été effectuée. La seconde édition de l'étude sur le cadre politique et juridique permettant de mettre en place la PP à l'échelle nationale, les agents qui sont intervenus dans la promotion de la PP, les programmes et les plans d'action ainsi que les outils et les activités de promotion et de diffusion de la PP, a été menée à bien et publiée en 2004 avec l'aide des points focaux nationaux du Centre d'activités régionales pour la production propre (CAR/PP). Dans cette optique, nous avons inclus un article présentant certaines conclusions de l'étude, notamment en ce qui concerne les pays arabes méditerranéens.

Cette quatrième édition présente également des projets ainsi que des initiatives dont l'objectif est de faciliter l'introduction des meilleures techniques disponibles et de la production plus propre au sein des petites et moyennes industries, et notamment au sein des industries textiles. De plus, elle inclut un cas pratique sur l'application de la production plus propre dans un système de condensation et de vapeur afin d'assurer son fonctionnement optimal dans les activités industrielles.

En outre, deux articles introduisent la mise en place du cadre général pour l'application de la production plus propre à l'échelle nationale. Enfin, cette dernière édition s'attache aux mesures incitatives et non aux problèmes rencontrés lors de l'introduction de la production plus propre au sein des entreprises. Une étude menée auprès des entreprises montre que les principales motivations pour l'application de la PP sont toujours le facteur économique et la législation.

À l'aube d'une nouvelle perspective d'avenir pour le CAR/PP, nous souhaitons remercier les auteurs de la présente édition pour leur fidélité et très précieuse collaboration à cette publication. Par ailleurs, nous aimerions encourager les particuliers, les institutions, les organisations ainsi que les entreprises à participer à ce projet qui a pour objectif d'échanger des expériences techniques et des connaissances afin d'améliorer la qualité de la région méditerranéenne.

## Presentación

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El cuarto número de *RAC/CP Annual Technical Publication – Mediterranean Enterprises and Sustainability*, la publicación técnica anual del CAR/PL, aparece en una nueva etapa política de la Generalitat de Cataluña y el Departamento de Medio Ambiente y Vivienda. Una nueva situación que implica también un cambio en la dirección del Centro de Actividad Regional para la Producción Limpia (CAR/PL). Por esta razón, nos gustaría empezar esta publicación con un editorial que incluye la visión del nuevo Consejero de Medio Ambiente y Vivienda acerca de la política ambiental de Cataluña, que establece el marco de actuación de un nuevo período que comienza para el CAR/PL.

Asimismo, se ha llevado a cabo una nueva evaluación del estado de la producción más limpia en los países mediterráneos. En 2004 se elaboró y se publicó, en colaboración con los puntos focales nacionales del Centro de Actividad Regional para la Producción Limpia (CAR/PL), la segunda edición del estudio sobre el marco normativo y legal para la aplicación de la P+L en el ámbito nacional, los agentes involucrados en la promoción de la P+L, los programas y planes de acción, así como las herramientas y actividades necesarias para la promoción y difusión de la P+L. Por este motivo, hemos incluido un artículo que presenta algunas de las conclusiones del estudio, en particular las que conciernen a los países árabes mediterráneos.

Este cuarto número también presenta proyectos e iniciativas que tienen como fin facilitar la introducción de las mejores técnicas disponibles y la producción más limpia en la pequeña y mediana industria en general, y particularmente en la industria textil. Por otra parte, incluye un caso práctico sobre la aplicación de la producción más limpia en un sistema de vapor y condensación para garantizar un óptimo funcionamiento en las actividades industriales.

Además, en otros dos artículos se presenta el establecimiento de un marco de acción general para la aplicación de la producción más limpia a escala nacional. Para concluir, en esta ocasión el número no hace referencia a los obstáculos, sino a los incentivos para la introducción de la producción más limpia en las empresas, respaldados por una encuesta realizada a las empresas que demuestra que los principales motivos para la aplicación de la producción más limpia siguen siendo de carácter económico y legislativo.

Ahora que se inicia esta era de nuevas oportunidades para el CAR/PL, nos gustaría expresar nuestro más sincero agradecimiento a los autores de este número, por su fidelidad y sus valiosas contribuciones a esta publicación, así como animar a las personas, instituciones, organizaciones y empresas a participar en este proyecto, que pretende intercambiar experiencias y conocimientos técnicos con el objetivo de seguir avanzando hacia una región mediterránea mejor.

## Editorial

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By now, almost nobody would question that the only way in which developed societies can continue to grow and improve their quality of life, whilst at the same time preserving the right of future generations to enjoy an environment able to meet their needs, is to make an effort to achieve environmental, social and economic sustainability.

The current government of Catalonia fully shares this approach and is willing to work so that Catalan society welcomes the transition towards sustainability as a great challenge for the future that affects us all. This challenge must be taken up with the conviction that sustainability and economic growth are neither antagonistic nor mutually exclusive terms; rather they are compatible if we know how to combine them correctly. This is possible if we change our behaviour to build a more respectful and responsible relationship with our environment, if we make a constant effort in scientific and technical areas to better understand the function of the natural systems, perfecting techniques that enable us to advance towards eco-efficiency, if we overcome our dependence on fossil fuels and rationalise the use of scarce resources such as water, and if we manage, in short, to develop and share a civic sense of environmental responsibility, and a spirit of fairness and of solidarity that help us to prevent certain unfair situations leading to social exclusion.

In this new stage of government, the Ministry of the Environment and Housing of the Government of Catalonia has the firm intention of encouraging and leading this extraordinarily complex transition. It proposes to do so by seeking the involvement of all stakeholders in society, reaching an appropriate level of agreement with them on the main strategic policies leading to sustainability.

The Government programme on the environment for this legislature is based on the conviction that the global nature of environmental problems and challenges requires that they be viewed from a supranational perspective. It plans also to guarantee the coherence of the national, regional and local decisions adopted and actions taken.

In the case of Catalonia, the framework for action has, at the very least, a continental character - that of the European Union, recently extended to 25 Member States. Our programme substantially coincides with the strategic approaches of the *6th European Framework Programme on Environmental Matters*; and therefore its priority lines of action, and the sectorial and time deployment, fit in both with the objectives established in the framework programme, and the directives and regulatory acts that come from the European Council and Parliament, which the state, autonomous and local administrations are obliged to apply.

One of our priority objectives is to ensure that those who dedicate their time and effort to getting to know the nature and development of environmental phenomena, do not become distanced from those of us who are responsible for managing the problems and providing solutions that dignify and improve people's quality of life. In this sense, we plan to improve the environmental information systems, transforming the huge amount of knowledge currently available regarding diverse aspects of the environment and its complex relationships, into reliable and comprehensible information, and with the collaboration of the productive sectors, we plan to establish mechanisms to access this information.

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We also aim to convert our ecological footprint –the global pressure we in Catalonia place on the natural systems– into a new indicator of government policies, and to use the Agenda 21 for Catalonia, as an instrument for strategic planning, allowing us to channel the participation of the social and economic agents into drafting territorial plans, transversally integrating the actions of various departments of the Government of Catalonia, making strategic pacts for sustainability with different productive sectors and incorporating sustainability indicators into government action.

We will also create an independent body –the Catalan Institute of the Environment (or something similar)– that will integrate and co-ordinate the work of the applied research teams currently in existence (universities, foundations, NGOs, professional colleges, etc.). The aim is that this body will become the ultimate scientific and technical authority in the country when making decisions about the use of environmental technologies, obtaining data about different areas of the environment, setting up sustainability indicators, formulating plans for environmental management in various areas (water resources, waste, energy networks), and it will also offer guarantees to the public affected by any developments in public infrastructure or facilities.

A second line of action is a progressive advancement on the internalisation of environmental costs. It is envisaged that all productive and service processes which affect the environment, in particular that of Catalonia, which is considered to be a public asset, must correct or compensate for any negative effects on the landscape, biodiversity, biological connectivity or the sink-effect of greenhouse gases.

With regard to the productive economy, we plan to strengthen the policies of support, offering incentives to introduce and improve environmental measures in Catalan companies. In this sense, the government wants to make the very most of the opportunity offered by the European Union's *action plan to boost Environmental Technologies for innovation, growth and sustainable development*, to assist companies in matters of technological innovation. We have already started to work in this direction: in March we established the first 'Sectoral Board of Companies and the Environment', made up by representatives from the Administration of the Government of Catalonia, business associations, social agents, trade unions and universities. This board has already proposed the creation of two working groups: one to start the drafting of the Catalan Strategy against climate change, and the other to foster improvements in environmental technology in companies.

In the area of technology, the Catalan Ministry of the Environment and Housing will, in addition, promote the participation of Catalonia in the *Community Programme to define the Best Available Techniques (BATs)* and will maintain a permanent line of information on the works of the Institute for Prospective Technological Studies (IPTS). As far as the application of eco-management and eco-labelling systems is concerned, the aim is to considerably increase the number of companies and organisations certified under the EMAS and ISO-14001 systems to carry EU eco-labels or the emblem of guarantee of environmental quality. The Catalan Ministry of the Environment and Housing also intends to strengthen cross-cutting actions, in matters of production and consumption of products and services, to include environmental criteria.



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With regard to the generation and use of renewable energy sources, in addition to working to fulfil the European commitment to achieve 12% of energy production by means of renewable sources, we will set up a line of grants for individuals for the installation and maintenance of solar panels, and, in accordance with the *Strategic Forestry Plan of Catalonia*, we will set up a network of biomass power stations. With regard specifically to wind energy, within the framework of the Wind Energy Advisory Board of Catalonia, we will start a process of territorial and social co-ordination for a review of the *Map of Introduction of Wind Energy in Catalonia*, to incorporate into it the variable of the territorial distribution of the installations, and create a regional fund to distribute fairly the economic benefits from the wind parks.

Naturally, we intend to register the actions of the Catalan Ministry of the Environment and Housing on an international level. In order to be able to progressively take on our intra- and inter-generational and interterritorial responsibilities, we intend to become increasingly involved in projects of co-operation in sustainable development, in areas as essential as water, technology transfer or environmental capacity building, with specific regard to the Mediterranean Region.

In short, we want to opt for a different model of globalisation, and therefore, we need to place Catalonia, with its environmental and sustainability policy, in the Mediterranean, European and world contexts. To do this, we will make the most of the recent creation of interregional networks, such as the World Network of Regional Governments for Sustainable Development, to enter into collaboration agreements with other regional governments, preferably with developing countries. Naturally, we will look into all the ways possible to guarantee the presence of the Government of Catalonia in the debate and decision-making process, both in matters in which we have full legislative authority, and in matters particularly relevant from the point of view of sustainability (the transition towards the hydrogen economy, the fight against climate change or the protection of biodiversity).

Salvador Milà i Solsona  
Minister for the Environment and Housing  
Government of Catalonia

## Éditorial

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Jusqu'à présent, presque personne ne conteste que l'unique manière de poursuivre la croissance et d'améliorer la qualité de vie des sociétés développées, tout en préservant le droit des générations futures à bénéficier d'un environnement capable de satisfaire leurs besoins, est d'entreprendre des efforts pour mener à bien des initiatives en vue d'atteindre la durabilité environnementale, sociale et économique.

Le Gouvernement de la Catalogne actuel partage entièrement ce point de vue et s'engage à travailler pour que sa population envisage la transition vers la durabilité comme un défi majeur pour l'avenir, un défi qui concerne chacun d'entre nous. Ce dernier doit être relevé avec la conviction que les termes durabilité et croissance économique ne sont ni antagonistes ni incompatibles, mais qu'au contraire ils sont conciliables si nous savons comment les combiner correctement. Ceci peut devenir réalité si nous modifions notre comportement afin de construire une relation plus responsable et respectueuse envers notre environnement, si nous faisons un effort permanent dans les domaines scientifique et technique afin de mieux comprendre la fonction des systèmes naturels et de perfectionner les techniques qui nous permettent d'avancer vers l'efficacité écologique, si nous surmontons notre dépendance aux combustibles fossiles et rationalisons l'utilisation des ressources rares telle que l'eau, et si nous parvenons, dans un futur proche, à développer et partager un esprit civique de responsabilité environnementale ainsi qu'un esprit d'équité et de solidarité qui nous aide à prévenir certaines injustices qui engendrent l'exclusion sociale.

Dans cette nouvelle étape entreprise par le gouvernement, le Ministère de l'environnement et du logement du Gouvernement de la Catalogne a la ferme intention d'encourager et de mener à bien cette transition extrêmement complexe. Pour ce faire, il propose de coordonner l'engagement de l'ensemble des partenaires sociaux afin qu'ils s'accordent sur les principales politiques stratégiques conduisant à la durabilité.

Le programme du gouvernement en matière d'environnement, durant ce mandat, est basé sur la conviction que les problèmes et les défis environnementaux d'ordre planétaire doivent être envisagés selon une perspective supranationale. Par ailleurs, il prévoit d'assurer la cohérence des décisions prises au niveau local, régional et national, ainsi que celle des actions qui sont menées.

Dans le cas de la Catalogne, le cadre d'action a, au moins, un caractère continental : celui de l'Union européenne récemment élargie à 25 États membres. En substance, notre programme coïncide avec les approches stratégiques du 6<sup>e</sup> programme-cadre communautaire pour l'environnement et, par conséquent, avec ses lignes d'action prioritaires ainsi que le déploiement temporel et sectoriel correspondant, et avec les objectifs établis dans le programme-cadre ainsi que les directives et les actes réglementaires émanant du Conseil et du Parlement européen, que l'État, les administrations locales et autonomes sont contraintes d'appliquer.

Un de nos objectifs prioritaires est d'assurer que ceux qui consacrent leur temps et leurs efforts à connaître la nature et le développement des phénomènes environnementaux ne soient pas distancés de ceux d'entre nous qui sommes responsables de la gestion des problèmes et qui apportent des solutions pour défendre et améliorer la qualité de vie des populations. Dans cette optique, nous prévoyons d'améliorer les systèmes d'information sur l'environnement, en transformant l'importante somme des connaissances, dont nous disposons actuellement sur les différents aspects environnementaux et la complexité de leurs relations, en informations compréhensibles et fiables, et en mettant en place des mécanismes permettant d'accéder à cette information, avec la collaboration des secteurs productifs.

En outre, nous avons l'intention de convertir notre empreinte écologique (la pression au niveau mondial que, nous, en Catalogne, plaçons sur les systèmes naturels) en un nouvel indicateur des politiques gouvernementales et d'utiliser l'Agenda 21 de la Catalogne comme un instrument de planification stratégique, nous permettant de canaliser la participation des partenaires économiques et sociaux en rédigeant des projets de plans territoriaux, en intégrant, de manière transversale, l'action de différents ministères du Gouvernement de la Catalogne, en concluant des pactes stratégiques de durabilité avec les différents secteurs productifs et en incorporant les indicateurs de durabilité à l'action du gouvernement.

Par ailleurs, nous créerons un organisme indépendant qui devrait s'appeler l'Institut catalan de l'environnement. Il intégrera et coordonnera les équipes de recherche appliquée qui existent actuellement (universités, fondations, ONG, collèges de professionnels, etc.). L'objectif est que cet organisme devienne l'autorité scientifique et technique de référence au sein du pays quant à la prise de décisions relatives à l'utilisation des technologies environnementales, l'obtention des données sur les différents domaines de l'environnement, la mise en place des indicateurs de durabilité, la formulation des plans de gestion de l'environnement dans plusieurs domaines (ressources en eau, déchets, réseaux énergétiques), et qu'en outre, il offre des garanties au public concerné par le développement d'infrastructures publiques.

La seconde ligne d'action est l'avancée progressive en matière d'internationalisation des coûts environnementaux. Il est prévu que tous les procédés de production et les services ayant un impact sur l'environnement et notamment sur celui de la Catalogne, considéré comme un actif public, doivent corriger ou compenser les effets négatifs sur le paysage, la biodiversité, la connectivité biologique et les puits de carbone.

En ce qui concerne l'économie productive, nous prévoyons de renforcer les politiques de soutien en accordant des primes afin d'introduire et d'améliorer les mesures environnementales au sein des entreprises catalanes. Dans cette optique, le gouvernement souhaite mettre toutes les chances offertes par le plan d'action de l'Union

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européenne de son côté. Ce plan vise à encourager les *technologies environnementales pour l'innovation, la croissance et le développement durable* afin d'aider les entreprises en matière d'innovation technologique. Nous avons déjà commencé à travailler dans cette direction en constituant, au mois de mars dernier, le premier bureau sectoriel d'entreprises et de l'environnement, constitué par les représentants de l'administration du Gouvernement catalan, des associations d'hommes d'affaires, des partenaires sociaux, des syndicats et des universités. Ce bureau a déjà proposé la création de deux groupes de travail. L'un d'entre eux doit commencer la rédaction de la stratégie catalane contre les changements climatiques, et l'autre stimuler les améliorations relatives à la technologie environnementale au sein des entreprises.

Dans le domaine des technologies, le Ministère de l'environnement et du logement de la Catalogne a, en outre, l'intention de promouvoir la participation de la Catalogne dans le *programme communautaire visant à définir les meilleures techniques disponibles* (MTD) et de maintenir une ligne continue de renseignements sur les travaux de l'Institut de prospective technologique (IPTTS). En ce qui concerne l'application de systèmes de gestion de l'environnement et de labels écologiques, l'objectif est d'augmenter de manière considérable le nombre d'entreprises et d'organisations certifiées par les systèmes EMAS et ISO-14001, le label écologique communautaire ainsi que le label de garantie de qualité environnementale. En outre, le ministère tente de renforcer les actions transversales en matière de production et de consommation des produits et services qui incluent des critères environnementaux.

En ce qui concerne la création et l'utilisation de sources d'énergies renouvelables, outre le fait de travailler à remplir les engagements européens prévoyant que 12 % de la production d'énergie doit provenir d'une source renouvelable, nous allons créer des subventions pour les particuliers qui installent et entretiennent des panneaux solaires, et, en accord avec le plan forestier stratégique de la Catalogne, nous allons mettre en place un réseau de centrales électriques à biomasse. En ce qui concerne l'énergie éolienne, nous commencerons, dans le cadre du Conseil consultatif d'énergie éolienne de la Catalogne, un procédé de coordination sociale et territoriale pour réviser la *carte d'introduction de l'énergie éolienne en Catalogne*, afin d'y incorporer la variable relative à la distribution territoriale des installations et de créer un fonds régional de distribution équitable des bénéfices économiques générés par les parcs d'éoliennes.

Naturellement, nous sommes résolus à inscrire l'action du Ministère de l'environnement et du logement de la Catalogne au niveau international. Afin d'être capable de progressivement assumer nos responsabilités interterritoriales, inter et intragénérationnelles, nous nous engagerons davantage dans des projets de coopération de développement durable dans des domaines d'importance majeure tels que l'eau, le transfert de technologie ou le renforcement des capacités environnementales, avec une attention spéciale pour la région méditerranéenne.

En bref, nous souhaitons opter pour un modèle de mondialisation différent, et par conséquent, nous avons besoin de repositionner la Catalogne, ainsi que sa politique environnementale et de durabilité, dans le contexte mondial, européen et méditerranéen. Pour ce faire, nous allons tirer le meilleur parti de la récente création des réseaux interrégionaux tel que le réseau mondial des gouvernements régionaux pour le développement durable, afin de créer des accords de collaboration avec les autres gouvernements régionaux, de préférence avec les pays en développement. Naturellement, nous envisagerons l'ensemble des solutions possibles pour garantir la présence du Gouvernement de la Catalogne dans le débat et la prise de décision, aussi bien dans des domaines pour lesquels nous possédons les pleins pouvoirs législatifs, que pour des domaines particulièrement importants d'un point de vue durable : la transition vers l'économie de l'hydrogène, la lutte contre les changements climatiques ou la protection de la biodiversité.

Salvador Milà i Solsona  
Ministre de l'environnement et du logement  
Gouvernement de la Catalogne

## Editorial

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Actualmente, prácticamente ya nadie cuestiona que la única manera que las sociedades desarrolladas tienen para poder continuar creciendo y mejorando su calidad de vida, preservando al mismo tiempo el derecho de las generaciones futuras de disfrutar de un medio ambiente capaz de cubrir sus necesidades, consiste en esforzarse para conseguir la sostenibilidad ambiental, social y económica.

La actual Generalitat de Cataluña comparte plenamente este punto de vista y trabaja para que la sociedad catalana acoja el cambio hacia la sostenibilidad como un reto de futuro que nos afecta a todos. Este reto debe afrontarse con la convicción de que la sostenibilidad y el crecimiento económico no son conceptos antagónicos ni excluyentes entre sí, sino conceptos que pueden compatibilizarse si sabemos combinarlos correctamente. Podemos conseguirlo si cambiamos nuestra conducta cotidiana con el objetivo de construir una relación más responsable y respetuosa con nuestro entorno, si realizamos un esfuerzo constante en el ámbito científico y técnico para comprender mejor las funciones de los sistemas naturales y perfeccionar técnicas que nos permitan avanzar hacia la ecoeficiencia, si superamos nuestra dependencia de los combustibles fósiles y racionalizamos el uso de recursos escasos como el agua. En resumen, si conseguimos desarrollar y compartir un sentido cívico de responsabilidad ambiental y un espíritu de igualdad y solidaridad que nos ayude a evitar determinadas injusticias que generan exclusión social.

En esta nueva etapa de gobierno, el Departamento de Medio Ambiente y Vivienda de la Generalitat de Cataluña posee la firme intención de promover y dirigir este cambio tan complejo y extraordinario. Con este objetivo, pretendemos buscar la implicación de todos los grupos de interés para conseguir un grado de acuerdo apropiado en relación con las principales políticas estratégicas de sostenibilidad.

El programa de la Generalitat en materia ambiental para esta legislatura se basa en el convencimiento de que el alcance mundial de los problemas y los retos ambientales exige que sean examinados desde una perspectiva supranacional. De igual modo, nuestro gobierno planifica garantizar la coherencia de las decisiones locales, regionales y nacionales que se toman y las acciones que se llevan a cabo.

En el caso de Cataluña, el marco de acción tiene, como mínimo, un alcance continental: el de la Unión Europea, que recientemente ha ampliado su territorio a 25 Estados miembros. Nuestro programa coincide sustancialmente con los enfoques estratégicos del *VI Programa Marco Europeo de Medio Ambiente* y, por tanto, sus líneas de acción prioritarias y el despliegue horario y sectorial encajan tanto con los objetivos marcados en el marco del programa como con las directivas y reglamentos del Consejo y el Parlamento Europeo, que las administraciones locales, autonómicas y estatales deben aplicar.

Uno de los objetivos prioritarios es asegurar que aquellos que dedican su tiempo y esfuerzo a conocer la natu-

raleza y el desarrollo de los fenómenos ambientales no se distancien de los que nos ocupamos de los problemas y somos responsables de ofrecer soluciones que dignifiquen y mejoren la calidad de vida de la población. En este sentido, pretendemos mejorar los sistemas de información ambiental para transformar la enorme cantidad de conocimiento disponible sobre diversos aspectos ambientales y sus complejas relaciones en información fiable y comprensible, así como establecer mecanismos para acceder a la información con la colaboración de los sectores productivos.

Desde esta perspectiva, también nos hemos propuesto el objetivo de convertir la huella ecológica —la presión global que Cataluña ejerce en los sistemas naturales— en un nuevo indicador de las políticas gubernamentales y utilizar la Agenda 21 de Cataluña como un instrumento de planificación estratégica que permita canalizar la participación de los agentes sociales y económicos a la hora de esbozar planes territoriales, mediante la integración de manera transversal de la actividad de diversos departamentos de la Generalitat de Cataluña, para construir pactos estratégicos de sostenibilidad con los diferentes sectores productivos e incorporar los indicadores de sostenibilidad en la acción del gobierno.

También crearemos un organismo independiente —el Instituto Catalán del Medio Ambiente, o una designación similar— que integrará y coordinará los equipos de investigación aplicada que existen actualmente (universidades, fundaciones, ONG, centros profesionales, etc.). El objetivo es que esta nueva entidad se convierta en el organismo científico-técnico último del país a la hora de adoptar decisiones sobre el uso de tecnologías ambientales, obtener datos sobre diferentes zonas ambientales, creación de indicadores de sostenibilidad, crear planes de gestión ambiental en varios ámbitos (recursos hídricos, residuos, redes de energía) u ofrecer garantías al público afectado por desarrollos en infraestructura pública.

Una segunda línea de acción es avanzar de forma progresiva en la internalización de los costes ambientales, de manera que todos los procesos productivos y los servicios que tengan un impacto sobre el medio ambiente y, en particular, sobre el de Cataluña, que se considera un bien público, corrijan o compensen por cualquier impacto negativo en el paisaje, la biodiversidad, la conectividad biológica y los sumideros de carbono.

En relación con la economía productiva, prevemos reforzar las políticas de ayuda, ofreciendo incentivos para introducir y mejorar las medidas ambientales en las empresas catalanas. En este sentido, el gobierno quiere aprovechar al máximo la oportunidad que ofrece el plan de acción de la Unión Europea, que pretende promover el uso de *tecnologías ambientales para la innovación, el crecimiento y el desarrollo sostenible*. Todo ello con el objetivo de ayudar a las empresas en materia de innovación tecnológica. Ya nos hemos puesto a trabajar en esta dirección con la creación, el pasado mes de marzo, de la primera Mesa sectorial empresa y medio ambiente, en la que la Adminis-

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tracción de la Generalitat de Cataluña, las asociaciones de empresarios, agentes sociales, sindicatos y universidades están representados. Esta mesa ya ha propuesto la creación de dos grupos de trabajo: uno para empezar la redacción de la estrategia catalana contra el cambio climático y, el otro, para fomentar las mejoras relativas a la tecnología ambiental en el seno de las empresas.

Dentro del ámbito de las tecnologías, el Departamento promoverá además la participación de Cataluña en el *Programa Comunitario para la Definición de las Mejores Técnicas Disponibles* (MTD) y mantendrá un flujo constante de información sobre los trabajos del Instituto de Prospectiva Tecnológica (IPTTS). En cuanto a la aplicación de los sistemas de gestión ambiental y etiquetaje ecológico, el objetivo es aumentar considerablemente el número de empresas y organizaciones que se acogen a los sistemas EMAS e ISO-14001, para el etiquetaje ecológico comunitario y de garantía de la calidad ambiental. El Departamento de Medio Ambiente y Vivienda también fortalecerá las acciones interdepartamentales para incluir criterios ambientales en materia de producción y consumo de productos y servicios.

En relación con la generación y uso de fuentes de energía renovables, además de trabajar para cumplir el compromiso europeo de alcanzar el 12% de la producción de energía a través de fuentes renovables, abriremos una línea de subvenciones para la instalación y mantenimiento de paneles solares en viviendas y, de acuerdo con el *Plan Estratégico Forestal de Cataluña*, crearemos una red de centrales eléctricas de biomasa. En cuanto a la energía eólica, iniciaremos —dentro del marco del Consejo consultivo de energía eólica de Cataluña— un proceso de coordinación territorial y social para la revisión del *Atlas para la introducción de la energía eólica de Cataluña*, para incluir en éste la distribución territorial de las instalaciones y crear un fondo regional de distribución equitativa de los beneficios económicos de los parques eólicos.

Lógicamente, estamos decididos a inscribir la acción del Departamento de Medio Ambiente y Vivienda dentro del contexto internacional. Con el objetivo de asumir progresivamente nuestras responsabilidades interterritoriales, intra e intergeneracionales, nos involucraremos cada vez más en proyectos de cooperación para el desarrollo sostenible en ámbitos tan importantes como el agua, la transferencia de tecnologías o la creación de capacidades ambientales, con especial atención en la región mediterránea.

En definitiva, queremos optar por un modelo diferente de globalización y, por tanto, necesitamos situar a Cataluña, con su política ambiental y de sostenibilidad, en un contexto mediterráneo, europeo y mundial. Para conseguirlo, vamos a aprovechar al máximo la creación de redes interregionales, como la Red Mundial de Gobiernos Regionales para el Desarrollo Sostenible, para formalizar acuerdos de colaboración con otros gobiernos regionales, preferentemente con países en vías de desarrollo. Buscaremos todas las vías posibles para garantizar la presencia de la

Generalitat de Cataluña en el debate y en el proceso de toma de decisiones, tanto en asuntos en los que tiene plena autoridad legislativa como en asuntos especialmente relevantes desde el punto de vista de la sostenibilidad (la transición hacia la economía del hidrógeno, la lucha contra el cambio climático o la protección de la biodiversidad).

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# CAPACITY BUILDING IN CLEANER PRODUCTION IN BOSNIA AND HERZEGOVINA

## PART I – LAYING THE GROUNDWORK AND PROVIDING THE FRAMEWORK FOR CP IMPLEMENTATION

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Bosnia and Herzegovina (B&H) is a country where industrial pollution has increased significantly over the past decade. In order to comply with EU regulations and various other international protocols, it is urgently addressing this issue.

The Capacity-Building Programme was implemented with the assistance of the Centre for Environmentally Sustainable Development, the Centre for the Enterprises and the Environment in Barcelona and the Croatian Cleaner Production Centre. The latter has developed a two-pronged approach aimed at professionals i.e. industrialists, various government departments, academic institutions and the general public throughout the country.

The first aspect, dissemination, included two types of meetings: “face to face” meetings, aimed at obtaining feedback from stakeholders by encouraging discussion on specific subjects relating to CP implementation, and “sector” meetings that gathered together businesses from various selected industrial sectors to introduce them to the CP concept and demonstrate opportunities for its implementation in their particular industries.

The second aspect, training, organised as a combination of theoretical training, in-class study and demonstration projects, was divided into two modules. The first module was theoretical and the second was an interactive combination of in-class study and on-site demonstration project.

**Key words:** Bosnia and Herzegovina, Capacity-Building Programme, information dissemination, training, awareness-raising.

### Introduction

Over the past ten years, Bosnia and Herzegovina (B&H) has experienced upheaval and instability. As attention was focused on other issues, the country's rich natural environment, already under pressure from decades of urban and industrial pollution, became increasingly degraded. Fortunately, momentum in the country has shifted. Reconstruction efforts are underway and protection of the environment is an emerging priority. Environmental problems relating to industrial pollution represent one of the aspects that require special attention. Bosnia and Herzegovina is slowly returning to normal international relationships with its acceptance of international obligations and fulfilment of environmental requirements arising from international protocols, agreements and conventions.

As Bosnia and Herzegovina is party to the Barcelona Convention, the country is also obliged to fulfil the requirements of the protocols of the Convention. Based on the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities, the so-called LBS Protocol, the parties to the Convention, including Bosnia and Herzegovina, must take into consideration the BAT and BEP<sup>1</sup> including, where appropriate, cleaner production technologies, taking into account the social, economic and technological conditions [1]. Cleaner production (CP) and other similar concepts, such as eco-efficiency and pollution prevention, were also recognized as the main tools for the improvement of environmental management in Central and Eastern Europe (CEE) at the Aarhus Ministerial Conference in June 1998. The United Nations Environment Programme (UNEP) International Declaration on Cleaner Production has been signed by most of the CEE Countries [2].

Cleaner production, being a key concept in creating environmentally sustainable and economically successful

## CONCEPT OF THE CAPACITY-BUILDING PROGRAMME

business practices, is recognized as a supporting tool in finding a way out of the closed loop of environmental and economic problems in industrial enterprises. By applying only end-of-pipe treatments and clean technologies, industry can be faced with a requirement for capital investment and with an increase in operational and maintenance costs, which in turn increase the final product price.

With the objective of improving the quality of the environment and creating economic incentives for industrial development, the Centre for Environmentally Sustainable Development of Bosnia and Herzegovina<sup>2</sup> prepared a project proposal for the LIFE Third Countries Programme in their call for proposals in the year 2000. The project proposal was approved and its period of implementation is from 2002 to 2005. As reconstruction takes place in B&H, the role of this project is essential in assisting industries to develop practices that will both make them competitive with their European counterparts and support sustainable development. The project represents a set of specific activities that will contribute to meeting the objectives of EU policy and bring B&H closer to integration with the EU.

1 BAT - best available techniques, BEP - best environmental practices.  
2 <http://www.coor.ba>.

The project aims to build cleaner production capacities in Bosnia and Herzegovina through a number of tasks relating to raising awareness and information dissemination, marketing and training. Special emphasis is placed on building the capacities of all the stakeholders involved: government, industries, universities and the CP centre (Centre for Environmentally Sustainable Development - CESD). CP centres with experience in this area provided expert assistance from the Mediterranean region (Regional Activity Centre for Cleaner Production - RAC/CP), and the region of Central and Eastern Europe (Croatian Cleaner Production Centre CRO-CPC) provided technical assistance to the project and contributed with knowledge and know-how.

All the activities in the project are grouped under two main tasks:

### Information Dissemination and Awareness-Raising

The first task of the project is fully dedicated to information dissemination and awareness-raising activities.

The Marketing and Communication project team provided the information to be targeted at a specific audience, and worked on the marketing of CP through a series of activities, including organising different meetings with stakeholders, building up a library of information, preparing brochures and industry-specific leaflets with case studies, publishing general articles in local publications and the CP magazine, and through the creation and maintenance of a web site.

*The project aims to build cleaner production capacities in Bosnia and Herzegovina through raising awareness and information dissemination, marketing and training*

### Training

The second task was fully dedicated to the training of professionals from industry, government, universities and the CP centre (Centre for Environmentally Sustainable Development - CESD) in CP. The main aims were to create awareness among selected industries of the CP concept and its advantages, to support them in taking action and applying CP tools, to build the capacities of national experts, and to reduce pollution in selected industry sectors by implementing the CP concept.



Figure 1. Media coverage of the project was very satisfactory



## ACHIEVEMENTS OF THE CAPACITY-BUILDING PROGRAMME

Within the first two years of the project, the Centre established contact and disseminated information on CP to 70 industrial enterprises, with 30 of them receiving on-site visits. Information and a reference library services were developed through the CESD library. The library was officially opened on June 18th, 2002.

### The Reference Library

The MAP Regional Activity Centre for Cleaner Production in Barcelona (RAC/CP) sent a large number of books, guidelines, textbooks, CDs and video tapes on CP, free-of-charge, to the CESD. They included:

- Study, video and leaflet on Pollution Prevention in the Metal Plating Industry
- Study, video and leaflet on Pollution Prevention in Olive Oil Production
- Study and leaflet on Pollution Prevention in the Food Preserving Industry
- Study and kit for tanners on Pollution Prevention in the Tanning Industry
- Study on Recycling Possibilities and Potential Uses of Used Oils (vegetable and mineral oils)
- Annual publications with technical articles on CP
- Working Groups Manual
- Study and leaflet on Pollution Prevention in the Textiles Industry
- Good Housekeeping Practices Guide
- etc.

The library currently has 170 titles including publications, brochures, case studies, guidelines, textbooks, and magazines relevant to cleaner production and the environment in general. The “Minimisation Opportunities Environmental Diagnosis (MOED)” guide-

lines and “Good Housekeeping Practices” prepared by the RAC/CP in Barcelona (Spain) and 10 leaflets with CP case studies, have been translated into the Bosnian language and were used as working material for participants in the training modules.

### Mission to Barcelona

A delegation consisting of nine representatives of ministries and other bodies responsible for the environment, industry and technology, the food industry and the CESD visited the RAC/CP. The aim of the mission was to introduce the delegates to the work and the mission of the RAC/CP, the activities that the government of Catalonia undertakes with the aim of promoting sustainable development in industry, and to the successful industrial projects implemented by the RAC/CP. Special attention was paid to the implementation of the EU Directive on Integrated Pollution Prevention and Control (IPPC).



Figure 2. Leaflets with CP case studies

### Dissemination

The CESD has launched a periodical magazine on CP and sustainable development named “The Voice of Sustainability”. The main objective was to keep relevant stakeholders informed on ongoing project activities, offer them an opportunity to give their opinion on different subjects concerning CP and to inform readers about CP activities and initiatives around the world. The CESD designed and launched a web site which had had over 7,500 visitors as at June 2004.



Figure 3. The B&H delegation and RAC/CP representatives during the mission to RAC/CP



Figure 4. “The Voice of Sustainability” the CP magazine

**Training Programme**

Training sessions, planned under the dissemination programme, were divided into two groups –“face to face” and “sector” meetings– four of each type were organised. The main aim of the “sector” meetings was to gather industries from one sector and introduce them to the CP concept and demonstrate opportunities for the implementation of CP in their processes.

The idea behind the “face to face” meetings was to obtain feedback from the stakeholders by encouraging discussion on a specific subject relating to the implementation of cleaner production in certain sectors of industry.

The first “face to face” meeting, with government officials, was entitled “*The Role of the Government in Sustainable Industrial Development*” and aimed to pro-

vide them with information on CP, and advise them what government might do to promote CP and sustainable development.

The second “face to face” meeting, with independent intellectuals, was held during a session of the Association of Independent Intellectuals, “CIRCLE 99”, where a presentation was given entitled, “Reducing Poverty through Cleaner Production”.

The third “face to face” meeting, with members of the universities, was entitled “Cleaner Production in University Curricula”. This aimed to gather all the most appropriate representatives of the universities in B&H, providing them with information on CP and suggesting activities they might carry out to promote CP and sustainable development.



**Figure 6. First theoretical module —Introduction to CP— exercise with play dough**

The fourth “face to face” meeting, between government officials and industrialists was aimed at all of the major sectors of industry in B&H, along with officials from the relevant government departments whose participation in the previous meetings and activities realized within the framework of the LIFE project had been very low, to discuss the opportunities for and obstacles to the efficient implementation of CP.



**Figure 5. Sector meetings of the metal finishing industry, the meat processing and slaughtering industry, large scale industries and the food processing industry**

The training programme was organised as a combination of theoretical training, in-class study and demonstration projects where participants learnt what CP is, how to carry out a Minimisation Opportunities Environmental Diagnosis (MOED) —the tool used to carry out environmental diagnosis and define the opportunities for pollution reduction at source— prepare an MOED Study, and implement the pollution prevention techniques recommended by the Study. The programme was built around multi-enterprise group: this cost-effective approach enabled participants to learn from the experiences of others. Learning by doing is crucial; real life experiences are more interesting and motivating than theoretical lectures. A combination of lecture, “tell and show”

experiences and exercises based on in-company projects improved the relevancy and effectiveness of the training courses. The result of this kind of training is two-fold: professionals from industry, government, universities and the CP centre are trained in CP, and the demonstration projects are implemented with clear environmental and economic benefits.

### Training Modules

The programme was organised in two interactive training modules. The first module was organised as an introductory theoretical module. The second was an interactive combination of in-class study and on-site project demonstrations. Experts from the RAC/CP and the CRO-CPC contributed to the success of the training programme with their expertise and experience.

During the two in-class studies, the participants learned how to carry out the MOED methodology, while during the period in between the class studies, the industries that expressed an interest in continuing with the training, implemented the steps they had learned, carrying out the diagnosis of their production process and collecting relevant data and information for the continuation of the theoretical training. During the second in-class study, participants learnt how to generate pollution minimisation alternatives and to undertake technical and economical evaluation.

### Selected industries

Real demonstrations were carried out in the following 10 selected industries, with the ultimate goal of implementing CP into their production processes:

- Energoinvest TDS – long distance power line industry, Sarajevo.
- Žica – wire industry, Sarajevo.
- Sarajevo Brewery – beverage industry, Sarajevo.
- Sinalco – beverage industry, Sarajevo.
- Frigos – vegetables and fruit processing industry, Čelič.
- Vegafruit – vegetables and fruit processing industry, Mala Brijesnica.
- Omerbašić – vegetables and fruit processing industry, Odžak.
- Fana – vegetables and fruit processing industry, Srebrenica.
- Krajinaklas – bread and pastry industry, Banja Luka.
- Meboš – boilers and drum industry, Šamac.
- Živinoprodukt – poultry slaughterhouse and processing industry, Srbac.
- Ekodozvola – consulting company, Banja Luka.
- Faculty of Technology, Banja Luka.

### Some initial results

The individual MOED Studies showed that water and energy consumption in some food and beverage industries is irrational compared to the benchmark values. Water used mainly for fruit and vegetable cleaning could also be used for other cleaning purposes. It was concluded that by implementing good housekeeping practices significant amounts of water could be saved. These companies were also considering opportunities to reduce amounts of organic wastes. They are currently working together with consultants to select optimum pollution reduction measures that are both economically and technically feasible for their companies.



Figure 7. Mrs Rivero and Mr Vara of the RAC/CP and Mrs Šupan and Mr Host from CRO-CPC during their visits to B&H Companies

### Conclusions

The results of applying a combined capacity-building methodology in this project were very satisfactory. It was observed that the dissemination component was the key to raising awareness on CP with all of the stakeholders involved and to the success of CP implementation.

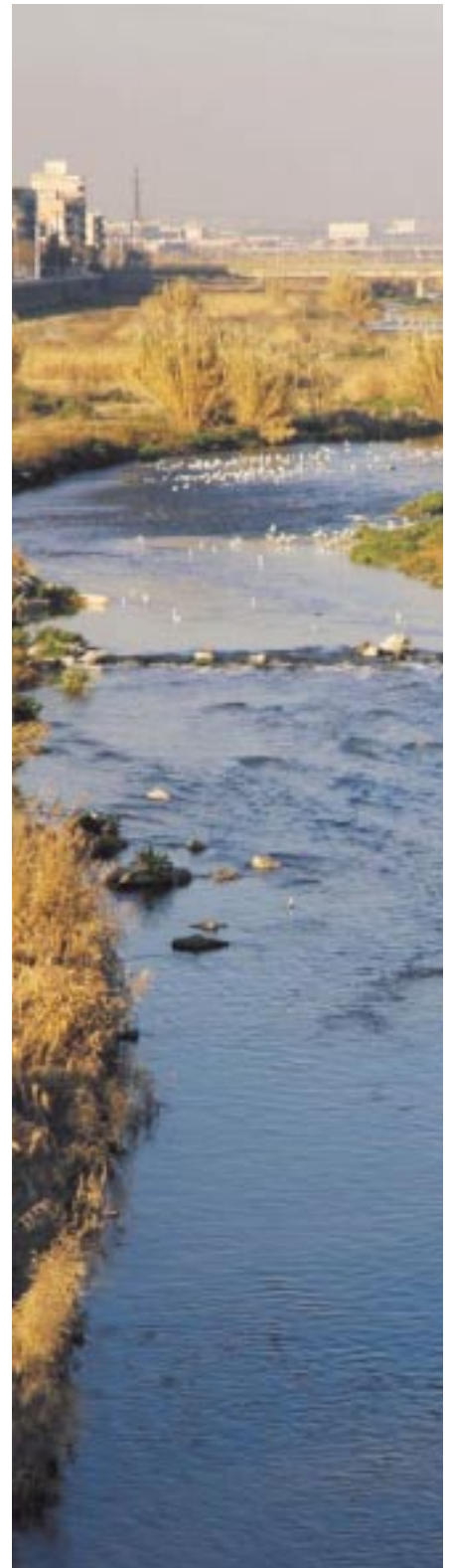
During the project implementation, and bearing in mind the economic and environmental benefits of pollution prevention, the B&H government has adopted a new law on the environment, transposing the Directive on Integrated Pollution Prevention and Control. The Directive requires that countries apply the BAT principle in an integral way during the licensing process. The use of BAT in achieving clear environmental objectives was recommended as an option to be tested for cost/benefit.

The industrial companies where the demonstration activities were implemented, experienced many problems relating to data-collection during implementation of the MOED methodology. This proved useful to them, pointing out areas where management might be improved. They also became aware of the environmental impact and character of pollutant released from each of the production process analyzed. Techno-economical analysis from the MOED study revealed the phases of each production process in which pollution prevention opportunities can be applied. It is expected that the companies involved will implement selected pollution prevention alternatives, and obtain exact data on their environmental and economic benefits before the end of the project in February 2005.

MOED studies were of double benefit to the companies involved. On the one hand they summarized the environmental impacts of industrial processes to identify pollution reduction measures, and on the other, they can serve as a basic document containing all the necessary data required for applying for integral environmental permits, according to the IPPC Directive. It is the obligation of all existing installations to obtain new environmental permits before 2008.

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## CRÉATION DE CAPACITÉS EN PRODUCTION PLUS PROPRE EN BOSNIE-HERZÉGOVINE

Partie I – Mettre en place le travail de terrain et fournir un cadre à l'application de la PP

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La Bosnie-Herzégovine (B-H) est un pays où la pollution industrielle a considérablement augmenté lors de la dernière décennie. Afin de remplir les conditions requises par les différents protocoles internationaux et de l'UE, il devient urgent de s'attaquer à ce problème.

Grâce à l'aide du Centre de développement durable écologique, du Centre pour l'entreprise et l'environnement, situé à Barcelone, et du Centre croate de production plus propre, le Programme de création de capacités a été mis en place. Ce dernier se développe selon une double approche et est destiné aux professionnels tels que les industriels, les différents ministères, les institutions académiques ainsi qu'à la population à travers le pays.

La première, relative à la diffusion de l'information, comprend deux types de rencontres : le « face-à-face » dont l'objectif est d'obtenir un retour des agents concernés en encourageant les débats sur des sujets spécifiques relatifs à la mise en place de la PP ; et les réunions « intersectorielles », rassemblant plusieurs secteurs industriels sélectionnés, afin de les familiariser avec le concept de la PP.

La seconde, relative à la formation, combinant formation théorique et pratique, ainsi que des projets pilotes, est divisé en deux modules : l'un est théorique et l'autre est une combinaison interactive entre étude théorique et projets pilotes.

**Mots-clés :** Bosnie-Herzégovine, Programme de création de capacités, diffusion de l'information, formation, sensibilisation.

## CREACIÓN DE CAPACIDAD SOBRE PRODUCCIÓN MÁS LIMPIA

Partie I – Création del marco para la aplicación de la P+L

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Bosnia-Herzegovina (B-H) es un país donde la contaminación industrial ha aumentado significativamente durante la última década. Resulta urgente afrontar este problema para poder cumplir los requisitos de los diferentes protocolos internacionales y de la UE.

Con la ayuda del Centro para el Desarrollo Ambiental Sostenible, el Centre per a l'Empresa i el Medi Ambient de Barcelona y el Centro Croata de Producción más Limpia, se puso en marcha el Programa de Creación de Capacidad en materia de producción más limpia. Este programa se desarrolla de acuerdo con un enfoque doble y se dirige a profesionales como, por ejemplo, los industriales, varias instituciones gubernamentales y académicas, y público general de todo el país.

La primera etapa, centrada en la difusión de la información, incluyó dos tipos de encuentros. Por un lado, los encuentros « cara a cara », destinados a obtener una reacción de los agentes implicados mediante la discusión de asuntos específicos relativos a la puesta en marcha de la P+L. Por otro lado, los encuentros « intersectoriales », que acogieron diversos negocios procedentes de varios sectores industriales seleccionados con el objetivo de presentarles el concepto de P+L y demostrarles las oportunidades de su puesta en marcha.

La segunda etapa, centrada en la formación y organizada como una combinación de formación teórica y práctica, así como proyectos pilotes, se divide en dos módulos: uno es teórico y el otro es una combinación interactiva de teoría y proyectos pilotes.

**Palabras clave:** Bosnia-Herzegovina, Programa de Creación de Capacidad, difusión de la información, formación, sensibilización.



# A DECISION-SUPPORT TOOL FOR THE SELECTION OF CLEAN TECHNOLOGIES IN SMEs

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A methodological approach to the identification of the requirements and results of the implementation of clean technologies (CT) in SMEs was developed in order to promote the introduction of CTs in the industrial sector. An innovative and user-friendly software package decision support tool (DST) using an integrated techno-economical full-scale application was developed.

The methodology used for the design of the DST was based on the formulation of a clean technologies database in a neutral, uniform structure, in order to be able to be used in different industrial sectors. The textile industry was selected as a reference case, and a relevant database was developed by a survey of the “clean” textile processes, and mass/energy balances of the textile processes were drawn up. The DST was simulated successfully in an industrial environment.

In more detail the main characteristics of the DST are as follows:

- Formulation of typical production process flow-charts representative of the Greek and Portuguese textile industries.
- Identification/Registration of all major input-output parameters as drawn up in the “mass/energy balances per unit” operation.
- Standardisation of input-output parameters according to reference parameter units.
- Best available techniques (BAT) database formulation.
- Standardisation of BAT according to input-output quantified parameters.

**Key words:** decision support tool, SMEs, best available techniques, clean technologies, textile industry.



## Introduction

The European Council Directive on Integrated Pollution Prevention and Control of industrial activities (96/61/EC-IPPC) aims to achieve a high level of protection of the environment using a global approach. The Directive introduces the “best available techniques” (BAT), which combine the advanced performance and viability of the proposed technological concepts (European Council, 1996). The BATs serve as a basis for the determination of reference values for emission limits and emission permit allocation (Geldermann et al. 2004).

“Cleaner production is the continuous application of an integrated, preventive environmental strategy applied to processes, products and services to increase eco-efficiency and reduce risks to humans and the environment.” (UNEP, 2001).

The promotion of CT in SMEs has been approached from a range of viewpoints, ranging from a simple diagnosis of environmental problems and end-of-pipe techniques for confronting environmental requirements, to the use of advanced-engineered systems in large industrial units. The scope of the development of the DST was to provide a reliable and easy-to-use tool, customised to the requirements of SMEs, and to facilitate the update in handling environmental problems in small industrial units.

The textile industry was selected as the reference sector for the software tool because of the vast differentiation of its production processes, and conse-

## METHODOLOGY FOR EVALUATING CTs

quently, the difficulties in standardizing of applied techniques. Approximately 177,000 enterprises (in 2002) form the textile and the clothing sector, an important part of the European manufacturing industry, with a turnover in 2002 of over €200 billion. After the EU enlargement of May 2004 it was estimated that the sector would employ approximately 2.7 million workers. Textiles and clothing account for around 4% of total manufacturing added value, and 7% of manufacturing employment in the EU-15 (European Commission 2003).

BATs will be considered mandatory in the textile industry once they are incorporated into national legislation for pre-treatment plants and fibre or textile-dyeing with a treatment capacity exceeding 10 tons per day, and for installations for the surface treatment of substances, objects or products using organic solvents, in particular for dressing, printing, coating, degreasing, waterproofing, sizing, painting, cleaning or impregnating, with a consumption capacity of more than 150 kg per hour or more than 200 tons annually.

The European IPPC Bureau, in Seville (Spain), issues guidelines for establishing the technological options as best available techniques for several industrial sectors.

The development of the DST was based on three different levels.

The first one deals with structuring a database populated by the technical, operational and economic parameters of the clean technologies candidate. The information supplied to the database was derived from a survey of advanced textile technological options.

The second level is related to the identification of the production line characteristics and the configuration of each unit's operation streams and products.

The third and final level aims to evaluate the changes in the environmental and economic performance of the industrial process after the selection of a CT to be used in that process. Using a different approach than a scoring method (Dijkmans R., 2000), this methodology comprises the following steps.

### Step 1: Analysis of production lines and identification of parameters

The production stages are identified and analysed in relation to their complexity, and the respective input and output elements are determined for each unit operation. According to the type of parameter, absolute or relative figures based on the type and quantity of Raw Material (RM) can be used. Energy and mass flow charts are developed, either for single unit operations, or the global industrial process. Typical inputs and outputs used by DST include operational, environmental and economic parameters, as follows:

#### Unit Operation Input Parameters:

- Electricity consumption per weight of textile (kWh/ton of RM)
- Thermal energy consumption per weight of textile (MJ/ton of RM)
- Water consumption, defined in absolute figures of volume, weight or per textile weight (e.g. l/kg of RM)
- Chemical type input (e.g. l/ton of RM)





Unit Operation Output Parameters:

- Wastewater, defined both in quantity and quality (pH, BOD and COD discharged, BOD and COD discharged per textile weight, TSS, Conductivity, colour absorbency, temperature)
- Solid waste, by-products etc.

The Decision Support Tool provides information on these parameters according to standard values common in the textile industry and/or a typical range and/or recommended optimum values.

**Step 2: Data Collection**

The Data can be either typical pollution loads acquired from literature, or data from measurements made at the specific SME. In this second case, they will have been carried out during real production conditions and with an average load capacity of every unit operation. The information is classified in the following categories:

- Energy Consumption (thermal and electricity)
- Water Consumption
- Waste management (solid waste and wastewater)

*The DST provides information on these parameters according to standard values common in the textile industry and/or a typical range and/or recommended optimum values*

- Re-use and recycling
- Storage and handling of raw material and products (type and quantity)
- Management of toxic and hazardous substances
- Production and operational costs

**Step 3: Standardisation of input-output parameters according to reference parameter units**

The existing production line is evaluated on the basis of good performance parameters, and any “weak spots”, from an environmental point of view, are determined. Legislative and Regulatory limitations are also identified.

**Step 4: Clean technology database formulation for each unit operation**

**Step 5: Simulation of new process and selection of clean technology/ies**

The flow chart is recomposed and the whole textile process of a specific site is simulated incorporating the implementation of the CT.

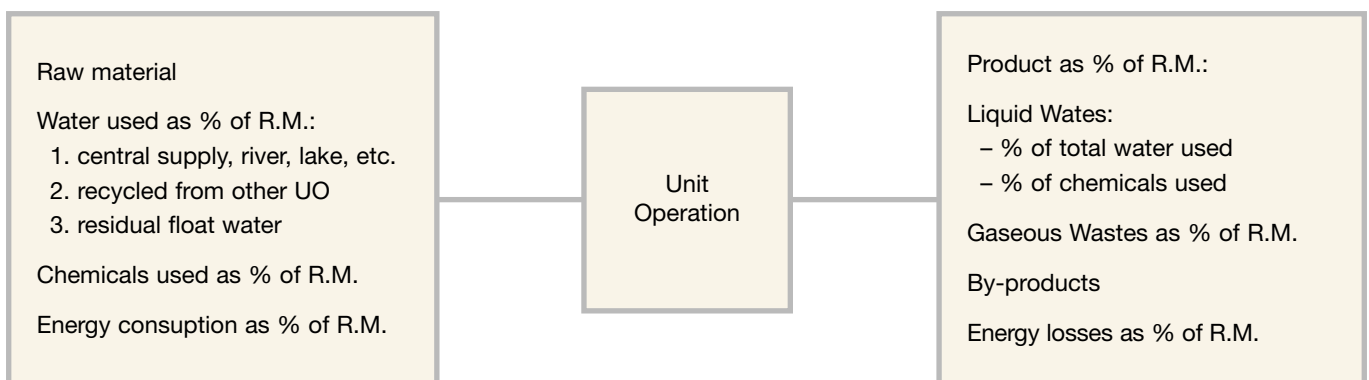


Figure 1. Mass and Energy balance per Unit Operation (Kakaras (et al), 2001)

## THE STRUCTURE OF THE DECISION SUPPORT

The aim of the DST is to manage and evaluate environmental, economic and technical aspects of the production line in a user-friendly manner resulting in a quantitative and qualitative evaluation for the whole production process, and for various types of environmental technologies. Specific efforts were made on the tool's flexibility regarding the replacement of techniques used in parts of the production process, as well as on its capability to combine the appropriate techniques in the order of specific "Recipes". The innovative characteristics of the DST are illustrated in the following table.

The application includes three main modules, namely: Management, Environment and Audit modules.

**Table 1. Innovative Elements of the Tool**

Previous situation	Innovative elements of the project
Environmental problem diagnosis	Integrated methodology of environmental analysis
Partially organized information	Organized information with increased transferability
Reference of examples of techniques implementation in industries	Possibility of comparison between existing and new technique according to parameters, predetermined (by the user) of the production process
Environmental performance improvement on a unit operation level	Environmental performance improvement on a unit operation level as well as on the level of the entire production process
General instructions on good housekeeping practices	Possibility of selecting alternative solutions based on quantified parameters
Environmental performance improvement in large industrial units	Interaction User Tool – Guide for environmental performance improvement

In the Management module (figure 2), input parameters related to water type (such as input water, wastewater), chemicals (inventory code, name, cost and supplier), raw materials (description, cost), recipes (description, ID, raw material), environmental parameters (description), gaseous, liquid and solid waste (description, cost), miscellaneous inputs and outputs (description, cost) and by-products (description, income) are defined.

Unit operations are defined in the Environment module. Furthermore, the information of the CT database is available, enabling either access to the collected data or to the population with new, clean technologies.



**Figure 2. The management section options of the DST**



**Figure 3. The audit section options of DST**

The database of the DST includes 18 clean technology options enlisted:

1. Collection and re-use of wastewater from the mercerising stage.
2. Collection and re-use of dyes.
3. Separation of wastewater flows during wastewater treatment.
4. Post bleaching.
5. New jets technology (AFS Airflow System).
6. New jets technology (AFS Airflow System).
7. New jets technology (SCLAVOS Twin Soft Flow System).
8. Use of bio-degradable agents.
9. Counter current washing.
10. Cold pad batch dyeing.
11. Sizing with synthetic sizes and recovery.
12. Energy recovery from effluents.
13. Radio-frequency (RF) drying.
14. Foam finishing.
15. Co-generation in textile processing.
16. Supercritical CO<sub>2</sub> dyeing.
17. High temperature rinsing and membrane filtration in re-active dyeing of cotton.
18. Enzymatic process for the removal of peroxide residues from cotton bleaching.

Considering that performance often has to be described by a range, rather than a fixed figure (GFEPA 2000), the results of the implementation of these eighteen potential BATs to a typical textile industry are shown in Table 2.

The Audit module flow charts show cost and material balances, in addition to graphs for material, costs per unit operation and total costs.

*The aim of the DST  
is to manage and  
evaluate  
environmental,  
economic and  
technical aspects of  
the production line*



Table 2. Benefits from clean technology application in percentage values

Unit operation	Energy consumption	Water consumption	Chemicals and Additives	Other parameters
1 Mercerising		↓	↓ NaOH 60%	↓ COD 54.5% ↓ NaOH load in ww 72.2%
2 Dyeing	Thermal ↓ 25%	↓ 25%		
3 Dyeing				↓ COD 88% ↓ NaOH load in ww 53%
4 Bleaching	Total ↓ 15%	↓ 15%		↓ processing time BOD, COD maintained low
5 Dyeing		↓ 50%	↓ NaCl: 35%	↓ processing time 40-60%
6 Dyeing	↓ steam		↓ Chemicals: 5-6%	↓ processing time 50%
7 Dyeing		↓ 41%		↓ processing time 54%
8 Washing				↓ BOD 25-35%
9 Washing		↓ 50%		
10 Dyeing	Total ↓ 70%	↓	↓ chemicals and NaCl	
11 Sizing/Desizing		↓ 80%	↓ sizing agents: 80% ↓ enzymes: 100%	↓ BOD 25% ↓ COD 72% ↓ total solids 31%
12 Dyeing-Printing	Thermal ↓ 15-35%			↓ Air emissions 15-35%
13 Drying	Thermal ↓ 90%			↓ processing time 90%
14 Finishing/ Drying	Total ↓ 25%	↓ 66%		↓ processing time 50% ↓ Air emissions 60%
15 Knitting/Dyeing/ Finishing	Total ↓ 10%			
16 Dyeing		↓ 35-50%	↓ chemicals	↓ COD ↓ processing time 25%
17 Dyeing/Rinsing	↓	↓ 47%		↓ processing time
18 Bleaching/ Dyeing	↓			

## DST APPLICATION

The DST was simulated successfully in an industrial environment, and test cases of typical textile processes in Greece and Portugal were examined. The implementation of the CT results in benefits that are in some cases more properly described by a range (GFEPA, 2000) rather than a fixed number, due to a dependence on specific conditions.

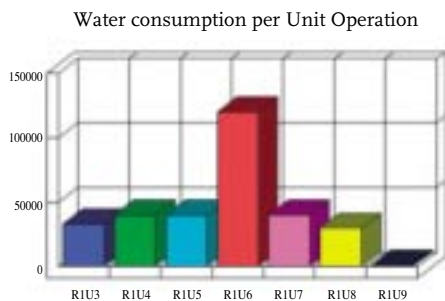
An example of the variation of the “water consumption” parameter for a ‘typical’ textile process when implementing a new clean technology is shown in the graphs (figure 4).

## SOFTWARE FEATURES

*No license or password is needed to run the DST software application*

The DST software application is designed to run on a Microsoft Windows® operating system. The database tables of DST were designed with Microsoft Access® and the programming environment was developed using Microsoft Visual Basic®. No license or password is needed to run the DST software application. DST can give the results of calculations in two different types of electronic file: text format files (reports) and graphic format files (charts). The reports produced are on Microsoft Excel® worksheets, which can be further elaborated or modified by the user of the application.

Typical Textile Process



Clean Technology Process

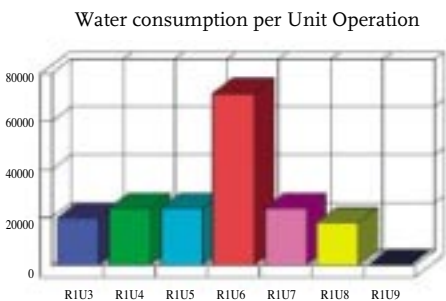


Figure 4. Example of Clean Technology Application (reuse of wastewater from the mercerising stage) with the DST

## CONCLUSIONS

The information provided by the DST can be transformed to easily-adapted standard data which enables SME managers to determine the environmentally “weak” points of their processes and easily select appropriate “clean” solutions adaptable to their actual circumstances (e. g. process optimisation through clean technologies, or good housekeeping options). SMEs can benefit largely from such a system since they possess neither the resources for detailed and costly specialised computerised systems, nor for the related trained personnel costs. By using the DST which incorporates a standardization of information and a clean technologies database, the end-user is able to evaluate alternative options on the basis of the particular characteristics and requirements of their production processes, which can also be upgraded with the addition of new clean technologies by the user.

The DST software application has been distributed to 140 SMEs in the Greek and Portuguese textile industry.

## Acknowledgements

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## UN OUTIL D'AIDE À LA DÉCISION POUR LA SÉLECTION DE TECHNOLOGIES PROPRES DANS LES PME

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Une approche méthodologique pour l'identification des conditions requises et des résultats, issue de la mise en place de technologies propres (TP) au sein des PME, a été développée afin de promouvoir l'introduction de TP dans le secteur industriel. Un progiciel, un outil d'aide à la décision (OAD), innovateur et convivial, utilisant une application industrielle techno-économique, a également été développé.

La méthode utilisée pour la conception de l'OAD est basée sur l'élaboration d'une base de données de technologies propres dans une structure uniforme et neutre afin qu'elle puisse être utilisée dans différents secteurs industriels. L'industrie textile a été sélectionnée comme cas de référence, une base de données significative à pu être fournie grâce à une étude relative aux procédés textiles « propres », et un bilan énergétique et de matière dans les procédés textiles a été effectué. L'OAD a été stimulé avec succès dans un contexte industriel.

Voici le détail des principales caractéristiques de l'OAD :

- Élaboration de diagrammes de flux des processus de production type représentatifs des industries textiles grecques et portugaises.
- Identification / enregistrement de l'ensemble des paramètres d'input-output tels qu'ils ont été élaborés dans les bilans énergétique et de matière par opération unitaire.
- Standardisation des paramètres d'input-output selon les unités de référence paramétriques.
- Élaboration d'une base de données de meilleures techniques disponibles (MTD).
- Standardisation des MTD selon les paramètres quantifiés d'input-output.

**Mots-clés :** outil d'aide à la décision, PME, meilleures techniques disponibles, technologies propres, industrie textile.

## UNA HERRAMIENTA DE AYUDA A LA TOMA DE DECISIONES PARA LA SELECCIÓN DE TECNOLOGÍAS LIMPIAS EN LAS PYME

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Se ha desarrollado una metodología para identificar las necesidades y los resultados derivados de la aplicación de tecnologías limpias (TL) en las PYME, con el objetivo de promover la introducción de las TL en la industria. De igual modo, se ha desarrollado un paquete informático, una herramienta de ayuda a la toma de decisiones (HATD), mediante una aplicación industrial técnica y económica.

La metodología utilizada en el diseño de la HATD se ha basado en la elaboración de una base de datos de estructura uniforme y neutra con el objetivo de que sea aplicable a los diferentes sectores industriales. Se eligió como caso de referencia la industria textil y se desarrolló una base de datos de los procesos textiles «limpios» por medio de una encuesta. De igual modo, se efectuaron balances energéticos y de masa de los procesos textiles. Se ha simulado con éxito la HATD en un contexto industrial.

Las características principales de la HATD se detallan a continuación:

- Elaboración de diagramas de flujo tradicionales sobre el proceso de producción representativo de las industrias textiles griegas y portuguesas.
- Identificación/registro del conjunto de parámetros de entradas-salidas tal como se elaboraron en los balances energético y de masa por operación unitaria.
- Estandarización de parámetros entradas-salidas de acuerdo con las unidades de referencia paramétricas.
- Elaboración de una base de datos de mejores técnicas disponibles (MTD).
- Estandarización de las MTD de acuerdo con los parámetros cuantificados de entradas-salidas.

**Palabras clave:** herramienta de ayuda a la toma de decisiones, PYME, mejores técnicas disponibles, tecnologías limpias, industria textil.





# NATIONAL STRATEGY FOR CLEANER PRODUCTION IN EGYPTIAN INDUSTRY

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This paper presents the National Cleaner Production Strategy for Egypt. The objective of this strategy is to encourage the adoption of CP in the Egyptian industry sector and to establish, mainly by the Egyptian government, an enabling environment that would facilitate and promote its implementation by Egyptian industry. The scope of this strategy covers industrial production processes. The vision of the strategy, goal, and goal indicators are included. The tools for overcoming different obstacles facing this strategy, such as prerequisites for its operationalisation are highlighted, and the approach adopted in this strategy indicated. The objectives of the strategy are clearly stated, along with action items for implementing them. Finally, the institutional arrangements including the core organisations and the executive mechanisms are specified.

## Introduction

The CP strategy aims at developing an integrated framework for the implementation of CP in Egyptian industry within the overall context of national policy. The document adopts the definition of the United Nations Environment Program (UNEP), which states that:

*Cleaner production means the continuous application of an integrated preventative environmental strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment.*

The document presents the benefits as well as the obstacles to the effective implementation of CP on a wider scale.

The CP strategy is mapped out to encourage the adoption of CP in the Egyptian industry sector and to establish, mainly by the Egyptian government, an enabling environment that would facilitate and promote its implementation by Egyptian industry. Therefore, the primary target organisations for the CP strategy are the various governmental organisations due to their competency to overcome obstacles and solve the problems facing the implementation of CP. This implies a pivotal role for the Ministry of Industry and Technology and the Egyptian Environmental Affairs Agency. However, the success of the implementation of the strategy and action plan is greatly dependent on the cooperation and partnership of the Egyptian industries which are the actual implementers of the required measures. In this regard, the Federation of Egyptian Industries plays a key role as the institutional umbrella of the Egyptian industries.

**Key words:** CP strategy, Egypt, cleaner production, Egyptian industry.

## SCOPE

The main focus of the strategy and action plan is industrial production processes. This is mainly because the industrial sector in Egypt contributes about 20% of the Egyptian GDP and employs approximately 15% of the workforce. Moreover, it is a source of various and high environmental impacts. The scope of the strategy and action plan encompasses the manufacturing processes and other related internal activities including on-site recycling and re-use of waste. Although off-site recycling of generated waste addresses an important environmental problem, it comes second to waste prevention and is not part of the issues addressed by this strategy, together with the end-of-pipe treatment practices that should be considered as a last resort after CP to achieve legal compliance and minimize the adverse impacts on the environment.

The strategy and action plan does not only focus on large industrial establishments, as some action items are also applicable to small and medium enterprises (SMEs). Targeting SMEs is especially critical since establishments with fewer than 50 employees represent more than 99% of industrial establishments in Egypt.

It does not, however, address issues related to the deep-rooted financial problems facing large state-owned industrial establishments, nor the illegal status of unregistered SMEs to which the CP concept would be applicable. These issues would require political interventions of a different nature outside the scope of the document.

*Cleaner production contributes significantly to the modernization of Egyptian industry and sustainable development*



**Conversion of the manual spraying process to an automatic process**

## VISION AND GOAL

Cleaner production contributes significantly to realizing two main national visions corresponding to the aims of the political leadership: the modernization of Egyptian industry to improve quality of life, with industry being the engine towards that end, and sustainable development achieving a healthy environment for current and future generations.

*By the year 2022, Egypt is to become a leading industrialized country in the MENA Region (Middle East and North Africa) being an investment magnet in the region and positively integrated in the world economy. (Green Paper on Industrial Policy in Egypt, 2003)*

*Egypt is also to balance between its economic and industrial development needs, and at the same time strive to overcome the environmental challenges resulting from such developments. This is to be carried out within the implementation framework of the Egyptian Agenda 21. (NEAP, 2002)*

Within this context, the goal of the CP strategy is:

*The performance of Egyptian industries is improved to become in line with current international developments through the wide and accelerated adoption of CP in the Egyptian industries.*

## GOAL INDICATORS

The main indicator for realizing this goal is continuous improvement in material efficiency. This means decreasing specific consumption of input materials, as well as the waste generated per unit production. The quantitative targets set according to the national benchmarking of industries determine the extent of improvement. Therefore a fundamental and crucial activity is to identify the current status of Egyptian industry and compare it with international standards.

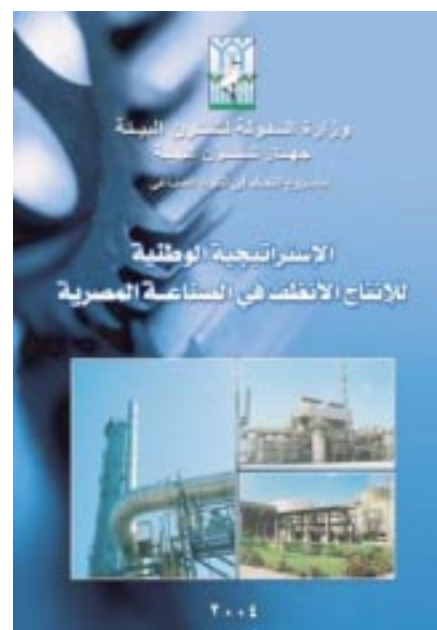
The performance indicators would be calculated for each industrial sector based on the inputs and waste characterizing this sector, with particular focus on priority areas that are mainly related to scarcity of resource and/or the hazardousness of the waste generated. Taking into account the wide range and diversity of the different industries, one overall indicator cannot be developed for the Egyptian industry sector as a whole.

It is worth mentioning that ISO 14001 is selected as an indicator for achieving the goal, although its nature differs from the other indicator types. This is mainly because the adoption of EMS in the establishments should reflect a deeper change in attitude that should support sustainability and the continuity of the adoption of CP. Although ISO 14001 is not the only system of this type, it is certified and hence information for indicator calculation is available and accessible. Moreover, the number of certified establishments is expected to be proportional to the number of establishments implementing environmental management systems.

*A change in attitude  
should support  
sustainability and  
the continuity of the  
adoption of CP*

## POLICY STATEMENT

Currently, there is no Egyptian policy on cleaner production. However, previous experience shows that declarations of commitment from top officials in Egypt, on similar high profile concepts, have been effective in bringing the issues of interest to the forefront of community interest. Therefore, the signing of the international CP declaration by the Prime Minister would ensure the flexibility of its implementation. The declaration is a voluntary public statement of commitment, thus there is no legal onus on Egypt to sign it, rather it is ethical. The policy statement would pave the way for implementing the strategy for which the framework is developed.



## THE STRATEGY

Achieving the objectives of the strategy depends on various tools that contribute to overcoming the different obstacles to the implementation of CP and establishing an encouraging environment for its adoption in the Egyptian industry sector. The use of the legislative, financial and awareness tools correlates with various issues, the most important of which is the difference in nature and status between existing and new industrial establishments.

### • Prerequisites

There are a number of requirements that are essential for the operationalization of the strategy. These include improving the efficiency and effectiveness of enforcement activities, improving public disclosure of pollution information and increasing the enforcement likelihood to industry. These apply to new as well as existing establishments. However, the main difference between both types of establishment lies in the integration of CP in existing regulations. Whereas the new establishments are required to comply with the relevant regulations during the early phases of the project development (during design and EIA preparation), the existing ones will need certain legislative transition arrangements and financial support to be able to carry out changes.

### • Approach

The approach adopted in the document is summarized as follows:

- Addressing the attitude of industries towards compliance and overcoming the technical and informational barriers
- Relying on positive incentives as a first stage
- Turning to disincentives as a second stage
- Use of the legislative approach to differentiate between new and existing

*The evolving legislation will become pivotal for CP activities in Egypt*

establishments to support positive trends rather than initiate them.

In due time, the evolving legislation will become pivotal for CP activities in Egypt, in the sense that it should be preceded by certain activities to prepare for its adoption, and followed by others that facilitate its implementation. This would achieve the correlation between the continuous evolution of the legislative requirements and the industrial performance.

A delay in reaching the legislative stage would result in dealing with all types of establishments following the suggested approach for existing ones. This has the main disadvantages of a slow rate of progress, and the need for intensive resources in order to move industries in its direction.

The improvement of Egyptian industry's performance is to be accompanied by a similar improvement in planning methodologies. The benchmarking of industries should reflect on the targets to be achieved in the relevant legislations. By accumulating and documenting the implementation experiences, emphasis could be placed on a number of tools that prove to be more effective in achieving the goal.

### • Objectives

The objectives leading to realizing the goal of the strategy are:

- The performance of new industrial establishments exceeds national average performance
- Existing industrial establishments progress towards cleaner production within a specified timeframe
- The share of clean products increase continuously on the local market

Table 1. Lead and Support Agencies for Implementation of Action Items (● denotes a lead agency, while ○ denotes a support agency)

	Action Items	Entities Involved in the Implementation of the Action Items										
		EEAA	Ministry of Electricity	Ministry of Industry	Ministry of Finance	Ministry of Petroleum	Ministry of Foreign Trade	FEI	Ministry of Scientific Research	Ministry of Planning	Cabinet of Ministers	Other major stakeholders
	<b>1. The Performance of New Industrial Establishments exceeds the National Average Performance</b>											
Immediate term	1.1 Establishing Public Recognition Schemes	●		○			○	○				NGOs
	1.2 Modifying EIA Guidelines to include CP Practices	●										Local Administration / Technical service providers
Short term	1.3 Adoption of CP Practices in Applicable Regulations	●		○		○		○				Other regulators
	<b>2. Existing establishments progressing towards CP within specified time frame</b>											
Immediate term	2.1 Increase Awareness of Upper Industrial Management concerning CP practices	○		●		○		●				Training providers
	2.2 Establishing Public Recognition Schemes	●		●				○				NGOs
	2.3 Facilitating Access to Available Funds	●						○				
	2.4 Capitalizing on International Agreements	●		●		○		○				Ministry of Foreign Affairs
Short term	2.5 Negotiate Transitions with Industrial Sectors	●		●				●				Other regulators
	2.6 Supporting CP Technical Studies and Audits	○		●								Service providers / Banking sector
	2.7 Compliance Agreements to Encourage Facilities to Adopt CP	●						○				Other regulators
Long term	2.8 Fiscal Incentives for Technology upgrading in Egyptian industry			○	●			○				Central Auditing Agency / General Authority for Investment
	<b>3. The Share of Clean Product Increases Continuously on The Local Markets</b>											
Immediate term	3.1 Raising Public Awareness about Benefits of Clean Products	○		●				○				NGOs
Short term	3.2 Establishing a Local «Eco-label» Scheme	○		●			○	○				NGOs
	3.3 Developing National Environmental Standards			●			○	○				
Long term	3.4 Government procurement policy			○	●			○				
	<b>4. Industrial Establishments Bear Increasing Percentage of Actual Costs of Input Material and Services</b>											
Short term	4.1 Use Economic Instruments	●	○	○	●	○		○		●	●	Ministry of Labor
Long term	4.2 Economic Pricing of Inputs		○	○	○	○		○		●	●	Ministry of Housing
	4.3 Recovering Full Costs of Services			○	○			○		●	●	Other regulators / Ministry of Housing
	<b>5. Availability of the Necessary Knowledge</b>											
Immediate term	5.1 Establishing a CP Clearinghouse	○		●		○		●	○			Technical service providers
	5.2 Implementing Selected Demonstration Projects	●		●				●				Local Administration / SFD
	5.3 Knowledge dissemination	●		●				●				
Short term	5.4 Encouraging Local Targeted Research	●		●				○	○			
	5.5 Extension Services for SMEs	○		●				●				Local Administration / SFD / Technical service providers
	<b>6. Availability of the Required Technical Capacities</b>											
Immediate term	6.1 Establishing CP Training Facilities	○		●				○				Training Centres
Short term	6.2 Integrating of CP Concepts in Higher Education Curricula	○		○								Ministry of Higher Education / Private Universities
Long term	6.3 Increasing the Availability of Skilled Technical Labor to Implement CP Practices			●								Ministry of Labor (Labor University) / Ministry of Education (technical education institutes)

## INSTITUTIONAL ARRANGEMENTS

- Industrial establishments bear an increasing percentage of actual costs of input material and services
- The necessary knowledge is available
- The required technical capacities are available

### • Action items

For each of the objectives, corresponding action items are identified and categorized into immediate, short- and long-term action items. For each action item, the leading support agencies are identified.

An action plan is currently being developed for selected immediate action items, for which the time-frame for implementation is to be determined, as well as the required resources, means of verification and potential risks.

The following table summarizes the different objectives and the corresponding action items categorized into immediate, short- and long-term action items, based on set criteria including:

- Existing capabilities and organisational framework within which they can be implemented
- Availability of ongoing stakeholders' activities interested in carrying out such activities
- Existing favourable implementation conditions.

*Central to the successful implementation of this strategy and action plan is the availability of an organisation, or a core group of organisations, which would act as a champion for the document*

### • Core organisations

Central to the successful implementation of this strategy and action plan is the availability of an organisation, or a core group of organisations, which would act as a champion for the document. This entails seeing it through to the implementation phase, monitoring the implementation progress, and collecting feedback from the industry. Seeing into the roles of the lead and supporting agencies in implementation of the different action items, it is proposed that this core group should consist of the Ministry of Industry and Technology (MIT), and the Egyptian Environmental Affairs Agency (EEAA) both representing the policy-making bodies of industry and environment respectively and the Federation of Egyptian Industries, presenting the institutional umbrella for the Egyptian industries. The necessity of such a core group does not diminish the importance of the involvement of other concerned stakeholders.

### • Executive mechanism

The cooperation mechanism between the core organisations need not involve the establishment of a new organisation to be responsible for implementing the strategy. A separate, potentially isolated organisation could be counter-productive, as it may involve further institutional arrangements to develop communication channels with the existing bodies. Therefore, it is recommended that a steering committee be established, which would be responsible for the execution of the cooperation protocol signed between the core entities. The committee will play a key role in attracting resources and directing them towards implementation of the

identified action plans as well developing norms and standards related to CP. Additionally, a joint technical secretariat should be formed by the Ministry of Industry and Technological Development and the EEAA, located in either organisation, to be responsible for developing the details of action programmes and follow-up of the implementation of the action plan and a periodical update.

Currently, activities are undertaken for establishing the policy umbrella for CP implementation. These entail elaboration of the draft CP cooperation between the core organisations. The current activities also include developing detailed descriptions of the function of the steering committee and technical secretariat, including staffing, possible funding sources and mode of operation.

*The cooperation mechanism between the core organisations need not involve the establishment of a new organisation to be responsible for implementing the strategy*



**Installation of a new toaster unit**



**Installation of a new sanitary furnace that runs on natural gas**



**Installation of a new bottling line**



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## STRATÉGIE NATIONALE DE PRODUCTION PROPRE POUR L'INDUSTRIE ÉGYPTIENNE

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Cet article présente la stratégie nationale adoptée par l'Égypte en matière de production plus propre (PP). L'objectif de cette stratégie est d'encourager l'adoption de la PP par le secteur industriel égyptien et d'établir, principalement sur l'initiative du Gouvernement égyptien, un environnement favorable qui faciliterait et promouvrait sa mise en place par l'industrie égyptienne. Cette stratégie englobe les processus de production industriels. L'article présente la vision de la stratégie ainsi que les objectifs et ses indicateurs. Les instruments élaborés pour surmonter les obstacles que présente la stratégie sont mis en valeur, telles que les conditions requises pour rendre opérationnelle la stratégie et l'approche adoptée par cette stratégie adaptée. Les objectifs de la stratégie sont clairement établis ainsi que les thèmes d'action permettant de les atteindre. Enfin, l'article montre les mesures institutionnelles au sujet des organismes centraux et du mécanisme d'exécution.

**Mots-clé :** Stratégie de PP, Égypte, production plus propre, industrie égyptienne.

## ESTRATEGIA NACIONAL DE PRODUCCIÓN MÁS LIMPIA EN LA INDUSTRIA EGIPCIA

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Este artículo presenta la estrategia nacional egipcia de producción más limpia (P+L). El objetivo de la estrategia consiste en promover la adopción de la P+L en el sector industrial egipcio y crear, principalmente con la iniciativa del gobierno, un ambiente favorable que facilite y promueva su aplicación. El alcance de la estrategia cubre los procesos de producción industrial. Se incluyen las intenciones de la estrategia, los objetivos y sus indicadores. Asimismo, se destacan los instrumentos para superar los diferentes obstáculos que presenta la estrategia como, por ejemplo, los prerrequisitos para hacerla operativa y el enfoque adoptado. Los objetivos de la estrategia se presentan claramente, junto con los actores que hacen posible su puesta en marcha. Por último, se muestran los planes del gobierno en materia de organismos centrales y mecanismo de ejecución.

**Palabras clave:** Estrategia de P+L, Egipto, producción más limpia, industria egipcia.



# CLEANER PRODUCTION IN A STEAM AND CONDENSATE SYSTEM

## A CASE STUDY IN AN ANIMAL FEED PRODUCTION PLANT

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Steam has been in use since the 18<sup>th</sup> century to supply power and heat to industrial and commercial organisations. Steam can generate large amounts of energy compared to other systems; therefore the steam and condensate system is one of the most important used in process industries. To ensure its optimal operation it should be audited, regularly checked and maintained. Its efficient operation reduces costs, saves resources (fuel, water, chemicals), and reduces waste production.

An assessment was made of a steam and condensate system in an animal feed production plant. The methodology of the assessment includes a flow sheet, mass and energy balances of the process and boiler house, identification of all steam consumers, the flow sheet of steam and condensate systems, producing rational steam consumption and condensate recovery options, and making technical, economic and environmental assessments. Only the most beneficial options should be proposed and implemented.

The analyses show that the options proposed can improve the efficiency of a plant. The steam should be consumed efficiently; all steam traps should be correctly selected and installed in the process. The staff should check the operating of the steam and condensate armatures, inspect for leaks, etc. on a regular basis.

The results show that it is possible to reduce the production of flue-gas emissions by up to 5%, wastewater by 23%, fuel by 5% and waste heat by up to 4%. Payback periods of the proposed options are between 1.2 and 3 years.

### Introduction

Steam has been in use since the 18<sup>th</sup> century to supply power and heat to industrial and commercial organisations. Steam can generate large amounts of energy compared to other systems (e.g. water systems, oil systems) therefore the steam and condensate system is one of the most used in process industries. A typical steam and condensate system, such as the one shown in Figure 1, consists of:

- a steam boiler with or without a steam turbine (combined heat and power or CHP);
- a feed water treatment plant;
- a steam distribution system;
- a condensate system.



**Key words:** Steam and condensate system, energy efficiency, cleaner production.

## A STEAM AND CONDENSATE SYSTEM

### Steam boiler

In boilers, the mixture of fuel and air combusts, producing energy, waste gases, wastewater and waste heat. High steam pressure can be decreased through a steam turbine where electricity is produced. Boilers differ in construction, in design, in type of fuel etc. Several types of boiler exist [1]:

- fire tube boilers;
- electrical boilers;
- water tube boilers;
- super heaters.

Figure 2 shows a typical steam boiler with inputs (fuel, feed water) and outputs (steam, flue gas, wastewater).

Fuels, such as natural gas, liquid fuel, coal, municipal solid waste, methane from waste, and wood, are usually used. The amount of waste gas depends on the capacity of the boiler, while the composition of the waste gas depends on the type of fuel and its composites (e.g. concentration of sulphur, concentration of carbon, concentration of hy-

*Steam can generate large amounts of energy compared to other systems*

drogen etc.). The efficiency of the overall boiler plant depends particularly on combustion efficiency.

Boiler bottom blowdown and total dissolved solids control (TDS) prevent boiler scale, and corrosion of the heating surfaces [2]. The wastewater contains dissolved solids, waste gases (CO<sub>2</sub>, O<sub>2</sub>), and waste heat. The wastewater can be minimised by the proper chemical and thermal treatment of the feed water, the degree of condensate returned from the process, efficient TDS and bottom blowdown control, and waste heat recovery. Figure 3 shows an efficient TDS and bottom blowdown control with the waste heat recovery. Namely the TDS control means optimisation of the impurities' concentration of the boiler water. But there is still a requirement for occasional blowdown from the bottom of the boiler to remove sludge. Usually water blowdown at steam pressure is flashed off in order to produce a low-pressure steam that can be used for the deaeration of the feed water or for heating purposes in the

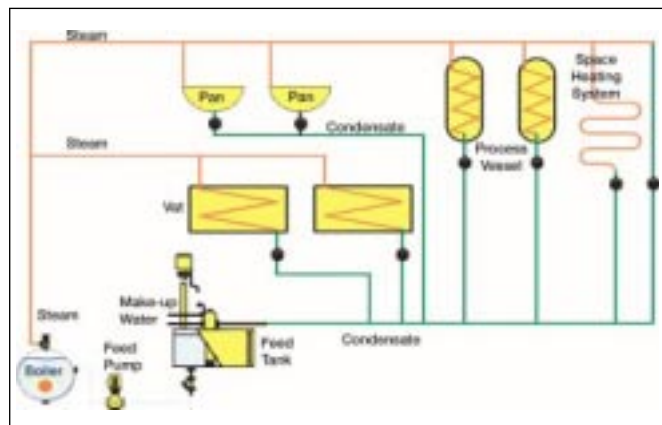


Figure 1. A typical steam and condensate system

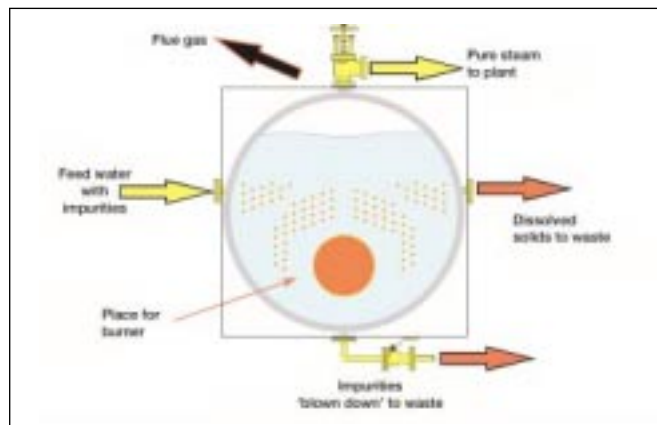


Figure 2. Steam boiler

process. Condensate pipe from the flash vessel and the bottom blowdown wastewater is connected with a heat exchanger where make-up water is heated.

**Water treatment**

Natural water is hard. Hardness is caused by the presence of the mineral salts of calcium and magnesium. These minerals encourage the formation of scale on the heat exchange surfaces [3].

The chemical treatment that needs to be applied to the feed water, depends on many factors such as:

- the impurities inherent in the make-up water and its hardness;
- the volume of the condensate returned for re-use and its quality;
- the design of the boiler and its operation conditions.

Several types of external water treatment are known:

- the lime and lime/soda softening;
- the ion exchange;
- the reverse osmosis.

Softening is the most widely used and the simplest form of ion exchange. Hydrated lime (calcium hydroxide) reacts with calcium and magnesium bicarbonates to form removable sludge (waste). In the case of a base-exchange softening the resin bed is initially activated or charged by passing sodium chloride (NaCl) through it. Calcium and magnesium ions are replaced with sodium ones. After the resin is saturated with the calcium and magnesium ions, the resin has to be regenerated with a NaCl solution. The regeneration water reacts with Ca and Mg ions and is then drained to the sewers as wastewater. Where there is little or no condensate return, a more sophisticated type of ion exchange is preferable, e.g. dealkalisation, demineralisation or even reverse osmosis. Reverse osmosis is a process whereby pure water is forced through a semi-permeable membrane leaving a concentrated solution of impurities, which is rejected to waste.

Boiler feed water is a mixture of soft cold water and returned condensate. It

contains dissolved gases (oxygen, carbon dioxide and other gases) that cause the corrosion of the boiler and pipes. By heating the feed water the amount of scavenging chemicals subsequently required can be reduced by up to 75%. This improves the boiler efficiency by reducing the TDS level and hence the blowdown requirements. Figure 4 shows the feed water tank with the deaerator head and utilisation of the low-pressure steam from a flash vessel. To minimise the heat requirements for the feed water that is heated up to the required temperature (usually at 105 °C), the waste heat can be recovered as:

- a low pressure steam from flash vessel;
- hot water from the water bottom blowdown and as a condensate from flash vessel and
- processed hot waste streams.

The waste heat from the deaerator's vent can be also used for the preheating of the cold make-up water that enters the feed water tank.

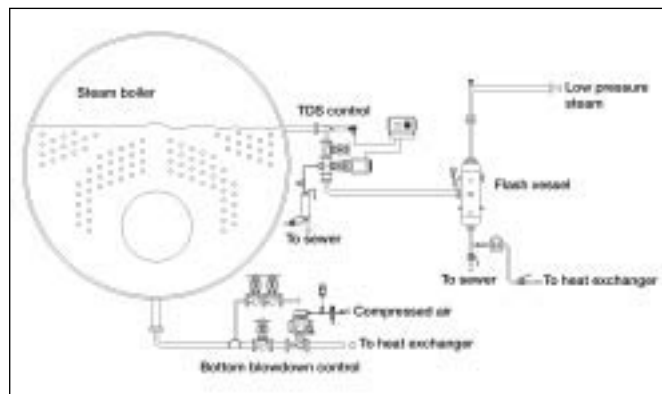


Figure 3. Efficient TDS and bottom blowdown control with waste heat recovery

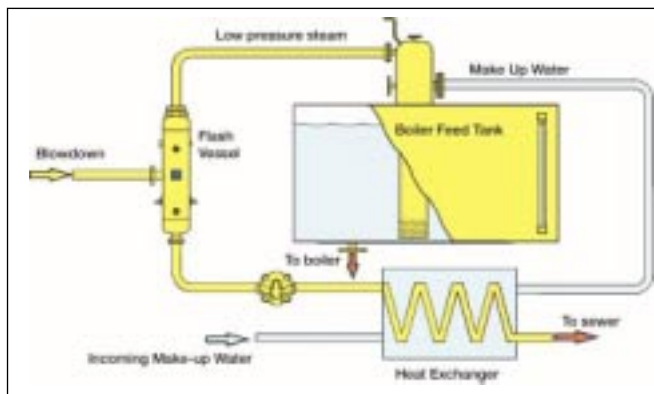


Figure 4. Recycling of the flash steam and waste heat recovery

**The steam distribution system**

The steam distribution system is an important link between the steam source and the steam users [4]. It must supply good quality steam at the required rate and at the right pressure. An optimal design and operation of the steam distribution systems will decrease operating costs and minimise the impact on the environment. For example a steam distribution system at high pressure has many advantages:

- smaller diameter steam mains lower investment costs and heat losses, as a result of smaller mains' surfaces;
- obtaining dryer steam at the point of steam usage;
- the steam boiler operates at a higher pressure and therefore with higher efficiency;
- the thermal storage capacity of the boiler is increased, helping it to cope more efficiently with fluctuating loads, and enabling a reduced risk of priming and carryover.

As soon as steam has left the boiler, some of it condenses due to heat losses

through the pipe and due to pipe heating. The condensate can form a water hammer that damages the pipe work and fittings (e.g. stop valves, reducing valves, control valves, check valves, etc.) and reduces heating efficiency in the heat exchangers. It has to be drained out of the pipe work at the lowest points. At the start-up a steam-air mixture is present in the pipework. Air must be released from the pipe work as soon as possible to shorten the start-up time. A normally balanced pressure air vent is used at the highest points of the pipe work (Figure 5). Regular checking of the heat insulation is normally necessary. Preventing steam leaks contributes to the overall efficiency of the steam system and improves working conditions.

**Condensate system**

When steam condenses, the enthalpy transferred to the cooler material being heated accounts for about only 75% of the enthalpy supplied in the boiler to produce the steam. The remainder, about 25%, is still held by the conden-

sate. This proves the great importance of condensate recovery [5].

An effective condensate recovery system means collecting the hot condensate from the process and returning it to the boiler feed system. Condensate is such a valuable resource that the recovery of even small quantities becomes economically justifiable.

Condensate recovery ensures:

- more efficient steam and condensate systems;
- less flue gas emission from the boiler plant;
- less waste water from the boiler plant;
- less waste heat released into the environment.

For efficient steam trapping, steam traps are needed. Steam traps are automatic valves which are closed to steam but open to the discharge air and the condensate [6]. Several types of steam traps are known (Figure 6):

- thermostatic traps (the balanced pressure thermostatic trap, the liquid expansion trap, the bimetallic trap);

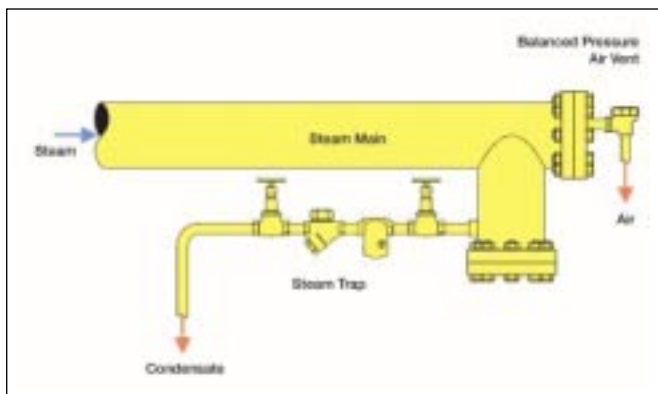


Figure 5. Air venting and steam trapping from the steam main

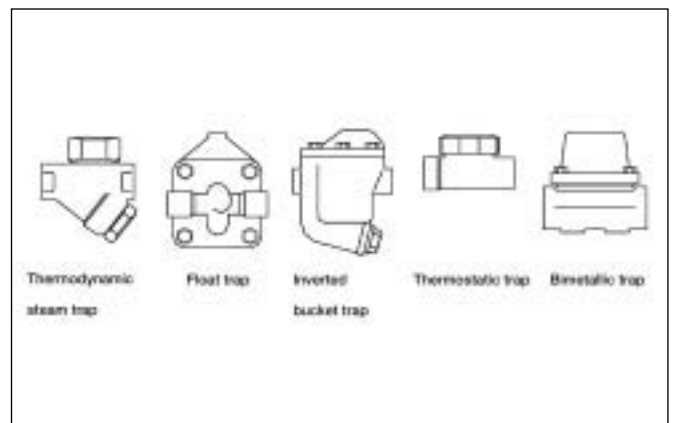


Figure 6. Steam traps

- mechanical traps (the float trap, the inverted bucket trap);
- thermodynamic trap.

Condensate return lines should be properly designed in order for the condensate to flow to the steam traps and then to the receiver by gravity. Traps usually operate at different pressures. Discharges from different traps are usually connected with the same return pipe. Interference between traps may occur and condensate cannot be discharged at lower pressure. The higher pressure of the condensate is usually reduced by a flash vessel. Low-pressure (LP) steam is produced as shown in Figure 7.

Defective steam traps can waste large amounts of energy. Therefore steam traps have to be tested regularly [7]. Four tests are commonly used to evaluate steam trap operation:

- checking the inlet temperature;
- checking the trap flow;
- checking the outlet temperature;
- checking the discharge pressure.

*Defective steam traps can waste large amounts of energy*

In case of a large number of steam traps an inspection-repair record can be carried out in the form of a computer database. Every steam trap should be checked. Information about all repairs, cleaning, rebuilding, or replacement is stored in this database. The expected failures and life span can be predicted from these records [8].

After the condensate is stored in a receiver it should be efficiently pumped to the boiler house. Electrical centrifugal pumps are used in most cases. Nowadays, efficient mechanical pumps are available on the market. Figure 8 shows the steam-powered mechanical condensate pump for condensate removal from an air heater.

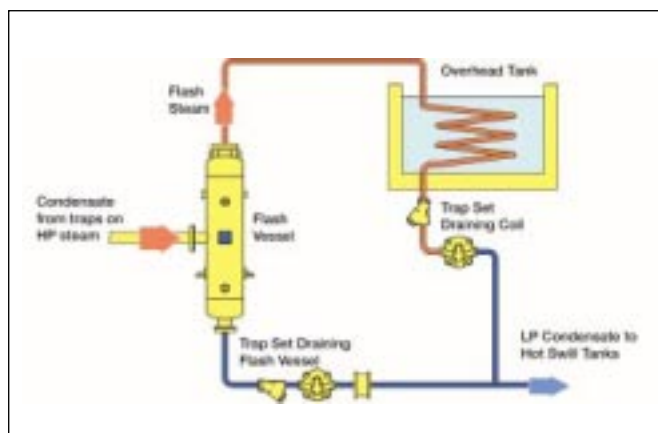


Figure 7. Flash steam recovery from high-pressure (HP) condensate

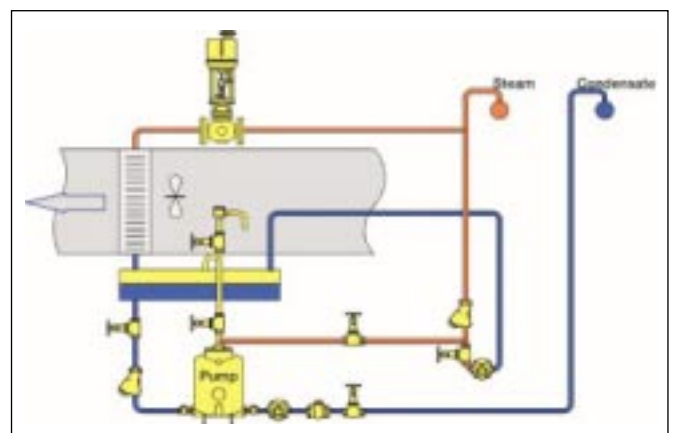


Figure 8. Condensate pumping from an air heater by the steam powered mechanical pump

## CLEANER PRODUCTION OF A STEAM AND CONDENSATE SYSTEM IN AN ANIMAL FEED PLANT

In the animal production plant analysed, steam was primarily used for the sterilising and maintenance of the correct water content in the pellets. Steam was produced in a boiler house equipped with a tube steam generator, a feed water treatment plant, and a feed water tank.

A detailed audit of the steam and condensate system was carried out. After the available data was collected and analysed, the flow sheet of the system was produced. From the steam balance carried out, the loss of water, energy, steam, and condensate was estimated.

The consumption of heating oil was 66 t/year and that of process steam 900 t/year. A total of 31,000 tons of animal feed pellets were produced, 1,380 t/year of flue gas, 60 t/year of wastewater from blowdown, and 28 kW of waste heat were released into the environment. Also 204 t/year of condensate were lost, with 45 kW of heat content.

*Improved efficiency could save water, energy, fuel and reduce waste generation*

Several inefficiencies were found:

- dissolved gases in the feed water were removed by the chemicals instead in the deaerator;
- temperature control of the feed water was inappropriate;
- the temperature of the feed water was about 80 °C;
- the steam traps were damaged and therefore did not work;
- inverted bucket steam traps were used instead of float steam ones;
- drained condensate from the steam pipes was released into the sewer.

### CP options

Three CP options were proposed to improve the efficiency of the steam and condensate system, to cut costs and minimise impact on the environment:

1. Deaeration of the feed water. The investment demanded a new feed water tank with a self acting temperature control, a deaerator with a

Table 1. Investment and saving of the proposed CP options

CP option	Investment costs (EUR)	Savings (EUR)	Payback period (years)
1	12,200	9,800	1.2
2	1,500	500	3.0
3	500	300	1.7
<b>Total</b>	<b>14,200</b>	<b>10,600</b>	<b>1.3</b>



pressure reducing valve, and other fittings (stop valves, safety valve, strainer, and feed water pump).

2. Condensate recovery. Formed condensate should be returned to the feed water tank. The investment demanded pipes with thermal insulation.
3. Replacing of the inefficient, damaged and inappropriate steam traps.

**Table 2. Reduction of effluents, fuels, and chemicals**

	Reduction	Fraction (%)
Chemicals (L/y)	130	100
Water (m <sup>3</sup> /y)	240	23
Fuel (kg/y)	3,200	5
Flue gas emissions (t/y)	67	5
Waste heat (kW)	9	4

Table 1 shows that the payback periods of the proposed options were rather short, from 1.2 to a maximum of 3 years. It was recommended that all measures be implemented at the same time making the total payback period 1.3 years only.

Improved efficiency could save water, energy, fuel (resources) and reduce waste generation (wastewater, flue gas and waste heat). Table 2 shows the estimated reduction of effluents, fuels and chemicals.



**Conclusions:**

Auditing of the steam and condensate systems is a useful tool for saving fuel, steam, water, chemicals, reducing the environmental impact and improving working conditions in the plant. As is evident from this study, and also from the literature, there are numerous CP options that also improve the overall efficiency of the system and decrease operating costs.

Steam and condensate systems should be regularly audited. It is recommended that mass and energy balance be completed in spreadsheet form (e.g. Microsoft Excel). The consumption of fuel, water, chemicals and steam should be regularly recorded. If the data obtained is downloaded onto the computer, any inappropriate operations can be easily identified by comparing old and new results.

It is well known that engineers usually over-design the capacity of steam and condensate systems in case an investor wishes to enlarge his operations. This “just-in-case” designing is the main cause of lower system efficiency.

Additional changes are also made during the construction of such systems, so supervision is necessary to ensure that every change in the system is carefully considered, and its impact on operation and system efficiency is estimated.

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## PRODUCTION PLUS PROPRE DANS UN SYSTÈME DE CONDENSATION ET DE VAPEUR.

Cas pratique dans une usine de  
production d'aliments pour animaux

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Depuis le XVIII<sup>e</sup> siècle, organisations industrielles et commerciales utilisent la vapeur pour sa capacité à générer de l'électricité et de la chaleur. La vapeur peut transférer de grandes quantités d'énergie en comparaison aux autres systèmes, c'est pourquoi le système de condensation et vapeur est un des plus utilisés dans le processus de production industriel. Afin d'assurer un fonctionnement optimal, il doit être inspecté, régulièrement vérifié et entretenu. Ce fonctionnement efficace permet de réduire les coûts, d'économiser des ressources (combustibles, eau, produits chimiques), et de diminuer la production de déchets.

Une évaluation d'un système de condensation et de vapeur dans une usine de production d'aliments pour animaux à été effectué. La méthode d'évaluation comprend un diagramme de flux, les bilans énergétiques et de masse du processus et de la chaufferie, l'identification de l'ensemble des consommateurs de vapeur, le diagramme de flux des systèmes de condensation et de vapeur, elle instaure une consommation rationnelle de la vapeur et des options de récupération de la condensation, et effectue une évaluation environnementale, économique et technique. Seules les options les plus bénéficiaires devraient être proposées et appliquées. Les analyses montrent que les options proposées peuvent améliorer l'efficacité d'une usine. La vapeur devrait être consommée de manière efficace ; tous les purgeurs de vapeur devraient être correctement sélectionnés et installés dans le processus. Régulièrement, le personnel devrait vérifier le fonctionnement des structures de condensation et de vapeur, surveiller les fuites... Les résultats révèlent qu'il est possible de réduire la production des émissions d'effluents gazeux de cheminée de 5 % maximum, les eaux résiduaires de 23 %, les combustibles de 5 % et l'énergie résiduaire de 4 % maximum. Les périodes d'amortissement de l'investissement des options proposées se situent entre 1,2 et 3 ans.

**Mots-clés :** système de condensation et de vapeur, énergie efficace, production plus propre.

## PRODUCCIÓN MÁS LIMPIA EN UN SISTEMA DE VAPOR Y CONDENSACIÓN.

Caso práctico en una planta de  
producción de alimentos para animales

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Desde el siglo XVIII se utiliza el vapor como fuente de electricidad y calor tanto en industrias como en comercios. El vapor puede generar grandes cantidades de energía en comparación con otros sistemas; por tanto, el sistema de condensación y vapor es uno de los sistemas más importantes utilizados en las industrias manufactureras. Para asegurar su correcto funcionamiento, debería someterse a inspección, revisión y mantenimiento periódicamente. Dicho funcionamiento abarata costes, ahorra recursos (combustible, agua, productos químicos) y reduce la producción de residuos.

Se ha llevado a cabo la evaluación de un sistema de condensación y vapor en una planta de producción de alimentos para animales. La metodología de la evaluación incluye el diagrama de flujo, balances energéticos y de masa del proceso y de la sala de calderas, la identificación de todos los consumidores de vapor, el diagrama de flujo de los sistemas de vapor y condensación, la consecución de un consumo racional de vapor y opciones de recuperación de la condensación, así como la realización de evaluaciones ambientales, económicas y técnicas. Sólo deberían ponerse en práctica las opciones más beneficiosas.

Los análisis muestran que las opciones propuestas pueden mejorar la eficiencia de la planta. El vapor debería consumirse eficientemente; todos los purgadores de vapor deberían seleccionarse e instalarse correctamente en el proceso. El personal debería revisar regularmente el funcionamiento de las válvulas de vapor y condensación, buscar fugas, etc.

Los resultados evidencian la posibilidad de reducir la producción de emisiones de gases de escape un 5% como máximo, de aguas residuales un 23%, de combustible un 5% y de energía calorífica residual un 4% como máximo. Los períodos de recuperación de las opciones propuestas se sitúan entre 1,2 y 3 años.

**Palabras clave:** sistema de condensación y vapor, eficiencia energética, producción más limpia.



# L'OPÉRATION ECOSIND : UNE OPPORTUNITÉ POUR AMÉLIORER LA GESTION DE L'ENVIRONNEMENT DES PME INDUSTRIELLES

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L'article fait état des antécédents et des problèmes auxquels ECOSIND souhaite apporter des solutions. Il s'agit principalement de traiter les difficultés des petites et moyennes entreprises industrielles pour développer une gestion efficace de l'environnement. L'article présente les principaux objectifs, composantes et résultats prévus par l'opération cadre régionale ECOSIND. Il explique également le processus de sélection des sous-projets pilotes qui serviront à fonder le futur développement de l'écologie industrielle dans les régions ECOSIND et dans d'autres régions de l'UE. Enfin, il commente l'avenir de l'opération.

## Introduction

En Europe, le développement industriel est souvent cause de dégradation de l'environnement. En général, les zones industrielles nécessitent des ressources comme l'eau, l'énergie ou les matériaux et, en parallèle, elles rejettent des déchets gazeux, solides et liquides.

Les grandes entreprises optent pour l'utilisation de systèmes de gestion de l'environnement comme l'EMAS ou ISO 14001 qui garantissent la durabilité de l'activité industrielle.

Les petites et moyennes entreprises ont plus de difficultés pour s'adapter à la réglementation environnementale en vigueur et demandent que des efforts spécifiques soient faits pour que la gestion soit économiquement viable.

Dans ce contexte général, la Catalogne et la Toscane, régions qui ont bénéficié d'un développement industriel important, ont commencé en 2002 une collaboration intense qui a abouti à la présentation, conjointement avec le Péloponnèse et l'Abruzzo, du projet ECOSIND (écosystème industriel, une stratégie de développement durable des activités industrielles) dans le programme Interreg IIIC zone sud.

ECOSIND a été approuvé par le comité de programmation Interreg IIIC au mois de juin 2003. Le contrat de subvention et la convention interpartenariale ont été signés au mois d'octobre 2003, et l'appel des sous-projets pilotes a été ouvert fin février 2004. L'approbation des 12 premiers sous-projets a eu lieu le 2 septembre 2004.

**Mots-clés :** écosystème industriel, ECOSIND, écologie industrielle, gestion coopérative de l'environnement, développement durable de l'industrie, déchets industriels.

## OBJECTIFS, COMPOSANTES ET RÉSULTATS PRÉVUS

Les deux premiers objectifs d'ECOSIND sont la mise en place de politiques régionales en matière de gestion coopérative de l'environnement pour optimiser la gestion du tissu industriel existant en établissant les fondements d'une nouvelle stratégie régionale du développement industriel durable et, en matière de planification territoriale des futures activités industrielles pour mettre en œuvre une politique d'aménagement du tissu industriel durable. De plus, l'innovation apportée par l'application des principes d'écologie industrielle pour l'amélioration des relations « environnement-industrie-territoire » implique un troisième objectif de formation et de collaboration pour le développement de l'écosystème industriel.

Pour développer ces trois objectifs stratégiques nous avons prévu de faire un appel de projets pilotes interrégionaux sur trois issues ou composantes :

- La gestion coopérative de l'environnement.
- Les directives relatives à l'aménagement durable des zones industrielles.
- La formation sur les principes de l'écologie industrielle.

Par ailleurs, afin de garantir et de faciliter la coordination technique et la gestion économique de l'OCR, deux composantes supplémentaires ont été prévues :

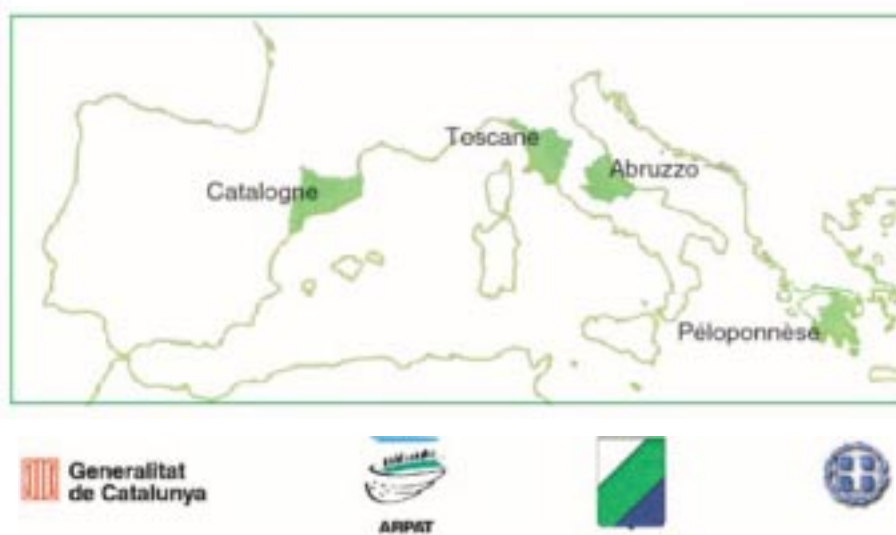
- La coordination et la gestion
- Les bases stratégiques ECOSIND : communication, information et planification

Cette dernière composante intègre le système d'information géographique (SIG), le site web et les directives de planification.

Les résultats les plus importants de l'OCR ECOSIND figurent dans le tableau I.



Figure 1. Cartographie des régions partenaires d'ECOSIND



## LES SOUS-PROJETS PILOTES D'ECOSIND

Tableau 1. Résultats prévus par l'OCR ECOSIND

- Réalisation des différents projets interrégionaux pilotes pour la gestion coopérative de l'environnement (6 projets).
- Réalisation de différents projets de coopération interrégionale pour la planification du développement industriel durable (5 projets).
- Création d'un mastère international d'écologie industrielle.
- Élaboration des directives de planification du tissu industriel à échelle régionale.

Le 2 septembre 2004, le groupe de travail interrégional (GTI), organe supérieur de direction d'ECOSIND, a retenu, dans un premier temps, 12 sous-projets qui seront le fondement des résultats les plus importants de l'OCR.

Le tableau 2 montre les projets présentés ainsi que les projets retenus.

*Les petites et moyennes entreprises ont plus de difficultés pour s'adapter à la réglementation environnementale*



Tableau 2. Sous-projets présentés et sélectionnés

Sous-projet	Région	Leader	Résumé
CICLE PELL	CAT	EUETII-CETI-UPC	Écologie industrielle chaîne abattoir - tannerie
MESVAL	CAT	UPC	Nouvelles voies de mise en valeur de déchets industriels
MITCO <sub>2</sub>	CAT	URV-CREVER	Mitigation des émissions de CO <sub>2</sub> dans des zones industrielles
MEDUSE	TOS	INST. PHYSIQUE APPLIQUÉE	Méthodes et techniques d'analyse environnementale dans des zones à haute densité industrielle
ETOILES	TOS	CONSORZIO PISA RICERCHÉ	Évolution du territoire pour l'organisation industrielle de l'environnement
GATSPOT	TOS	UNIV. FIRENZE	Gestion agroterritoriale durable pour le secteur textile
PISEVI	CAT	CONSEIL DE LA RÉGION CATALANE ALT PENEDEÈS	Gestion de l'environnement durable du secteur vinicole de l'Alt Penedès
RECIPOLIS	CAT	MAIRIE DE VILADECANS	Parc environnemental
PLANCOST	CAT	CONSEIL DE LA RÉGION CATALANE LA SELVA	Planification industrielle durable dans les zones côtières
BLU	TOS	COMMUNE DE PISE	Programme pilote d'amélioration environnementale d'entreprises et d'administrations liées au secteur nautique
PLASOS	CAT	CONSORTIUM URBANISTIQUE DU CENTRE DIRECTIONNEL DE CERDANYOLA DEL VALLÈS	Bases pour une planification urbanistique du tissu industriel durable
PISA	CAT	CONSORTIUM DU RÉSEAU LOCAL DE PROMOTION ÉCONOMIQUE	Zone industrielle durable
PASMO	CAT	MAIRIE DE VILADECANS	Parc aérospatial et de mobilité
GEDESOS	CAT	PACTE INDUSTRIEL RÉGION MÉTROPOLITAINE DE BARCELONE	Plateforme géoréférencée d'activités et de services à Barcelone et en Toscane
DFAV	CAT	UPC	Double façade en verre et ventilée
AUGUI	CAT	UPC	Utilisation d'eaux grises dans des urbanisations industrielles



Sous-projet	Région	Leader	Résumé
ESEMPLA	TOS	SSEUPSA-PISE	Utilisation d'EMAS pour le suivi et la planification locale
MECOSIND	CAT	UAB	Mastère d'écologie industrielle
UDAI	CAT	CHAMBRE DE COMMERCE DE BARCELONE	Union de zones industrielles
PLAINDSO	CAT	UPC	Diplôme de 3e cycle sur la planification et gestion de zones industrielles durables
CAT – Catalogne		TOS – Toscane	
Les sous-projets qui ont été sélectionnés sont marqués en gris.			

Les critères techniques utilisés pour l'évaluation des sous-projets avaient été accordés par les régions, à la demande de la Catalogne, lors de la réunion du groupe de travail interrégional, le 1er juillet 2004, à Florence, dans la ligne des critères généraux définis au moment de l'appel d'offre du projet ECOSIND. Les voici dans le tableau 3 :

**Tableau 3. Critères utilisés pour l'évaluation des sous-projets**

- Relation avec l'écologie industrielle.
- Conformité avec la législation et les politiques de l'UE et nationales.
- Adaptation des objectifs et des résultats prévus par rapport aux objectifs et résultats prévus d'ECOSIND, ainsi qu'au développement durable des régions.
- Méthodologie.
- Degré d'innovation.
- Capacité à rendre les résultats mesurables et visibles. Possibilité de diffusion et de réapplicabilité dans d'autres régions.
- Capacité à développer de futures phases du projet dans le cadre de l'écologie industrielle.
- Capacité du projet à servir de base pour rédiger des plans directeurs définis par ECOSIND.
- Interrelation avec d'autres plans directeurs régionaux existants.
- Degré de coopération interrégionale.

**Conclusions et avenir d'ECOSIND :**

Après un an de travail, nous avons terminé la première phase d'ECOSIND. Dans cette première phase, nous avons retenu les sous-projets qui seront les protagonistes de la phase 2. Lorsque l'expérimentation des sous-projets sera terminée, elle nous servira de base pour élaborer un guide de planification des zones industrielles. À partir de ce moment, et notamment grâce au mastère, aux quelques projets sélectionnés et à l'infrastructure interrégionale créée par ECOSIND, nous pourrons assurer sa continuité et son expansion dans les régions d'Europe.

Le défi le plus important pour le futur développement d'ECOSIND est de mettre en place les bases qui permettront de créer un modèle durable de tissu industriel qui maximise la symbiose entre tous les agents et réduire l'impact environnemental, sans diminuer la compétitivité des entreprises.

**Tableau 4. PHASES DE L'OCR ECOSIND**

<p><b>PHASE 1</b> Préparation de l'OCR et sélection des sous-projets pilotes</p> <p><b>PHASE 2</b> Développement des sous-projets</p> <p><b>PHASE 3</b> Préparation des lignes directrices pour la planification du tissu industriel</p> <p><b>PHASE 4</b> Réplication des résultats</p>
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Le Mastère international d'écologie industrielle est un excellent outil scientifique qui nous permettra de relever ce défi. Ce mastère est une première étape qui fournira, progressivement, un allié de choix aux personnes possédant une formation, pour que la gestion coopérative de l'environnement entre les industries devienne réalité.

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Sites web de référence :

[http://antalya.uab.es/\\_c\\_ceambientals/XTEI/xt\\_ecologia\\_industrial.htm](http://antalya.uab.es/_c_ceambientals/XTEI/xt_ecologia_industrial.htm)

<http://www.is4ie.org/>

<http://www.ambinet.org/>

<http://www.ecosind.net/>

## THE ECOSIND PROJECT: AN OPPORTUNITY TO IMPROVE THE ENVIRONMENTAL MANAGEMENT OF SMALL AND MEDIUM INDUSTRIAL ENTERPRISES

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The article summarises the background and problems to which ECOSIND wishes to find solutions. It deals mainly with the difficulties encountered by industrial SMEs when these try to develop effective environmental management policies. The article details the main objectives, issues and expected findings of ECOSIND's regional network. It also explains the selection procedures of the "sub-pilot projects" which will serve as a basis for the future development of industrial ecology in the ECOSIND regions and other areas in the EU. Finally, it mentions the future of the project.

## ECOSIND: UNA OPORTUNIDAD PARA MEJORAR LA GESTIÓN AMBIENTAL DE LAS PEQUEÑAS Y MEDIANAS EMPRESAS INDUSTRIALES

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El artículo repasa los antecedentes y los problemas a los que ECOSIND desea proponer soluciones. Se trata principalmente de trabajar sobre las dificultades de las pequeñas y medianas empresas industriales para desarrollar una gestión ambiental eficaz. El artículo presenta los objetivos, las fases y los resultados principales previstos por el proyecto regional ECOSIND. Se exponen igualmente los procesos de selección de los subproyectos piloto que servirán de base para el futuro desarrollo de la ecología industrial en las regiones ECOSIND y en otras regiones de la UE. Por último, se menciona el futuro del proyecto.

**Key words:** Industrial ecosystem, ECOSIND, industrial ecology, environmental cooperative management, industrial sustainable development, industrial waste.

**Palabras clave:** Ecosistema industrial, ECOSIND, ecología industrial, cooperación en gestión ambiental, desarrollo sostenible de la industria, residuos industriales.



# INCENTIVES FOR THE ADOPTION OF CLEANER PRODUCTION

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This article is an analysis of the instruments available for encouraging industry to adopt cleaner production (CP) processes. It includes a description of the possible economic, financial and legislative measures which might be employed to stimulate the adoption of cleaner production technologies. There are “positive” economic and financial measures, such as subsidies and preferential credit terms, and “negative” ones, such as penalties or fines. Governments can also introduce new legislation to oblige industry to adopt CP technology, however, in order to be effective, this must be accompanied by vigorous and consistent enforcement.

The article recommends some practical measures. These measures would include record-keeping to gauge the uptake and success of CP technology, training and pioneering projects to encourage the success of CP, and awareness-raising to stimulate public demand for CP products.

Different analysts give different priority to the possible incentive instruments that governments might employ to encourage industry to adopt CP, however the two principal drivers are given as economics and legislation. A total of 125 Maltese companies which were surveyed corroborated these two motivators.

## Introduction

Despite the efforts of UNEP and various national and international institutions over the last twenty years or so, the cleaner production challenge remains.

There is a substantial potential for reasonably attractive financial rewards connected with environmental improvements in industry.

Admittedly, the potential for environmental improvements is somewhat unevenly distributed. Some industries are more amenable to implementing cleaner production than others.

Consequently the challenge of how to promote cleaner production is of fundamental importance, and the strategies and instruments employed have to be varied and attractive.

In as much as there are barriers and obstacles to the adoption of cleaner production, there are also several enabling measures that can be taken to motivate its adoption. Top of the list of motivators, as far as industry is concerned – and this is borne out even in the surveys carried out (Pizzuto, 2004) – are financial incentives. The legislative and regulatory frameworks are another strong motivator (Gee, 1994).

What follows is a brief review of some incentives/instruments that can be adopted to promote cleaner production.

**Key words:** cleaner production, incentives, training, industry.

## ECONOMIC INSTRUMENTS

Economic instruments can take many forms, such as:

- *Subsidies* to encourage investment in low-waste technology installation and production processes for environmentally sound products.
- *Depreciation allowances* even up to 100% on investments in waste minimisation processes and energy-efficient systems, etc. These allowances could be considered for industries where resource consumption and waste generation are below a certain, specified level.
- *Water and energy pricing policy* can be rationalised and determined on an “avoided cost” basis rather than a “consumption cost” basis. The price of these two commodities should be high enough to justify their conservation and efficient use, but not so high as to affect the profitability of the industry.
- *Preferential credit terms.* Industries that submit cleaner, economically beneficial projects to a screening agency should be recommended to the banks for preferential credit terms. These measures must be coupled with capacity building in the banking sector to enable them to deal with such applications.
- *Shifting the burden of taxation* away from income and profits and towards resource use and pollution.

The above can be considered “positive” financial incentives in the sense that industry is being rewarded for adopting cleaner production. There are other

forms of incentives that can be termed “negative” as they penalise those who do not comply with regulations —e.g. the Polluter Pays Principle, the Best Available Technology Principle, etc—.

These “negative” economic instruments serve as a deterrent to pollution and as an indirect incentive to adopt cleaner production.

## LEGISLATION

The Government can stimulate the adoption of cleaner production and set high environmental standards through legislation and regulations. However, it is not enough to set up a regulatory framework alone: enforcement needs to be pursued with vigour and consistency to be effective. In fact, the actual level of enforcement is crucial, otherwise this strategy will fail. Regulations and permits should specify discharge goals, not discharge limits and pollution charges.



## SYSTEMATIC MEASURES FOR INDUSTRY

*Record Keeping* – A survey carried out in Malta has shown that practically no record keeping and environmental reporting procedures are in place in virtually any (93%) of the responding industries. If simple record keeping and reporting procedures are introduced, data compilation can be effectively started with a view to illustrating and monitoring the effects of cleaner production adoption.

*Training* – Personnel involvement in cleaner production methodology, through formal training programmes, would overcome the barrier of resistance due to fear of the unknown, or poorly understood new processes.

*Stakeholder pressure* – This is linked with attitudinal change in consumption patterns. It was also shown in a recent survey (Pizzuto, 2003) that customers can exert pressure on manufacturing enterprises to adopt cleaner production methods. Increased environmental protection awareness can mobilise lobby groups, competitors, and even shareholders and employees to impress upon the particular industry the need for cleaner production adoption.

*Incentive programmes* – These can motivate employees to come up with suggestions for more efficient use of raw materials and energy. Waste minimisation practices can be suggested by employees at the factory floor level, as they are the people that usually handle the bulk of materials from which waste is generated. Monetary rewards would acknowledge the contribution made by the worker making the suggestions. These incentive programmes are also perceived by shop-floor employees as evidence of management's commitment to cleaner production adoption.

*The actual level  
of enforcement  
is crucial*

*Pioneer demonstration projects* – The adage, “seeing is believing” can be applied also to motivate the introduction of cleaner production. Pilot demonstration projects (preferably industry-specific) can be set up, with the help of Government, to show that cleaner production methodology is feasible. These projects can induce related industries to investigate the possibility of adapting the methodology themselves.

*Information dissemination* – Information can be used as a tool to sensitise producers and consumers to environmentally sound manufacturing processes and products. Measures to promote information flow between industry, authorities and the public at large, can take various forms, e.g. seminars (the Malta Cleaner Technology Centre is currently using this form), information centres, and similar types of infrastructure, such as clearing houses, can be set up.

Another form of specific information initiative is the Company Environmental Reporting that links environmental, economic, and social aspects of corporate performance, supported by indicators of sustainability. Such reports can give the competitive edge to a company, often so important in industrial activities. It is being increasingly used in industry as a measure of progress in sustainable development, and as a form of “green” advertising (see UNEP/IE, Technical Report no. 24).

Information transfer between companies involved in environmental protection can also be a motivator towards cleaner production adoption.



## EDUCATION AND TRAINING PROGRAMMES

Both government and industry can organise a series of education and training programmes for their employees. Under this heading, one might include the organisation of public relations campaigns for various influential target groups such as managers and decision-makers, politicians, journalists, teachers and others.

Some authors, considered to be authorities on the subject of introducing cleaner production in industry, give different priorities to the incentive tool used. Some of them even advocate the adoption of these motivators before legislation is even developed and enacted. Hollod (1993) lists four basic incentives which he considers will motivate decision-makers in industry to implement a waste minimisation programme:

- 1) Real cost and economics
- 2) Corporate policies
- 3) Corporate public image and risk reduction
- 4) Legal requirements

On the other hand, Sutter (1993) lists basically the same instruments but in a different order of priority:

- 1) Statutes
- 2) Regulations
- 3) Economic Incentives
- 4) Training and educational programmes
- 5) Dissemination of Information

Shen (1993) maintains that it is the regulatory aspect that shapes industry's decision with regard to cleaner production adoption. Nonetheless, he lists financial incentives such as:

- Low interest rates
- Tax credits or deductions for cleaner production expenditure
- Support for joint reduction strategies
- Support for research and development groups in cleaner production that could be important when significant capital investment is needed.

It is clear that the two main driving forces in any programme to motivate and encourage the implementation of cleaner production methods are ECONOMICS and LEGISLATION.





## THE SITUATION IN MALTA

In Malta, the legislative framework is in place and conforms to EU Environmental Laws. What is needed now is a complete review of the laws and regulations pertaining to pollution prevention to establish the necessary enforcement mechanisms, because an ineffectual enforcement of environmental regulations would result in the complete failure of said efforts.

*The economic incentives need to be seriously considered*

A survey to gauge what motivates Maltese industry to implement cleaner production was carried out between July and December 2003. In all, 125 manufacturing companies from different sectors (Figure 1) were asked to identify factors that would act as an incentive to the implementation of Cleaner Production methods. The results are shown in Figure 2.

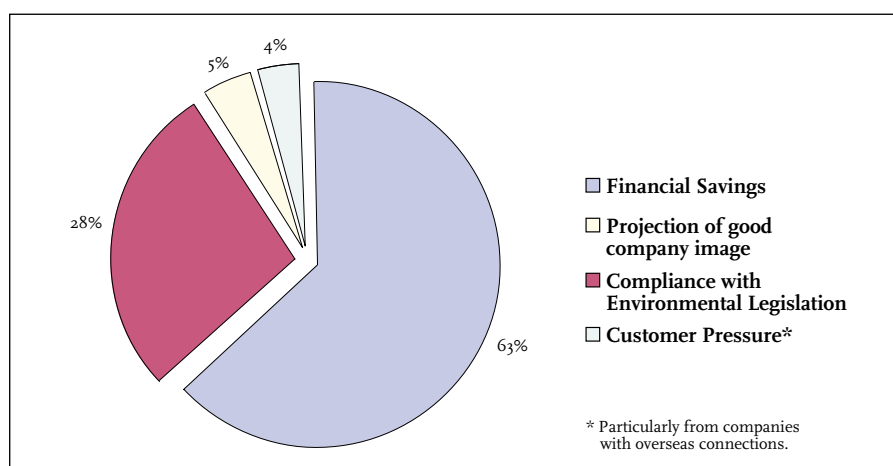
Figure 1. Profile of Companies Surveyed

Industrial Activities	Number of Companies Surveyed
Plastics and Rubber	7
Electronics	8
Chemicals and Pharmaceuticals	9
Building Materials	10
Clothing, Footwear, Textiles	10
Paper and Printing	11
Furniture and Fittings	14
Metal Products	15
Foodstuffs, Beverages and Tobacco	18
Industrial Products and Parts	23
<b>Total</b>	<b>125</b>

Whilst all the companies interviewed were convinced of the benefits of cleaner production, Figure 2 shows those that were cited as the main motivators.

Figure 2 clearly shows that, at least amongst the Maltese industrial community, financial considerations far outweigh all other concerns. The economic incentives are far from being in place and need to be seriously considered in order to ensure that a combination of supportive and deterrent economic tools are adopted to achieve the objective of environmental protection and promotion of sustainable development.

Figure 2. Main Motivators for Cleaner Production in Malta



### Conclusions

It is a pity that in spite of various incentives, the concept of cleaner production is still largely misunderstood. However, as Margot Wallström (EU Commissioner for the Environment) stated *People in business (for instance) need to understand that there is no gain in maintaining bad environmental practices and in refraining from taking initiatives that are environmentally friendly* (Opening address at Green Week 2004, 1<sup>st</sup> June 2004 - Brussels).

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## MESURES INCITATIVES POUR L'ADOPTION DE LA PRODUCTION PLUS PROPRE

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Cet article est une analyse des instruments disponibles pour encourager l'industrie à adopter des procédés de production plus propre (PP). Il décrit les éventuelles mesures législatives, financières et économiques qui pourraient être utilisées afin de stimuler l'adoption de technologies de production plus propre. Certaines mesures économiques et financières sont dites « positives », telles que les subventions et les conditions de crédit préférentielles, et d'autres « négatives », telles que les pénalités et les amendes. Le gouvernement peut également introduire une nouvelle législation afin de contraindre l'industrie à adopter des technologies de production plus propre, cependant, pour que cela soit efficace, elle doit être appliquée de manière cohérente et stricte.

Cet article recommande certaines mesures pratiques. Ces mesures regroupent la conservation des archives afin d'évaluer l'assimilation et la réussite des technologies de PP, la formation et les projets pilotes afin d'encourager le succès de la PP, et la sensibilisation afin de stimuler la demande du public en produits issus de la PP.

Les analystes donnent des priorités différentes aux éventuels instruments d'incitation auxquels le gouvernement pourrait avoir recours afin d'encourager l'industrie à adopter des mesures de PP, cependant, les deux principaux moteurs se basent sur les domaines économique et législatif. Un ensemble de 125 entreprises maltaises, qui ont fait l'objet d'une enquête, ont corroboré ces deux derniers comme facteurs d'incitation.

**Mots-clés :** Production plus propre, mesures incitatives, formation, industrie.

## INCENTIVOS PARA LA ADOCIÓN DE LA PRODUCCIÓN MÁS LIMPIA

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Este artículo es un análisis de los instrumentos disponibles para promover la adopción en la industria de los procesos de producción más limpia (P+L). El artículo incluye una descripción de las posibles medidas económicas, financieras y legislativas que podrían utilizarse para impulsar la adopción de las tecnologías de producción más limpia. Existe una distinción entre medidas financieras y económicas «positivas», como los subsidios y las condiciones de crédito preferenciales, y medidas «negativas», como las sanciones y las multas. El gobierno también puede introducir legislación nueva para obligar a la industria a que adopte tecnologías más limpias; sin embargo, para que ello resulte efectivo, debe ir de la mano de un cumplimiento riguroso y efectivo.

Asimismo, el artículo propone algunas medidas prácticas. Estas medidas incluirían el mantenimiento de un registro que evaluase la puesta en práctica y el éxito de las tecnologías más limpias, la formación y la promoción de proyectos para promover el éxito de la P+L, así como la concienciación para que el público en general estimule la demanda de productos de P+L.

Los diferentes analistas priorizan de forma diferente los posibles instrumentos que el gobierno podría utilizar para incentivar la adopción de la P+L por parte de la industria; sin embargo, todos coinciden en que los dos incentivos principales son la economía y la legislación. Las 125 empresas maltesas encuestadas estos dos últimos como factores de motivación.

**Palabras clave:** Producción más limpia, incentivos, formación, industria.



# AN OVERVIEW OF THE LEGAL, INSTITUTIONAL AND PLANNING FRAMEWORKS IN THE MEDITERRANEAN ARAB COUNTRIES TO PROMOTE CLEANER PRODUCTION

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This article aims to give a general overview of the measures undertaken by Mediterranean Arab (MA) countries, to promote cleaner production (CP), both at the legal and institutional level, and at the level of plans and projects. This group of countries includes Algeria, Egypt, Lebanon, Libya, Morocco, Syria and Tunisia. All of them are members of the League of Arab States and have specific common characteristics, regardless of differences in political regimes. They share some cultural principles and similar languages that should facilitate common action and the transfer of experiences in CP between them. Basically, the article summarises the information that is provided about these countries in the second edition of the study *State of Cleaner Production in the Mediterranean Action Plan Countries* published by the RAC/CP at the beginning of 2004.

**Key words:** Mediterranean Arab (MA) countries, cleaner production, CP, industry, laws, plans, programmes, CP centres.



## INTRODUCTION

### Overview of MA countries development

MA countries have experienced improvements in health, education, and social welfare over the past three decades. However, development in the sub-region has been achieved at the expense of increasing population pressures and economic recessions.

The population of the MA countries is increasing at a fast rate. The growing population and expanding human activities, particularly in urban areas, strain natural resources, increase waste and pollution, exert severe pressure on the environment and pose significant health hazards to the population exposed.

Factors that influence the sustainable development of the MA countries, particularly in the coastal areas, include:

- Rapid industrialisation (the share of MA countries is about 10 percent of the Mediterranean manufacturing capacity);
- Agriculture, which is highly dependent on irrigation, consuming more than 75 percent of the water extracted in the sub-region
- Flourishing tourism, growing by more than 5 percent annually and causing severe pressure on coastal eco-systems;
- Rapid urbanisation, particularly along the coastline, with metropolises accounting for more than 35 percent of the total inhabitants of MA countries;
- Increasing pressure from growing oil exploration, production and export, and the associated tanker traffic along many of the coastal areas.

The total Gross Domestic Product (GDP) of MA countries has grown considerably in the last decade. Most of them have undergone economic re-

forms and restructuring, promoting market economies, decentralisation and lowering inflation rates. Industry contributes significantly to their GDP as it accounts for about 25.5 percent of the total GDP (not including oil extraction). Therefore, industrialisation represents a vital component of the development processes in this region, providing an important source of national income from trade, creating jobs and adding to the value of primary products.

### Industrial development

The industrial structure in MA countries shares some basic features:

- Industrial development is mostly based on the exploitation of non-renewable natural resources. Oil and

gas resources in Libya, Algeria and Egypt are playing an important role as exports and as inputs supporting energy-intensive, value-added industries proliferating throughout the region. Almost all MA countries made temporary gains either directly or indirectly from the oil boom of the 1970s. However, none of them have been able to harness that windfall income and achieve a sustainable growth of their national economies and industrial bases.

- In addition to oil and gas, MA countries are concentrating on other extractive industries or the primary processing of their raw materials, such as phosphates and other ores in Morocco, and the agro-industry in Syria. The opportunity to increase the value added from the further processing of primary materials is substantial in these countries (e.g. downstream petrochemicals, plastics, metal products, textiles, etc.).
- The relatively small presence of the capital goods industry contrasts with the importance of building up this viable sector in countries like Egypt, Morocco and Tunisia. These countries still rely heavily on imports of basic components and are only participating through the local assembly of such goods.
- Finally, the export performance of manufactured goods is very poor while the trade balance deficit is high. This situation could be remedied with proper export promotion policies. Despite the recent emphasis on diversification of the industrial base, with a large portion of the national budgets allocated to industry and its infrastructure needs, the manufacturing performance in MA countries has not been satisfactory. Key impediments include the dom-



inant preference given to imported goods, erratic industrial development strategies, the artificial protection of national industries, and the absence of co-operation within the region in trade and industry.

Mining and processing of industrial minerals and metals has increased, along with fossil fuel extraction, and is considered an important source of foreign currency in MA countries. Iron extracted in Algeria and Libya represents 6% of the extracting industry outputs, while phosphate extracted in Morocco, Tunisia, Egypt and Syria represents 12% of the total extracting industry outputs. Mining in general (metallic and non-metallic ores) accounts for 18 percent of the extracting industries in the SM countries. These percentages are approximate figures as they are affected by the price fluctuations in the international market and may change from year to year.

Countries with diversified economies (Egypt, Syria, Tunisia and Morocco) continue to focus on traditional industries such as food processing, cement and textiles. There has also been a gradual shift towards the production of intermediate and capital goods, particularly chemicals, rubber, plastics, iron and electrical machinery. While this could signal the development of the sector and an increase in upstream linkages, there is still concern about the potential environmental impacts of increased production in these new sectors.

### **Industry performance and environment**

Industry performance developed by MA countries is mostly heterogeneous. Few countries have been able to set up

## *Industrialisation represents a vital component of the development processes in this region*

competitive industries by introducing modern technologies, although most of them have not been able to absorb technological advances or to maintain a competitive edge in their industries. Besides, industrialisation in most MA countries is still promoted by policies that defy the concept of sustainability. These policies include protection against competing imports, financial subsidies, credits, and discrimination in government procurement in favour of public sector industries. Such measures have resulted in the creation of some highly polluting industries such as mining, heavy chemicals, and iron and steel.

Small and medium-sized enterprises (SMEs) perform diverse activities such as textile finishing, food processing, furniture manufacturing, and the formulation of chemicals. The availability of land for industrial and housing developments, the demand for cheap consumer goods and an abundance of unskilled workers encourages the development of simple-technology SMEs

in provincial towns. Many industries that have developed in these circumstances enjoy government protection to run inefficient and unprofitable businesses.

The pattern of industrial development existing in MA countries has contributed to the formation of “pockets of intensive pollution”, which have caused severe degradation of the environment and an overloading of the public infrastructures for environmental protection in major cities. In countries with a comparatively higher level of industrialisation (Egypt, Morocco, Tunisia and Syria), pollution issues are further complicated due to:

- Improper end-of-pipe treatment and unacceptable disposal practices of hazardous waste; difficulties in monitoring industrial effluents and emissions due to the lack of instruments and trained personnel;
- Reluctance on the part of most dischargers to invest money in pollution abatement;
- Lack of professional management and trained personnel to operate waste treatment facilities.

However, industries are now recognising the need to avoid or minimise waste generation through the introduction of new pollution prevention technologies. Businesses and decision-makers regard pollution prevention as a dynamic concept that implies gradual development of technical know-how and enhanced understanding of environmental problems and conditions under which the social demand for products and services is generated. This trend has resulted in progressive improvements in patterns of production and consumption.

## LEGAL FRAMEWORK

### **Pollution prevention in environmental regulations**

Environmental legislation in MA countries has been substantially revised and amended in recent years. In general, a framework or comprehensive law on the environment has been adopted and is supplemented and developed by laws in specific sectors. All countries have adopted legislation concerning the control of industrial water pollution, directly or indirectly protecting the marine environment, and most of them have adopted Environmental Impact Assessment (EIA) regulations for their permit systems.

In most cases, with the modernisation of the legal framework, CP-related requirements have been introduced, mainly through waste legislation and as new environmental requirements within the permit system. This is the case, for example, of the Waste Law of Algeria which incorporates legislation re-

garding prevention and reduction at source, jointly with the valorisation of waste as a secondary option; the waste minimisation requirements in the Egyptian regulations, and as planned in the draft law on waste in Morocco. The legal revision has been used by Tunisia to include also more specific requirements to save energy and water.

Nevertheless, some time may be necessary to achieve full enforcement of these laws in practice. On the one hand, it requires an adequate administrative structure. On the other hand, industry will be more ready to accept enforcement if command-and-control regulations are well combined with pro-active measures, such as voluntary agreements and economic incentives.

### **Legal instruments to promote pollution prevention**

Most MA countries use taxes or levies for polluting activities, but there are few





incentives to introduce CP, other than avoiding potential fines. In order to accelerate environmental performance updating, in some cases, audits have been financed—in Lebanon, for example, through the Euro-Lebanese Centre for Industrial Studies—and subsidies have been increased on discount loans for environmental upgrading, amongst other measures.

Voluntary agreements and voluntary instruments are being introduced in some countries, with the aim of raising awareness within industries and increasing their environmental responsibility. In Algeria, voluntary measures are being implemented through environmental efficiency contracts between the Ministry of Land-Use Planning and the Environment and the industrial sectors. In Lebanon, agreements between the Ministry of Environment and the manufacturing sector have focused on phasing out the use of ozone-depleting substances and asbestos, and on controlling dust emissions from cement plants. Partnership agreements have been adopted in Morocco with companies belonging to different industrial sectors (cement, chemistry / para-chemistry, oil refining, mining, etc.).

Labelling schemes are already implemented in countries such as Tunisia, Egypt, Lebanon and Morocco, ranging from warnings about harmful products to the green labelling of efficient electrical appliances. Labelling may be of future interest, not only for the country itself as a source of public information to consumers, but as an element to support exports to international markets where green labels act as an element of marketing.

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*Commitment to International legal instruments for preventing land-based pollution*

Most MA countries have undertaken a strong commitment in the international framework for the protection of the environment through pollution prevention. All of them have agreed to the Basel Convention on Hazardous Wastes, and most of them have signed or ratified the Stockholm Convention on Persistent Organic Pollutants. Concerning ozone depletion, they have signed or ratified the Montreal Protocol and its amendments, except the Beijing amendments of 1999. However, regarding climate change, only Morocco and Tunisia have ratified the Kyoto Protocol, while Egypt has signed it.

Within the framework of the Mediterranean Action Plan, and with regard to the protocols mainly focusing on land-based activities, only Morocco and Tunisia have accepted the amendments of 1995 to the Land-Based Sources Protocol, introducing, among other things, the precautionary and the polluter pays principles, as well as Best Available Techniques (BAT), Best Environmental Practices (BEP) and Cleaner Technologies as components to be taken into account when drawing up a national plan to address pollution. The Hazardous Waste Protocol has been ratified by Morocco and Tunisia, and has been signed by Algeria and Libya.

## INSTITUTIONAL FRAMEWORK

### General remarks

A progressive increase in the number of agents dealing with CP is taking place in MA countries, either because new CP centres and other CP-related agencies have been created, or because existing environmental agencies are being further involved in pollution prevention approaches.

Algeria, Morocco and Lebanon have recently established National Cleaner Production Centres (NCPCs). Tunisia has one of the longest experiences in CP through the *Tunis International Centre for Environmental Technologies (CITET)*. For their part, Egypt and Syria are maintaining contact with both international organizations and potential country donors for implementing NCPCs.

There is a strong connection between the Cleaner Production centres existing in Southern Mediterranean countries and the Ministries of the Environment. It is perceived that, in general, the ministries have seen CP as one of the best instruments to facilitate the penetration

of environmental concerns into industries. Otherwise it would be very difficult for them to enforce environmental obligations in a sector that must grow in the face of very stiff competition from the international market. It is the message of increased competitiveness associated with CP that has moved these ministries to give strong support to the implementation of CP centres.

### National agents promoting CP

Since 2000, Algeria has undertaken a firm commitment to promote CP. In addition to the establishment of the NCPC, as envisaged by the National Environmental and Sustainable Development Action Plan of the country, it has also created a Sub-Directorate of Cleaner Technologies and recovery of waste and by-products, within the Ministry of Land-Use Planning and the Environment. Its main tasks are to:

- Initiate and prepare, with the industrial sectors concerned, the texts and regulatory mechanisms facilitating



the rational and safe use of raw materials and by-products;

- Carry out actions to promote the recovery, recycling and economic recovery of industrial waste and by-products;
- Carry out actions, with the industrial sectors and institutions concerned, to facilitate the use of cleaner technologies;
- Carry out actions, with the industrial sectors and institutions concerned, for the promotion and use of water-saving technologies in the industrial environment.

As well as these two institutions, the other public bodies of Algeria involved in promoting CP in the field of energy are the National Agency for the Promotion and Rational Use of Energy, and the Centre for the Development of Renewable Energies.

In Egypt there is no agent specifically devoted to promoting CP, although several contacts have been made at the institutional level for establishing a NCPC. Meanwhile, the Egyptian Environmental Affairs Agency (EEAA), the central body in charge of monitoring the compliance of industries with environmental regulations, acts also as a main CP promoter. The EEAA has drafted a CP policy framework intended to highlight the main issues, identify stakeholders, formulate the motivations and challenges and propose instruments for achieving increased uptake and implementation of CP in Egyptian industry.

Syria has also started contacts with some regional and international organisations (Arab States League, UNEP, UNIDO, RAC/CP) in order to establish an NCPC. Nevertheless, as with Egypt,

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these contacts are still at the preliminary phase. Currently, the Ministry of Local Administration and Environment assumes the tasks for promoting CP.

In Lebanon, the National CP Centre was established by UNIDO in May 2002 with funding from the European Union LIFE – Third Countries Program, and the Austrian Government.



The first phase of the project for the implementation of the centre focuses on raising awareness amongst concerned stakeholders (industry, public agents) of what CP actually is, and its benefits, as well as on the development of demonstration projects and training activities in several areas related to CP (EMS, energy audits, etc).

In Tunisia, the main agent involved in CP promotion and implementation is the Tunis International Centre for Environmental Technologies (CITET), a government institution acting as the Tunisian National Cleaner Production Centre in the international Cleaner Production network. Furthermore, the strong institutional framework existing in this country to prevent pollution, made up of the National Agency for the Protection of the Environment (ANPE), the National Wastewater Management Agency (ONAS), the Agency for Coastal Protection and Planning and the National Renewable Energies Agency (ANER), must be noted.

As with Tunisia, in Morocco the establishment of a Cleaner Production centre has been a particularly major step for facilitating the dissemination and implementation of CP among the industrial sector and especially in small and medium-sized companies. The Moroccan Cleaner Production Centre (CMPP) was established from a public-private partnership between the Ministry of Industry, Trade, Energy and Mining, and the General Confederation of Moroccan Enterprises (CGEM). The centre performs as a support structure to Moroccan industry and, since it is hosted by the CGEM, the private side of the partnership, direct contact with companies is ensured.

*In Morocco the establishment of a Cleaner Production Centre has been a major step for facilitating the dissemination and implementation of CP*

Finally, at the regional level, the co-ordination and networking tasks performed by the RAC/CP for CP promotion and dissemination within the framework of the Mediterranean Action Plan (MAP), along with UNIDO's CP programmes and NCPC networks and the clearing house facilities of UNEP, have played a key role in the interaction and exchange of experiences amongst MA countries.



## PROGRAMMES AND ACTION PLANS FOR PROMOTING CP

As an effective starting point towards sustainable development, most MA countries (Algeria, Egypt, Morocco, Syria and Tunisia) have recently adopted National Environmental Action Plans (NEAP). These plans are reinforced in some instances by corresponding strategies for industry modernisation, following the principles of sustainable development. Some of these NEAPs have also included explicit requirements for environmentally-friendly technologies, as in Egypt, or the appropriate use of resources, as in Algeria. On the scale of environmentally preferred options, waste minimisation at source is the first priority, followed by recycling. According to the information available, Algeria and Tunisia in particular have adopted a clear position in favour of recycling, as part of the general national waste management policy. Concerning energy conservation and efficient use of resources, specific programmes have been implemented by Egypt and Lebanon through the support of the Global Environment Facility (GEF).

One of the most recognised obstacles to CP implementation is the scarcity of financial resources for CP projects. Some countries, such as Algeria, Morocco and Tunisia, have tackled this constraint by establishing national funds for projects in environmental improvement (the National Fund for the Environment and Pollution Abatement in Algeria, and the Industrial De-Pollution Funds in Morocco and Tunisia).

Furthermore, both regional and international institutions such as the RAC/CP, UNIDO, World Bank, GEF, etc., and assisting agencies from countries such as Germany (GTZ), Switzerland, Finland, Norway, Denmark, the

*One of the most recognised obstacles to CP implementation is the scarcity of financial resources for CP projects*

United Kingdom and the USA (USAID) are playing a major role in supporting CP-related programmes and projects implemented in MA countries, as well as in providing expertise to local institutions to promote CP. The *Egyptian Pollution Abatement Project*, the *SEAM Project*, and the *Environmental Sector Programme* in Egypt and the *Environmental Pollution Prevention Project (EP3)* in Tunisia are just a few examples of the partnerships existing between MA country governments and these institutions and countries to address pollution and include CP as one of the main components to improve the environmental performance of industry and keep up efficient rates of production at the same time.

These bilateral initiatives are in addition to national programmes developed to address industry as one of the priorities identified by the NEAPs, and which also include pollution prevention and Cleaner Production measures amongst the major initiatives for action. This is the case for example of the *Environmentally Friendly Industrial Cities Programme* carried out in Egypt, through which pollution prevention approaches have been implemented so far in the chemical, metallurgical, food and textile industries, amongst others, located in new industrial cities.

At the level of national sectoral programmes, the component of minimisation has been strongly supported in waste management programmes such as the PRONAGDES in Tunisia, which has established the reduction of waste production and its hazardousness, along with recovery and reuse, as one of its specific targets.





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## RÉSUMÉ DES CADRES INSTITUTIONNEL, LÉGAL ET DE PLANIFICATION EN VIGUEUR DANS LES PAYS ARABES MÉDITERRANÉENS POUR LA PROMOTION DE LA PRODUCTION PLUS PROPRE

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L'objectif de cet article est de donner une vue générale des mesures prises par les pays arabes méditerranéens afin de promouvoir la production plus propre (PP), tant au niveau légal et institutionnel qu'au niveau des plans et des projets. Ce groupe de pays est formé par l'Algérie, l'Égypte, le Liban, la Libye, le Maroc, la Syrie et la Tunisie. Ils sont tous membres de la Ligue des États arabes et possèdent des caractéristiques spécifiques communes, indépendamment des différences de régimes politiques. Ils partagent des principes culturels et parlent des langues similaires, ce qui devrait faciliter les actions communes ainsi que le transfert d'expériences en matière de PP. L'article résume l'information relative à ces pays contenue dans la seconde édition de l'étude sur *État de la production plus propre dans les pays du Plan d'action pour la Méditerranée* publiée par le CAR/PP en début de 2004.

**Mots-clés :** Pays arabes méditerranéens, production plus propre, PP, industrie, lois, plans, programmes, centres de PP.

## RESUMEN DE LOS MARCOS INSTITUCIONAL, LEGAL Y DE PLANIFICACIÓN EN LOS PAÍSES ÁRABES DEL MEDITERRÁNEO PARA LA PROMOCIÓN DE LA PRODUCCIÓN MÁS LIMPIA

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Este artículo pretende ofrecer una visión general de las medidas adoptadas por los países árabes mediterráneos para promover una producción más limpia (P+L), tanto desde el punto de vista legal como institucional, así como desde el punto de vista de los planes y proyectos. Este grupo de países incluye Argelia, Egipto, Libano, Libia, Marruecos, Siria y Túnez. Todos ellos son miembros de la Liga de los Estados Árabes y poseen características específicas comunes, al margen de las diferencias entre sus regímenes políticos. Comparten principios culturales y lenguas próximas entre sí, lo que debería facilitar una acción común y la transferencia de experiencias de P+L. Este artículo resume, principalmente, la información que se facilita en la segunda edición del estudio *Estado de la Producción más Limpia en los países del Plan de Acción para el Mediterráneo* publicado por el CAR/PL a principios de 2004.

**Palabras clave:** Países árabes del Mediterráneo, producción más limpia, P+L, industria, leyes, planes, programas, centros de P+L.





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The **Mediterranean Action Plan (MAP)** strives to protect the environment and to foster development of the Mediterranean Basin. It was adopted in Barcelona (Spain) in 1975 by Mediterranean States and the EC, under the auspices of the United Nations Environmental Programme (UNEP). Its legal framework is made up of the Barcelona Convention (1976, revised in 1995) and six Protocols covering certain specific aspects of environmental protection.

The Action Plan is built up around an Athens-based Coordinating Unit, the MED POL Programme and six Regional Activity Centres.

**The Regional Activity Centre for Cleaner Production (RAC/CP),**

based in Barcelona-Spain, was established in 1996 with the aim of disseminating and promoting the concept of cleaner production, along with the opportunities and advantages of pollution prevention in the industrial activities in Mediterranean countries. The RAC/CP activities are financed by the Spanish Government once they have been submitted and approved by the Contracting Parties to the Barcelona Convention and by the Bilateral Monitoring Commission made up of representatives from the Spanish and Catalan Governments.

This technical publication is issued yearly by RAC/CP. It is aimed at providing an information exchange system among experts in the Mediterranean region with articles related to cleaner production and waste minimisation.

It is intended as a technical publication and does not necessarily reflect the official view of RAC/CP.