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Fifth Steering Committee Meeting and final event of the Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) and Integration of climatic variability and change into national strategies to implement the ICZM Protocol in the Mediterranean (ClimVar & ICZM) projects

3-4 November 2015, Athens, Greece

Agenda item 4: Communication Strategy and Dissemination of the Results

Draft Collection of Lessons Learned from the MedPartnership and ClimVar & ICZM Projects



Together for the Mediterranean Sea

For environmental and economic reasons, this document is printed in a limited number. Delegates are kindly requested to bring their copies to meetings and not to request additional copies.

UNEP/MAP
Athens, 2015

Experience Note



Photo: 123rf

Aquifer vulnerability mapping: Evaluating simultaneously an aquifer's vulnerability to land-based pollutants and saltwater intrusion

AT A GLANCE

The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading environmental institutions and organizations together with countries sharing the Mediterranean Sea to address environmental challenges that Mediterranean marine and coastal ecosystems face. The project's 78 demonstration and the promotion and replication of good practices will maximize impact and ensure the sustainability of the project beyond its lifespan.

Total budget: 48 millions USD.
13 million USD: Global Environment Facility
35 million USD: Participating countries, executing agencies, and donors.

www.themedpartnership.org

ABSTRACT

This study was conducted on the coastal aquifer of Ghar El Melh in Tunisia where the aquifer's vulnerability was evaluated by applying a new, experimental method called **ACVM (Aquifer Comprehensive Vulnerability Mapping)**. This method establishes a single parameter called "**comprehensive vulnerability**" that describes simultaneously an aquifer's "**vertical vulnerability**" linked to contamination threats from land-based pollution, and its "**horizontal vulnerability**" related salt water intrusion.

An additional vulnerability aspect that was incorporated in the ACVM method is the potential impact on groundwater quality due to the variation of sea levels and the resulting increase in vulnerability to seawater intrusion. Therefore, the ACVM method can be used to establish a map that identifies the parts of an aquifer that are more or less vulnerable to global climate change.

Moreover, the ACVM method can incorporate many aspects of aquifer vulnerability describing all them using only one parameter so ACVM can be a valuable tool for stakeholders and for territory planning in the short and long terms.



United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme

ACTIVITY DESCRIPTION

The ACVM method was applied in the Ghar El Melh area in Tunisia in the context of the GEF/UNEP-MAP Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership). UNESCO's International Hydrological Programme is responsible for the execution of MedPartnership Sub-component 1.1 on "Management of Coastal Aquifers and Groundwater".

The coastal aquifer in the Ghar El Melh area – like most Mediterranean coastal aquifers – is subject to contamination from both land-based sources and salt water intrusion. Throughout the area, there are many human activities that have the potential to discharge pollutants into the environment which can then infiltrate into groundwater resources.

THE EXPERIENCE

Groundwater resources in coastal aquifers are often under heavy pressure from intense touristic, industrial and agriculture activities along the coast. In many cases, drinking water in these areas is supplied partially or wholly by groundwater, which can be degraded by pollution from land-based activities and intrusion of seawater.

Moreover, sea level rise, due to climate change, can have a negative impact on coastal aquifers quality submerging areas near the shore line and increasing the level of the water table.



The Ghar El Melh coastal area in Tunisia. Credit: Salvatore Carrubba 2015

Comprehensive assessment of aquifer vulnerability

For our purposes, we define aquifer vulnerability as an intrinsic characteristic of the aquifer that describes the natural defences from an external threat such as a pollutant or a contaminant.

Coastal aquifers, like all aquifers, are vulnerable to contamination from infiltration of pollutants from land-based activities (vertical vulnerability). Unlike other aquifers, however, coastal aquifers are also subject to the threat of salt water intrusion, if there is a hydraulic connection between the aquifer and the sea (horizontal vulnerability).

Usually, vertical vulnerability is evaluated separately from horizontal vulnerability, but in coastal areas the two phenomena are linked. In fact, salt water can heavily influence the chemical reaction between pollutants and rocks and the reactions between pollutants themselves.

There are currently many methods for studying vertical vulnerability, but no methods for studying horizontal and vertical vulnerability at the same time. Therefore, in coastal aquifers it is necessary to consider a new, wider concept of vulnerability, a sort of "comprehensive vulnerability" that simultaneously considers these two aspects of aquifer vulnerability.

For that reason, the new A.C.V.M. (Aquifer Comprehensive Vulnerability Mapping) methodology is an innovative approach that incorporates both vertical and horizontal vulnerability in a single parameter called "comprehensive vulnerability" that can then be used to establish a map that illustrates this parameter.

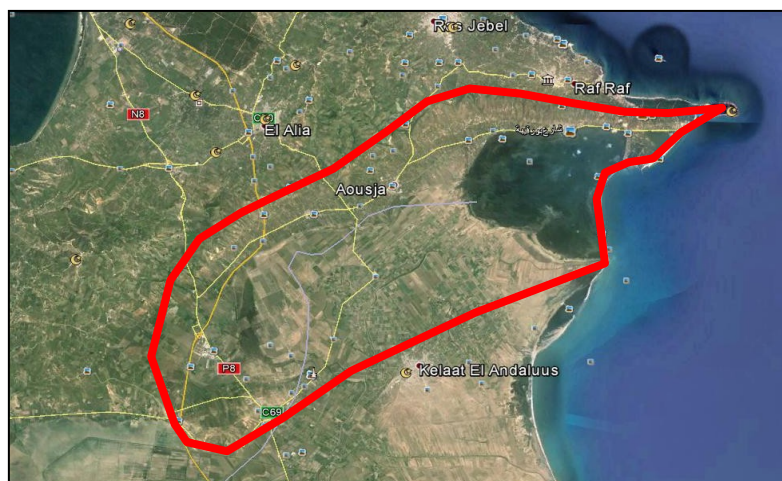
Furthermore, coastal aquifers are vulnerable to climate change, and in fact a modest increase in sea levels can result in significant salt water intrusion and consequently, an increase in an aquifer's comprehensive vulnerability. The ACVM method can incorporate many aspects of aquifer vulnerability and describe them with a single parameter, which can be used to study the potential impact on groundwater quality due to the variation of sea levels and the resulting increase in "comprehensive vulnerability".

RESULTS

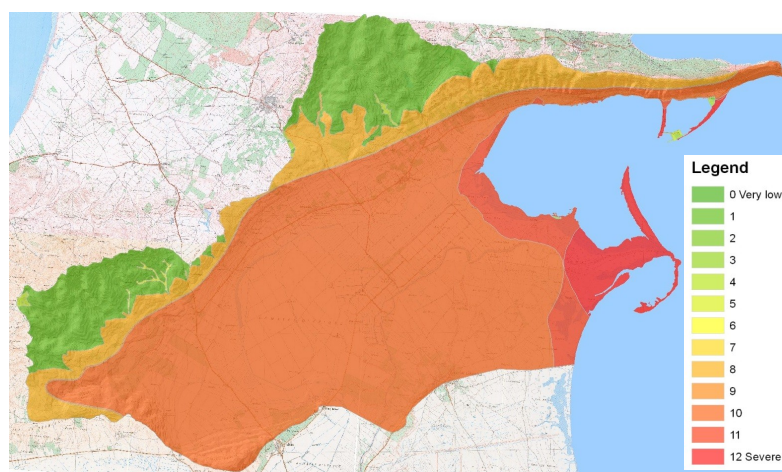
The new methodology, called A.C.V.M. (Aquifer Comprehensive Vulnerability Mapping), encompasses:

- A new methodology for mapping horizontal vulnerability associated with salt water intrusion;
- A new methodology for merging vertical and horizontal vulnerability in order to map "comprehensive vulnerability" in coastal areas;
- A new methodology for evaluating the potential impact on groundwater quality due to the variation of sea levels and the resulting increase in vulnerability from land-based activities and seawater intrusion.

The innovative aspect of ACVM methodology lies in its ability to provide vulnerability map with a visual representation of an aquifer's vulnerability to several types of external threats, by establishing a cumulative parameter called comprehensive vulnerability.



**Ghar El Melh Coastal Aquifer
Comprehensive Vulnerability Map**



LESSONS LEARNED

Comprehensive vulnerability mapping is a new tool that uses a single parameter to simultaneously describe the many aspects of aquifer vulnerability. In the Ghar El Melh area we incorporated in one single parameter the vulnerability of an aquifer to pollution from land-based activities (vertical vulnerability), to salt water intrusion (horizontal vulnerability) and to sea level rise due to climate change.

Consequently, the comprehensive vulnerability map can be a valuable resource for land use and water resources management, since it provides a visual representation of an aquifer's vulnerability to those types of threats that can have a negative potential impact on groundwater quality.

The comprehensive vulnerability map is based on the information contained in the individual vulnerability maps associated with it. Consequently, it is important to consider all the individual maps when viewing the comprehensive vulnerability map, in order to understand which component of vulnerability is prevalent.

This methodology is easy to use and can be applied with inexpensive data. The accuracy of the results will of course be linked to the quality of the data available.

Vulnerability maps established with the ACVM method can be a valuable tool for sound territory planning and for safeguarding the environment and groundwater resources against pollution and overexploitation in the short and long terms.

IMPACTS

A.C.V.M. method is a new tool that uses a single parameter to simultaneously describe the many aspects of aquifer vulnerability. In this study we incorporated in one parameter the vulnerability of an aquifer to pollution from land-based activities (vertical vulnerability), from salt water intrusion (horizontal vulnerability) and from sea level rise.

Consequently, the resulting map can be a valuable resource for land use management, since it provides an immediate visual representation of aquifer's vulnerability to several different threats that can have a negative potential impact on groundwater quality.

The presentation of this information allows stakeholders to easily identify the areas where human activities should be regulated to avoid pollution of groundwater or salt water intrusion in the aquifer while also considering climate change.

Finally, the A.C.V.M. methodology developed for mapping the 'comprehensive vulnerability' of this system is a new concept and could be replicated at other Mediterranean coastal aquifers.



The Ghar El Melh coastal area in Tunisia.

Photo: Salvatore Carrubba 2013.

REFERENCES

Carrubba S., Lagod M. and Stephan R. (2015), "A.C.V.M. (Aquifer Comprehensive Vulnerability Mapping) a new method for evaluating coastal aquifer vulnerability", 25-29 May 2015, Ustron, Poland.
www.geoprospezioni.it/ACVM

KEYWORDS

Coastal aquifer vulnerability mapping
 Comprehensive vulnerability
 Sea water intrusion
 Groundwater management
 Impact of sea level rise on groundwater

EXECUTING PARTNER

UNESCO-IHP, the International Hydrological Programme (IHP) is the only intergovernmental programme of the UN system devoted to water research, water resources management, and education and capacity building. Since its inception in 1975, IHP has evolved from an internationally coordinated hydrological research programme into an encompassing, holistic programme to facilitate education and capacity building, and enhance water resources management and governance.

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Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem

Together for the Mediterranean Sea

MedPartnership



Executing partners: FAO, UNESCO/IHP, UNIDO, GWP-Med, MIO-ECSDE, WWF MedPO, UNEP/MAP's MEDPOL programme and regional activity centres (CP/RAC, SPA/RAC and PAP/RAC).

Participating countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.

Partner countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.

Experience Note



Photo: Boris Bašić

Assessment of climate variability and change impacts and evaluation of response options (a case study of Croatia)

AT A GLANCE

The “*Integration of climatic variability and change into national strategies to implement the ICZM Protocol in the Mediterranean*” project (“*ClimVar & ICZM*”) is a collective effort to promote the use of Integrated Coastal Zone Management (ICZM) in countries sharing the Mediterranean as an effective tool to deal with the impacts of climate variability and change in coastal zones, by mainstreaming them into the ICZM process. It was adopted in January 2012 and will be completed late in 2015.

The project is led by UNEP/MAP, within the framework of the MedPartnership project. Its executing partners are PAP/RAC, Plan Bleu/RAC and GWP-Med.

Participating countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Libya, Morocco, Montenegro, Palestine, Syria and Tunisia.

Total budget: 9.2 million USD.

2.2 million, USD: Global Environment Facility
7 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

The aim of this activity was to provide the tools to influence the current practice of unsustainable coastal development around the Mediterranean. Croatia is one of the Mediterranean countries with highest ratio of coastal length per inhabitant. Driven by tourism, this resulted in high coastal urbanisation, often of the ribbon type. The estimated costs that future generations will have to bear is expected to assist in developing the needed political will to change unsustainable coastal development patterns.

For this assessment the Dynamic Integrated Vulnerability Assessment (DIVA) method was selected. It focused on increased coastal flood risk in terms of the expected annual damage from extreme sea level events and dry land loss due to sea-level rise.

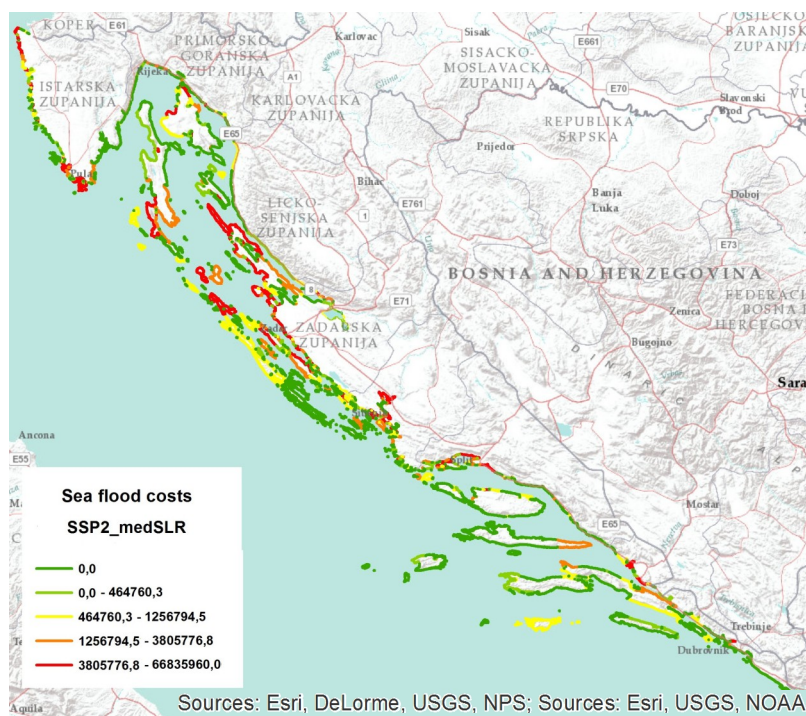
The assessment showed that the impacts of sea-level rise will be substantial in the 21st century for Croatia if no adaptation measures are implemented. Hard adaptation measures are still less costly than the possible damage.

ACTIVITY DESCRIPTION

This activity used the most promising methodology to estimate the economic costs of climate variability and change (CVC), and applied it in two countries. All project countries were invited to apply if they could guarantee the necessary input data. From the countries that applied, Croatia and Tunisia were selected. The assessment for Croatia was completed in September 2015 and published as a report.

THE EXPERIENCE

The DIVA model provided estimates of potential damage and adaptation costs for the Croatian coastal zone. Because of Croatia's ribbon-type coastal development and its low share of residential population, the key question for the future of Croatia, as well as for other Mediterranean touristic countries is – who will bear these costs?



Addressing the Issue/Methodology

DIVA is an integrated, global research framework for assessing the biophysical and socio-economic consequences of sea-level rise and associated extreme water levels under different physical and socio-economic scenarios that considers various adaptation strategies. For the assessment on Croatia the application of DIVA focused on:

- increased coastal flood risk in terms of the expected annual damages of extreme sea level events (storm surges), in terms of monetary damages to assets and number of people affected, and
- dry land loss due to increased coastal erosion from sea-level rise and resulting damages

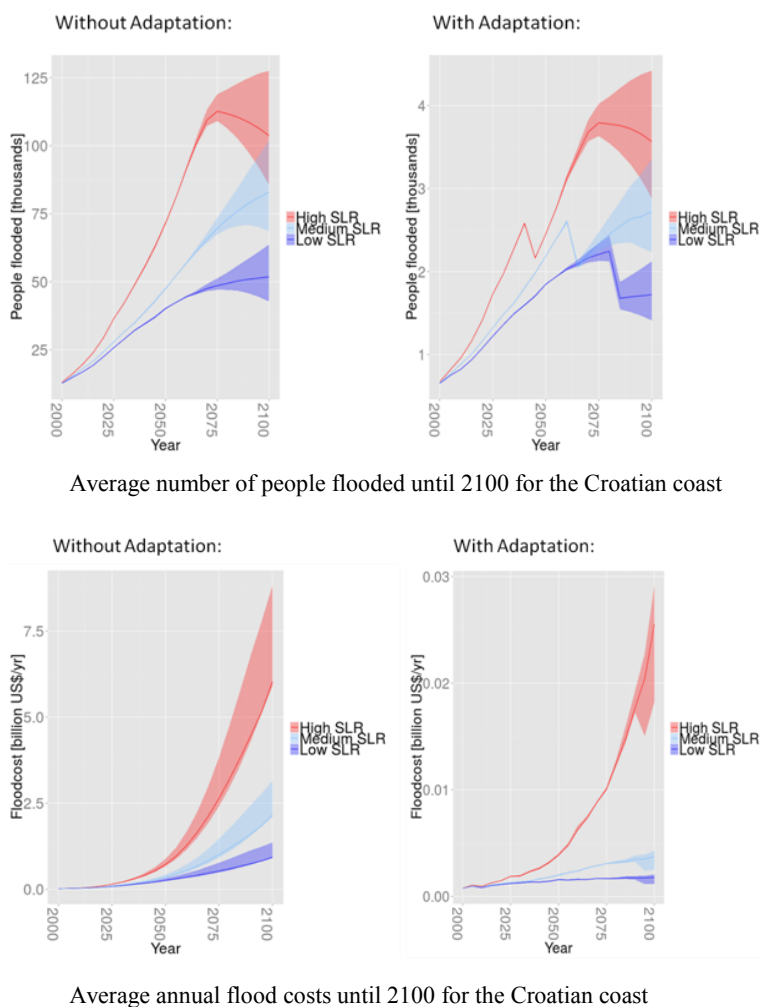
The assessment was based on three sea-level rise scenarios (a 21st century sea-level rise of 0.28m, 0.49m and 1.08m) and three socio-economic development scenarios based on the shared socio-economic pathways (SSPs). Impacts were assessed with adaptation and without adaptation in the form of upgrading dikes to protect against flooding and nourishing beaches and shores to protect against erosion.

For this project DIVA has been downscaled to the national level. Many Croatian institutions provided the required data. Some of the data were used as-is, while some were used to validate the data from global datasets. Particular attention was paid to estimating the value of coastal housing and tourism facilities, the data for which were obtained from the Tax Office of Croatia. DIVA method, as well as the results, together with the outputs from local vulnerability assessment, were discussed at Climagine workshops and Final ClimVar & ICZM workshop. The results serve as an input for the Marine and Coastal Strategy for Croatia.

RESULTS

The assessment showed that the impacts of sea-level rise in Croatia will be substantial in the 21st century if no adaptation measures are taken. The area of Croatian coastal zone exposed to the 1-in-100 year coastal extreme water level will increase from the current 240 km² to 320-360 km² in the late 21st century. The expected number of people flooded annually will increase from 17,000 in 2010 to 43,000-128,000 in 2100, and the expected annual damages from USD 40 million in 2010 to 0.9 to 8.9 billion per year in 2100.

The analysis also showed that impacts would be significantly reduced by applying the appropriate adaptation measures. Adaptation investment depends on the population density thresholds above which dike construction should take place. In case that segments with more than 30 inhabitants/km² are protected, this would result in protecting 84% of Croatia's coastline, costing USD 8.4 billion. In case that segments with more than 200 inhabitants/km² are protected the share of coastline to protect would be 47%, costing USD 4.6 billion. While these costs are substantial, they are at least one order of magnitude lower than the avoided damage costs. Compared to the impacts of sea-level rise on coastal flooding, coastal erosion was found to be a minor issue for Croatia.



LESSONS LEARNED

By applying the DIVA method to the Croatian coast, the discrepancy between population projections and the intense coastal urbanization came into focus. Although the projections for Croatia indicate a population decrease, spatial plans allow for a 10-fold increase in the urbanized coast compared to before the 1960s. The highly seasonal character of tourism focused on “sun, sea and beach” encourages the construction of tourism facilities in the zone with the greatest danger from sea-level rise and related events. The expected increase in temperatures in July and August may result in a more favourable tourist distribution in the shoulder season making many of the existing capacities in the Mediterranean redundant in those months.

The outputs of the DIVA assessment summarize the potential costs of increasing the exposure of this high-density construction to sea-level rise and extreme water levels. The results identified hotspots of coastal vulnerability for which future assessments of specific adaptation options is needed, such as floodplain areas of Zadar and Šibenik. It should be highlighted that DIVA assesses dikes as the only adaptation option, even though there are many more options available, including the adjustment of already-established setback zones, green adaptation, or other visionary options, such as strategic retreat.

IMPACTS

The results of this assessment will be included in the Marine and Coastal Strategy for Croatia, and also in the National Strategy for Adaptation to Climate Change. This study was presented to the Inter-Ministerial Committee (IMC), established to prepare the Marine and Coastal Strategy for Croatia. The IMC is supported by the MedPartnership Project, while the coastal part of the Strategy is a MedPartnership replication project.

DIVA's results downscaled to the county level and the results of the local vulnerability assessment have been introduced into the coastal plan for Šibenik-Knin, which will in turn serve as a base for the county's spatial plan.

It is important to stress that neither coastal flood nor coastal erosion risks have been assessed before for Croatia. These new insights should be considered in future development and land-use plans, and accounted for in adapting the widths of setback zones to changing sea levels.

REFERENCES

Priority Actions Programme/Regional Activity Centre (PAP/RAC)
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KEYWORDS

climate change; sea level rise; coastal flooding; coastal management; adaptation

EXECUTING PARTNER

PAP/RAC is established in 1977 in Split, Croatia, as part of the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP). PAP/RAC's mandate is to provide support to Mediterranean countries in the implementation of the Barcelona Convention and its Protocols, and in particular of the Protocol on Integrated Coastal Zone Management. PAP/RAC is oriented towards carrying out activities contributing to sustainable development of coastal zones and strengthening capacities for their implementation. Thereby, it cooperates with national, regional and local authorities, as well as with a large number of international organisations and institutions.



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Partner countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.



Photo: Nino Strmotić/PIXSELL



Photo: L.-M. Preau / Initiative PIM

Assessment of climate variability and change impacts and evaluation of response options - case study of Tunisia

AT A GLANCE

The "*Integration of climatic variability and change into national strategies to implement the ICZM Protocol in the Mediterranean*" project ("**ClimVar & ICZM**") is a collective effort to promote the use of Integrated Coastal Zone Management (ICZM) in countries sharing the Mediterranean as an effective tool to deal with the impacts of climate variability and change in coastal zones, by mainstreaming them into the ICZM process. It was adopted in January 2012 and will be completed in late 2015.

The project is led by UNEP/MAP, within the framework of the MedPartnership project. Its executing partners are PAP/RAC, Plan Bleu/RAC and GWP-Med.

Participating countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Libya, Morocco, Montenegro, Palestine, Syria and Tunisia.

Total budget: USD 9.2 million.

USD 2.2 million: Global Environment

Facility; USD 7 million: Participating

countries, executing agencies, and donors.

ABSTRACT

Tunisia is considered as one of the Mediterranean countries most vulnerable to climate variability and change, and particularly to sea-level rise and storm surges. The coastline of Tunisia is more than 1,700 km long, including the continental part and the islands, with a variety of coastal types. Its coastal wetlands, which are located at a very low level, are of particular concern. This activity will help evaluate the future costs expected to occur in coastal zones, in terms of assets and persons impacted, if the current practices in coastal management remain unchanged and under different development scenarios. The Dynamic Integrated Vulnerability Assessment (DIVA) model is intended to highlight the need for and support future adaptation policies in coastal management. The DIVA modelling framework is used to assess the increased coastal flood risk in terms of the expected annual damage from extreme sea-level events and dry land loss due to sea-level rise.

The first results of the assessment are in agreement with the vulnerability trends identified by the Tunisian experts studying the impacts of the sea-level rise. The sea-level rise will be significant across the century, and adaptation measures are required. Results show that hard defence construction and continuous beach nourishment would be economically beneficial compared to "do-nothing" approaches.

ACTIVITY DESCRIPTION

The DIVA model is largely recognised in climate science as a key tool to estimate the economic costs of climate variability and change (CVC) with focus in coastal regions. The model was applied in two countries – Croatia and Tunisia. All partner countries were invited to apply if they could guarantee the necessary input data. Based on the selection criteria, Tunisia and Croatia were selected. In Tunisia, preliminary results were presented in 2014, while the final results will be published in 2015.

THE EXPERIENCE

The DIVA model was downscaled at national level in Tunisia. Since the democratic uprising in 2012, the institutional and political background has been constantly evolving. However, the data and information exchange between the DIVA team and its Tunisian counterparts, under the Tunisian Coastal Agency (APAL), has been continuous and productive.

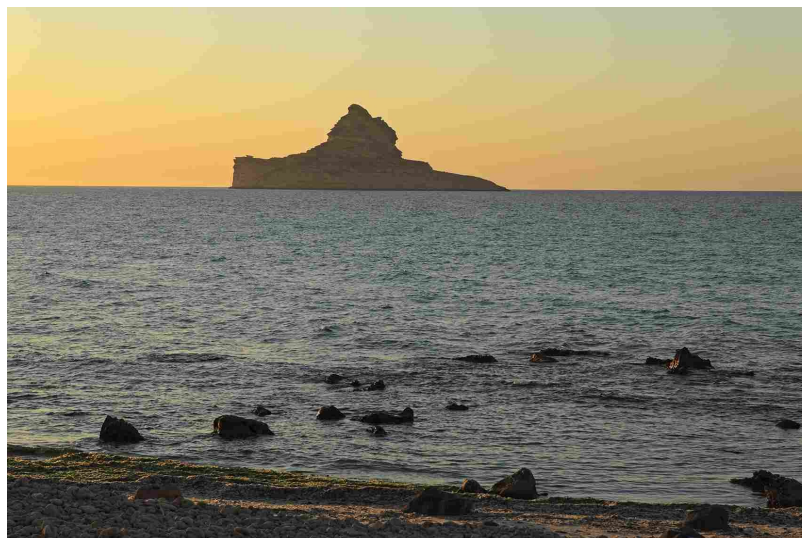


Photo: L.-M. Preau / Initiative PIM

Methodology

DIVA is an integrated, global research framework for assessing the biophysical and socio-economic consequences of sea-level rise and associated extreme water levels under different physical and socio-economic scenarios that considers various adaptation strategies. The general approach of the DIVA segmentation was applied to the Tunisian coasts and included:

- elements of the coastline, such as coastal types, plain, river mouth and lagoon;
- population density and
- administrative units.

The Tunisian DIVA segmentation of the coast constitutes the data model for a spatial data base that includes more than 80 physical, ecological and socioeconomic parameters. The initial global DIVA segmentation represented Tunisia with 35 segments; with the downscaled Tunisian DIVA segmentation a total of 564 segments were defined.

The preliminary results provided by the Global Climate Forum and the University of Kiel were based on the processing of open source and online available data (i.e., coastal type, coastal plain, river mouth, population, administration unit, lagoon). The following key inputs were used to define DIVA in Tunisia:

Coast length: 2,151 km; erodible coast length: 486 km

Current (2015) exposure below 2m:

- People: 384,785
- Assets: USD 8.9 billion
- Area: 8,463 km²

Current (2015) exposure below 100-year flood:

- Average height of 100-year flood: 1.58 m
- People: 304,732
- Assets: USD 6.8 billion
- Area: 1,461 km²

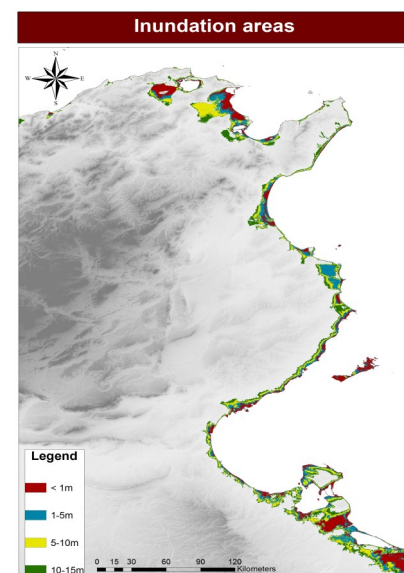
Coastal administrative Units: 78

The final results provided by the Global Climate Forum and the University of Kiel combine preliminary results and inputs from the Tunisian partners, essentially GIS data provided by APAL.

RESULTS

Flooding is an issue in Tunisia (exposure):

- 443km² of the Tunisian coastal zone is currently exposed to the 1-in-100 year coastal extreme water level;
- 21st century sea-level rise (RCP 8.5) would increase this area to 1,666km²;
- Médenine is the municipality with the biggest potential 100-year floodplain, followed by Bizerte and Sfax;
- Tunis, Ben Arous and Sfax have the highest asset values and population in the potential 100-year floodplain;
- Worst case in 2100: up to 436,000 people flooded annually, annual cost of up to USD 22.1 billion;



Inundation areas in Tunisia



- Damages are mainly concentrated in Sfax, Tunis and Ben Arous;
- Impacts can be reduced significantly when applying appropriate adaptation measures (Avoided annual flood damages in 2100: US\$ 19,00 – 49,428 million due to adaptation via dikes);
- Up-front investments of US\$ 18.8 billion to build initial dikes for about 86% of Tunisia's coastline plus annual investment and maintenance costs increasing from US\$ 169 million per year in 2100 to US\$ 219-302 million at the end of the century would be required. Protection by dikes will not be very attractive for tourism.

Erosion is an issue in Tunisia:

- Without adaptation: annual land loss of up to 522,755 m² (around 1/3 of the Tunisian coastline consists of erodible beaches);
- Municipalities most affected by erosion are Nabeul, Soussè, Médenine and Bizerte;
- Adaptation (beach nourishment) in 2100 would cost about USD 43.82 million annually and up to 7,2 km² of sand;

LESSONS LEARNED

After presenting the preliminary results, the partners agreed to push forward with the DIVA Tunisia modelling. Further analysis, to be completed in June 2015, will be based on the integration of more specific data forwarded by the Tunisian partners. A list of comments will illustrate (i) the value of data provided (e.g. more details on the coastal types, etc.), (ii) steps beyond the final results, and (iii) guidelines for future cooperation.

Greater involvement of Tunisian partners in the early stages of the socio-economic evaluation of CVC impacts would guarantee better adaptation of the model as a decision-making tool suited to local needs and capacity improvement.

It will be important to enhance local expertise (i.e. inundation modelling, harbour development analysis, etc.). Other areas for further cooperation were also identified. Brief recommendations should provide insight into what can be done and will provide “material” to sustain the discussion with the Tunisian partners on further cooperation.

IMPACTS

First results of the DIVA model were presented in 2014 to 30 senior Tunisian experts in coastal zone management and representatives of national research institutions and organisations, such as the National Institute for Marine Studies, the National Institute of Meteorology, and the National Coastal Agency. Great interest was shown in the technical aspects of the DIVA model.

After the meeting, it was decided to work on a more detailed analysis using available Tunisian data. The latest findings of DIVA Tunisia will be presented at the MedPartnership Final Conference on ICZM in Split on 12-13 May 2015. A study on CVC impacts per sector in Tunisia was launched in cooperation with the Pr. Markandya, for which a Tunisian expert was hired to gather and analyse the data (results are expected in June 2015).

Because of the interest shown in Tunisia and by partners in the project countries, a regional DIVA training session will be organised. This meeting will be an opportunity to discuss the methodologies and results of the evaluation of socio-economic CVC impacts on coastal zones.

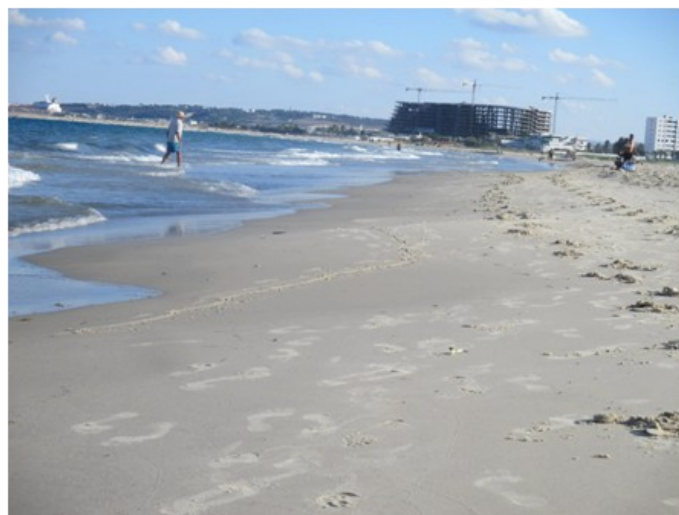


Photo: S. Petit

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Priority Actions Programme/Regional Activity Centre (PAP/RAC)

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KEYWORDS

climate change; sea level rise; coastal flooding; coastal management; adaptation; resilience; mitigation

EXECUTING PARTNER

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Experience Note



Photo: Šibenik-IN

Local assessment of vulnerability to climate variability and change

AT A GLANCE

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Total budget: 9.2 million USD.

2.2 million, USD: Global Environment Facility

7 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

This assessment seeks to strengthen the understanding of impacts of climate variability and change (CVC) on coastal zones in the Mediterranean region. The method consists of assessing the impacts of CVC on different economic sectors and other areas of importance for the study area. In this case, impacts were assessed on a level of the coastal region Šibenik-Knin County in Croatia. The results showed that the sectors that contribute significantly to development of this county – tourism, agriculture, fisheries and aquaculture, and water management – are likely to be affected by CVC. The greatest potential impacts will be on coastal assets, which will affect primary residents, owners of secondary houses and tourism facilities in low-lying coastal zones.

Solid ground for resilient future coasts will be possible only by considering long-term CVC impacts in development plans. The results of such assessments feed into national and regional coastal plans, development plans, marine and coastal strategies, strategies for adaptation to climate change, and other strategic documents.

ACTIVITY DESCRIPTION

This study is part of the ClimVar & ICZM Project. It falls under the project objective to strengthen understanding of CVC impacts on coastal zones of the Mediterranean region by assessing environmental and socio-economic impacts in vulnerable sites. The results of the study were presented to key stakeholders which acknowledged the significance of its findings as a contribution to other planning efforts in the area.

THE EXPERIENCE

This assessment uses an integrated approach to study the economic impacts of CVC on coastal zones at the sub-national level. Its comprehensive approach covers many different sectors. This experience is valuable on broader level because the issues discussed here happen throughout the Mediterranean.



Photo: Daria Povh Škugor

Methodology

The assessment covered CVC impacts on economic sectors that are important for the Šibenik-Knin County, including tourism, agriculture, fisheries, water management, manufacturing, maritime transport and energy sector. The selection of the CVC issues covered in this assessment was based on priority climate change issues raised by stakeholders during the “*Climagine*” participatory process. The selection was further verified with the team of PAP/RAC experts.

Because of the range and complexity of CVC impacts across different sectors, there was no common methodology to estimate the effects of these impacts. For that reason, this study used a number of approaches to quantify and monetize those impacts.

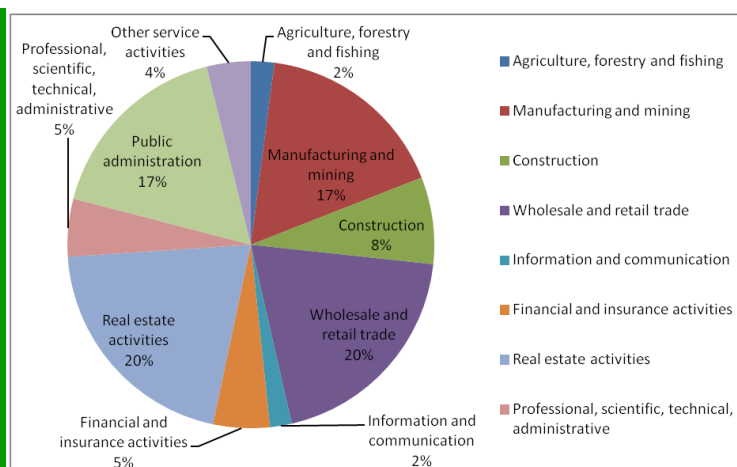
Parts of the assessment that focused on damages from sea-level rise and extreme water levels were also informed by the results of other PAP/RAC’s studies in the ClimVar & ICZM Project, specifically the effect of sea-level rise impacts on Croatia based on the Dynamic Integrated Vulnerability Assessment (DIVA) model, and a vulnerability analysis of coastal areas for Šibenik-Knin County.

In addition to assessing CVC impacts on different economic sectors, the study also covered impacts on forest fires, human health and cultural heritage.

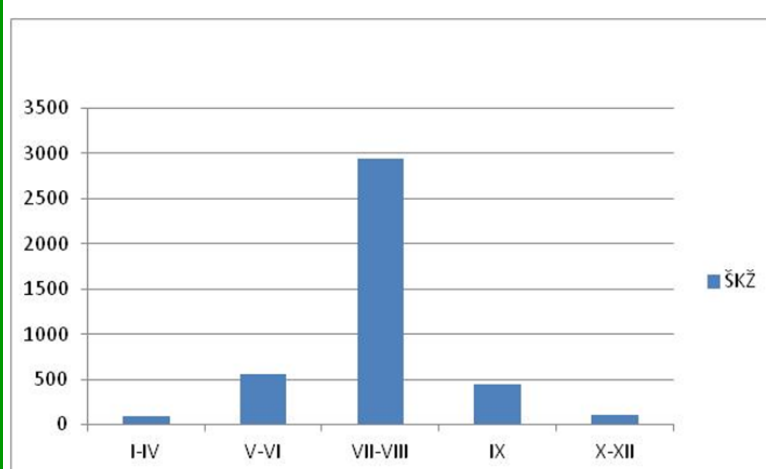
The conclusions of this assessment feed into the recommendations for prioritizing the issues within the coastal zone management plans and inform about the adaptation deficit in the region.

RESULTS

The greatest potential CVC impacts in the region will be reflected in damage to coastal assets. According to the DIVA study, Šibenik and Vodic are among ten floodplain areas with highest projected expenses from sea flood damages. Primary residents, owners of the secondary houses and tourism facilities located in the low-lying coastal zones will be particularly affected. These impacts will also include nautical tourism assets and protected sites. Agriculture yields are likely to be impacted by changing precipitation and temperature trends, and crop damage from more extreme weather. Fisheries may be affected by altered distribution of fish species and a greater number of invasive species, while aquaculture may be affected by increased salinity. Climate change will worsen the current issues with water supply, with increasing temperatures and reduced precipitation leading to decreased water availability in the summer months. In the winter, on the other hand, heavier precipitation, and flash floods will pose a risk to assets and infrastructure in urban areas and coastal zones. Impacts on other sectors, such as manufacturing, maritime transportation and the energy sector, are also likely, but more detailed studies are needed in these fields. Impacts on human health and cultural heritage sites and on the incidence of wild fires are also imminent.



Economic structure of ŠKC in 2011(GVA)



Overnight stays in ŠKC in 000 for 2012

LESSONS LEARNED

Like many other Mediterranean coastal regions, this one has been faced with an economic decline that has resulted in unemployment and an uncertain future. Its plans are understandably focusing on ways to create sustainable development based on its comparative advantages in sectors such as tourism, agriculture, fisheries and aquaculture, and possibly energy.

Although the extent and timing of its impacts are uncertain, there are strong evidence that the climate will become warmer, with longer and possibly more intense floods and droughts. Any development plan therefore must bear in mind the need to make the economic structure of the county more resilient to climate variability and change.

Since the greatest economic impacts will be on coastal assets, particularly housing and tourism facilities, these assets must be addressed in two ways. First, protection should be provided for those locations with high-value assets. Second, plans for future development and land-use plans should take into account the increased risk of damage from storm surges and sea-level rise. For example, the established setback zones should be adjustable by taking into account the latest CVC projections and related vulnerability assessments.

As for economic sectors, more detailed estimates are needed on the local level because of the complex nature of CVC impacts.

IMPACTS

The selection of CVC issues to be covered in this report was strongly influenced by the opinions of local stakeholders involved in “*Climagine*” participatory process from the very beginning. The outputs were presented and discussed during later “*Climagine*” workshops. These outputs have been introduced into coastal plan of Šibenik-Knin County, and will serve as a basis for the county’s spatial plan and other relevant plans and strategies. In addition, the conclusions and recommendations will inform the preparation of the Marine and Coastal Strategy of Croatia. The nature of the assessment might also serve as example to other Mediterranean countries that are likely to experience similar CVC impacts to develop their own coastal plans and strategies.

In addition, the outputs of this assessment will be provided as inputs to a National strategy for adaptation to climate change and a National strategy for regional development.



“*Climagine*” participatory meeting
Photo: Daria Povh Škugor

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Priority Actions Programme/Regional Activity Centre
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KEYWORDS

methodology; sector-based assessment; climate change impacts; adaptation; impacts on economy

EXECUTING PARTNER

PAP/RAC was established in 1977 in Split, Croatia, as part of the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP). PAP/RAC's mandate is to provide support to Mediterranean countries in the implementation of the Barcelona Convention and its Protocols, and in particular of the Protocol on Integrated Coastal Zone Management. PAP/RAC is oriented towards carrying out of activities contributing to sustainable development of coastal zones and strengthening capacities for their implementation. Thereby, it co-operates with national, regional and local authorities.



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Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem

Together for the Mediterranean Sea

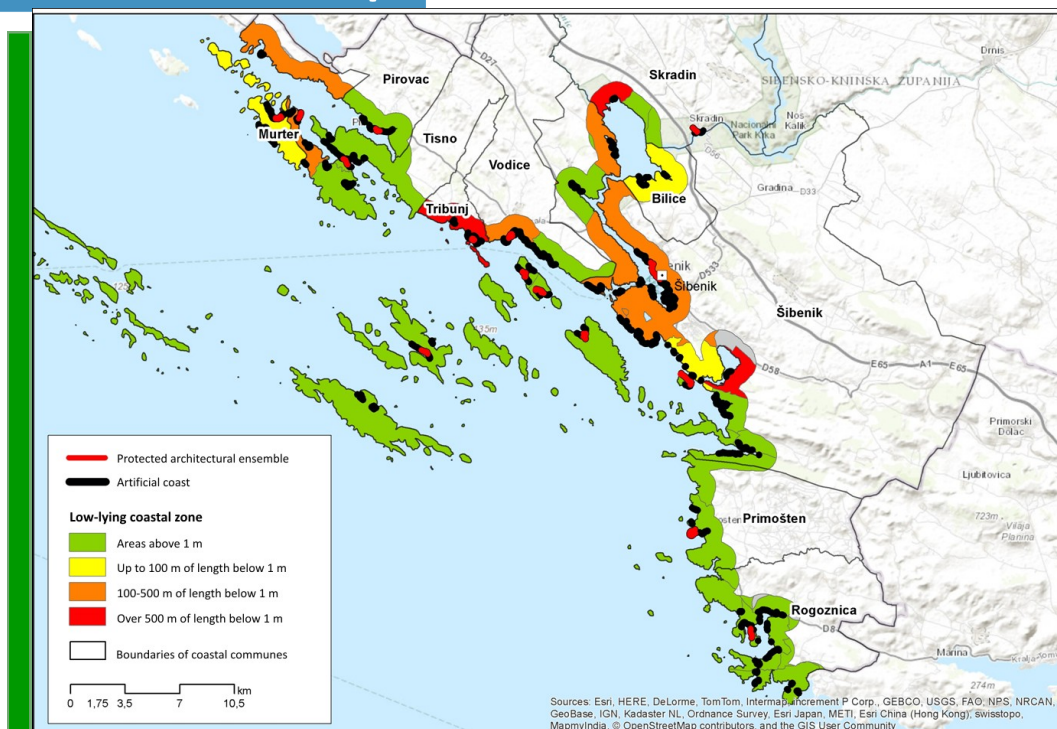
MedPartnership



Executing partners: FAO, UNESCO/IHP, UNIDO, GWP-Med, MIO-ECSDE, WWF MedPO, UNEP/MAP’s MEDPOL programme and regional activity centres (CP/RAC, SPA/RAC and PAP/RAC).

Participating countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.

Partner countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.



Building coastal resilience in Šibenik-Knin County in Croatia - Coastal Plan

AT A GLANCE

The "Integration of climatic variability and change into national strategies to implement the ICZM Protocol in the Mediterranean" project ("**ClimVar & ICZM**") is a collective effort to promote the use of Integrated Coastal Zone Management (ICZM) in countries sharing the Mediterranean as an effective tool to deal with the impacts of climate variability and change in coastal zones, by mainstreaming them into the ICZM process. It was adopted in January 2012 and will be completed in late 2015.

The project is led by UNEP/MAP, within the framework of the MedPartnership project. Its executing partners are PAP/RAC, Plan Bleu/RAC and GWP-Med.

Participating countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Libya, Montenegro, Morocco, Palestine, Syria and Tunisia.

Total budget: USD 9.2 million.

USD 2.2 million: Global Environment Facility; USD 7 million: Participating countries, executing agencies, and donors.

ABSTRACT

The Coastal Plan, as foreseen by the ICZM Protocol, recommends ways to increase the resilience of coastal zone and sustainability of its development. It addresses the planning process defined in the MedPartnership project and is supported by PAP/RAC's guidelines from the ClimVar and ICZM project. It is based on several assessments and was prepared for coastal zone of the Šibenik-Knin County by a multi-disciplinary team of experts. The Plan and those assessments were guided by local knowledge, expressed at "*Climagine*" workshops that paralleled Plan preparation.

The Plan was completed in September 2015 and is ready for adoption. It will feed into local spatial plans, a regional development strategy and other sectoral policy documents.

The Plan generated interest by stakeholders around the Mediterranean. During its preparation, it was presented at national and international conferences and workshops. The need for a systematic approach to increase coastal resilience is recognised by many coastal regions. This Plan, based on scientific projections and local responses, represents an example to follow.

ACTIVITY DESCRIPTION

This activity falls under the project objective to support implementation of the ICZM Protocol for the Mediterranean and capacity building. Its goal is to develop a Coastal Plan, as required by Article 18 of the ICZM Protocol. In this case the Coastal Plan, which may be self-standing or integrated into other plans and programmes, has a strong focus on adaptation to climate variability and change (CVC).

THE EXPERIENCE

Building coastal resilience is becoming a goal for all coastal regions. Since the Mediterranean coasts have always been attractive for living and more recently for tourism as well, this objective is even more important. The Coastal Plan for Šibenik-Knin County, based on scientific projections and local responses, is an example of how this complex issue can be tackled.



Photo: Daria Povh Škugor

Methodology

The methodology used to prepare the Coastal Plan is one proposed in the IMF Guidelines of the MedPartnership project. The methodology encompasses several planning phases: Establishment (scoping); Analysis and Futures (diagnostic analysis); Setting the Vision; Designing the Future; and finally, Realising the Vision. Especially focused on CVC, this Plan was developed in parallel to the “Guidelines for Adapting to Climate Variability and Change along the Mediterranean Coasts”, which was also published as part of this project. All named outputs were feeding each other in the process of their preparation.

The Coastal Plan addresses the challenges posed by CVC to the county’s coastal zone, primarily in terms of spatial planning, coastal protection, water management, regional development and biodiversity management. Because of the great pressures on the narrow coastal belt, special attention was devoted to preserving landscape values.

The Plan was developed in parallel with the “*Climage*” participatory workshops. Each of the four workshops had an educational component. These workshops were also used to agree on a vision for the future coast and to discuss the expert findings in the Plan preparation.

The Local Assessment of Vulnerability to CVC, which assessed CVC impacts on different economic sectors of the county and other impacts, such as those on forest fires, cultural heritage and human health, served as an input for the Plan.

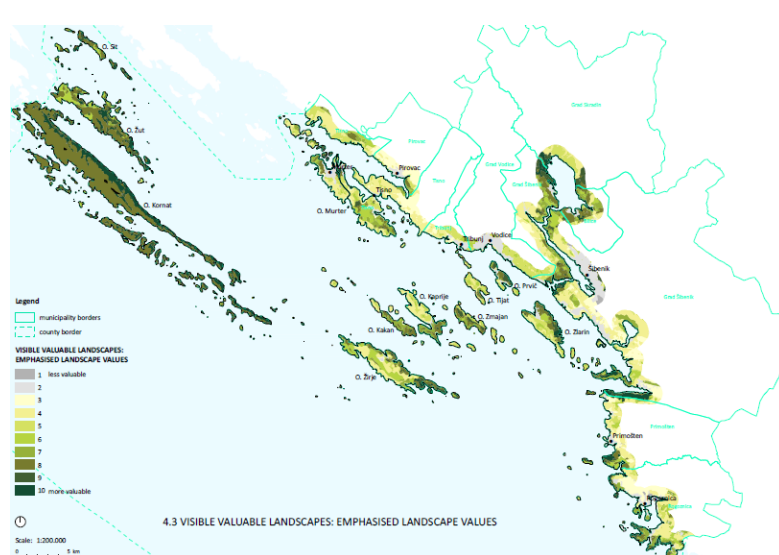
GIS tools were intensively used for spatial analysis, but also as tools for communicating the findings. A GIS course has been organised. Finally, the Plan will be presented to the County Assembly for adoption. It will provide recommendations for spatial plans in the coastal zone, for regional development strategy and for plans for other sectors facing CVC impacts.

RESULTS

The coastal plan was completed in September 2015. It is composed of two major parts. In the first part, which may be called strategic, the vision of the desirable future of the Šibenik-Knin County coastal zone was defined. This vision serves as a foundation for scenarios of development and management of the coastal zone. In the second part, key management policies are defined, as follows:

- policies for sustainable spatial development;
- policies for sustainable economic development;
- policies for water resources management; and
- policies for emergency situations.

For each of these policies a set of measures was defined for each coastal settlement. These represent solutions for building coastal resilience to CVC through reducing vulnerability (physical and economic), improvement in water management, management of spatial development and landscape valorisation and management. Implementing recommendations and measures of the Coastal Plan will decrease the damage caused by CVC, assist the internalization of environmental costs for more sustainable development, and provide a more resilient economy in the county's coastal zone. Consequently, the region will become a more desirable place to live.



Emphasized landscape values

The Coastal Plan also raised new questions. The level of investment to adapt to sea-level rise will be substantial, which puts forward an important question: Who will pay for these investments? In some settlements of the county primary residents own less than 25% of the houses. Studies conducted in the Hérault region of France (H. Rey-Valette, 2014) showed a difference in perceptions of climate risks depending on whether a person was a primary resident or the owner of a secondary home. Thus, their willingness to pay may also differ.

LESSONS LEARNED

When preparing any coastal plan, one of the tasks during the scoping stage will be to identify key issues. The Plan should apply a holistic approach, but due to different limitations (time, resources) it will often have to deal with several priority issues that are creating the greatest challenges for the zone.

Territorial coverage must also be defined. Whatever the definition may be, it is important to apply a problem-solving approach – meaning that key issues may extend beyond the Plan's territorial coverage. In that case, these problems may be analysed outside the Plan's boundaries.

Integration is easy to recommend but difficult to achieve. Establishing a steering committee with representatives from different sectors and an advisory board may help in this regard.

A Coastal Plan offers a number of recommendations, but also opens a number of questions. Climate change has opened new levels of uncertainty. Decision makers and planners must learn how to function with these new levels of uncertainty, which are higher than ever before. Consistent solutions require new levels of integration.

IMPACTS

The Coastal Plan for Šibenik-Knin County was presented to the Inter-Ministerial Committee for preparation and implementation of Marine and Coastal Strategy for Croatia. The Plan is to be adopted by the County Assembly in order to gain the legal status. The impact of the Plan on public awareness is evident. Because of the size of the challenge posed by climate change on the one hand and the short policy cycles of decision makers on the other, it is clear that the public's role in dealing with climate crises will be particularly important.

To illustrate the impact of the Coastal Plan for Šibenik-Knin County, we cite the statement of the Director of the County Department for Environment and Municipal Affairs: "We expected a lot from this Plan. At this moment, we must say that we got much more than we expected."



Photo: Daria Povh Škugor

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Priority Actions Programme/Regional Activity Centre (PAP/RAC) <http://www.pap-thecoastcentre.org/>
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KEYWORDS

Coastal plan; resilience; ICZM; adaptation; sustainable development.

EXECUTING PARTNER

PAP/RAC was established in 1977 in Split, Croatia, as part of the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP). PAP/RAC's mandate is to provide support to Mediterranean countries in the implementation of the Barcelona Convention and its Protocols, and in particular of the Protocol on Integrated Coastal Zone Management. PAP/RAC is oriented towards carrying out of activities contributing to sustainable development of coastal zones and strengthening capacities for their implementation. Thereby, it co-operates with national, regional and local authorities, as well as with a large number of international organisations and institutions.



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Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem

Together for the Mediterranean Sea

MedPartnership



Executing partners: FAO, UNESCO/IHP, UNIDO, GWP-Med, MIO-ECSDE, WWF MedPO, UNEP/MAP's MEDPOL programme and regional activity centres (CP/RAC, SPA/RAC and PAP/RAC).

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Experience Note

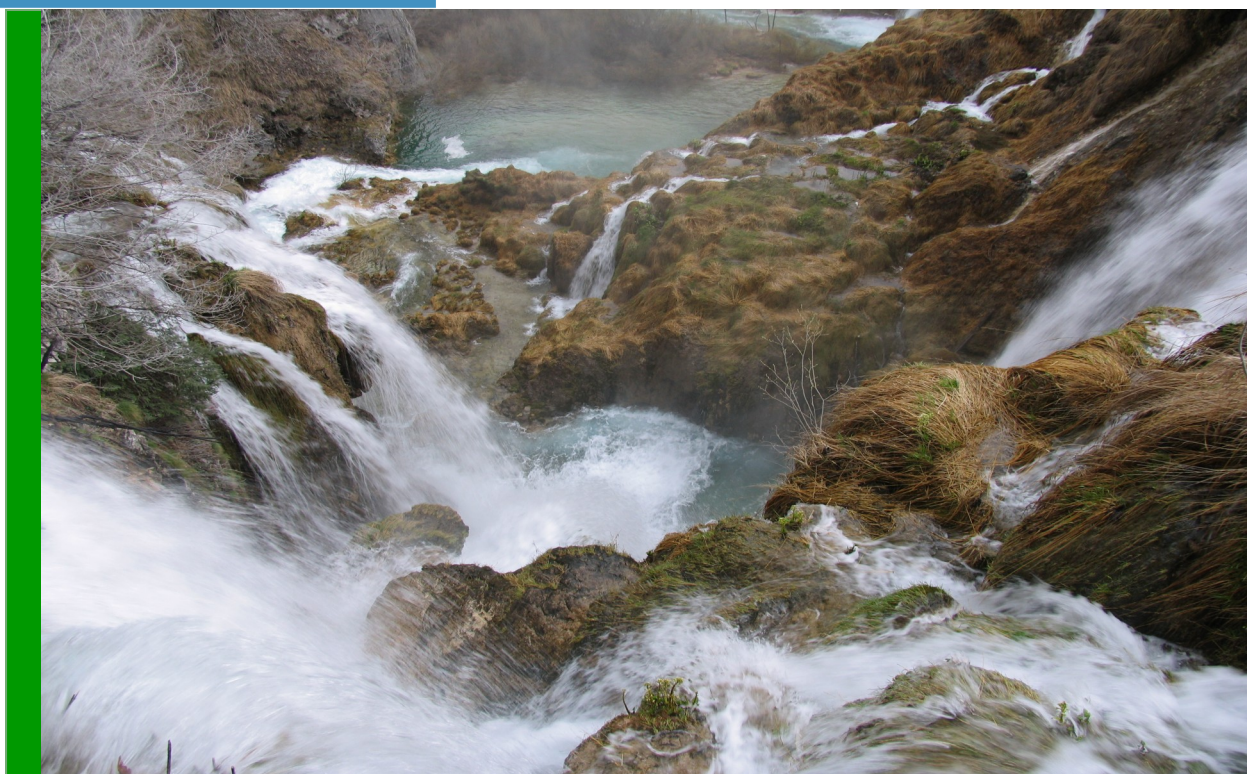


Photo: Marko Prem

An Integrative Methodological Framework (IMF) for coastal, river basin and aquifer management

AT A GLANCE

The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading environmental institutions and organizations together with countries sharing the Mediterranean Sea to address environmental challenges that Mediterranean marine and coastal ecosystems face. The project's 78 demonstration and the promotion and replication of good practices will maximize impact and ensure the sustainability of the project beyond its lifespan.

Total budget: 48 millions USD.
13 million USD: Global Environment Facility
35 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

In recent decades various management approaches have been developed for the terrestrial, freshwater and marine environments in the Mediterranean basin. These include Integrated Coastal Zone Management (ICZM), Integrated Water Resources Management (IWRM), and more recently Coastal Aquifer and Groundwater Management. The focus of these approaches has been most acute in coastal areas and in the management of the key resource – water – with the potential for overlap and duplication of resources.

The **Integrative Management Framework (IMF)**, a joint initiative by the Priority Actions Programme/Regional Activity Centre (PAP/RAC) of UNEP/MAP, the UNESCO-International Hydrological Programme (IHP) and the Global Water Partnership (GWP-Med) combines the expertise of these programmes in such a way that *'the whole is greater than the sum of the parts'*. The resulting IMF is a comprehensive and operational methodology for the integrated and sustainable management of the Mediterranean ecosystems constituted by the coastal zones, river basins and coastal aquifers.

ACTIVITY DESCRIPTION

The outcome is described in a single document published in 2015; “An Integrative Methodological Framework (IMF) for coastal, river basin and aquifer management - *towards converging management approaches for Mediterranean coastal zones*“. The IMF was prepared under the direction of an **Integrative Working Group (IWG)** composed of international experts with extensive experience in their respective fields across the Mediterranean region and globally established in 2010.

THE EXPERIENCE

The methodological integration of water resource management and planning into ICZM and IWRM Plans are key MedPartnership objectives. The project converged the methodologies into the unified IMF methodology, developed guidance for its replication and application across the Mediterranean through a transferable process, and for its implementation within three pilot coastal plans (Integrated Management Plan for Bojana/Buna Area; Coastal Plan Réghaia; and Coastal Plan for Šibenik-Knin County).



Complex coastal ecosystems
Photo: Marko Prem

Methodology

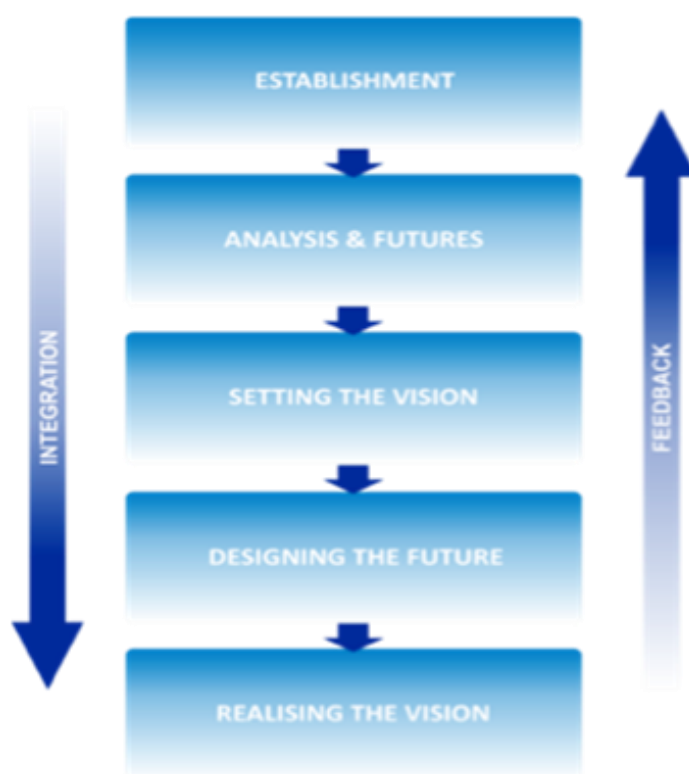
An estimated 80% of the pollution load received by the Mediterranean Sea derives from land-based sources through rivers, combined with that from coastal development and activity. This underpins the need for a multi-sectoral approach at the water basin-wide level, including groundwater bodies, and with particular attention to the coastal zone. Mediterranean countries are called to prepare specific strategies and plans at differing geographic scales to meet the requirements of international legal agreements, relating directly or indirectly to this issue, including for example the ICZM Protocol and the EU Water Framework Directive.

The risk of duplication, conflicts of objectives, and inefficiencies is therefore high. Integration is commonly advocated to avoid such duplication, to maximize the benefits of combining thematic and institutional approaches - with the common ultimate goal of achieving “sustainable development”. In practice however, real-world resources, differing time-scales along with institutional and sectoral rigidities have limited the achievement of the full integration of these approaches. Many of the approaches and subsequent plans have been developed in the latter parts of the 20th century, and the first years of the 21st century, mostly in parallel by practitioners of different disciplinary backgrounds, and frequently different philosophical departure. The IMF set out to establish a new and practical framework to achieve real integration.

RESULTS

The IMF identifies the key sectoral and spatial dimensions within which integration must be defined, and sets out the methodology to achieve this. The IMF sets out a common 5-stage process to guide the preparation of coastal plans in the Mediterranean and beyond. The process provides a step-by-step guide to an integrated planning process and begins at the very start of the planning process - “Establishment”, through to implementation and the facilitation of change – “Realising the Vision”. The process describes objectives, activities and outputs of each stage, proposing methodologies, tools and examples.

The diagram also acts as a convenient ‘top layer’ for use in a web environment. The IMF Process is used as the framework for “Roadmap towards Coastal Sustainability” – an online wiki through which each of the five stages can be explored and infinitely expanded in deeper detail developed in parallel with the EU FP7 PEGASO Project. The goal of PEGASO is to construct a shared ICZM ‘Governance Platform’ for the Mediterranean and Black Sea linked with new models of governance for the Mediterranean and Black Sea.



The planning process

LESSONS LEARNED

The IMF advocates simplicity and pragmatism as the keys to effectiveness, replication and sustainability.

Defining the common operational geographic space

In the IMF approach, the entire river basin may be considered, but in practice, the coastal sub-basin should be the focus, with its ground waters, transitional and coastal waters. The ICZM Protocol offers a pragmatic, administrative units-based approach.

Integration and governance

Each local situation will require a locally tailored governance approach, recognising national and local governance structures. Integration is easy to recommend but difficult to achieve as, in the majority of the Mediterranean countries, administrations function to a large extent in sectoral “silos”. Transboundary working further complicates this.

The Drivers-Pressures-State-Impact-Response (DPSIR) Framework provides a tool for integration

The DPSIR provides a simple tool for capturing, visualising, and analysing the cause-effect relationships between complex social, economic and environmental systems. In the multi-sectoral approach of the IMF an innovative unifying methodology was developed to elaborate the necessary multi-sectoral responses.

The value of simple, common roadmap adaptable to local circumstances

The simple roadmap is proposed by the IMF to guide the step-by-step preparation of coastal plans and deliver their outcomes. Its 5 stages are universal and therefore easily transferable and adaptable for use at local level.

Delivering results - the importance of realising the vision

The strong emphasis of the IMF is on delivering the real outcomes of direct benefit to local communities and the environment. The integrated plan should be politically, technically, financially, and legally implementable, and socially acceptable.

IMPACTS

The **Integrative Working Group (IWG)** prepared and agreed draft common conceptual definitions and a common process in order to:

- facilitate planners and practitioners to achieve a shared, efficient and effective use of the typical human and logistical resources available in most Mediterranean countries.
- facilitate the better coordination, integration and involvement of all stakeholders, including the general public, in the planning process.

This process was also developed in parallel with the EU funded FP7 PEGASO Project as a common roadmap for ICZM plan preparation that is adaptable to local circumstances and resources.

The plan preparation methodology has also been subject to parallel operational testing in the transboundary coastal area of Buna-Bojana in Albania and Montenegro, and the feedback from this has, in turn, fed back into the development of the IMF.



*Together for common results
Photo: Marko Prem*

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KEYWORDS

integration; ICZM; IWRM; coastal aquifer and groundwater management; governance

EXECUTING PARTNERS

PAP/RAC was established in 1977 in Split, Croatia, as part of the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP). PAP/RAC's mandate is to provide support to Mediterranean countries in the implementation of the Barcelona Convention and its Protocols, and in particular of the Protocol on Integrated Coastal Zone Management. PAP/RAC is oriented towards carrying out activities contributing to the sustainable development of coastal zones and strengthening capacities for their implementation. Thereby, it cooperates with national, regional and local authorities, as well as with a large number of international organisations and institutions.

Global Water Partnership – Mediterranean (GWP-Med) is a regional partnership of the Global Water Partnership (GWP) and constitutes a platform bringing together organisations advocating, facilitating and supporting the sustainable management of water resources in the Mediterranean Region and beyond. It aims at promoting design, knowledge and action on Integrated Water Resource Management (IWRM), including in relation to its environmental objectives and with a focus on the coastal areas, through the exchange of experiences, dialogue, and capacity-building.

UNESCO-IHP, is the only intergovernmental programme of the UN system devoted to water research, water resources management, and education and capacity building. Since its inception in 1975, the International Hydrological Programme (IHP) has evolved from an internationally coordinated hydrological research programme into an encompassing, holistic programme to facilitate education and capacity building, and enhance water resources management and governance.



Together for the Mediterranean Sea



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Executing partners: FAO, UNESCO/IHP, UNIDO, GWP-Med, MIO-ECSDE, WWF MedPO, UNEP/MAP's MEDPOL programme and regional activity centres (CP/RAC, SPA/RAC and PAP/RAC).

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Partner countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.



Integrated Management Plan (IMP) for Bojana/Buna Area

AT A GLANCE

The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading environmental institutions and organizations together with countries sharing the Mediterranean Sea to address environmental challenges that Mediterranean marine and coastal ecosystems face. The project's 78 demonstration and the promotion and replication of good practices will maximize impact and ensure the sustainability of the project beyond its lifespan.

Total budget: 48 millions USD.
13 million USD: Global Environment Facility
35 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

This Bojana/Buna Integrated Management Plan (IMP) is a pilot – “real world” - application of the “Integrated Methodological Framework” (IMF). The IMP helped to demonstrate and test to develop an operational methodology for the sustainable management of the ecological continuum constituted by the coastal zone, the river basin and the coastal aquifer.

The IMP encompasses the transboundary area of Albania and Montenegro, bringing together administrative structures from the two states. The Bojana/Buna River, its catchment, the underlying aquifers and coastal waters provide the common physical threads linking the two countries. Bringing together IWRM (including surface water and groundwater management), spatial planning, climate change adaptation and ICZM, the IMP adds value to the individual approaches such that *‘the whole is greater than the sum of the parts’*. The experiences from preparing the Bojana/Buna IMP can be used for the replication of the effort elsewhere in the Mediterranean basin instead of preparing separate IWRM and ICZM plans.

ACTIVITY DESCRIPTION

The IMP demonstrated, tested, and provided feedback into the plan-making methodology developed under the Integrative Methodological Framework (IMF) of the MedPartnership-ICZM component. A joint management plan for the area was developed based on the guidelines of both the ICZM Protocol and the EU's Water Framework, and refined according to local circumstances. To structure the analysis of the complex interplay between topic areas the "DPSIR" framework was used. The IMP was developed over a 5-year timeframe and completed in 2015.

THE EXPERIENCE

The IMP considers impacts on the coastal zone and the Bojana/Buna basin of upstream activities from, the impacts of agriculture, tourism and urbanisation, and marine impacts on the river delta and coastal aquifers. The IMP encompasses the transboundary area of Albania and Montenegro, considering the river basin and coastal zone as a single entity.



Bojana/Buna delta

Photo: RLC Montenegro

Methodology

Transboundary issues and problems

The Bojana/Buna area is a single natural system extending into two countries, and the transboundary issues and problems addressed reflect the multi-sectoral, integrated nature of the IMP. These issues include the unsustainable spatial development; solid waste and wastewater management; agricultural, fisheries, hunting and forestry practices; the over-extraction of groundwater and inadequate infrastructure including flood defences.

These problems are compounded by structural economic weaknesses, including some of the lowest incomes in Europe, weak institutional and technical capacity, and an inadequate policy framework. Upstream pressures include urbanization and land use management; hydropower production result in increased flood risk, and pollution. The area has a high vulnerability to climate variability and change, sea-level rise, increasing salinity and extreme events. Transboundary coordination at present is largely ad-hoc.

An Integrative Working Group (IWG) representing the key sectors oversaw the preparation of the IMP. Within the simple 5-Stage Plan Process roadmap defined by the parallel IMF project, the analysis of the complex interplay between issues and problems utilised the "DPSIR" Drivers-Pressures-State-Impact-Response Framework. The DPSIR's key value was in breaking down boundaries between the IWRM, ICZM and Coastal aquifer and groundwater management, allowing an integrated approach.

In such a complex policy environment, the analysis of problems and issues does not automatically lead to the "Responses" in a simple linear fashion. A parallel dialogue was required to identify common societal objectives.

To "marry" these objectives to the policy responses, an innovative adaptation of the Bow-tie methodology developed to manage risk, typically in a complex industrial environment, was used. Simply, the method combines multiple 'causes' and multi-sectoral responses into a single diagram centred on a set of agreed objectives.

RESULTS

The IMP for Bojana/Buna area affects a terrestrial area of approximately 500km² drawn using local administrative boundaries, along with the adjacent inshore marine zone comprises approximately half the national territorial waters. The IMP area is thus defined according to guidelines in the ICZM Protocol and the EU WFD, the ecosystem approach, refined according to local circumstances. The IMP area had a total population of over 53.000 in 2011. The resulting IMP is a multi-sectoral approach, including measures to improve spatial planning, including the economy, water quality, land, flood and waste management, and to maintain biodiversity. The resulting measures are set according to the objectives addressed and the short-term priority actions required to achieve them. In addition, the IMP identifies potential transboundary governance structures to deliver the IMP.

The measures agreed with stakeholders are designed to improve the transboundary governance and cooperation between the two countries; support policy changes at national levels; develop the knowledge base for the management of the system; prevent, mitigate and remediate negative impacts of anthropogenic activities; raise the economic and social well-being of the area's communities; and to increase IMP area's resilience to the impacts of climate change and natural disasters.

Each measure is further refined by the short-term priority actions required to achieve them during the short-term 2015-2020 period, along with success indicators.



Transboundary Plan area

LESSONS LEARNED

The experiences can be used for replication elsewhere in the Mediterranean basin, instead of preparing separate IWRM and ICZM and other sectoral plans. The benefits of this integrated approach are the potentials for win-win solutions, generating economies of scale through shared responses, along with reducing the likelihood of conflict between sectoral interests.

The natural and physical systems of the Bojana/Buna coast do not function exclusively within national boundaries. The integration of management to include the riverine systems was absolutely necessary as the management of the upstream parts is critical to the situation downstream and vice versa.

The Bojana/Buna IMP experience tested the practical realities of defining the coastal zone as required by Article 3 of the ICZM Protocol. The landward boundary was drawn using local administrative boundaries ("competent coastal units") that broadly conform to the physical boundary of the watershed. The marine zone included a more restricted area of the territorial waters based on a proxy measure of the main influences of land-based activities.

The scoping stage of IMP preparation demonstrated that a realistic period must be allowed in transboundary planning for harmonising data and mapping and for the engagement of stakeholders, and the governance procedures, etc.

The Bojana/Buna experience illustrated that in transboundary planning, the support of relevant national governments and unified governance structures are vital, both in the preparation of the IMP and in its future delivery. Clarity of process is vital.

IMPACTS

The preparation of the Integrated Management Plan for Bojana/Buna helped understand that the ultimate prerequisite of transboundary management of the joint resource are the harmonised data and monitoring procedures. Without same understanding of the process no constructive measures could be reached. Even though the purpose of this Plan was ultimately to test the methodology its findings could be used to strengthen cooperation through joint actions for the management of the transboundary area.

REFERENCES

Priority Actions Programme/Regional Activity Centre (PAP/RAC) www.pap-thecoastcentre.org
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KEYWORDS

ICZM; IWRM; coastal aquifer and groundwater management; integration; transboundary



Fishing practice on river Buna Bojana
 Photo: RLC Montenegro

EXECUTING PARTNER

PAP/RAC was established in 1977 in Split, Croatia, as part of the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP). PAP/RAC's mandate is to provide support to Mediterranean countries in the implementation of the Barcelona Convention and its Protocols, and in particular of the Protocol on Integrated Coastal Zone Management. PAP/RAC is oriented towards carrying out activities contributing to the sustainable development of coastal zones and strengthening capacities for their implementation. Thereby, it cooperates with national, regional and local authorities, as well as with a large number of international organisations and institutions



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Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem

Together for the Mediterranean Sea

MedPartnership



Executing partners: FAO, UNESCO/IHP, UNIDO, GWP-Med, MIO-ECSDE, WWF MedPO, UNEP/MAP's MEDPOL programme and regional activity centres (CP/RAC, SPA/RAC and PAP/RAC).

Participating countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.

Partner countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.

Experience Note



Photo: Marko Prem

National Marine and Coastal Strategy for Croatia

AT A GLANCE

The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading environmental institutions and organizations together with countries sharing the Mediterranean Sea to address environmental challenges that Mediterranean marine and coastal ecosystems face. The project's 78 demonstration and the promotion and replication of good practices will maximize impact and ensure the sustainability of the project beyond its lifespan.

Total budget: 48 millions USD.
13 million USD: Global Environment Facility
35 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

To provide an integrated policy for the sea and the coast that takes into account climate variability and change and that is harmonized with the National Water Strategy, the Croatian government decided to prepare an integrated Marine and Coastal Strategy for Croatia. In this way the country will meet its obligations from the EU Marine Strategy Framework Directive (MSFD) and the ICZM Protocol for the Mediterranean, both inviting the countries to prepare relevant strategies. PAP/RAC developed this proposal for MedPartnership's Mediterranean Environmental Replication Strategy (MeReS), which recognized this idea as a potential showcase for the Mediterranean. The territorial coverage of the Strategy extends from the marine area in which Croatia has jurisdictional rights to the administrative borders of 134 coastal municipalities and towns on its land territory.

The Strategy should be completed by the end of 2015. At the same time, the Croatian government is preparing two more strategies – the spatial and the regional development strategies. Coordination and integration of these three strategies is one of the important objectives to be achieved.

ACTIVITY DESCRIPTION

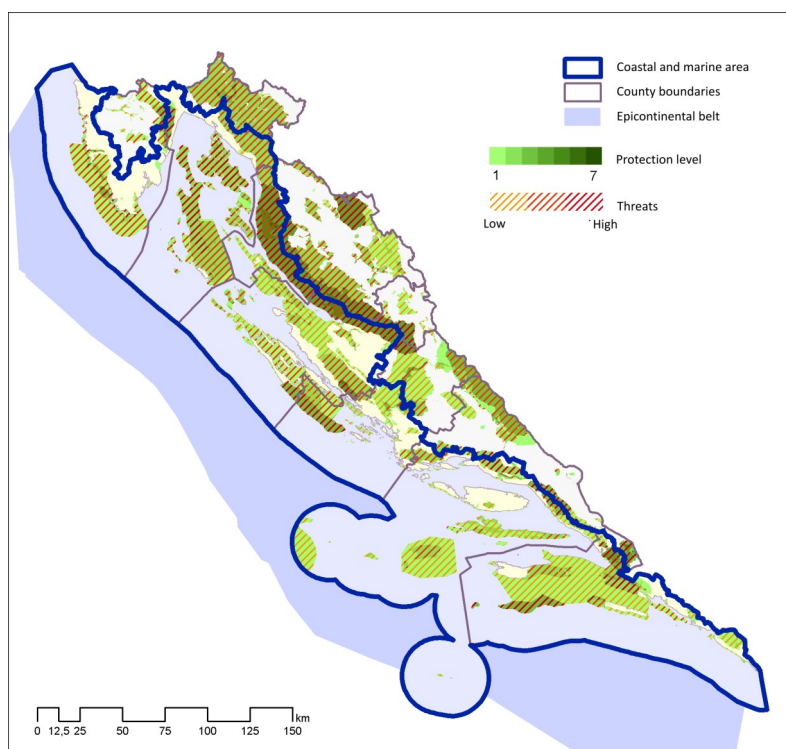
The goal of this activity is to prepare a national strategy, as mandated by the Article 18 of the ICZM Protocol for the Mediterranean. The national strategy will set the objectives, determine priorities, and develop measures and instruments to achieve these objectives. In this case, ICZM approach must demonstrate its adaptability by producing an integrated strategy for Croatia's sea and coast, following the EU MSFD and the ICZM Protocol.

THE EXPERIENCE

Knowing that 80% of marine pollution comes from the land-based sources, the Croatian government has integrated two strategies requested by international legal documents into a single Marine and Coastal Strategy. The Strategy takes into account the Ecosystem Approach (EcAp) implemented by Mediterranean Action Plan (MAP) and addresses impacts from climate variability and change. It may be an excellent example for the rest of the Mediterranean.

Methodology

When the decision on an integrated Marine and Coastal Strategy was made, several steps regarding the marine environment had already been completed, such as an initial assessment of the state of the marine environment, while the goals, targets and indicators were agreed. The Croatian government had also established an Inter-Ministerial Committee (IMC) to prepare and implement the Strategy.



Croatian marine and coastal area with threats and protection levels

Meanwhile, Croatia ratified the ICZM Protocol for the Mediterranean. One of the requirements of the Protocol is the adoption of a coastal strategy. To avoid duplication, Croatia decided to prepare an integrated strategic document. The IMC was expanded to include coastal stakeholders. Today, it has more than 50 members from ministries and agencies involved with the sea and coast. The Croatian parliament passed a legal act on the new Marine and Coastal Strategy, which extended the territorial coverage from the marine areas in which Croatia has jurisdiction to the borders of 134 coastal municipalities and towns on land.

In the framework of MedPartnership, PAP/RAC secured the first joint output, an economic and social assessment of the Croatian sea and coast. In addition, an assessment of potential costs of sea-level rise was completed within the ClimVar & ICZM project. Finally, to undertake a harmonized approach, a problem analysis included the major aspects of coastal natural resource use and protection, coastal spatial development, and coastal governance mechanisms. The results of these and other analyses will be presented for adoption by the IMC and discussed at participatory workshops.

RESULTS

The preparation of the marine strategy began in 2012. The coastal analysis started in 2014. The studies confirmed that the state of the Croatian Adriatic is good but that it may be difficult for the Croatian economy to support all of the country's requirements and obligations from the EU accession process.

Croatia's bathing water quality is ranked third in the EU (after Cyprus and Malta). On the other hand, Croatia can be ranked among countries with the greatest pressure for coastal urbanisation per population density. Croatia is one of the least populated countries in the EU. Since the 1960s, its population grew by only 3%, while the urbanization of the coast was extremely rapid i.e. 4 times more was built than by all previous generations.

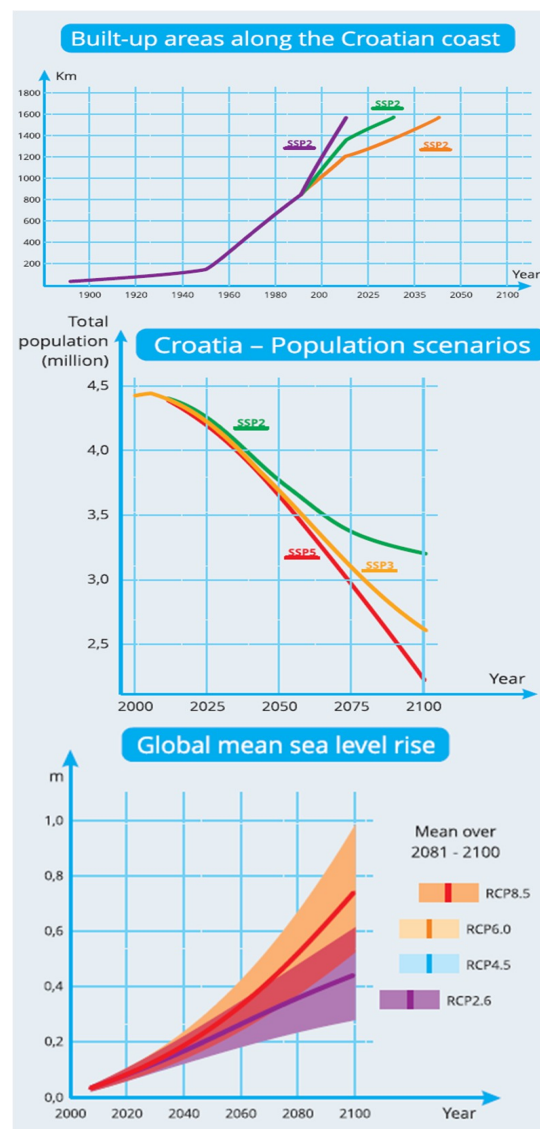
Although national and international population projections for Croatia indicate a decrease in population, spatial plans allow for an increase of the urbanized coast 10 times greater than before the 1960s. As is the case for many other Mediterranean tourist destinations, the highest density of construction is in the zone closest to the sea. This zone also has the highest risks of being impacted by sea-level rise and storm surges.

LESSONS LEARNED

The preparation of the Croatian Marine and Coastal Strategy is still in its analytical stage.

By applying a systematic participatory approach it is expected to identify key issues for successful management and to involve all relevant stakeholders. The ownership of the Strategy is being built during the participatory workshops, increasing the chances for its successful implementation. Participants were content to have the opportunity to express their views, needs and desires, and to integrate them into a national strategy. This only confirms that building consensus is one of the top priorities for Croatia's coastal population, and that the integration over sectors for something as important as the future of the coast will be a major challenge for the national Marine and Coastal Strategy.

During 2015, the Croatian government should finalize strategies in three important fields for the country's future: regional development, spatial development and marine and coastal management. One of the objectives of PAP/RAC's efforts is to create enabling conditions for the integration of these three strategies. In this, a key characteristic of the ICZM – its adaptability – will be crucial: the integration of analytical findings, together with the harmonisation of objectives, targets and indicators, and the future monitoring process, are going to result in more sustainable strategies for the future.



Opposing trends in Croatia

IMPACTS

Due to the fact that 80% of the marine pollution comes from the land-based sources, integrating strategies dealing with the sea and land is a step towards consistent solutions. It is particularly important to integrate development, spatial and economic strategies with environmental protection strategies; that is a key reason why ICZM strategies have management and governance as their central theme.

In the framework of the MedPartnership project PAP/RAC prepared Guidelines for preparation of the national ICZM strategies. These were used to prepare the integrated Marine and Coastal Strategy for Croatia. The Croatian case demonstrates that it is possible to merge requirements of the EU MSFD and the ICZM Protocol for the Mediterranean.

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Photo: Marko Prem

KEYWORDS

National strategy; ICZM Protocol; MSFD Directive

EXECUTING PARTNER

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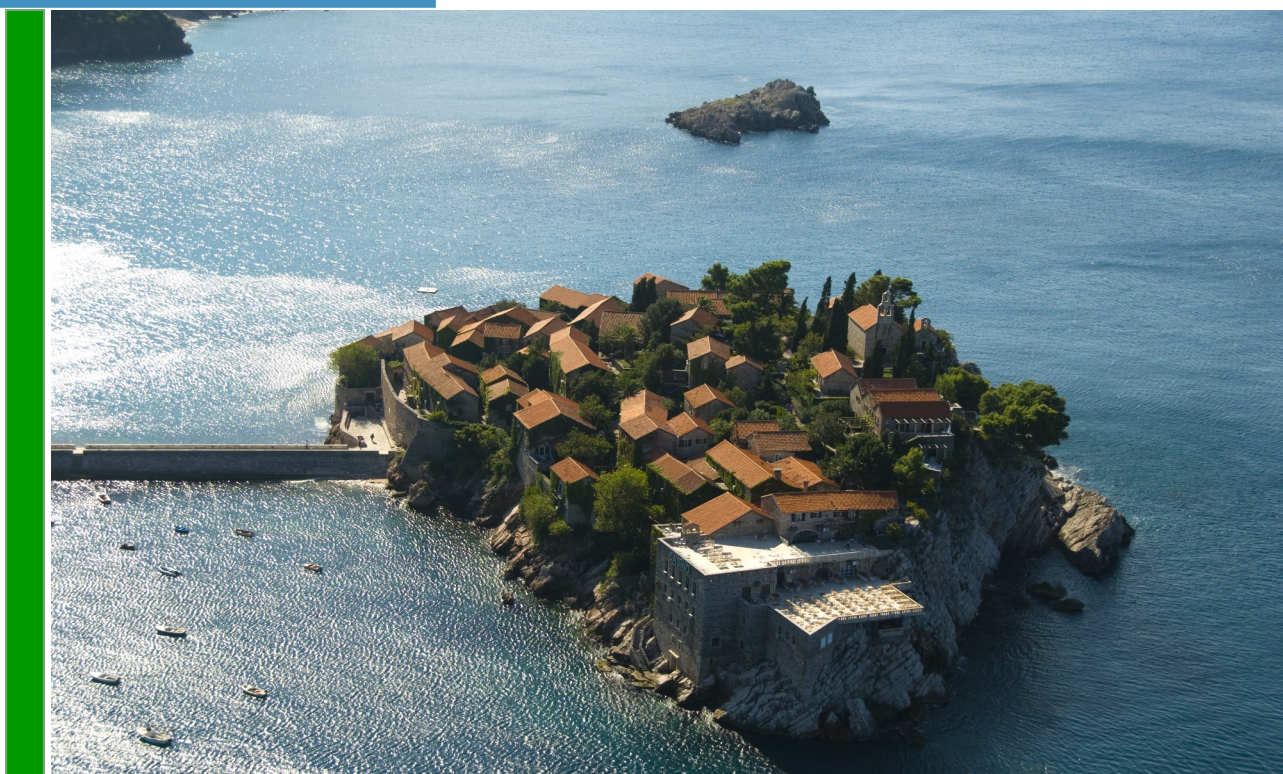


Photo: Island St Stefan © RLC Montenegro

Integrated Coastal Zone Management Strategy in Montenegro

AT A GLANCE

The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading environmental institutions and organizations together with countries sharing the Mediterranean Sea to address environmental challenges that Mediterranean marine and coastal ecosystems face. The project's 78 demonstration and the promotion and replication of good practices will maximize impact and ensure the sustainability of the project beyond its lifespan.

Total budget: 48 millions USD.
 13 million USD: Global Environment Facility
 35 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

Preparation of the Integrated Coastal Zone Management (ICZM) Strategy for Montenegro was undertaken in parallel with the preparation of the Coastal Area Spatial Plan, the most important planning document for coastal areas in Montenegro.

Having in mind the fact that the Montenegrin coastline is only 300 km long, but with high pressure from coastal urbanization, as well as that a specific spatial plan for this same coastal zone is being prepared in parallel, the ICZM Strategy for Montenegro was designed to incorporate elements of the management plan as a guide for the preparation and implementation of the Coastal Area Spatial Plan, in line with the requirements of the ICZM Protocol.

Specific recommendations for the plan were based on the results of a vulnerability assessment adapted for use within coastal management strategies and plans. The main recommendations include criteria and guidelines for determining future land uses, the key instruments enabling their implementation, and proposing an appropriate mechanism for coordinated planning and management.

ACTIVITY DESCRIPTION

The Montenegrin coastal zone is one of the country's most valuable national resources, with high development potential and exceptional natural and cultural values. However, it is subjected to intense pressures from human activities. To ensure preservation of the development potential and to restrain growing pressures on coastal resources, implementation of the Strategy started in 2013 to establish an efficient, responsible and adaptable system for managing the coastal zone.

THE EXPERIENCE

One of the key threats to sustainable coastal development in Montenegro is rapidly growing linear coastal urbanization, which degrades natural, cultural and landscape values and reduces future development opportunities. In addition, significant new construction zones are being planned in current spatial plans, resulting in 46% of the coastline being planned for urbanization, often in valuable and fragile coastal ecosystems.



Methodology

To provide a decision-making tool to guide the coastal development process toward sustainability, the first step in developing the ICZM Strategy was the preparation of a vulnerability assessment. It is a method used to determine the more vulnerable coastal areas that should be protected from future degradation.

The vulnerability assessment was based on the analysis of selected environmental segments and on the preparation of vulnerability and pollution models. It covered six coastal municipalities – Herceg Novi, Kotor, Tivat, Budva, Bar and Ulcinj. The environmental segments considered in the assessment were selected in line with the Law on Strategic Environmental Assessment. They include:

- environment and human health (noise, air, and soil pollution at hot spots);
- flora and fauna – biodiversity (flora and fauna, nature protected areas, marine biodiversity);
- soil (erosion, agriculture and agricultural land, seismic hazards);
- water (terrestrial surface waters, terrestrial groundwater, sea water);
- air/climate, climate change (droughts, forest fires, heavy rains, storm winds, joint vulnerability model for climate change), and
- landscape.

Vulnerability to climate change and the extent to which the marine and land environments and human health are endangered, were also assessed. The assessment determined the most valuable spatial units in which intense development should be limited. In addition, the results were used to identify "conflict" zones between areas of high vulnerability and areas in which construction is already planned (vulnerability model figure).

Ulcinj coastline
Photo: RLC Montenegro

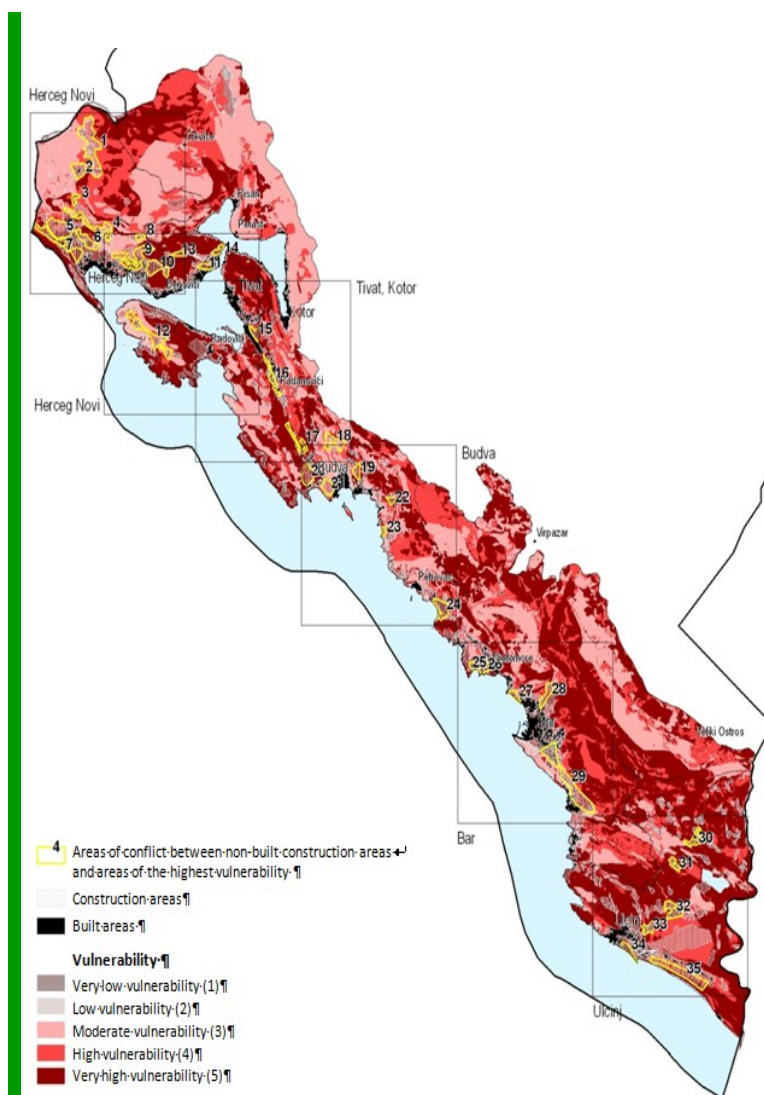
RESULTS

The results of the vulnerability assessment clearly show exceptional vulnerability of the environment in the coastal zone of Montenegro where **35% of the area are highly vulnerable**. These results became inputs for the ICZM Strategy and the Coastal Area Spatial Plan, and were used to:

- develop **criteria and guidelines** to determine land uses in the Coastal Area Spatial Plan so as to direct construction to the least vulnerable areas. They included the introduction of a coastal setback zone and preservation of valuable inland areas suitable for rural development.
- propose key **instruments** within the ICZM Strategy to enable implementation of the above criteria and to guide changes in the desired direction. They include land-use and fiscal policy instruments, as well as those for monitoring and evaluating progress.
- propose an appropriate **coordination mechanism** to improve integration and convergence of sectoral management, with the overall responsibility for the coastal zone development.

With strong political support and commitment, these findings and the overall participatory process of the ICZM Strategy preparation resulted in:

- construction areas reduced by 45%;
- construction areas within one kilometre of the coast-line reduced by 27%;
- the areas of conflict between highly vulnerable, open areas and construction areas reduced by 45%;
- introduced 100-meter coastal setback, applicable to almost 50% of the coastline; and
- initiated establishment of an ICZM coordination mechanism.



Vulnerability model with conflict zones

LESSONS LEARNED

Preparation of the ICZM Strategy was expert based but highly participatory. However, without high-level policy support this approach would have not been as nearly successful.

Replication: The approach used to prepare the ICZM Strategy with a vulnerability assessment and a strong emphasis on coastal construction can be replicated in other areas with heavy urbanization pressures. However, the principal strength of this process was the opportunity and political mandate given for integrating the assessment's findings into the Coastal Area Spatial Plan.

Effectiveness/efficiency: The approach was very effective in pragmatically and visually identifying problem areas. However, to be cost effective and efficient, it is recommended to carefully select assessment themes based on the availability of information and their overall usability.

Sustainability: Although the vulnerability assessment was not invented by this process, its methodological approach was adapted for use within coastal management strategies and plans. Along with the target analysis of land use (the state and transformation of the coastal zone) the vulnerability assessment was developed and used as a decision-making tool to identify (in)compatibility between human activities and the land on which they occur and to propose remedial measures. Therefore it is recommended to use as a starting point in similar processes.

IMPACTS

The coordinated preparation of the ICZM Strategy and the Coastal Area Spatial Plan and their mutual integration initiated the reformed approach for coastal planning and management. It enabled the adoption of a new integrated management policy and initiated significant changes in important national legislation. Built capacities of public administration and professional institutions, especially those in the spatial planning sector, were among the most important effects of the process. Particular value of this process was its participatory character, the openness to the exchange of information and main findings, and the mutual respect for comments and suggestions among all of the parties involved.

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Montenegro's coast

Photo: RLC Montenegro

KEYWORDS

ICZM strategy; vulnerability assessment

EXECUTING PARTNER

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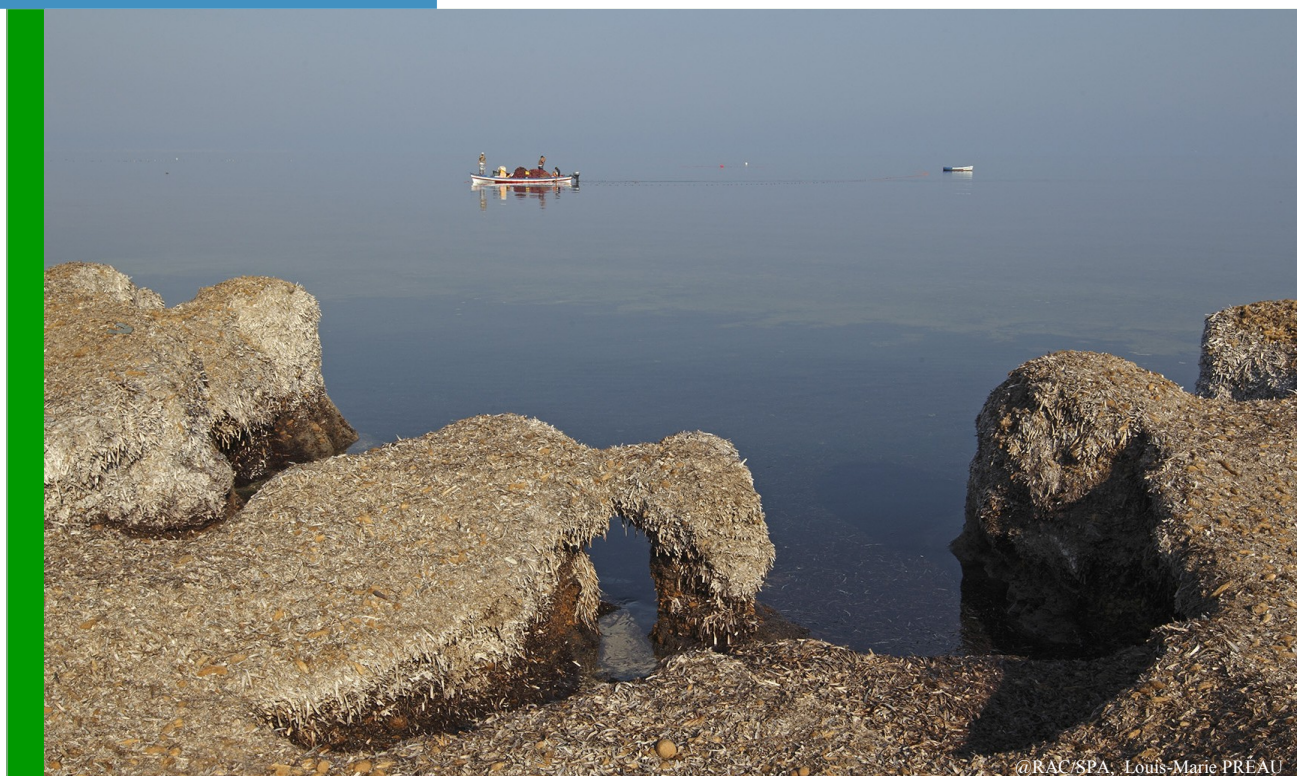
MedPartnership



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Regional Project for the Development of a Mediterranean Marine and Coastal Protected Areas Network through the boosting of MPAs Creation and Management “MedMPAnet” Project

AT A GLANCE

The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading environmental institutions and organizations together with countries sharing the Mediterranean Sea to address environmental challenges that Mediterranean marine and coastal ecosystems face. The project's 78 demonstration and the promotion and replication of good practices will maximize impact and ensure the sustainability of the project beyond its lifespan.

Total budget: 48 millions USD.

13 million USD: Global Environment Facility

35 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

This activity aims mainly at assisting Mediterranean riparian countries in the setting up of an ecologically coherent network of marine protected areas (MPAs) in the region. It has been addressed through the identification and characterisation of marine sites suitable to become MPAs, and also through demonstration projects for MPA creation and planning, including stakeholders' participation and financial sustainability mechanisms.

The project allowed the identification, listing and ecological characterisation of 24 priority areas of conservation interest in Croatia, Lebanon, Morocco and Montenegro. It provided support for the inception, ecological and socioeconomic characterization, zoning and management planning of four new MPAs in Albania (Porto Palermo), Algeria (Réghaia), Morocco (Cap des Trois Fourches) and Tunisia (Kuriat Islands). Business plans have been elaborated for the three demonstrations in Albania, Algeria and Morocco.

Furthermore, technical assistance and capacity building activities to improve MPA management have been provided through regional and national training workshops, on-the-job training, small-granted projects, and technical tools and teaching packages. The project's efforts led to the declaration or the launching of declaration processes of seven MPAs (totalling a surface of 98,411 ha of marine waters), which are: Porto Palermo (Albania), Réghaia (Algeria), Ras Chekaa, and Naqoura (Lebanon), Ain Al-Ghazala & Bomba Gulf (Libya), Cap des Trois Fourches (Morocco) and Kuriat Islands (Tunisia).

ACTIVITY DESCRIPTION

Between 2010 and 2015, SPA/RAC provided its support to a number of Mediterranean countries in identifying and characterizing marine and coastal sites suitable to be declared as MPAs, but also for some demonstration cases, in preparing management and zoning plans in view of immediately declaring such areas and setting up suitable management efforts on the ground.

Such activities contribute to the global (Convention on Biological Diversity) and regional (Barcelona Convention and its Protocol concerning Specially Protected Areas and Biological Diversity) objectives, stating that by 2020, at least 10 per cent of coastal and marine areas are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas (Aichi Target 11).

THE EXPERIENCE

According to the 2012 MPA Status Report, elaborated by MedPAN and SPA/RAC, marine and coastal protected areas are very unevenly distributed across the Mediterranean's sub-regions and countries. The imbalance is particularly seen in the Northern basin region, which has 84 % of all the MPAs in the Mediterranean. The Southern region has thus the least MPAs (16 %).

Methodology

In order to address under-representation and enhance the coverage, quality and representativity of MPAs in the Mediterranean region, SPA/RAC joined efforts with Mediterranean countries from the South and the East in order to identify and establish new MPAs based on a sound knowledge of the prevailing ecological and socioeconomic contexts of the concerned areas.

In view of the identification and ecological characterisation of priority areas of conservation interest, technical assistance has been provided to Croatia, Lebanon, Morocco and Montenegro, through joint national/international expert teams, who were in charge of undertaking ecological studies, whose objective is to quantitatively survey marine areas that could be declared as MPAs.

Furthermore and in order to establish new MPAs in demonstration areas in Albania (Porto Palermo), Algeria (Réghaia), Morocco (Cap des Trois Fourches) and Tunisia (Kuriat Islands), SPA/RAC has first undertaken the needed enabling ecological, socio-economic, and fisheries studies as appropriate.

Based on the knowledge gained through these multidisciplinary diagnosis studies, draft management and zoning plans were elaborated in a participative and concerted manner with all the concerned stakeholders, including government agencies, NGOs, local community groups, (fishers, divers, boaters, business people, etc.), local communities, scientists and other resource management agencies.

Management plans were then produced and validated during local public workshops, taking into account both conservation objectives and the requirement that the MPA is integrated and compatible with its economic and social environments.

For the three demonstrations in Albania, Algeria and Morocco, financial sustainability was ensured through the establishment of business plans.

In order to respond to Mediterranean MPAs short staffing or staff lack of management, conservation or planning background, several efforts have addressed the need to build MPA management capacity: regional and national training workshops, on-the-job training, small-granted projects, and technical tools and teaching packages.



RESULTS

The project allowed the identification, listing and ecological characterisation of 24 priority areas of conservation interest in Croatia, Lebanon, Morocco and Montenegro, as well as the elaboration of a national strategy and the drafting of a law on protected areas in Libya. It provided support for the inception, ecological and socioeconomic characterization, zoning and management planning of four new MPAs in Albania (Porto Palermo), Algeria (Réghaia), Morocco (Cap des Trois Fourches) and Tunisia (Kuriat Islands).

A regional study on financial needs of Mediterranean MPAs was developed by MedPAN and SPA/RAC in collaboration with WWF-MedPO, and business plans have been elaborated for the three demonstrations in Albania, Algeria and Morocco.

Capacity building and training activities implemented within the project allowed enhancing the capacities of 600 MPA manager, practitioner or stakeholder from the participating Mediterranean countries.

These efforts led to the declaration or the launching of declaration processes of seven MPAs, which are: Porto Palermo (Albania), Réghaia (Algeria), Ras Chekaa, and Naqoura (Lebanon), Ain Al-Ghazala & Bomba Gulf (Libya), Cap des Trois Fourches (Morocco) and Kuriat Islands (Tunisia).

These newly declared or future MPAs protect a surface of 98,411 ha of marine waters.



LESSONS LEARNED

The identification and selection of marine sites suitable to be declared as MPAs by the Mediterranean countries are based most of the time on ecological criteria, whereas it is key to introduce social and economic criteria into MPA selection schemes.

Furthermore and in order to properly and timely meet Aichi Target 11 in the Mediterranean region, other effective area-based conservation measures should also be considered and taken into consideration with regard to marine and coastal areas conservation and the creation of MPA network/s in the region.

In order to achieve such shortages, gap analysis for ecological coherence and for considering socio-economic criteria and ecosystem services should be undertaken at national and regional levels.

Stakeholder engagement in MPAs can be described as a process of maturity from initial stages to more developed and self-sustaining stages. In the Mediterranean region, such processes are more and more recognized by governments as essential and unavoidable steps for establishing effective marine and coastal protected areas, especially with the developing and nascent democracies in the region, accompanied with a reinforced NGOs and civil society institutions.

As far as capacity building is concerned, the selection of course facilitators needs to strike a balance between professional trainers and experienced MPA practitioners in the topical areas covered by the training curriculum. In the way, a successful capacity building programme is dependent on the selection of programme participants who are willing and interested in making a professional investment in building their own capacity with the intent of implementing new skills and knowledge in the field. Moreover, post-training coaching and experience sharing proved being of significant value to continuing the learning process.

This set of lessons learnt gained through this five year-process will serve to sustain the project results and sustaining them in other locations in the Mediterranean region.

IMPACTS

The best illustration of the project's immediate impact on people's lives resides certainly in training. Capacity-building activities targeted stakeholders playing an important role in terms of marine life conservation in their countries, and were structured so that they meet stakeholders' specific needs and fill in their knowledge gaps.

If Montenegro for example doesn't yet have MPAs, men and women have been trained to prepare the ground, thanks to the project efforts.

In Lebanon, MPAs exist yet, but management resources and methods are lacking. Simple and inexpensive tools were taught to MPA practitioners, in order to set up efficient monitoring and management.

MPA establishment being painstaking and time-consuming processes, the project impacts are unlikely to be seen in such a short time (five years). What we can do is to first investing in people, so that declarations and resolutions on paper are implemented with conviction, for the sake of the planet and people.

Vesna Mačić: *"In my country, unfortunately, there are no MPAs, but there are several projects towards the creation of marine protected areas. So, to my institute and Montenegro, as a country, it is important to be prepared for activities we should perform. I am working at the Institute of Marine Biology, which is part of the University. So, we are a scientific institution, but we will be included in the management of marine protected areas. And we are now trying to pass on this knowledge, I get here, to other stakeholders in my country and to involve more people in this activity [of creating MPAs]."*

Ziad Samaha: *"The advantage of this course is actually it offers both the practical on side data collection and monitoring as well as analysis of data using an open source software, which makes it easy and makes it really good for a state owned enterprise and Government agencies so they don't have to buy the license. We use most of the time they suffer from lack of finance."*

For more information, click [here](#).



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REFERENCES

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KEYWORDS

Mediterranean, MPA creation, MPA management, MPA network.

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The MedMPAnet Project is implemented in the framework of the UNEP/MAP-GEF MedPartnership, with the financial support of: EC, AECID and FFEM.

Experience Note



Identification of the effects of human pressure on groundwater quality to support water management strategies in coastal regions: a multi-tracer hydrogeochemical approach in the region of Nador (Morocco)

AT A GLANCE

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Total budget: 48 millions USD.
 13 million USD: Global Environment Facility
 35 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

Groundwater pollution from anthropogenic sources is a serious concern affecting several coastal aquifers in the Mediterranean Basin. In this region adequate science-based management strategies to protect groundwater from contamination and overexploitation are of paramount importance. In particular special attention has to be paid to coastal aquifers in arid and semi-arid regions, often representing the main freshwater resource to sustain human needs, as in the case of the Bou-Areg Aquifer (Nador Region, Morocco). A complete assessment of human impacts on groundwater quality determined that the Bou-Areg aquifer is characterized by a high natural salinity, increased by the effects of agricultural activities through irrigation return flows. The coupled multi-tracer and statistical analysis confirmed the strong dependency on irrigation activities and favoured the identification of the processes governing the aquifer's hydrochemistry in the different seasons. This study represents a reproducible example of the application of hydrogeochemistry as a tool for groundwater management in rural coastal areas.

ACTIVITY DESCRIPTION

Between September 2009 and September 2012 a hydrogeochemical investigation was performed in the region of Nador (Morocco) with the overall objective of supporting new water management plans in the Bou-Areg aquifer and the nearby lagoon of Nador. In particular the study addressed (i) the identification of aquifer recharge processes in the different seasons, (ii) the evaluation of the impact of human activities on groundwater quality, and (iii) the assessment of aquifer/lagoon interactions.

THE EXPERIENCE

Coastal aquifers often represent an important source of renewable freshwater exploited to sustain human activities worldwide. Those areas are also among the most inhabited zones, especially in arid and semi-arid regions, hence greatly exposed to all the negative externalities associated to human activities (e.g. excessive abstraction and contaminant loads).

Methodology

Preserving natural groundwater quality of coastal aquifers is of paramount importance, especially in zones where renewable resources are unevenly distributed, or scarce, and average rainfall is low, as in the case of the region of Nador (North Morocco). In this area, the Bou-Areg Aquifer (119 Km²) is a perfect example of a coastal aquifer constantly exposed to all the negative externalities associated with groundwater use for agricultural and domestic purposes, which lead to a general increase in aquifer salinization. In addition, the aquifer borders with a coastal shallow lagoon, the Lagoon of Nador, hence the aquifer-lagoon water interaction needs to be studied to verify the occurrence of saline water intrusion and/or lagoon contamination due to aquifer discharge.

In order to assess the impact of human activities on both groundwater and lagoon waters in the region of Nador, and to support new science-based water management practices, an integrated hydrogeochemical investigation was conducted between September 2009 and September 2012. The investigation was carried out by researchers from the Ca' Foscari University of Venice (Italy), in collaboration with local colleagues from the University of Oujda (Morocco) and the University Hassan I of Settat (Morocco) with the support of the Italian Ministry for Environment, Land and Sea and UNESCO-IHP.

The hydrogeological investigation, geochemical analysis of major and trace element, Isotope geochemistry

($\delta^{18}\text{O}$, $\delta^2\text{H}$, $\delta^{18}\text{O}_{\text{NO}_3}$, $\delta^{15}\text{N}_{\text{NO}_3}$, $\delta^{13}\text{C}_{\text{DIC}}$, $\delta^{11}\text{B}$) on more than 100 groundwater and lagoon water samples, together with subsequent statistical data treatment enables researchers to assess the baseline aquifer conditions, the impact of human activities on natural water quality and aquifer-lagoon interactions.



Dr. Elisa Sacchi and Dr. Viviana Re performing
in situ measurements in Nador suburbs
(© Tomas Lovato 2011)

RESULTS

Results show that groundwater is mainly characterized by sodium-chloride hydrochemical facies and by a high natural salinity, primarily due to water-rock interaction processes (dissolution of evaporative rocks and carbonates). Agricultural return flow has been recognized to be the main contribution to anthropogenic groundwater salinization especially in the central part of the aquifer.

On the other hand, saline water intrusion from the lagoon in the shallow aquifer can be considered as negligible, while discharge of polluted groundwater into the lagoon has been found to partially alter its quality.

Most of the sampled sites show high NO_3^- concentrations often exceeding the WHO statutory limits for drinking water (WHO, 2011). Analysis of $\delta^{18}\text{O}_{\text{NO}_3}$, $\delta^{15}\text{N}_{\text{NO}_3}$ permitted to associate nitrate pollution in groundwater to two main drivers, namely manure and septic effluents (especially in the urban and sub-urban areas) and synthetic fertilizers (in the agricultural zones; Figure 1).

However, despite the high vulnerability to agricultural (and urban) pollution the Bou-Areg coastal aquifer has shown a good resilience to intense agricultural activities as proven by the strong seasonal hydrochemical variations (i.e. difference with irrigation and no irrigation; Figure 2).

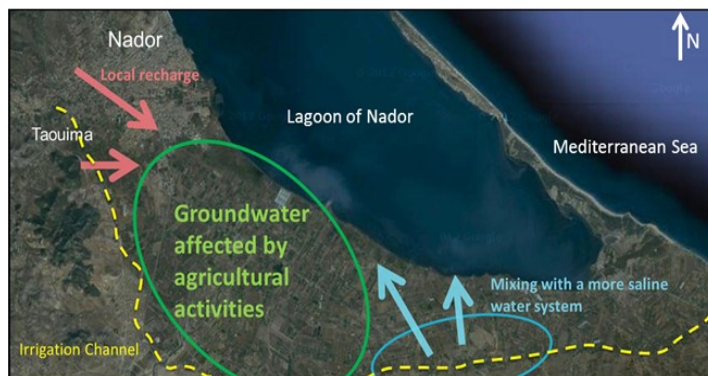


Figure 1 Schematic representation of salinization processes in the Bou-Areg coastal aquifer (Re, 2011)

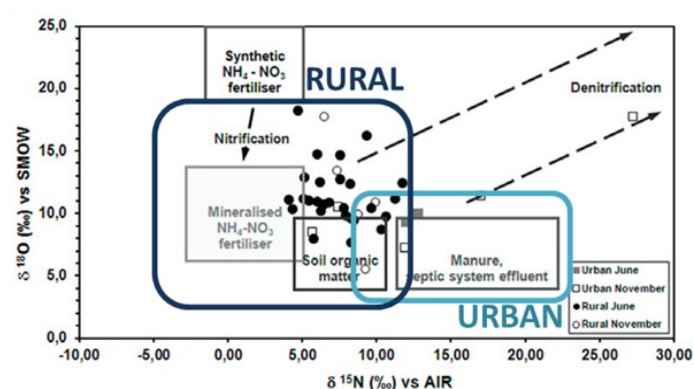


Figure 2 Isotopic composition of dissolved nitrates (‰) for groundwater samples in the Bou-Areg aquifer (Re, 2011)

LESSONS LEARNED

The investigations performed in the framework of MedPartnership were focused on the study of seasonal variations (low irrigation - recharge from precipitation and low use of groundwater from October to April, and high irrigation - no recharge from precipitation and high use of groundwater for irrigation from May to October) to assess aquifer vulnerability, with special attention on the agricultural and sub-urban parts of the Bou-Areg coastal aquifer.

The proposed integrated approach proved to be effective in identifying the drivers of pollution and salinization in the aquifer and in providing inputs for the development of new groundwater management strategies. In order to make this process even more effective, stakeholder engagement and public participation (especially of local farmers and civil society) could foster the identification of alternative strategies for pollution reduction and the proposition of shared decisions in the water sector.

To ensure the sustainability of the project a long term monitoring strategy should be implemented order to control the variation of both groundwater quality and quantity, also in view of the current tourist development plan of the region of Nador (e.g., Marchica Med project).

Hydrogeochemistry has proven to be a useful tool for coastal aquifers management, as the understanding the hydrogeology system and of the associated contaminants' behaviour is not only a necessary step in groundwater vulnerability assessment but also the base for the promotion of more sustainable water management practices.

IMPACTS

The results obtained with the project have important management implications and must be taken into account for future agricultural development plans of the region. In fact, the high aquifer vulnerability implies the need to better control both the quantity and the quality of irrigation waters. Managing the impacts of agricultural return flow and urban inputs will enhance groundwater quality with relevant positive effects on crop efficiency, soil salinization, and environmental issues. Conversely, results highlight the need for a more efficient use of available water resources coupled with the identification of alternative irrigation sources, and the implementation of more efficient agricultural practices. Indeed the promotion of stakeholder engagement together with the development of participatory monitoring assessment would favour the implementation of new water management plans tailored on the real needs of local population.

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 Raya Stephan, r.stephan@unesco.org
 Matthew Lagod, m.lagod@unesco.org

KEYWORDS

Bou Areg, Water Basin, Groundwater, Hydrogeochemistry, Water Management

EXECUTING PARTNER

UNESCO-IHP, the International Hydrological Programme (IHP) is the only intergovernmental programme of the UN system devoted to water research, water resources management, and education and capacity building. Since its inception in 1975, IHP has evolved from an internationally coordinated hydrological research programme into an encompassing, holistic programme to facilitate education and capacity building, and enhance water resources management and governance.

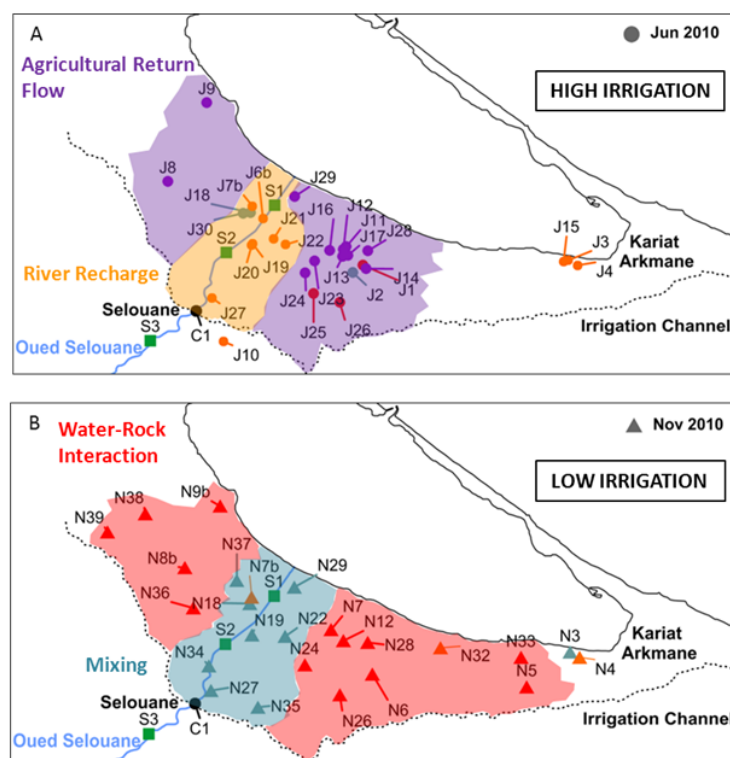
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Executing partners: FAO, UNESCO/IHP, UNIDO, GWP-Med, MIO-ECSDE, WWF MedPO, UNEP/MAP's MEDPOL programme and regional activity centres (CP/RAC, SPA/RAC and PAP/RAC).

Participating countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.

Partner countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.



Seasonal variations in the Bou-Areg aquifer and impacts of agricultural activities in (A) High Irrigation season (June 2010) and (B) Low Irrigation season (November 2010) (Re et al., 2014)



Photo P. Ioakimidis

PCBs Sound Management and Disposal

AT A GLANCE

The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading environmental institutions and organizations together with countries sharing the Mediterranean Sea to address environmental challenges that Mediterranean marine and coastal ecosystems face.

The project's 78 demonstration and the promotion and replication of good practices will maximize impact and ensure the sustainability of the project beyond its lifespan.

Total budget: 48 millions USD.
13 million USD: Global Environment Facility
35 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

PCBs are pollutants more specifically known as polychlorinated biphenyls. They are highly toxic, very long lasting (over 100 years) and bioaccumulative, and one of the most harmful persistent organic chemicals to be manufactured by man. PCBs have been proven to be damaging to the environment. They cause immunotoxicity, skin problems, reproductive alterations and cancer in humans and animals. PCBs were manufactured worldwide by a number of companies in many industrialized countries and were mostly used as cooling and isolating agents in transformers and capacitors and many more applications.

This activity aimed to introduce environmentally sound management (ESM) to all stages of the "life-cycle" of electrical equipment containing or being contaminated with PCBs in four Mediterranean countries (Albania, Bosnia and Herzegovina, Egypt and Turkey), providing training for more than 390 people, taking and analyzing more than 500 PCB oil samples, identifying more than 1000 tonnes and disposing of 931 tonnes of PCBs in order to support countries to meet obligations of the Stockholm and Barcelona Conventions.

ACTIVITY DESCRIPTION

This activity seeks to build technical capacity for ESM of PCBs equipment and PCBs phase-out and disposal programs and PCB awareness raising in Albania, Bosnia and Herzegovina, Egypt and Turkey.

The activity also has implemented demonstration projects to improve management including the final disposal of at least 931 tons of PCBs. In addition, the project promotes the reviewing and reforming of institutional and legal frameworks for the implementation of ESM of PCBs in participating countries. The delivery of all activities is expected by the end of 2015.



Photo: Manolo Clar

THE EXPERIENCE

Transboundary pollution of PCBs is a fact. PCBs can travel hundreds and even thousands of kilometers by wind, river and ocean currents and by the grasshopper effect (attached to dust particles). The project seeks to address the PCB problem by acting along its life cycle to actively prevent the release of PCBs into the environment by all means and in all phases.

Methodology

PCBs might be carried away by transboundary pollution from a heavy emitter and deposit in a country further away and whose emissions are relatively low. The heavy pollution that is evident in the developed world also becomes evident in remote areas. For example, transboundary pollution of PCBs becomes visible in a remote area like the Arctic where PCBs are causing great damage to the environment. In order to avoid local and also transboundary pollution of PCBs, they must be inventoried and destroyed.

As stated above, in order to prevent the release of PCBs into the environment, the project intervenes along its life cycle going from awareness and training to sampling, analysis, inventory, handling, transport and final disposal, partnering with all key stakeholders involved in the PCB problem and final solution.

The project seek first to raise awareness on the importance of ESM of PCBs equipment by providing knowledge and understanding to all stakeholders involved in the PCB life cycle, from public servants to private sector, academia, civil society and media.

Second, the project is also building the technical capacity for ESM of PCBs equipment of key stakeholders such as Ministries of Environment, Ministries of Energy, customs, electric utilities, industry, laboratories, transformer repairing shops and others by providing specific theoretical and practical training and skills on PCB site audit, sampling, analysis and inventory.

Third, the project has already build national capacity to implement PCBs phase-out and disposal programs for the Government including PCB inventory, database and phase-out and final disposal of PCB stocks.

Fourth, the project is implementing demonstration projects to improve management and disposal of PCBs, including handling, transport and destruction of 931 tons of PCBs in Bosnia-Herzegovina, Egypt and Turkey. This task includes practical training on the notification procedure for import/export of PCBs, PCB handling and transformers draining, packing, labeling and loading.



Photo P. Ioakimidis

RESULTS

This activity has resulted in the development of 17 awareness and training workshops in Albania, Bosnia and Herzegovina, Egypt and Turkey on theoretical and practical PCBs management with 392 local experts trained. In addition, 363 local experts were trained in transformers and capacitors auditing, 38 local experts were trained in PCB handling and 77 local experts trained in import and export of PCBs (notification procedure). More than 60 awareness and training documents including presentations, brochures, guides, manuals, handouts, inventory forms, videos and other documents were translated to local language and placed online at the project website for countries and other stakeholders use.



Photo Urs Wagner

The project also granted 12 PCB analyzers and reagents for approximately 2000 oil samples. More than 500 oil samples were taken and analyzed during the project while identifying more than 1000 tonnes of PCB equipment and liquids. Another task included the packaging, collection and transport for final disposal of identified PCBs. In particular, 931 tonnes of PCBs in Bosnia-Herzegovina, Egypt and Turkey will be sent shortly for final disposal. In addition to this achievement and project impact, the project aims at revising legal, regulatory and administrative instruments in four participant countries at the end of the project.

LESSONS LEARNED

Several important lessons learned can be extracted from project experience.

First, **ownership and leadership of the project by the country is a must**. Country ownership and leadership in this project has been relevant. The project attempted to be implemented as country-driven as compared to donor-driven. This is also expressed in the interest and willingness of Governments to participate in a possible second phase of the project. The activity has been successful on striving to cover the whole life cycle of PCBs management from inventory, sampling, analysis, to handling, transport and final disposal of PCBs, generating information, knowledge, building capacity, ownership, leadership, sustainability and fostering cooperation among PCBs key stakeholders in participating countries. It is encouraging to note that PCBs management and inventory are at present still on-going and implemented in some countries, using national funding, which also attests to successful country-ownership of project activities and results and to project sustainability.

Another important lesson learned is that **the lack of human resources, budget and time from the involved Ministries must be supported to attain project objectives**. Most of international projects are usually facing, especially at the beginning of the project, lack of human resources, budget and time from the Ministry or Ministries involved to efficiently implement the project. The project has solved this usual problem by hiring local and international consultants to provide support and sometimes act as “catalysts” in most of implemented activities. It is important to mention that the sustainability of project results at medium term will largely depend on funding made available from participating governments, funding agencies and/or donors, as well as investments from the publicly owned companies and the private sector owning PCBs. In addition, commitment from Government to keep complying with international and national obligations regarding POPs and PCBs is required and also expected, but it will need additional resources to enforce or generate legal compliance, despite the fact many governments are facing relevant economic problems at the moment.

Finally, **PCB reliable inventory data was not available in all countries and is key to prepare a realistic plan**. In most industrial countries, inventories of PCB containing electrical devices such as transformers and capacitors have been conducted and most of the PCB equipment eliminated over the past 30 years. However, in developing and transition countries, there are several million tonnes of equipment containing or contaminated with PCBs still in use. Therefore, detailed and reliable inventories of PCB containing or contaminated equipment are a top priority in these countries. This was the case in participating countries, where PCB inventory data was not reliable at the beginning of the project. This reliability has significantly advanced in all participating countries thanks to conducting awareness and training activities for PCB key stakeholders, wise planning of site visits, sampling and inventory, PCB data compilation as well as legal enforcement.

IMPACTS

This activity aimed to introduce environmentally sound management (ESM) to all stages of the "life-cycle" of electrical equipment containing or being contaminated with PCBs is already causing an effect on countries strategies, international compliance on PCBs management and final disposal and project sustainability. Several countries are already implementing additional project national inventory, sampling and analysis activities. In a specific case, an electricity distribution company in a participating country has acquired a PCB analyzer and is already sampling and analyzing oil from incoming transformers ready for repair to avoid cross-contamination. Also, some customs authority already require for any import or export of transformers and capacitors, a declaration of PCB free before approve its import or export. This action is crucial to control PCB cross contamination. Some Basel Convention focal points implemented for the first time, the administration procedure to export PCB (hazardous waste) according to the requirements of the Basel Convention. The PCBs management process to comply with the Stockholm and Barcelona Conventions is advancing in participating countries.



Photo: Manolo Clar

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Relevant websites: www.pcbsmed.org

KEYWORDS

Polychlorinated biphenyls, PCBs, Environmentally Sound Management (ESM), Hazardous waste

EXECUTING PARTNER

MEDPOL Programme for the assessment and control of marine pollution in the Mediterranean aims to assist Mediterranean countries to implement three major protocols of the Barcelona Convention: Land based sources Protocol, dumping Protocol and hazardous waste Protocol.

SCP/RAC the Regional Activity Centre for Sustainable Consumption and Production works to contribute to pollution prevention and sustainable and efficient management of services, products and resources based on the sustainable consumption and production integrated approach adopted by UNEP.

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Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem

Together for the Mediterranean Sea

MedPartnership



Executing partners: FAO, UNESCO/IHP, UNIDO, GWP-Med, MIO-ECSDE, WWF MedPO, UNEP/MAP's MEDPOL programme and regional activity centres (CP/RAC, SPA/RAC and PAP/RAC).

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Partner countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Palestine, Syria, Tunisia and Turkey.

MedPartnership



Experience Note



Stakeholder engagement in Marine Protected Areas planning, development and management

AT A GLANCE

The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading environmental institutions and organizations together with countries sharing the Mediterranean Sea to address environmental challenges that Mediterranean marine and coastal ecosystems face. The project's 78 demonstration and the promotion and replication of good practices will maximize impact and ensure the sustainability of the project beyond its lifespan.

Total budget: 48 millions USD.
13 million USD: Global Environment Facility
35 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

Within the MedPartnership project, WWF-MedPO built the capacity and guided MPA managers and practitioners in the project countries through the successful implementation of participatory MPA management planning processes. Secured commitment and support of decision-makers and meaningful engagement of stakeholders are the foundations of functioning MPAs. Participatory stakeholder engagement is therefore one of the most important steps in planning and implementing an MPA, and it should start at the very outset of the MPA development process. However, full engagement can be reached only when MPA managers and practitioners have the ability to build healthy, lasting and trustful relationships with their stakeholders, including local communities. Different techniques and tools were applied at each site depending on the stakeholder engagement maturity of local partners.



ACTIVITY DESCRIPTION

Within the MedPartnership project, a wide range of activities, techniques and tools have been developed and implemented by WWF-MedPO to guide and support managers and staff of project MPAs in the identification and active engagement of stakeholders in the first phases of MPA development and in securing the buy-in and support of both stakeholders and decision-makers to their MPA.

THE EXPERIENCE

The long term success of a MPA largely depends on the level of engagement, shared ownership and commitment of its stakeholders. Stakeholders should be involved at every stage of the development of an MPA to ensure that their perspectives, knowledge, and support are included. If brought in too late in the process, MPAs may fail in delivering on their expected objectives.

To ensure full stakeholders' participation to the planning and development of the project MPAs, the following set of actions - including specific techniques and tools - were implemented by local partners with the technical support of WWF-MedPO:

1. **Understanding and informing stakeholders** to build a foundation of mutual trust, create opportunities for sharing information, and identify areas of common interest, through the organization of:

- participatory training workshops to characterise stakeholders
- informal and formal meetings, and exchange visits with more advanced MPAs to improve stakeholders' understanding of the purpose and benefits of MPAs and ultimately built trust

2. **Engaging stakeholders** through multi-stakeholder MPA planning processes, entailing the following steps:

- establishment of a planning team at each project MPA
- design and implementation of a step-by-step planning processes to develop the MPA management plans of each project MPA
- organization of a series of thematic workshops built into the planning process to ensure the participations of all relevant stakeholders
- organization of training workshops on stakeholder engagement techniques and participatory planning processes
- compilation of the information gained through the participatory process and presentation of the MPA proposal to decision-makers from local and national steering committees for final approval.

3. **Engaging stakeholders as advisors:**

establish formal multi-stakeholder advisory bodies to collaboratively and collectively find shared approaches to complex resource management issues, and to make recommendations on management solutions to the MPA managers.

Engaging stakeholders with a range of activities and tools at Kaş-Kekova SPA



Source:

Gomei M. and Di Carlo G., 2012)

Each set of actions corresponded to progressively greater participation from stakeholders and increasingly more shared responsibility with the MPA management authority.

RESULTS

MPA managers and practitioners in the project countries (Croatia, Turkey, Algeria, Tunisia and Libya) successfully secured and maintained the support and commitment of relevant decision-makers and stakeholders during the preliminary implementation phases of their MPAs. They acquired the techniques and tools to effectively identify and characterise the groups having a vested interest in their MPAs. They were able to understand the needs and priorities of these groups, to learn from their knowledge, to find a common ground with each group, to build trust, and to secure their ownership. Step-by-step, multi-stakeholder MPA management planning processes were successfully completed, triggering an open dialogue among all institutions having authority on the project MPAs. Conflicts for the regulation of economic activities (fisheries and tourism in particular) were successfully worked out through the organization of information-exchange activities and participatory training workshops, as well as the establishment of Advisory Boards and Steering Committees. As for most of the countries involved in the project participatory management planning process was a new concept, tailored capacity building activities and trouble-shooting mechanisms were delivered by WWF to support MPA managers and practitioners in facilitating long negotiations and managing conflicts. Finally, local communities actively participated and contributed with their ideas throughout project implementation.

LESSONS LEARNED

Participatory stakeholder engagement is perhaps the most important component in the steps towards the establishment of functioning MPAs. However, most of the countries in the South and East of the Mediterranean are not used to set up and facilitate participatory processes. Practitioners from these countries, more often than not, lack the skills and capacities to bring all stakeholders together, build trust, manage confrontations and resolve conflicts. The project was successful in building these capacities in the project countries and guiding MPA managers and practitioners through the implementation of participatory MPA management planning processes at their sites. Well-established and trustful relationships between MPA managers and their stakeholders, including local communities and decision-makers, at each project sites, clearly show how an early and extensive stakeholder engagement is key for securing success in the designation, implementation and management of a MPA. Given its importance, a guidebook was developed by WWF, in collaboration with the National Oceanic and Atmospheric Administration (NOAA) of the USA, where key steps, techniques and tools, as well as lessons learned from the project sites, are summarized and made available to MPA practitioners worldwide.

IMPACTS

In early 2009, the authority of the Taza National Park in Algeria applied for the extension of its borders to the adjacent marine area and the creation of a new MPA. To ensure stakeholders' endorsement to the future MPA, the Park Authority adopted a participatory approach to the MPA management planning process. A Steering Committee was established to engage and secure the commitment of local administrations, while - for the first time in Algeria - an Advisory and Consultation Commission was constituted to further bring Park staff and community members together in the planning process. The consultations lasted three years and required long negotiations. However, the community responded positively to this new challenge and actively participated to the planning process. They finally agreed on a zoning plan that meets both conservation and socioeconomic objectives. They also developed a sense of ownership that will ensure higher compliance to and the effective implementation of MPA regulations.

"A key element in the preparation of the documents is to ensure that we cooperate with all local stakeholders in a participatory process. Failure to do so would seriously compromise the chances of success of the project."

Nadia Ramdane, Local project coordinator Algeria, Taza National Park

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Project Website: Giuseppe Di Carlo

WWF MedPO

Via Po 25/c,00197

Rome, ITALY

EXECUTING PARTNER

The mandate of WWF Mediterranean (also known as WWF MedPO) is to pursue WWF global priorities to conserve biodiversity and reduce the human footprint on nature. In the Mediterranean WWF works through field projects advocating improvements in regional and national policy processes affecting nature conservation and resource management. Complementing the work of the five WWF national organizations active in the region (France, Greece, Italy, Spain and Turkey), WWF Mediterranean operates in fourteen countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Montenegro, Morocco, Portugal, Serbia, Slovenia, Syria and Tunisia.

KEYWORDS

- Mediterranean,
 - Marine Protected Area,
 - Stakeholder engagement,
- Participatory MPA management planning process

The MedPartnership Project

UNEP/MAP Information Office

48, Vas Konstantinou, Athens, 11635, Greece



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Experience note



Hutovo Blato wetland (Bosnia-Herzegovina) (Courtesy of Z. Mateljak)

Management and protection of Mediterranean groundwater-related coastal wetlands and their services

AT A GLANCE

The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading environmental institutions and organizations together with countries sharing the Mediterranean Sea to address environmental challenges that Mediterranean marine and coastal ecosystems face. The project's 78 demonstration and the promotion and replication of good practices will maximize impact and ensure the sustainability of the project beyond its lifespan.

Total budget: 48 millions USD.
13 million USD: Global Environment Facility
35 million USD: Participating countries, executing agencies, and donors.

ABSTRACT

Coastal wetlands display a wide range of natural typologies such as springs, seepage areas, dune slacks, coastal lagoons, marshlands, abandoned stream courses, deltaic lagoons and ponds, etc., which are mostly the result of the geological processes originating the wetland. They are one of the most productive worldwide ecosystems and provide to humans a wide range of services. Besides, groundwater related coastal wetlands in arid and semiarid areas such as the Mediterranean produce and provide especially valuable services to the humans in the surroundings, as often they are the main or the only water source for all uses, from drinking to economic uses. Coastal wetlands in general, and those in the Mediterranean coastal areas in particular, are subject to many pressures. The preservation of these groundwater related wetlands depends largely on land and water management, not only in the coastal area but in the whole basin contributing water to the wetland, which is often much larger than the wetland area itself, and this often ignored.

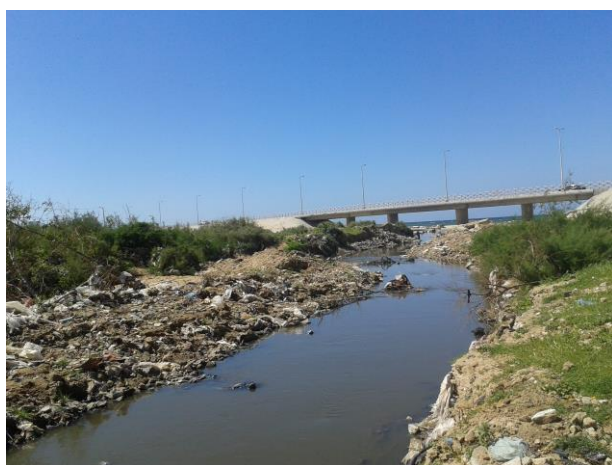
ACTIVITY DESCRIPTION

Three chart forms were designed and distributed to the national experts to compile the necessary data related to particular coastal wetlands in their countries. Based on these results two reports were prepared: a regional report including Guidelines and recommendations for the evaluation and integrated management of groundwater related coastal wetlands, and a technical report on the Main hydrogeological characteristics, ecosystem services, and drivers of change of 26 representative Mediterranean groundwater-related coastal wetlands. The wetlands are also represented on a map.

THE EXPERIENCE

ISSUE

Wetlands deliver a wide range of ecosystem services such as food and water, regulation of floods and droughts or cultural. In groundwater related coastal wetlands many ecosystem services are supported by the presence of groundwater inflow. The capacity of many wetlands around the world of offering ecosystem services has been diminished due to anthropogenic and natural causes.



Wadi Gaza wetland (Palestine) (Courtesy of K.Qahman)



Korba/Cap Bon wetland (Tunisia) (Courtesy of N. Gaaloul)

METHODOLOGY

To develop the activity related to coastal wetlands, UNESCO-IHP has relied on the expertise of the university researchers and professors given their experience on groundwater and groundwater-surface water relationships with emphasis in wetlands, in coastal areas, and in wetland classification. The team in charge thought that, further to the due emphasis in coastal wetlands- groundwater dependence and relations, the incorporation of the ecosystem services point of view was necessary. This ecosystem approach (EA) is a highly valuable framework to analyze the relationships between humans and the environment, as well as the related action.

The EA is based on the application of scientific methods to characterize and evaluate i) which services a given ecosystem provides to human wellbeing, ii) which is the state of functioning of those services when the evaluation is performed, iii) which are the factors that produce changes in these ecosystems functioning and their services, iv) how these changes will affect human wellbeing in the coming decades, and iv) which actions can be adopted at local, regional, national and global scale to improve ecosystem management and consequently contribute to human wellbeing and poverty reduction.

The sample of wetlands evaluated in the frame of the activity covers a wide area but is short for significant quantitative statistical treatment and thus qualitative treatment is used. However, they are fully representative of the most common types of groundwater-related wetlands existing along the Mediterranean coast.

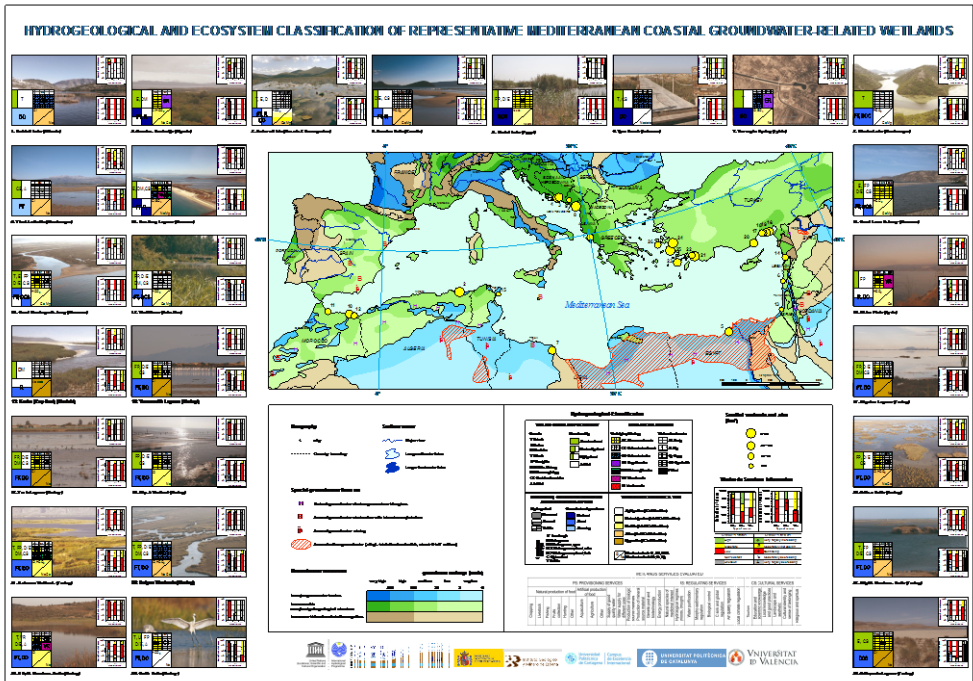


Second meeting on the management and protection of groundwater related coastal wetlands
12-13 June 2014. UNESCO HQ, Paris
(Courtesy of Jose Gaona)

RESULTS

The activity resulted with three products:

- 1. Regional report on the Management and protection of Mediterranean groundwater-related coastal wetlands and their services: it includes a compilation of the existing knowledge about groundwater related wetlands in the Mediterranean coast provided by the national experts. Its goal is to try to introduce the relevance and potential usefulness of the EA for the preservation, fostering and restoration of Mediterranean groundwater-related coastal wetlands services offered, or that were offered in past times, to the wellbeing of the human societies living around and near them.
- 2. Technical Report on the Main hydro(geo)logical characteristics, ecosystem services, and drivers of change of 26 representative Mediterranean groundwater-related coastal wetlands: The aim of this report is to perform a preliminary assessment in the 26 Mediterranean groundwater-related coastal wetlands reported by the National Experts from the participating countries: i) the general geological and hydrogeological characteristics, ii) the status and evolution trends of the ecosystem services, and iii) the drivers that induce changes in wetlands functioning.
- 3. A map with the assessed coastal wetlands and providing a classification system and representation of the ecosystem services provided by coastal groundwater related wetlands as an appropriate tool to strengthen the capacity of water management institutions in the Mediterranean region as a step to implement sustainable management and protection of groundwater resources.



Draft of the map of selected wetlands in the

LESSONS LEARNT

A main lesson learned from the work carried out is that even though nowadays there is abundant and good quality technical and scientific information easily available, it is necessary that the persons in charge of performing evaluations have a sound training about the background aspects related to ecosystem services, driver of changes to ecosystems, and their respective assessment.

Taking into consideration that groundwater is one of the water sources feeding most of the coastal wetlands reported within this project, and knowing the relevant role that groundwater plays in supporting wetland habitats and vegetation in times of low rainfall or permanently, as well as human needs of food, energy, building materials, etc., it seems clear that Earth scientists and technicians involved in works devoted to characterize coastal wetlands functioning and/or to design wetlands management plans should have an adequate understanding and knowledge on what refers to ecosystem services, as well as on the strong relationships existing between groundwater flows, wetlands services, and human wellbeing.

This points to the necessity of elaborating and using methodological guides, as well as to teach dedicated courses on ecosystem services and the methodologies to assess them, in order to build capacity in the professionals that would involucre in the mentioned projects and tasks. Those capacity-building activities should develop both at the national level and at the international one.

IMPACTS

The activity resulted with useful tools for a proper management of coastal wetlands at the intention of decision makers:

- a visual tool : the wetlands map, showing a relevant but also simple classification of the coastal wetlands dependent on groundwater according to the hydrogeology but also to the services provided and their trends.
- Guidelines and recommendations for the evaluation and integrated management of groundwater related coastal wetlands
- A web-based geo-referenced information system integrating all wetlands data

These tools as well as all the activity products will be disseminated at the regional and national level.



Second meeting on the management and protection of groundwater related coastal wetlands
12-13 June 2014. UNESCO HQ, Paris
(Courtesy of N. Laftouhi)

RÉFÉRENCES

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Map of selected wetlands in the Mediterranean area; Hydrogeological and ecosystem classification, 2015



MED TEST

Transfer of Environmental Sound Technology
in the South Mediterranean Region

Project Summary and Achievements

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Foreword

In the last few years, in keeping with its mandate, UNIDO has coined the **Green Industry** concept to place sustainable industrial development in the context of new global sustainable development challenges.

The Green Industry vision grasps the potential for industries to decouple economic growth and revenues from excessive and increasing resource use and pollution. It foresees a world where industrial sectors will minimize waste in every form, use renewable resources as input materials and fuels, and take every possible precaution to avoid harming workers, communities, climate, or the environment. Green industries will be creative and innovative, constantly developing new ways of improving their economic, environmental and social performance.

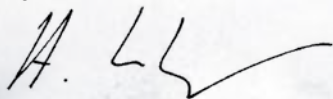
Enterprises of developing and transitional countries are facing numerous challenges in their effort to maintain or increase their competitiveness on the local market, access international markets with good quality products, comply with environmental standards and reduce operational costs. In order to assist companies in dealing with such challenges and to direct them toward the “green industry” paradigm, UNIDO designed a specific methodology, the Transfer of Environmentally Sound Technology (TEST), an integrated approach and a global program.

The first TEST pilot program was launched in 2000 in the Danube River Basin. Since then, TEST has been replicated in several Regions worldwide within industrial hot spots areas, contributing to prevent discharge of industrial effluents into international waters (rivers, lakes, wetlands and coastal areas) and thereby protecting water resources for future generations.

In 2009 UNIDO launched the MED TEST initiative with the financial support of the GEF and the Italian government to promote the transfer and adoption of cleaner technology in industries of the Southern Mediterranean Region. This publication intends to promote this successful experience and the positive results achieved by UNIDO during the implementation of MED TEST in 3 countries of the South Mediterranean Region: Egypt, Morocco and Tunisia.

Heinz Leuenberger

Director Environmental Management Branch
UNIDO





MED TEST Programme

MED TEST is a UNIDO green industry initiative supported by the GEF, the Italian Government and the “Strategic Partnership for the Mediterranean Large Marine Ecosystem (LME)”¹ of UNEP-MAP. The program addresses land-based sources of pollution within priority industrial hot spots of the Mediterranean Strategic Action Plan (SAP-MED).

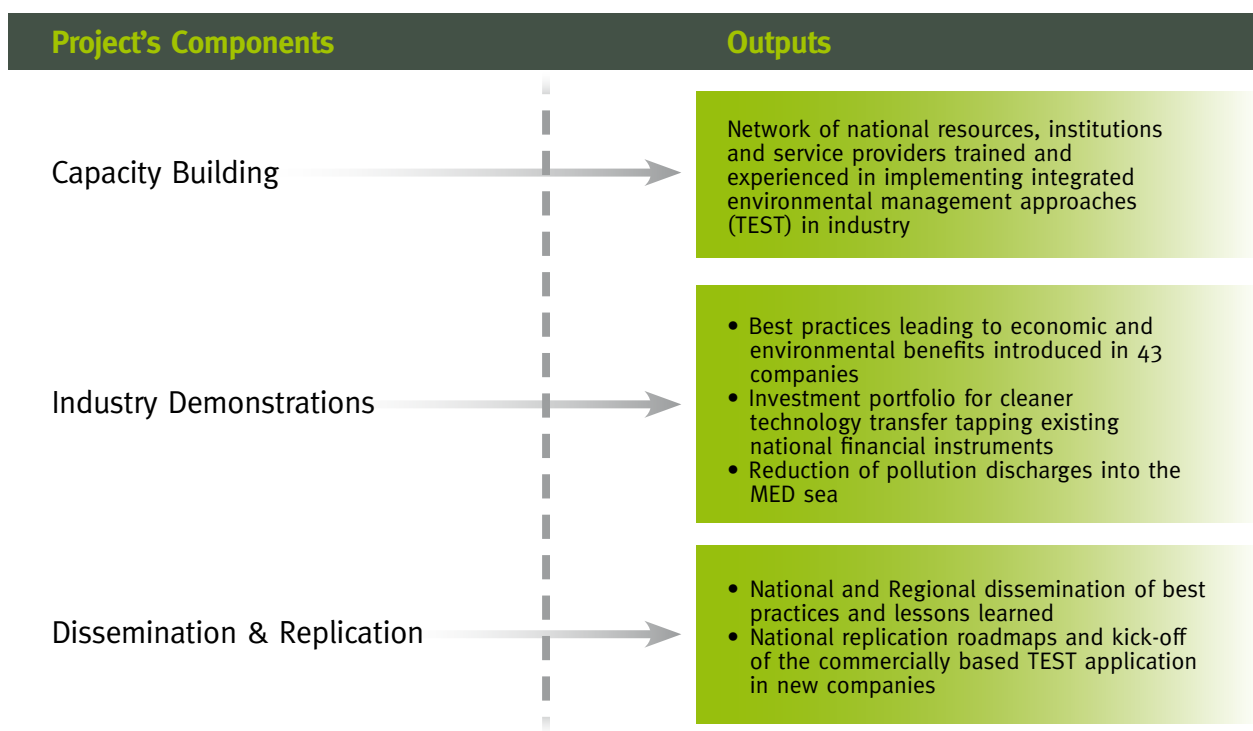
The project aims at demonstrating the effectiveness of introducing best practices and integrated management systems in industry of the Southern Mediterranean Region, in terms of cost reduction, productivity increase and environmental performance. A pool of 43 manufacturing sites, mostly SMEs, across 7 industrial sectors in Egypt, Morocco and Tunisia have actively participated in MED TEST during 2010-2011.

Building national capacity, a core objective of MED TEST, relies on extensive training and a technical assistance program that has targeted 6 national institutions & ser-

vice providers and 30 local professionals, in addition to the staff of the 43 demonstration companies. As a result, a network of local resources is now engaged in promoting the TEST approach and will serve to extend the experience gained to other industries in the Region. The active participation of the staff of the demonstration companies in the training and in the implementation of the project ensures sustainability of all identified actions at company level as well as the development of new projects.

National roadmaps for market uptake and upscale of TEST in each country have been designed: dissemination and replication activities targeting new industrial sites will be launched by the project’s national partners and their institutional stakeholders with UNIDO support. A wider dissemination of the project’s results to other countries of the Mediterranean Region is planned with the support of the MedPartnership.

¹ <http://www.medpartnership.org>





RESULTS

17 Millions USD/yr
economic savings
9.7 Millions m³/yr
water savings
263 GWh/yr energy
savings

KEY FIGURES

6 National partners/
service providers
30 TEST Trainees
43 Demonstration
industries
958 Man days of
training delivered to
industry and trainees

PROJECT'S LEVERAGE

20 Millions USD
private sector
investments portfolio
for cleaner technology



The TEST Approach

TEST combines the essential elements of tools like Resource Efficiency & Cleaner Production (RECP), Environmental Management Systems (EMS) and Environmental Management Accounting (EMA) as part of Corporate Social Responsibility (CSR), applied on the basis of a comprehensive diagnosis of enterprise needs (Initial Review). As a result of the customized integration and implementation of these tools and their elements, the key output is the adoption of best practices, new skills and management culture, enabling the company to carry on the improvement journey towards sustainable entrepreneurship.

TEST is building on management of change and addresses not only the operational level of a business, but also the managerial and strategic levels, along the following lines:

- At the operational level, TEST gives priority to resource efficiency & pollution

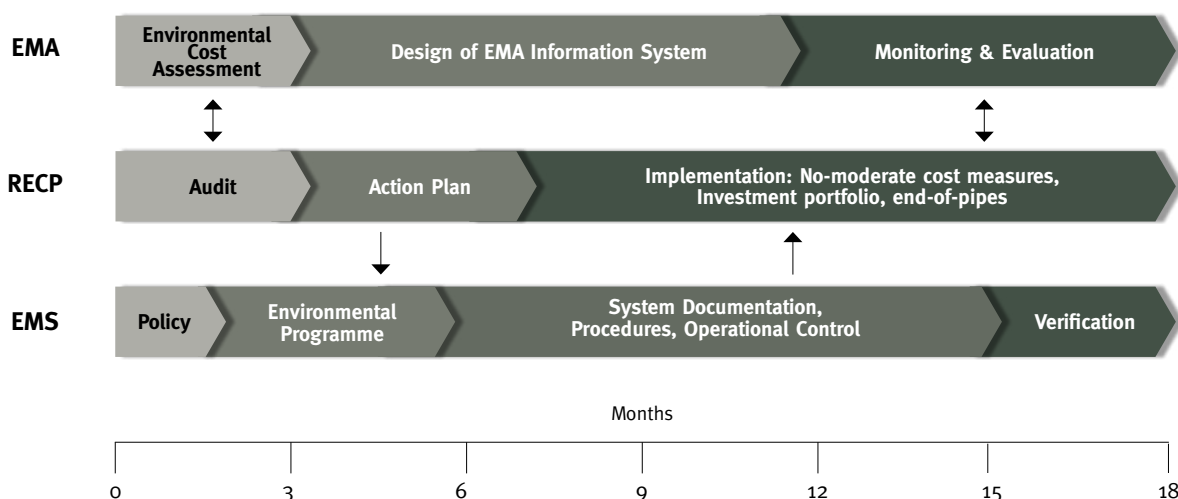
prevention techniques (RECP) in production processes, followed by transfer of cleaner technologies and pollution control solutions (end-of-pipe). Existing processes are optimized by implementing no-cost & low-cost measures with a short pay-back period (PBP), before a portfolio of high investment needing measures is put in place.

- At the level of management systems, EMS and EMA tools are used to establish the necessary information management system on relevant material, energy and related financial flows in order to link together the strategic and operational level of the business. The EMA reveals to top management the real costs of production, including hidden environmental costs like non-product output costs. The EMS provides procedures and resources to ensure that the outputs of the RECP audit are implemented, sustained and further developed.
- At the strategic level, TEST places environmental management within the broader strategy of environmental and corporate social responsibilities (CSR) by leading companies towards the adoption of sustainable enterprise strategies.

WHAT IS TEST?

- A UNIDO Green industry initiative
- An integrated approach for sustainable entrepreneurship
- A capacity building program for skills development in resource efficiency and industrial environmental management

TEST Implementation Workflow in company



CSR



MED TEST demonstration projects: highlights

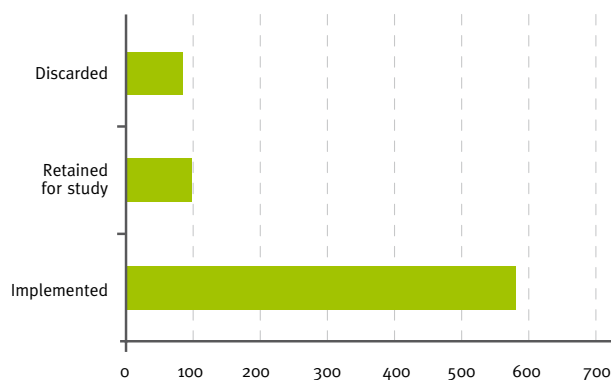
The effectiveness of the TEST approach has been largely demonstrated in the 43 companies participating in the Mediterranean initiative through the implementation of a large number of resource efficiency measures and cleaner technology investments. The benefits of TEST at the management and strategic levels have resulted in the adoption of new vision and policies by top management, as well as in the implementation of management systems (e.g. ISO 14001) that integrate the environmental dimension.

A total of 765 measures have been identified, of which 76% have been implemented, 14% retained for further technical and economical investigations and only 10% discarded. Approximately 54% of the total identified

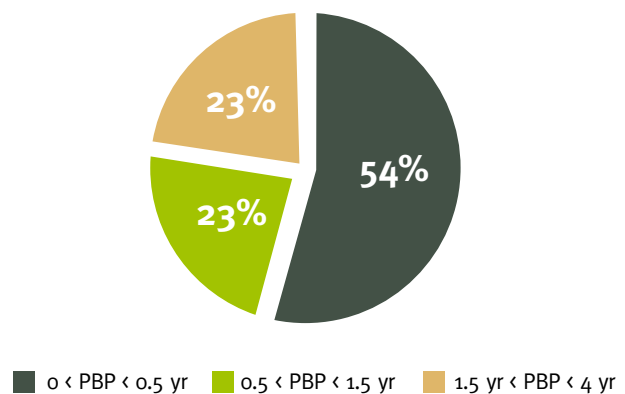
measures have a return on investment of less than 0.5 years, the rest is equally split among measures with PBP between 0.5 and 1.5 years and between 1.5 and 4 years.

In the three countries, the project has identified total annual savings of approximately 17 M USD in energy, water, raw materials and increased productivity corresponding to a portfolio of around 20 millions USD of private sector investments in improved processes and cleaner technology. These investments do not include end-of-pipe solutions, which in some companies have also been launched in order to achieve full environmental compliance with national laws. The total annual water and energy savings are respectively 9.7 millions m³ and 263 GWh.

Number of measures implemented, retained for study, discarded at the demonstration sites



Return on investment of identified measures at the demonstration sites



Companies' motivation for joining MED TEST

- Decreasing production losses & costs through a more efficient use of resources (energy, water, raw materials)
- Introducing best practices and cleaner technology, including access to grants and financing schemes
- Identifying opportunities for waste minimization and opportunities for their valorisation
- Reducing investment and operational costs of EoP
- Achieving environmental compliance and enhance relationships with stakeholders
- Improving the company's overall environmental management culture and obtain an EMS certification
- Greening their image along the supply chain for increased market penetration
- Training their staff on cleaner production





EGYPT

Country framework conditions for implementing MED TEST

Over the past decade, Egypt has transformed into a liberal private-led economy, implementing a comprehensive program of structural reforms and privatizations to attract foreign investment, ensure economic growth and integrate the environmental dimension into national planning. The Egyptian Environmental Affair Agency (EEAA) is actively leading the enforcement of the environmental protection law, which includes command and control measures, appropriate standards and the application of the polluter pays principle with a stringent penalties and fines regime.



The Egyptian Government, with the essential support of the international donors community, has implemented several programmes to minimize the adverse impact of industrial pollution. The most important schemes are: EPAP II & KfW for investments in cleaner technology and end-of-pipes, IMC for technical assistance and Italian credit lines for technology transfer.

Industry represents about 38% of the GDP and the most important sectors are textile, food and chemicals. Approximately 40% of the Egyptian industrial capacity is

located in the Alexandria region, which is affected by intense pollution into the Mediterranean Sea. The wide industrial base of Alexandria mostly comprises SMEs but also many large industries predominantly within the chemical and petrochemical sectors.

MED TEST has targeted 16 industries in Egypt, both SMEs and large industries, across several industrial sectors, contributing to the industrial pollution hot spots of Abou Qir, El Mex Bay and Maryut Lake, within the Alexandria Region.

MED TEST partners

The MED TEST project in Egypt was implemented by the Egyptian National Cleaner Production Center (ENCPC) in cooperation with Environmental and Water Engineering Consultants (EWATEC), a consultancy firm in Alexandria.

Institutional Stakeholders

- Ministry of Industry & Foreign Trade
- Egyptian Environmental Affairs Agency (EEAA), RBO Alexandria
- Federation of Egyptian industry, Environmental Compliance Office (FEI-ECO)
- Friends of the Environment Association (NGO)
- Italian Embassy in Egypt



EGYPT

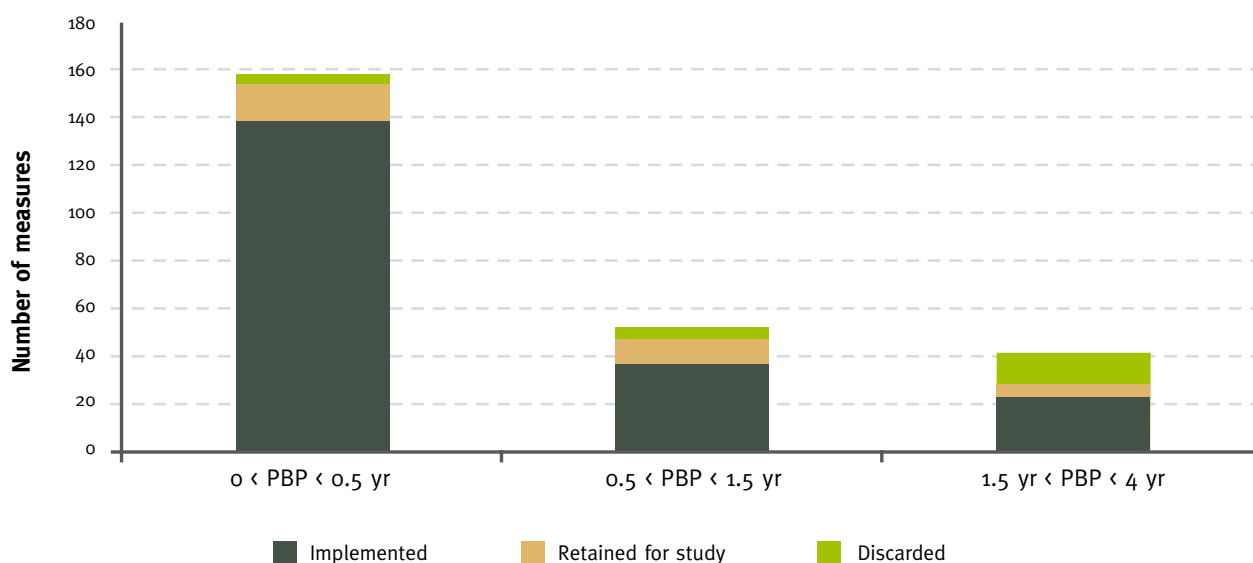
Results of the demonstration projects in Egypt

Following an extensive marketing campaign entailing workshops and one-to-one company site visits, a pool of 16 motivated companies were selected. At project start-up, companies were seeking advice on technological solutions and support in accessing financing to address existing problems and environmental compliance, as well as training of their staff and workers on resource efficiency. The project opened up a wide range of measures new to the management, as well as opportunities for accessing investment subsidies. Many companies were supported in establishing a proper monitoring system for water &

energy consumption, including the installation of metering and internal accounting procedures.

A total of 252 measures were identified, out of which 79% have been implemented by the companies, 13% retained for further assessments and 8% discarded.

The identified measures have a PBP of less than 0.5 years in about 63% of the cases, between 0.5 and 1.5 years for 20% of them, between 1.5 and 4 years for the remaining 17%. Most of the measures have demonstrated an attractive return on investment, which accounts for the high implementation rate, as illustrated in the chart below.



Distribution of identified measures by pay-back period and implementation rate in Egyptian demonstration companies

In Egypt, the MED TEST demonstrations were successful in linking up the technical assistance provided by the project's team with the existing grant schemes and investment subsidies available in the country, particularly IMC and EPAP II. This was essential for attracting top management interest and commitment toward implementing the action plan.

Utility costs are generally very low for Egyptian companies. This has resulted in higher return on investments for the selected measures, compared to the other countries (Tunisia or Morocco). In the near future, existing subsidies on water and energy costs in Egypt are expected to be progressively removed. Many more resource efficiency measures will become more profitable, providing the key driver for TEST replications in industry in the medium term.



EGYPT

The table below provides a summary of the financial figures and the water/energy savings associated to the identified measures in the demonstration companies.

Company	Size (*)	Investments [USD/yr]	Savings [USD/yr]	Water Savings [%]	Energy Savings [%]
Food & Beverage Sector					
Edfina Company for Preserved Food	660	257,518	889,000	32	3
Egyptian British Company for Development (Galina-Agrofreeze)	200	32,500	113,500	50	6
Egyptian Company for Starch, Yeast & Detergents	1,130	136,474	1,692,132	40	44
El-Nile Soft Drinks Company (Crush)	1,000	1,564,086	1,264,042	85	19
Chemicals, Petrochemicals and Petroleum Sector					
Extracted Oils and Derivatives Company	2,300	429,627	127,803	18	1
Misr Chemicals Company (MCI)	740	49,033	416,057	26	7
Solvay Alexandria Sodium Carbonate	700	55,383	491,793	20	10
Egyptian Petrochemicals Company (EPC)	3,300	1,536,667	530,638	4	37
Misr Petroleum Company (Lube Oil Blending Plant)	430	100,934	457,371	20	8
Leather Sector, Tanneries					
Atef El Sayed Tannery	40	416,850	97,377	30	47
Pulp and Paper Sector					
General Company for Paper Industry (RAKTA)	1,125	2,443,446	1,518,446	15	10
Moharrem Press Company	940	279,217	304,786	33	15
National Paper Company (NPC)	920	1,731,170	1,228,167	52	12
TOTAL		9,116,241	9,131,112		

(*) n. of employees, 2009

Estimated Environmental Benefits			
Water Savings [m³/yr]	Energy Savings [MWh/yr]	BOD ₅ Reductions [tons/yr]	COD Reductions [tons/yr]
8,878,090	212,600	1,628	1,773

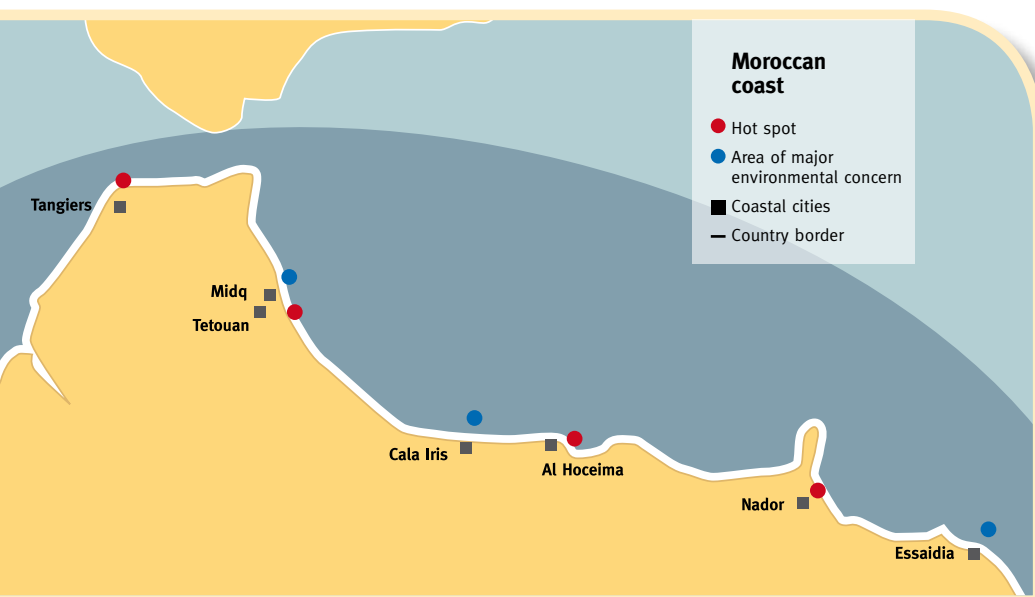
Six of the participating companies were already certified ISO 14001 at the beginning of their engagement with TEST. Nevertheless, their EMS needed upgrading to fully integrate resource efficiency: new actions and procedures

identified during the course of the project were included. Four companies with no EMS in place at project start-up have launched its design and implementation according to ISO 14001 standard during the course of the project.



MOROCCO

Country framework conditions for implementing MED TEST



The Moroccan environmental framework comprises a set of laws based on the polluter pays principle. The enforcement of the environmental legislation is still in progress. In 2006 the Moroccan Confederation of Enterprises (CGEM) adopted the Corporate Social Responsibility Label and accreditation scheme, which underline the government's commitment towards sustainable development.

Over the past decade, with the support of the EU and of KfW, the Moroccan government has managed the

Morocco, with its rather stable and diversified economy mostly driven by internal demand, has kept undergoing macroeconomic and structural reforms over the past decade, offering favorable prospects for growth.

The country's core economy relies on Small and Medium Enterprises (SMEs), which gather about 93% of the industrial activities and employ over 40 percent of the work force. The main industrial sectors are the Chemical sector, Agro Food processing, Textile and Leather, Mechanics and Metallurgy, Electronics and Electrics.

industrial depollution incentive and financing scheme (FODEP). The latter is to be replaced by the newly established National Environmental Fund. The ANPME, the national agency for SMEs promotion, is managing a large technical assistance program, which includes – among other things – subsidies for energy and environmental services.

MED TEST has targeted 12 companies in Morocco, mostly SMEs, within several industrial sectors located in the geographical areas of Tangier and Tetouan, the Mediterranean hot spots. Tangier is Morocco's second most important industrial centre with an ambitious development plan, four large industrial parks of which two have the status of economic free trade zone.

MED TEST partners

In Morocco the project was implemented with the local support of the Moroccan Cleaner Production Centre (CMPP) and the assistance of ECTI².

Institutional Stakeholders

- Ministry of Industry
- Ministry of Environment
- Moroccan Confederation of Enterprises (CGEM)
- Water Basin Authority Tangier
- Italian Embassy in Morocco

² Échanges et Consultations Techniques Internationales (ECTI)



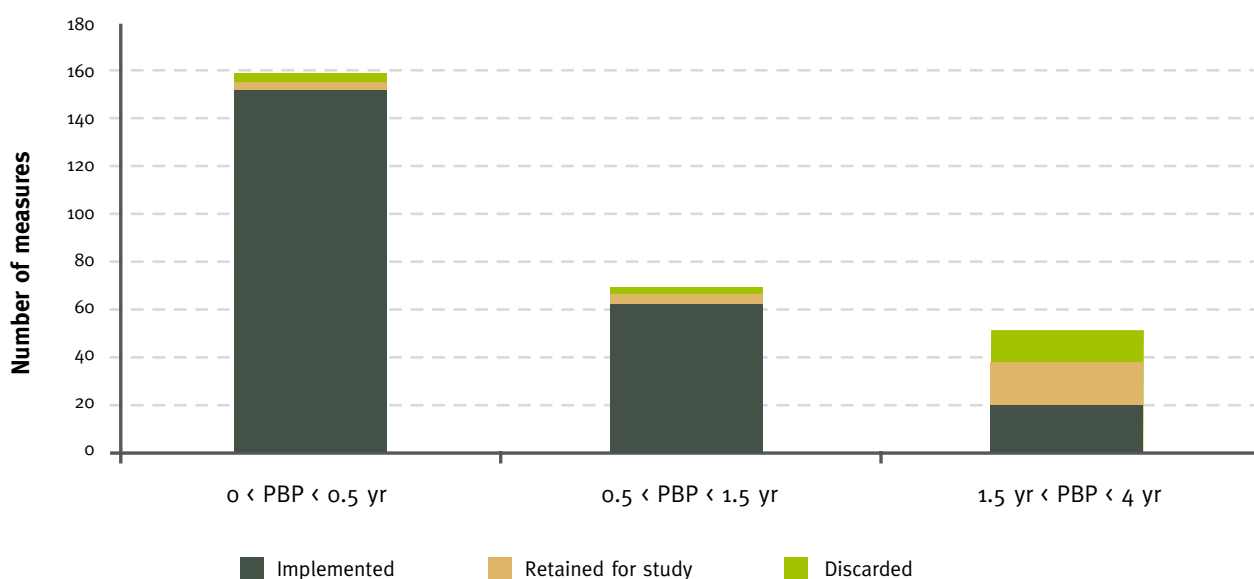
MOROCCO

Results of the demonstration projects in Morocco

The twelve demonstration companies adhered to MED TEST with the expectation that the project's team would assist them in identifying feasible opportunities for cutting production costs, increasing productivity, valorising waste into by-products as well as reducing pollution loads and therefore the investment & operating cost of future wastewater treatment plants (WWTP). At project start-up there was a general lack of awareness on the existing green financial tools available for companies.

A total of 280 measures were identified, out of which 85% have been implemented by the companies, 8% retained for further assessments and 7% discarded. Energy efficiency solutions, including heat recovery, have demonstrated very good potential in Morocco, due to the high energy costs of fuel (e.g. propane).

The identified measures have a PBP of less than 0.5 years in about 40% of the cases, between 0.5 and 1.5 years for 25% of them, between 1.5 and 4 years for the remaining 35%. Most of the measures have demonstrated an attractive return on investment, which accounts for the high implementation rate, as illustrated in the chart below.



Distribution of identified measures by pay-back period and implementation rate in Moroccan demonstration companies

The MED TEST project in Morocco has been timely in raising awareness of industries on environmental performance and existing green financing tools, in view of the upcoming enforcement of the environmental regulatory framework. High energy costs represented a major drive to implement TEST for local industry.

At project startup only one company had an operating wastewater treatment plant (WWTP) in place: most of the others had no data on their wastewater pollution loads. Through the project, a partnership was established with the water basin authority and eight of the participating companies were assisted in analyzing their wastewater flows, preparing technical specifications for setting up a WWTP and sending a request to the national depollution fund (FODEP) to obtain an investment grant. One of these eight companies completed the WWTP tendering phase during the project, selecting the contractor that will build the facility.



MOROCCO

The table below provides a summary of financial figures and water/energy savings associated to the identified measures in the demonstration companies.

Company	Size (*)	Investments [USD/yr]	Savings [USD/yr]	Water Savings [%]	Energy Savings [%]
Food Sector					
Fromagerie BEL (dairy)	500	280,328	333,830	20	7
Colainord (dairy)	600	117,929	381,436	23	13
Cumarex (fish)	320	1,252,565	3,943,800	10	20
Conserverie des 2 Mers (fish)	350	120,175	73,970	22	65
Boyauderie de l'Atlas (meat)	320	79,125	133,500	48	26
Textile Sector, Finishing					
Ecolorentel	400	324,327	242,041	4	7
Lavesma	300	250,911	474,615	2	27
Metal Sector					
Aluminium du Maroc	200	262,164	370,431	7	11
Industube	90	85,800	327,375	1	12
Ceramic Sector					
Ghorghiz	200	347,583	433,180	80	4
Ceramica Dersa	50	87,125	205,306	80	12
TOTAL		4,228,231	5,899,267		

(*) n. of employees, 2009

Estimated Environmental Benefits	
Water Savings [m³/yr]	Energy Savings [MWh/yr]
153,806	18,000

The companies received training and technical assistance for the EMS preparation, fully integrating resource efficiency principles in line with the identified measures. During the course of the project, one company obtained the ISO

14001 certification (June 2011). Two companies have established the EMS basic documentation, and two more companies have applied to the ANPME subsidy to receive additional assistance and complete the design of their EMS.



TUNISIA

Country framework conditions for implementing MED TEST

Tunisia is one of the most competitive African countries, that has been the first to sign up to the Euro Mediterranean partnership, and its proximity to the EU and its market has encouraged the introduction of institutional reforms, including those related to environmental protection.

The country has put in place a consolidated environmental regulatory and enforcement framework, as well as several national programmes and incentive schemes to rehabilitate and renovate industries, with the objective of guaranteeing a sustainable industrial development. Some of the most important schemes targeting industry include FODEP for investments in cleaner technology and end of pipe, FOCRED for technical assistance and technology upgrade, FNME for energy efficiency, and AFD for environmental credit lines.

The industrial sector in Tunisia essentially consists of small and medium enterprises (SME), most of which belong to the private sector while the role of the public sector is limited to heavy, extractive or transformation processing industries. The main areas affected by industrial pollution within the Mediterranean Sea hot spots are Tunis, Sfax, Ariana, Bizerte, Sousse, Na-beul, and Gabes.

MED TEST has targeted 3 industrial sectors in Tunisia, textile, agro food and leather, which are crucial for the country's economy and rank among the major contributors to industrial pollution generation in terms of wastewater, organic loads and toxic substances release, as well as water and energy usage.



MED TEST partners

In Tunisia the project was implemented with the local support of a consortium of three technical centres affiliated to the Ministry of Industry:

- CETTEX, textile
- CTAA, agribusiness
- CNCC, leather

Institutional Stakeholders

- Ministry of Industry, Energy and Small Medium Enterprises: industrial strategy unit and modernization bureau
- National Agency for Environmental Protection (ANPE)
- UTICA, industrial association
- Italian Embassy in Tunisia



TUNISIA

Results of the demonstration projects in Tunisia

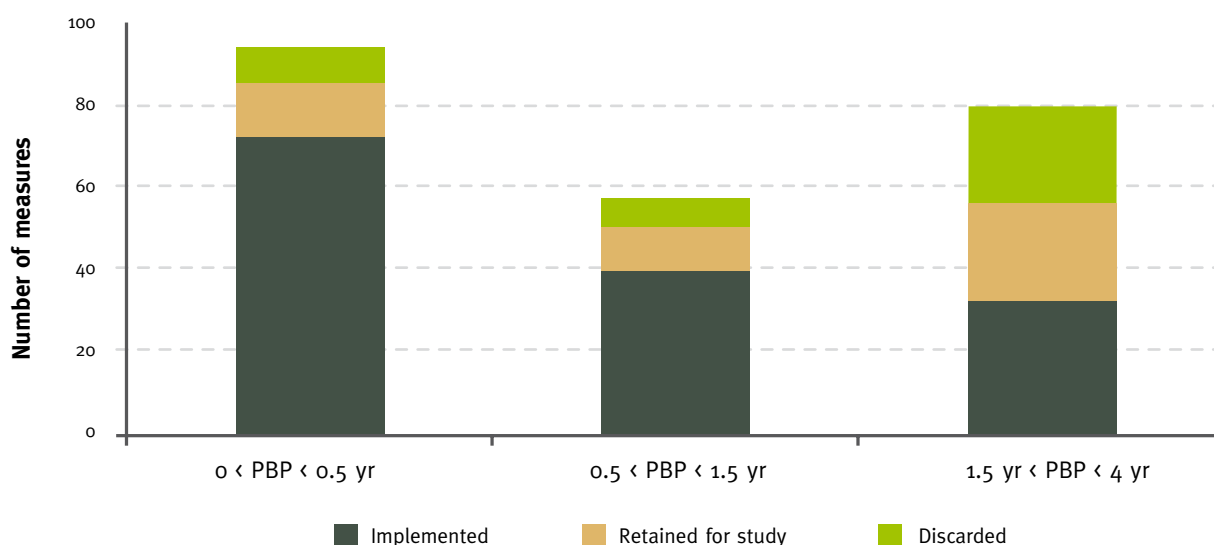
A total of 15 companies, out of a group of 50 initially contacted, decided to join MED TEST on a voluntary base providing cash co-financing. The increasing utilities and production costs, the growing governmental pressure and sanctions coupled with inefficient existing WWTP, the need to improve image and meet expectation of new clients were amongst the key driving factors that induced industry to actively participate in the UNIDO initiative.

The assessments conducted at these companies revealed a consistent gap between actual industry performance and international sector best practices, which

indicated a high potential for resource efficiency in Tunisian industry. It was demonstrated that the introduction of best practices would enable to reduce this gap, leading to the adoption of action plans and investment programmes in each company.

A total of 232 measures were identified, out of which 63% have been implemented by the companies, 20% retained for further assessments and 18% discarded.

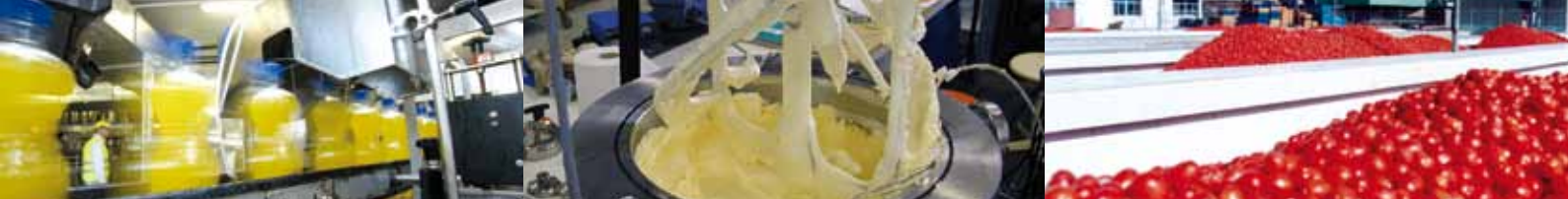
The identified measures have a PBP of less than 0.5 years in about 40% of the cases, between 0.5 and 1.5 years for 25% of them, between 1.5 and 4 years for the remaining 35%. Most of the measures have demonstrated an attractive return on investment, which accounts for the high implementation rate, as illustrated in the chart below.



Distribution of identified measures by pay-back period and implementation rate in Tunisian demonstration companies

The Tunisian context offers very favourable conditions for future TEST applications and scale up. The capacity built through the MED TEST initiative at the textile, agro-food and leather technical centres has contributed to develop the local market of environmental service providers.

The three technical centres are now a recognized national player in terms of provision of services related to resource efficiency, cleaner production and environmental management to industry, and are currently supporting CITET (Centre International des Technologies de l'Environnement de Tunis) in the implementation of other EU and UNIDO CP programmes in Tunisia.



TUNISIA

The table below provides a summary of financial figures and water/energy savings associated to the identified measures in the demonstration companies.

Company	Size (*)	Investments [USD/yr]	Savings [USD/yr]	Water Savings [%]	Energy Savings [%]
Food & Beverage Sector					
Générale Industrielle Alimentaires Slama (GIAS)	493	191,200	133,700	12	17
Société de Conserves Alimentaires du Cap Bon	50-250	98,139	73,639	44	9
Tunisie Lait	308	827,410	746,638	16	13
Société de Boissons du Cap-Bon (SBC)	119	56,331	75,454	22	21
Société Nouvelle de Boissons (SNB)	202	29,200	194,600	12	14
Centrale Latiere du Cap nord (CLC)	547	484,945	546,903	13	19
Textile Sector, Finishing					
Teinturerie et Finissage Mediterranee (TFM)	55	1,264,645	491,860	56	10
Gartex	185	76,200	67,200	19	15
Megastone	150	76,500	55,600	10	30
Traitex	60	181,800	111,836	19	39
Garment Dyeing Service	80	139,000	91,300	24	7
Star Wash	40	37,500	28,000	30	14
Leather Sector, Tanneries					
Tanneries Megisserie du Maghreb (TMM)	180	523,000	446,800	14	15
Société Moderne des Cuirs et Peaux (SMCP)	35	287,000	97,200	22	3
Tannerie du Nord Utique (TNU)	50	184,000	125,000	8	70
TOTAL		4,456,870	3,286,530		

(*) n. of employees, 2009

Estimated Environmental Benefits			
Water Savings [m³/yr]	Energy Savings [MWh/yr]	BOD ₅ Reductions [tons/yr]	COD Reductions [tons/yr]
650,00	25,083	1,610	2,762

During the course of the demonstration projects, the companies received assistance to integrate resource efficiency into existing management systems and to adopt international environmental management standards. Four companies advanced the design of their EMS according to the ISO 14001 standard.

The demonstration companies from the textile sector, with an increased awareness about environmentally friendly products that was facilitated by the MED TEST project, decided to move toward the adoption of the “Oeko-Tex Standard”: two companies obtained certification during the course of the project.





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EGYPT

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MED TEST Case Study

FOOD sector — EGYPT

Beverage industry — El-Nile Soft Drinks (Crush)

Company overview

Crush, a private Egyptian shareholding company founded in 1990, produces different types of soft drinks for the local market, Hi-Spot lemon, Crush orange and Sport cola, with a total production of 332,470 hl/year.

The company was motivated to join MED TEST to identify opportunities for increasing resource efficiency and productivity, reduce pollution loads so as to comply with environmental legislation and minimize investment/operational costs of the planned wastewater treatment plant.

At project start, Crush was already certified ISO 9001, OSHAS 18001, ISO 22000 and the Corporate EMS “Coca Cola” standard was already implemented. Within the course of MED TEST, the company initiated an EMS upgrading process according to the ISO 14001/2004 standard.

Benefits

The MED TEST project identified annual total savings of \$US 1,564,086 in water, raw materials, fuel and electricity, with an estimated investment of \$US 1,264,042. Some measures have excellent return on investment and immediate payback period. Most of the identified measures have been implemented in 2011.

Total energy costs will be reduced by 19% through implementation of several measures at the boiler house, RBG (Returnable Glass Bottle) line, lighting and the optimization of cleaning in place (CIP).

Water costs will decrease by more than 85% through the installation of a new CIP technology (ECA), good house-keeping and preventive maintenance measures and process water recycling. The new CIP unit uses Electro Chemical Activation (ECA) technology that dramatically reduces water, energy and chemicals consumptions,



“Through MED TEST, we have learned how to reduce production losses, save resources and increase productivity while complying with environmental regulations.”

Mr. I. Mahmoud MASSEKH, Chairman

besides increasing productivity due to a reduction of time for CIP.

Additional environmental benefits have been reached in terms of reductions of wastewater pollution loads, corresponding to 28% BOD₅ and 16% COD annual loads, mainly resulting from product recovery (19%).

These measures have cut down the investment and operational costs of the WWTP at design stage. MED TEST has assisted the company to fill in the required documentation for accessing EPAP II grants for funding both WWTP and ECA investment projects.

In parallel to the identification of saving opportunities, the site has updated the existing Coca Cola management system according to the ISO 14001 standard, fully integrating resource efficiency into company policy, action plans and internal procedures. This will ensure sustainability of all identified actions at company level as well as the development of new projects. New Environmental Management Accounting (EMA) protocols have also been introduced for tracking and monitoring the most important environmental costs, including those related to non product output costs.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
CIP using ECA technology	392 932	189 810	0.5	26 468 m ³ water	88
Water conservation and product recovery	253 086	51 433	0.2	122 320 m ³ water, 3 324 hl product	
Replacement of half-depth with new full depth plastic crates	193 939	750 000	4	3 324 hl product	
Good housekeeping and preventive maintenance	226 352	-	-	20 135 m ³ water, 10 306 hl product	
Boiler house	23 453	46 834	2		2 303
Optimization of RGB lines	474 324	225 965	0.5		64
TOTAL	1 564 086	1 264 042	0.8		2 455

CIP using ECA technology: Electro-Chemically Activated (ECA) water is a highly effective chemical substitute and a green alternative for cleaning and disinfection applicable to the beverage industries. This technology will enable savings of 88 MWh/year (3%) in electricity, 60% of CIP rinse water and 90% of chemicals used in the CIP. Accordingly, a reduction in TDS by about 634 tons/year (78%) has also been achieved. The new CIP reduces the duration of cleaning time to 1/3, thus increasing the site's productivity.

Water conservation and product recovery: The project identified several measures for optimizing water and product recovery: installation of water flow meters and monitoring plan; reuse of water discharged from washers I and II to save 54% of water consumption (this option has not been implemented because the company will reuse treated wastewater); installation of turbidity/refractive index transmitters to save 3,224 hl/year of product losses and reduce BOD₅ by 3% (2.4 tons/year) and COD by 1% (1.7 tons/year).

Boiler house: Insulating the large boiler, recovering heat from boiler exhaust and installing automatic blow-down system will save 21% of thermal energy consumption.

Good housekeeping and preventive maintenance: The project identified good housekeeping measures and maintenance programmes in order to eliminate excessive floor washing, close/seal running water taps; reroute forklifts pathways to avoid collision and prevent product damage and losses; avoid sending off-specs products to the drain through segregation and offsite recycling as animal feed. These measures resulted in reduction of product losses by 10,306 hl/year (3%), of raw materials losses by 8%, of BOD₅ by 12 tons/year and COD by 16 tons/year in wastewater.

Replacement of half-depth crates: The company manufactured and replaced its half-depth crates with full-depth ones to increase their lifetime and prevent glass bottles breaking due to accidents during transportation. This project resulted in increasing productivity due to reduced bottle-break incidents and pollution load (product to drain), BOD₅ by 5% (4 tons/year) and COD by 3% (5.3 tons/year).

Optimization of RGB lines: Two projects have been implemented for optimization of the RGB (Returnable Glass Bottle) line: replacing the glass walls with curtains to reduce heat stress; replacing the old forklifts with new models working with natural gas. The implementation of these two projects has reduced CO₂ emissions by 26 tons/year.



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MED TEST Case Study

FOOD sector — EGYPT

Vegetable and fruit processing — Edfina Company for Preserved Food

Company overview

Edfina is a large size food enterprise producing approximately 2,282 tons/year of frozen vegetables, juice, fruit nectar, canned food such as jam, tomato paste and legumes for the local market and for export (50%).

The company has joined the MED TEST project in order to improve its environmental performance, identify opportunities for increasing resource efficiency by solving the existing problems that mainly include: high water consumption, materials and energy losses.

At project start-up, the company was already certified ISO 9001, ISO 18001 and HACCP for food safety. The company has plans to design an EMS according to ISO 14001 in the near future.

Benefits

The MED TEST project has identified annual total savings of \$US 888,993 in water, raw materials and fuel against an estimated investment of \$US 257,518. The simple pay-back period is less than 4 months. Some of the planned measures have been implemented in 2011; the rest are scheduled for 2012.

Water costs will be reduced by 32% through good housekeeping measures, water reuse for raw materials washing and blanching, implementation of a monitoring and controlling system concerning water consumption, dry cleaning of floors in different units and improved technique for equipment washing.

Electricity costs will be reduced by 10% by retrofitting the electricity network and improving the power factor thanks to a redistribution of capacitors and measuring harmonics and the installation of soft starters for compressors. In addition, the company will implement heat recovery at the blancher and switch fuel to natural gas in order to reduce thermal energy consumption.



“Through the MED TEST training programme, the company has increased its staff awareness and diffused the cleaner production concept among the workers.”

Eng. Mohamed EMAD EL DEEN, Vice Chairman

The annual wastewater pollution loads will be reduced by 50% in BOD, 25% in COD and 15% in TSS through good housekeeping and mainly by upgrading the packaging unit, which will reduce product losses entering the drain system.

In parallel to the identification of saving opportunities, the site has plans to design an EMS system according to ISO 14001, fully integrating resource efficiency into company policy, action plans and internal procedures. This will ensure the sustainability of all identified actions at company level as well as the development of new projects.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Water conservation	19 542	12 267	0.6	93 798 m ³ water	
Electrical system, compressors	25 780	41 834	1.6		619
Process integration at blancher/cooler	1 413	3 417	2.4	4 680 m ³ water	31
Packaging	838 500	200 000	0.2	1 170 tons product	
Good housekeeping	3 758	-	-	18 038 m ³ water	
TOTAL	888 993	257 518	0.3		650

Water conservation: The following measures were identified: dry cleaning of floors, which could save 5% of water consumption; water reuse in raw materials washing; installation of water meters on the source of the feeder and set up of an effective monitoring plan; improvement of floors and equipments washing technique. The implementation of such measures will result in a reduction in water consumption (by 26%) and in BOD, COD and oil and grease pollution loads, by 32 tons/year (19%), 51 tons/year (15%) and 0.75 tons/year (7.5%), respectively.

Electrical system, compressors: A reduction in electricity consumption will be achieved by retrofitting and redistributing the electricity network to monitor and analyze specific energy consumption in different production lines; redistributing the existing capacitors to achieve a standard power factor in the 0.92-0.95 range. A standard power factor will reduce the electricity consumption by 4%, extend the equipment's lifetime, reduce risks for power drops in case of additional load and eventually prevent Edfina from getting a penalty from the Electricity Distribution Company. Installing soft starters and inverters at compressors will save 6% of their electrical consumption.

Process integration at blancher/cooler: the water discharged by the cooler is currently sent to drain, but could be reused to wash and preheat vegetables, saving water and reducing heat

demand at the blancher. Switching from direct to indirect steam injection at the blancher will enable the company to reuse steam condensate in raw materials washing and preheating. The implementation of this measure could save 1.3% of the water consumption and 31 MWh/year.

Packaging: Installing new automatic packaging machines for juice and legumes canning could save 20% of product losses and increase site productivity. The implementation of this investment project will reduce the discharge load of BOD by 42 tons/year (25%), of COD by 17 tons/year (5%) and of TSS by 32 tons/year (15%).

Good housekeeping: The project has identified several housekeeping measures: establishing regular maintenance programmes, eliminating all sources of spillage and leakages, closing/sealing running water taps, avoiding wastewater channels blockage by using screens to prevent solids from entering the drain system. They will result in a reduction of water consumption by 5%, of BOD, COD and oil and grease pollution loads by 10 tons/year (6%), 17 tons/year (5%) and 0.25 tons/year (2.5%), respectively.



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MED TEST Case Study

CHEMICAL sector — EGYPT

Detergent manufacturing — Extracted Oils and Derivatives Company

Company overview

Extracted Oils and Derivatives is a large-size publicly owned enterprise that produces approximately 4,460 tons/year of high and low foam detergents and a range of products such as edible oils, sodium silicate, animal feed and glycerine for the local market and for export (14%).

The company has joined the MED TEST project to improve its environmental performance, identify opportunities for increasing resource efficiency by solving the existing problems: high water and electricity consumption, materials and energy losses. The project is focused on the detergent plant.

At project start-up, the company was already certified ISO 9001, ISO 14001 and ISO 18001. MED TEST has enabled it to integrate cleaner production and resource efficiency into the existing ISO 14001 management system.

Benefits

MED TEST has identified annual total savings of \$US 127,803 in water, raw materials and fuel with an estimated investment of \$US 429,627 at the detergent plant. Some options have an excellent return on investment and an immediate payback period. The identified measures have been partially implemented by the company in 2011; the rest is planned for 2012.

Water costs will be reduced by 18% in the detergent plant by applying good housekeeping measures and implementing a monitoring and controlling system for water consumption.

Total electricity costs will be reduced by 23% through the implementation of an effective monitoring plan for electricity consumption, the improvement of the power factor by redistributing the capacitors and measuring harmonics, the installation of soft starters at air



“The implementation of no/low cost options identified by MED TEST helped the company to achieve reductions in water, energy and raw materials consumption.”

Mr. Ezz El Deen Abd Allah BADAWEY, Chairman

compressors and of variable speed drivers at agitators. In addition, the company has launched a new project for fuel switching to natural gas, which will reduce CO₂ emissions by 3,150 tons/year.

Environmental benefits will be achieved by reducing indoor air emissions through the installation of a powder dust collector for final product recovery, which will also improve working environment. Moreover, wastewater pollution loads will be reduced: the company plans to upgrade its common wastewater treatment plant and recycle wastewater for second-grade applications.

In parallel to the identification of saving opportunities, the company has updated the policy, actions plans and internal procedures related to the integration of cleaner production and resource efficiency into the existing ISO 14001 management system. This will ensure the sustainability of all identified actions at company level as well as the development of new cleaner production projects.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Electrical system, compressors and agitators	9 707	10 500	1		203
Powder dust collector, product recovery	76 667	283 794	3.7	230 tons product	
Good housekeeping, preventive maintenance and water conservation	9 429	2 000	0.2	316 tons materials, 5,500 m ³ water	
Wastewater recycling	32 000	133 333	4	80,000 m ³ water	
TOTAL	127 803	429 627	3.4		203

Electrical system, compressors and agitators: The project has identified several measures to reduce electricity consumption: installing an electricity meter for an effective monitoring plan; measuring harmonics to check for distortions in the electric feeder and protect capacitors from damage; installing a power factor correction panel. The power factor will reduce electricity consumption, extend the equipment's lifetime, reduce risks for power drops and eventually prevent the company from getting a penalty from the Electricity Distribution Company. The installation of variable speed drivers for the agitators and of 4 inverters (soft starters) for the dryers' air compressors will reduce their inrush current as well as the total electricity consumption (by 7%).

Powder dust collector and product recovery: This option will enable to recover product losses (powder dust) from the main production lines and convey them to the packaging station. The new collector (capacity: 55,000 m³/hr; efficiency: 99.9%) will be installed after the existing cyclone that currently works with low efficiency and product losses of approximately 4.5%. The implementation of this option will reduce product losses by 230 tons/year and dust emissions to the work and ambient environment by more than 85%.

Good housekeeping, preventive maintenance and water conservation: The project has identified several good housekeeping measures to save materials, improve work environment and reduce pollution loads: they consist of implementing regular maintenance programmes for pipes, equipments and compressors, eliminating excessive floor washing and all sources of leakages, closing/sealing running water taps, avoiding blockages of the wastewater channels thanks to screens that prevent dust impurities and solids from entering the drain. The site has reduced its water consumption by using pressurized water in the utilities department and installing water meters with an effective monitoring plan. The implementation of all these measures will reduce raw materials losses by 2%, water consumption by 18% and the hydraulic load to the WWTP by 8% of COD (2.7 tons/year) and 6% of TSS (1.458 tons/year).

Wastewater recycling: The site wastewater treatment plant will be upgraded by increasing the capacity and performance of the current physical-chemical process. The treated wastewater will be suitable for reuse (production processes, washing, cleaning of equipments). The implementation of this high investment project would save 70% of the overall water consumption.



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MED TEST Case Study

CHEMICAL sector — EGYPT

Chemical Industry — Misr Chemical Industries Company (MCI)

Company overview

MCI is a chemical enterprise affiliated to the Chemical Holding Company. It produces sodium hydroxide solution and flakes, chlorine gas, sodium hypochlorite, calcium hypochlorite and hydrochloric acid for the local market and for export (10%).

The company joined the MED TEST project to identify opportunities for increasing resource efficiency through solving the existing problems which mainly include: high water consumption, materials and energy losses in compliance with law limits for the discharged effluents.

At project start-up, the company was already certified ISO 9001 and ISO 14001 and had plans to establish a management system for safety and health according to the OSHAS 18001 standard.

Benefits

The MED TEST project has identified annual total savings of \$US 416,057 in water, raw materials, fuel and electricity with an estimated investment of \$US 49,033. Some options have excellent return on investment and immediate payback period. The identified measures have partially been implemented in 2011; the rest are scheduled for 2012.

Water costs will be reduced by 26% thanks to good housekeeping measures, segregation and recycling of compressors cooling water, implementation of a monitoring and controlling system for water consumption, control of washing water and overhaul of the cooling towers.

Thermal energy costs savings of 10% will be achieved by insulating the steam conveying system of the boiler inlet to reduce heat losses. Electrical energy costs will decrease by 6% through the redistribution of the capacitors in the capacitors bank to improve the power factor.



“The Med Test project is a very good opportunity to apply the concept of cleaner production and to rationalize resource consumption and environmental conservation.”

Eng. Ragab EL SAID ALI, Chairman

Environmental benefits will be reached by reducing the capacity of the WWTP and wastewater pollution loads (3% TSS and 1% TDS). The identified measures would reduce the investment and operational costs of the WWTP at design stage. MED TEST has assisted the company to fill in the required documentation for accessing EPAP II grants and funding scheme for the implementation of the WWTP, which will have a capacity of 1,500 m³/day, achieving 99% reduction in TSS pollution load as well as environmental compliance.

In parallel to the identification of saving opportunities, the company has updated the policy, actions plans and internal procedures related to integration of cleaner production and resource efficiency into the existing ISO 14001 management system. This will ensure the sustainability of all identified actions at company level as well as the development of new cleaner production projects.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Good housekeeping	46 128	-	-	112 500 m ³	
Power factor	288 750	1 000	< 0.1		6 930
Water conservation	39 111	3 700	< 0.1	117 332 m ³	
Insulation of the boiler	18 000	3 500	0.2		2 469
Cooling tower	24 068	40 833	1.7	72 204 m ³	
TOTAL	416 057	49 033	0.1	302 036	9 399

Good housekeeping: The project has identified several good housekeeping measures to improve work environment and reduce pollution loads, which include: implementing regular maintenance programmes, applying a brine recirculation process, eliminating excessive floor washing and all sources of spillage and water leakages, closing/sealing running water taps, avoiding blockages of the wastewater channels by using screens to prevent brine impurities and solids from entering them. These measures will save 9% of the water consumption and reduce the WWTP capacity, resulting in a decrease of TSS (4.3 tons/year, 3%) and TDS (5.7 tons/year, 1%).

Power factor: The power factor sometimes reaches 0.84 (which is below the standard) due to the inefficient distribution of the capacitor banks. The redistribution of the existing capacitors requires a small capital investment to achieve standard power factor in the range 0.92-0.95. This option would reduce the electricity consumption by 6%, extend the equipment's lifetime, limit risks for power drops in case of additional load in the future and eventually prevent the company from getting penalty from the Electricity Distribution Company.

Water conservation: Several measures have been identified to reduce water consumption: segregation and recycling of compressors cooling water; installation of water meters,

combined with an effective monitoring plan; control of washing water by using high pressure water. The implementation of these options will decrease water consumption by 11% as well as the hydraulic load to the WWTP.

Insulation of the boiler: The process requires high thermal energy inputs, which could be reduced by properly insulating the steam distribution system (mainly steam pipes) to prevent heat losses. This measure would save 10% of thermal energy consumption.

Cooling tower: The project has identified several actions for overhauling and tuning the cooling tower (which has not been maintained since its installation 16 years ago), resulting in increased performance and cooling capacity: fixing the fans (by adjusting blades' angle, changing belts, maintaining or replacing motors) and overhauling the hot water distribution system. The increased efficiency of the tower will allow recycling the compressors' cooling water back to the tower, which concerns 6% of the total water consumption. This option will also reduce the capacity of the WWTP under design.



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MED TEST Case Study

PULP and PAPER sector — EGYPT

Paper industry — National Paper Company (NPC)

Company overview

NPC is a large-size privatized paper enterprise owned by EMAK Paper Company (El-Kharafi Group) and producing approximately 72,000 tons/year of cardboard, Kraft linear, printing and fluting paper for the local market and for export (5%).

NPC joined the MED TEST project to identify opportunities for increasing resource efficiency through solving the existing problems, which mainly include: high water consumption, cellulosic fibre and energy losses, in compliance with law limits for the discharged effluents.

The company received MED TEST's technical assistance to design and implement an integrated management system for quality, environment and safety according to ISO 9001, ISO 14001, OSHAS 18001 standards.

Benefits

The MED TEST project has identified annual total savings of \$US 1,731,170 in water, raw materials, fuel and electricity with an estimated investment of \$US 1,228,167. Some options have excellent return on investment and immediate payback period. The identified measures have partially been implemented by the company in 2011; the rest are scheduled for 2012.

Water costs would decrease by 52% by adopting good housekeeping measures, implementing a monitoring and control system for water consumption, installing an empty cement sacks shredder, recycling of process water, and closing compressor and refiner cooling water circuits. Recirculation of some water streams limits fibre losses and eventually increases productivity.

The upgrade of the steam distribution system would reduce thermal energy costs by more than 11%. Electricity costs will decrease by 20%, mainly by improving the power factor of the turbines.



“MED TEST provided a good framework for the company to apply cleaner production, save resources and increase productivity while achieving compliance with the environmental legislation.”

Eng. Ibrahim SALEH, Chairman

Environmental benefits would be reached by reducing the annual wastewater pollution loads (corresponding to 6% BOD, 2% COD and 28% TSS), through good housekeeping measures, the upgrade of the automatic dosing system for the water treatment unit, and the installation of an empty cement sacks shredder with a dust removal filter. The identified measures would reduce the investment and operational costs of the WWTP at the design stage, which has a design capacity of 20,000 m³/day.

In parallel to the identification of saving opportunities, the company has received technical assistance through MED TEST to design and establish ISO 9001, an EMS according to ISO 14001 and safety system in line with OSHAS 18001 standards, and fully integrating resource efficiency into company policy, action plans and internal procedures. This will ensure sustainability of all identified actions at company level as well as the development of new cleaner production projects. The company plans to achieve the ISO 14001 certification in 2012.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Water conservation	183 427	42 833	0.2	3 057 120 m ³ water	
Steam system	705 504	475 000	0.7	90 288 m ³ water	41 367
Preventive maintenance and good housekeeping	318 863	no cost	immediate	902 880 m ³ water 982 tons fibre 213 tons materials	
Empty Cement Sacks Shredder	157 810	700 000	4.4	660 000 m ³ water 293 tons chemicals 1 100 tons product	
Chemical dosing system at process water treatment unit	13 333	8 334	0.6	355 tons chemicals	
Power factor of the turbines	352 233	2 000	< 0.1		8 453
TOTAL	1 731 170	1 228 167	0.7		49 820

Water conservation: Several identified measures have reduced the overall water consumption by 29%: installation of water meters with an effective monitoring plan; recycling of process water, and closing compressor and refiner cooling water circuits in paper making plant.

Steam system: The measures introduced to reduce steam consumption include: installation of a centralized tank to collect condensate from the paper machines; replacement of the existing old control valve on paper machines with a steam trap; pipes and turbines insulation; replacement of nine differential pressure control valves in paper machine by an equivalent system to recycle steam for other sections' heating; installation of steam flow meters with an effective monitoring of energy consumption. These measures would reduce energy and steam consumption by 11% and 8% respectively, as well as the hydraulic load to the WWTP.

Preventive maintenance and good housekeeping: Implementing regular maintenance programmes, eliminating excessive floor washing and all sources of spillage and water leakages, closing/sealing running water taps, using screens to prevent solids from entering the wastewater channels and blocking them: such options would save 10% of water

consumption, reduce fiber losses by 10%, raw and auxiliary materials by 8%, BOD by 160 tons/year and COD by 82 tons/year.

Empty cement sacks shredder: The installation of an empty cement sacks shredder with a dry system and an aerodynamic separator and dust removal filter will enable collection of cement dust. The latter currently causes severe problems during washing process as it turns into paste with water and rapidly solidifies, resulting in clogged pipes and productivity losses. This option will reduce water consumption by 7% and chemicals used to break the solidified cement by 293 tons/year; thus increasing site productivity. The TSS pollution load will decrease by 28% (2,524 tons/year).

Chemical dosing system at process water treatment unit: Replacing the manual dosing system of chemicals with an automatic one at the process water treatment unit would save 5% of chemicals used and lead to reductions in BOD by 3% (160 tons/year) and in COD by 1% (82 tons/year).

Power factor of the turbines: 20% reduction in electricity consumption could be achieved by increasing the load capacity of the electricity generated at the site, thus decreasing the amount of purchased electricity from the grid.



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MED TEST Case Study

PETROLEUM sector — EGYPT

Lube oil blending plant — Misr Petroleum Company

Company overview

Misr Petroleum is a major lubricant manufacturing and distributor company in Egypt, owned by the Egyptian General Authority for Petroleum and producing approximately 63,728 tons/year of a wide range of lubricants such as automotive and industrial greases for the local market and for international companies like BP and Castrol (20%).

The company joined the MED TEST project in order to improve its environmental performance and identify opportunities to increase resource efficiency by solving existing problems, mainly high water consumption and materials and energy losses.

At project start-up, the company was already certified ISO 9001 and the EMS Petroleum standard was in place. Within the course of the project, it initiated a process for upgrading its EMS according to the ISO 14001/2004 standard.

Benefits

The MED TEST project has identified annual total savings of \$US 457,371 in electricity, fuel, water, raw materials and products with an estimated investment of \$US 100,934. Some options have excellent return on investment and immediate payback period. The identified measures have partially been implemented in 2011; the rest are scheduled for 2012.

Water costs will be reduced by 20% through implementing good housekeeping measures, a regular maintenance programme and a monitoring and controlling system for water consumption.

Electricity costs will decrease by 50% mainly by installing soft starters and variable speed drivers at the pumps, agitators and compressors. Thermal energy costs will be



“It was a pleasure to cooperate with the distinguished MED TEST team. We have established together a system on how to convert environmental losses into a real gain at our plant.”

Chemist Magdy Ahmed YAKOUT, General Manager

reduced by 4% through the insulation of steam lines, improvement of the boiler's efficiency and maintenance of the steam system.

Environmental benefits will be achieved mainly by reducing leakages of raw materials and products and consequently of wastewater pollution loads. The company plans to upgrade the existing WWTP and recycle 27% of treated wastewater for second-grade applications.

In parallel to the identification of saving opportunities, the site has updated its existing management system according to the ISO 14001 standard, fully integrating resource efficiency into company policy, action plans and internal procedures. This will ensure the sustainability of all identified actions at company level as well as the development of new projects.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Good housekeeping, preventive maintenance	46 663	100	< 0.1	8,323 m ³ water, 186 tons product	
Variable speed drivers, electrical system	66 042	46 000	0.7		1 585
Raw materials unloading system	333 333	41 667	0.1	458 tons materials	
Steam system and boiler	11 333	13 167	1.2		1 397
TOTAL	457 371	100 934	0.2		2 982

Good housekeeping, preventive maintenance: The project has identified the following measures: regular maintenance programmes for pipes, equipments and compressors; operational control practices in the receiving, blending and filling sections to reduce materials and product losses; elimination of excessive floor washing and of all sources of spillage and leakages; and closing/sealing of running water taps. The site has reduced 11% of its total product losses, corresponding to 186 tons/year (77.5%) of losses in the filling section, by applying operation control best practices. The implementation of these measures will reduce water consumption by 15% and decrease the hydraulic load to the WWTP.

Variable speed drivers, electrical system: A reduction in electricity consumption will be achieved by installing soft starters and variable speed drivers for agitators at the oil blending unit, pumps and compressors, which will reduce their inrush current and achieve 50% savings (1,585 MWh/year) in total electricity consumption; measuring harmonics to check for distortions in the electrical feeder will protect the capacitors from damage.

Raw materials unloading system: The existing raw materials unloading system generates oil leakages upstream in the manufacturing process. These material losses are re-processed into low-grade final products that are sold at a lower price. Consequently, they represent an important economic loss for the company, due to energy and labor costs for reprocessing and due to reduced revenues from sales of mediocre products as opposed to first-grade ones. The implementation of a new automatic control system for raw materials unloading will detect leakages and, if any, will block the process. The implementation of this option would save 0.7% (458 tons/year) of raw materials losses that undergo downgrading to low quality products.

Steam system and boiler: Thermal energy inputs could be reduced through the proper insulation of the boiler's steam lines to prevent heat losses; the improvement of the boiler's efficiency by adjusting the air to fuel ratio and implementing an effective maintenance programme; and the installation of water meters on the source of the boiler's feeder with an effective monitoring plan. The implementation of these measures would save 4% of the site's thermal energy consumption (1,397 MWh/year).



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MED TEST Case Study

PULP and PAPER sector — EGYPT

Paper industry — Moharrem Press Company

Company overview

Moharrem Press is a medium-size paper enterprise with core business in production of corrugated board. It produces about 10,887 tons/year of corrugated carton, 18,338,136 sheets/year of printed white paper and carton and 450,000 packages/year of playing cards for the local market.

The company has joined the MED TEST project to identify opportunities to increase resource efficiency by solving the existing problems, which mainly include high water consumption and materials and energy losses.

At project start-up, the company was already certified ISO 9001, ISO 14001 and ISO 18001. Through MED TEST, the company has integrated cleaner production and resource efficiency into the existing ISO 14001 management system.

Benefits

The MED TEST project has identified annual total savings of \$US 304,786 in water, raw materials, fuel and electricity against an estimated investment of \$US 279,217. Some options have excellent return on investment and immediate payback period. The identified measures have partially been implemented in 2011; the rest are scheduled for 2012.

Water costs will be reduced by 33% by applying good housekeeping measures, implementing a monitor and control system for water consumption, reusing washing water in the starch section and using high pressure water in the washing processes.

Insulating the steam system, recovering steam condensate, installing a semi-automatic blow-down system at the boiler as well as soft starters and inverters, improving



“The MED TEST project is a symbol of technical cooperation and a model for realizing environmental sustainability.”

Eng. Mohamed Nagieb SALAH, Chairman

the lighting system and the power factor will reduce total energy costs by approximately 15% and CO₂ emissions by 370 tons/year.

Additional environmental benefits will be achieved through good housekeeping and water conservation measures as well as the replacement of the existing glue machine, resulting in a reduction of annual wastewater pollution loads by about 20% BOD₅ and 12% COD.

In parallel to the identification of saving opportunities, the company has updated their policy, actions plans and internal procedures by integrating cleaner production and resource efficiency into the existing ISO 14001 management system; this will ensure the sustainability of all identified actions at company level as well as the development of new cleaner production projects.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Good housekeeping	64 704	-	-	1 932 m ³ water, 787 tons materials	
Water conservation	7 343	5 134	0.7	7 270 m ³ water, 9.5 tons fibres	
Steam system	168 293	17 083	0.1	6 733 m ³ water	1 294
Electrical system	14 446	7 000	0.5		346
New glue machine	50 000	250 000	5	966 m ³ water, 2.4 tons glue 1 678 tons product	
TOTAL	304 786	279 217	0.9		1 640

Good housekeeping: Regular maintenance programmes, safe disposal/recycling of hazardous waste like lubricating oils, elimination of excessive floor washing and all sources of spillage and water leakages, closing/sealing running water taps, installation of screens to prevent solids from entering the wastewater channels and blocking them, water recycling in paper section: such measures will save 4% water consumption and 5% raw and auxiliary materials, and reduce BOD₅ by 5% and COD by 3%.

Water conservation: Several measures will reduce the overall water consumption by 15%, including: installing water meters with an effective monitoring plan, closing the cooling water circuit in the corrugated board section, using high pressure water in washing, reusing the starch tank washing water. The latter will save 9.5 tons/year of starch, reducing BOD and COD respectively by 338 and 308 kg/year.

Steam system: Thermal energy inputs could be reduced by properly insulating the boiler's steam lines to prevent heat losses; installing new steam condensate and blow-down tanks to replace the deteriorated ones; applying semi-automatic blow-down system. These options would save 16% of thermal energy consumption.

Electrical system: A reduction of 11% in electricity consumption could be achieved by: installing soft starters and inverters at pumps, compressors and printing machines; converting the existing manually controlled lightening system into an electronic system; measuring harmonics to check for distortions in the electrical feeder and protecting the capacitors from damage; redistributing the existing capacitors to achieve a standard power factor in the range 0.92-0.95. The power factor will extend the equipment's lifetime, reduce risks for power drops in case of additional load and prevent the company from getting penalty from the Electricity Distribution Company.

New glue machine: Replacing the existing old glue machine with a new one will improve the quality of the product, save 2% water and 30% glue consumption, reduce out-of-specification products by 13%, ultimately decreasing production costs and increasing productivity. The implementation of this high investment project will reduce pollution loads by more than 5% for BOD and 3% for COD.



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MED TEST Case Study

PULP and PAPER sector — EGYPT

Paper industry — General Company for Paper Industry (RAKTA)

Company overview

RAKTA is a publicly owned large size company. The company produces approx. 27,000 tons/year of writing and printing paper, cardboard, fluting and test liner mainly for the local market and for export (5%).

The company was motivated to join the MED TEST project to identify opportunities for increasing resource efficiency and solving the existing problems such as: high water consumption, cellulosic fibre and energy losses and in compliance with law limits for the discharged effluents.

At project's start the company was already certified ISO 9001 and has received technical assistance through the MED TEST project to design and establish EMS according to ISO14001.

Benefits

The MED TEST project identified annual total savings of \$US 1,518,466 in water, raw and auxiliary materials and fuel with an estimated investment \$US of 2,443,446. Some measures have excellent return on investment and immediate payback period. Some of the identified measures were implemented by the company in 2011 and the remaining measures are planned to be implemented in 2012.

Water costs would be reduced by 15% through applying good housekeeping measures and implementation of monitoring and controlling system for water consumption.

Thermal energy costs will be reduced by more than 10% by implementing a monitoring system for steam consumption and boiler efficiency, recycling of steam condensate and isolating the steam lines in boilers and paper section. These measures have been integrated into a larger investment project "Rehabilitation of steam, condensate and ventilation system".



"Med TEST Project supported the company to implement cleaner production technology including conservation of raw materials, energy and water."

Eng. Mahmoud EL BATOUTY, Chairman

Additional environmental benefits would be reached in terms of reducing wastewater pollution loads corresponding respectively to 6% BOD₅ and 2% COD annual loads. The identified measures will reduce the investment and operational costs of the WWTP at design stage, which will have a capacity of 26,000 m³/ day.

In parallel to the identification of saving opportunities, the site has received technical assistance to design and establish EMS according to ISO14001, fully integrating resource efficiency into company policy, action plans and internal procedures. This will ensure sustainability of all the identified actions at company level as well as the development of new projects. New environmental management accounting (EMA) protocols have also been introduced into the existing internal accounting system for tracking and monitoring the most important environmental costs including those related to non product output costs.

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Saving opportunities

Measure	Economic key figures		Resource savings per year		
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Good housekeeping	203 628	-	Immediately	1 075 200 m ³ water 585 tons fibres, 450 tons materials	
Process monitoring	124 257	37 333	0.3	537 600 m ³ water	6 809
Rehabilitation of steam system	250 000	400 280	1.6	150 000 m ³ water	15 200
Installation of a system for fibre recovery	815 581	2 000 000	2.5	5 847 tons fibres	
Activating the monitoring system for controlling boiler efficiency	125 000	5 833	< 0.1		180
TOTAL	1 518 466	2 443 446	1.6		22 189

Good housekeeping: The project identified several good housekeeping measures: regular maintenance programmes, eliminating excessive floor washing and all sources of spillage and water leakage holes, closing/ sealing running water taps, taking measures to avoid blockages of the wastewater channels by using screens to prevent solids from entering wastewater channels. The implementation of good housekeeping measures would save 10% of water consumption, reduce fibre losses by 10%, and raw and auxiliary materials by 8%. These measures resulted in reduction of 39.6 tons/ year (3%) BOD and 72.2 tons/ year (1%) COD.

Process monitoring: The installation of metering devices for water and steam flows will allow good monitoring and control of process consumptions. The implementation of these options could save 5% of water consumption, 3% energy consumption and accordingly reduce the capacity of the WWTP by 10%.

Rehabilitation of steam system: Important energy savings can be achieved by increasing the percentage of recycled steam condensate which is currently 20% only. The company applied a steam survey system to detect the steam leakage sources and start the insulation of steam lines in boilers and paper machines.

The implementation of this initiative will save total thermal energy consumption by 7%, increase the percentage of recycled steam condensate up to 90%, corresponding to 150,000 m³/ year of water. This project has been integrated into a large size investment plan of the company for improving and optimizing the steam, condensate and ventilation system in the paper making section.

Installation of a system for fibre recovery: This project will replace the old existing DAF (Dissolved Air Floatation) units with a new one for separating and recycling fibre, which in turn leads to increasing productivity of the site. The implementation of this option would save 16.5% (5,847 tons/year) of fibre losses, 16% of auxiliary chemicals and reduce the pollution load of the discharged effluent.

Activating the monitoring system for controlling boiler efficiency: The site implemented an effective monitoring system for adjusting the burning process of the boiler by: regulating air to fuel ratio; and controlling excess air emissions of the combustion process and exhaust temperature. The implementation of this option resulted in reduction of 180 MWh/year.



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MED TEST Case Study

FOOD sector — EGYPT

Egyptian Company for Starch, Yeast and Detergents

Company overview

Starch, Yeast and Detergents is a medium-size food enterprise owned by the Egyptian Holding Company for Food Industries and producing 10,079 tons/year of fresh and dry yeast for the local market.

The company joined the MED TEST project in order to identify opportunities to increase resource efficiency by solving the existing problems which mainly include: high water consumption, materials and energy losses and in compliance with law limits for discharged effluents.

At project start-up, the company was already certified ISO 9001. It has a short term plan to design an EMS according to the ISO 14001 standard.

Benefits

The MED TEST project has identified annual total savings of \$US 1,726,986 in water, raw materials, fuel and electricity with an estimated investment of \$US 136,474. The simple payback period is less than 2 months. Some of the identified measures have been implemented in 2011; the rest are scheduled for 2012.

Water costs will be reduced by 40% through good house-keeping and water conservation measures, implementation of a monitoring and controlling system for water consumption and improvement of the cooling towers efficiency.

Thermal energy costs will be reduced by 72% by installing a steam trap in the dry yeast plant, reducing steam consumption in CIP and optimizing boiler blowdown. Electricity costs will decrease by 22%, mainly by improving the power factor and installing inverters and soft starters at motors.



“The MED TEST project has supported us in reducing raw materials, water and energy losses through training and technical assistance and in complying with the environmental legislation.”

Chem. Mahmoud EL MIRASY, Chairman

Environmental benefits will be reached thanks to several measures aiming at recovering product and limiting product losses entering the drain system, thus reducing the annual wastewater pollution loads in the existing WWTP, respectively by 12% COD and 16% BOD₅. The company marketing strategy aims at improving product packaging through the installation of a new packaging machine, which in the future will further reduce product losses.

In parallel to the identification of saving opportunities, the site has plans to design an EMS according to the ISO 14001 standard, fully integrating resource efficiency into company policy, action plans and internal procedures. This will ensure the sustainability of all identified actions at company level as well as the development of new projects.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Water conservation and CIP of fermentation tanks	483 001	38 974	< 0.1	271 618 m ³ water, 201 tons materials	6 117
Electrical system and efficient motors	154 003	37 500	0.2		3 502
Product recovery	990 289	46 000	< 0.1	930 tons product, 198 tons materials	
Steam system	53 713	13 500	0.3	5 840 m ³ water	3 080
Preventive maintenance	45 980	500	< 0.1	130 790 m ³ water, 40 tons materials	
TOTAL	1 726 986	136 474	< 0.1		12 699

Water conservation and CIP of fermentation tanks: The existing manually operated CIP of the six large fermenters consumes a large amount of water and energy. An effective solution consists of installing rotating spray balls inside the fermentation tanks as well as turbidity/refractive index transmitters to detect product concentration in pipes before starting CIP cycle. Other water conservation measures include the use of high pressure water in washing and the installation of water meters with an effective monitoring plan. The total water consumption will decrease by 27%, energy for CIP by 48%, product losses by 2%, pollution loads by 3% for BOD₅ (20.3 tons/year) and 1% for COD (35.4 tons/year).

Electrical system and efficient motors: Adjusting the power factor will decrease the electricity consumption by 20%, extend the equipment's lifetime and reduce risks for power drops in case of additional load in the future. Installing soft starters at the blowers and inverters at the motors in the fresh and dry yeast formulation units will allow for 2% saving of total electricity consumption. Measuring harmonics will enable to check for distortions in the electrical feeder and to protect the capacitors from damage.

Product recovery: About 9% of yeast losses can be recovered by installing a rubber belt conveyor underneath the filter press,

replacing the existing manual collection and handling of yeast paste, which leads to appreciable product losses; the installation of mechanical seal pumps in molasses and yeast plants will also save 1% of molasses losses. BOD₅ and COD pollution loads will decrease by 10% respectively by 68 tons/year and 354 tons/year.

Steam system: Several measures were introduced to reduce thermal energy and steam consumption: recovery and reuse of steam condensate; optimization of the boiler blowdown system; and installation of a steam trap in the dry yeast plant. These measures would achieve a reduction of thermal energy consumption by 24%.

Preventive maintenance: Establishing regular maintenance programmes, eliminating excessive floor washing and all sources of spillage/water leakages, and avoiding blockage of the wastewater channels are effective measures to increase site performance. The cooling towers efficiency could be increased by periodically adjusting the fan blades angle and the cooling loads, in order to cope with the high cooling demand from the fermentation process and compressors. The implementation of these measures will reduce consumption of water by 13% and of raw and auxiliary materials by 1%, BOD₅ by 3% (20.3 tons/year) and COD by 1% (35.4 tons/year).



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MED TEST Case Study

LEATHER sector — EGYPT

Tannery industry — Atef El-Sayed Tannery

Company overview

Atef El-Sayed Tannery is a medium size private tannery recently established in Alexandria. The tannery produces approx. 231 tons/year of wet blue and crust leather for the local market (10%) and for export.

The tannery joined the MED TEST project to identify opportunities for increasing resource efficiency and productivity and reduce pollution loads to minimize investment/operational costs of the planned wastewater treatment plant.

At project's start there was no formalized management system in place. During the implementation of MED TEST project, the company established a management system for quality according to ISO 9001.

Benefits

The MED TEST project identified annual total savings of \$US 97,377 in water, raw materials, fuel and electricity with an estimated investment of \$US 416,850.

Water costs would be reduced by 30% through applying good housekeeping measures, implementation of monitoring and controlling system for water consumption and recycling of pickling bath.

Total electricity costs will be reduced by 62% through improving the power factor, installing soft starters and inverters at machines and improving the lighting system.



“The MED TEST project helped the tannery to understand the Cleaner Production concept and how to apply its tools in the production processes.”

Mr. Atef El Sayed, Chairman

The identified measures will entail environmental benefits in terms of reducing wastewater pollution loads by about 5% BOD₅ and 7% COD annual loads.

In parallel to the identification of saving opportunities, the site designed and established a management system for quality according to ISO 9001. The company was trained in EMS according to ISO 14001 during the MED TEST in order to be able to integrate CP into the internal quality procedures. This will ensure sustainability of all the identified actions at company level as well as the development of new projects.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Good housekeeping	1 119	767	0.7	149 m ³ water, 25 tons materials	
Electrical system, motors and lighting	3 583	5 083	1.4		30
New production machines	88 750	402 667	4.5	5.8 ton product	
Recycling of pickle bath	3 925	8 333	2.1	220 m ³ water, 23 tons chemicals	
TOTAL	97 377	416 850	4.3		30

Good housekeeping: The project identified good housekeeping measures, including: regular maintenance programmes, regular cleaning and washing of equipments to control odor generation, better collection of splits from fleshing to reduce waste accumulation and unnecessary washing; using screens to prevent solids from entering wastewater channels; and activating the grounding system to all machines in the tannery to maintain health and safety for employees. The implementation of good housekeeping measures would save 10% of water consumption and reduce the amount of wastewater discharged to sewage. These measures resulted in reduction of 646 kg/year (5%) BOD and 1,306 kg/year (7%) COD.

New production machines: The company has put in place an investment plan to replace the existing old deteriorated machines with new ones to increase productivity and quality of products as well as environmental performance. New machines are foreseen for toggling, measuring, ironing, spraying, sammying and overhead conveyor for drying the skins that will minimize out of specification products by 5.8 tons/year, reduce time of different tanning processes and ultimately improve labour safety.

Electrical system, motors and lighting: Actions identified to reduce electricity use include: installing power factor correction panel to achieve a standard value in the range of 0.92-0.95; measuring harmonics for checking distortion in the electrical feeder and protecting the capacitors from damage; installing soft starters and inverters on motors (drums) to reduce their electricity consumption; improving the lighting system by replacing the current incandescent lamps with energy saving lamps. The implementation of these options will save 62% of total electricity consumption corresponding to 30 MWh/year.

Recycling of pickle bath: Recycling of pickling bath would require installation of a vessel and a filter: this measure will reduce salinity of the discharged wastewater, which is a major problem of the company, achieve 15% water savings and lead to 23 tons/year of chemicals reduction.



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MED TEST Case Study

PETROCHEMICAL sector — EGYPT

Egyptian petrochemicals company (EPC) – Chlorine plant

Company overview

EPC is a large size petrochemical enterprise, affiliated to the Egyptian General Petroleum Corporation (EGPC). The company produces liquid and flakes caustic soda, liquid chlorine, Poly Vinyl Chloride (PVC) resins and compounds and sodium hypochlorite for the local market and for export (30%).

The company joined the MED TEST project to identify opportunities for increasing resource efficiency and productivity and reduce pollution loads to minimize investment/operational costs of the planned wastewater treatment plant. The project focused on the chlorine plant.

At project's start the company was already certified ISO 9001, ISO 14001 and ISO 18001. Through MED TEST, the company integrated cleaner production and resource efficiency into the existing ISO 14001 management system.

Benefits

The MED TEST project identified annual total savings of \$US 530,638 in water, raw materials and fuel with an estimated investment of \$US 1,536,667. Some measures have excellent return on investment and immediate pay-back period. There are some identified measures being implemented by the company in 2011 and the remaining measures are planned to be implemented in 2012.

Total energy cost will be reduced by 37% through the use of excess hydrogen generated as a by-product from the chlorine plant as fuel. CO₂ emissions will be reduced by 9,500 tons/year. In addition the company is planning to apply a steam system survey to identify reductions in thermal energy consumptions.

Water costs will be reduced by 4% by applying good housekeeping measures and implementation of control system for water consumption.

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“The MED TEST project supported EPC to comply with environmental regulations, increase productivity and improve quality.”

Eng. Ahmed EL BORDINY, Chairman

Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Good housekeeping	107 635	-	-	287 027 m ³ water	
Hydrogen recovery from chlorine plant	305 183	225 000	0.7		58 802
Filter press	69 150	500 000	> 5		
Water treatment unit	16 000	16 667	1		
TDS loads reduction	32 670	795 000	> 5	87 120 m ³ water	
TOTAL	530 638	1 536 667	2.9	374 147	58 802

Good housekeeping: The project identified several good housekeeping measure, such as: regular maintenance programmes, applying brine recirculation process, eliminating excessive floor washing and all sources of spillage and water leakages, and taking measures to avoid blockages of the wastewater channels by using screens to prevent brine impurities and solids from entering wastewater channels. The implementation of good housekeeping measures would save 3% of water consumption and achieve reduction of 9.2 tons/year (3%) TSS and 128.9 tons/year (1%) TDS.

Hydrogen recovery from chlorine plant: Hydrogen is produced as a by-product of the electrolysis process in the chlorine plant. Currently the excess hydrogen is flared in air after mixing with steam to prevent explosions. The reuse of excess hydrogen as fuel requires capital cost, but will allow significant reduction by 37% in energy consumption as well as in CO₂ emissions.

Filter press: The underflow of the clarifier is sent for dewatering and sludge separation to the filter press, which is in deteriorated conditions, causing leakage of filtrates in the work environment. The replacement of the current deteriorated filter press by a new fully automated one will prevent leakages of the brine solution to the work environment and reduce the weight of sludge and cost of its transportation to disposal by 30%.

Water treatment unit: Replacing the existing system with an automatic dosing system at the process water treatment unit will reduce chemical losses and consumption by 5% and subsequently reduce the hydraulic load of the unit.

TDS loads reduction: The site is experiencing a fluctuation in the levels of TDS pollution load generated by the chlorine plant. The company has started a project with the support of EPAP II funding scheme to address high TDS streams, which consists of several actions: recycling of the over analyzers flows (4m³/hr) back to the dissolution tank; design of a collection basin for segregation of the process streams with high TDS loads and installation of evaporators; installation of an on-line control system for in process recycling or discharge to the WWTP of the process streams based on their TDS concentration; and replacement of 10 pumps for effluent recirculation by new ones with closed cooling system. The implementation of these measures will prevent penalties associated to the fluctuation of TDS load, achieve water savings, maintain the effluent wastewater at 2000 mg/l TDS, reducing by 70% and 9,000 tons/year the TDS load discharged.



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MED TEST Case Study

FOOD sector — EGYPT

Frozen vegetables and fruits — The Egyptian British Company for General Development (Galina-Agrofreeze)

Company overview

Galina is a medium size joint stock food enterprise. The company produces approx. 10,000 tons/year of frozen vegetables and fruits for export.

The company joined the MED TEST project to improve its environmental performance, identify opportunities for increasing resource efficiency through solving the existing problems which mainly include: high water consumption, materials and energy losses.

At project's start the company was already certified ISO 9001, food safety according to HACCP of CODEX, while OHSAS 18001 was under development. The company just started designing EMS according to the ISO14001, BRC global standard for food safety.

Benefits

The MED TEST project identified annual total potential savings of \$US 113,499 in water, raw materials and fuel with an estimated investment of \$US 32,500. The average simple payback period is less than 3 months. Most identified measures are planned to be implemented in the near future.

Water costs would be reduced by 50% through applying good housekeeping measures, preventive maintenance programme, implementation of monitoring and controlling system for water consumption, dry cleaning of floors in different units and improved technique for equipments washing.

Electricity costs could be reduced by 10% through preventive maintenance programme for compressors and cooling towers, improving the lighting system and measuring harmonics. In addition the company can implement heat recovery at the blancher in order to reduce thermal energy consumption.



“MED TEST supported the company in identifying saving opportunities and we are satisfied with its methodology”

Dr. Abd EL WAHED SOLIMAN, Chairman

Environmental benefits could be reached in terms of reducing the wastewater pollution loads corresponding to 55% BOD₅, 40% COD and 15% TSS annual loads, mainly resulting from good housekeeping measures, water conservation measures and upgrading the packaging units which will reduce product losses entering the drain system.

In December 2011, as a follow up to the identification of saving opportunities, the company has requested the assistance of the MED TEST team to design EMS according to ISO14001, BRC global standard for food safety as well as updating the existing ISO 18001, fully integrating resource efficiency into company policy, action plans and internal procedures. This will ensure sustainability of all the identified actions at company level as well as the development of new cleaner production projects.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, materials	Energy [MWh]
Preventive maintenance	16 471	18 002	1.1	4 727 m ³ water	350
Water conservation	16 040	6 165	0.4	40 100 m ³ water	
Upgrading packaging unit	80 988	8 333	0.1	124 tons product	
TOTAL	113 499	32 500	0.3		350

Preventive maintenance: The site could implement an effective preventive maintenance programme for reducing water, materials and energy losses. These include: insulation of pipes and replacement of the evaporator with new one in the refrigeration system; reuse of defrost water; periodical maintenance of the compressors and cooling towers; improving the hygienic conditions and lighting system in the packaging unit; measuring harmonics for checking distortion in the electrical feeder and protecting the capacitors from damage. The implementation of these measures could save 10% of electricity consumption, 5 % in water consumption and wastewater generation. The BOD and COD would be reduced respectively by 3% (142) kg/year and 3% (213) kg/year.

Water conservation: There are several measures identified by the project for reducing water consumption. These included: dry cleaning of floors; installation of water meters at the source of

the feeder with effective monitoring plan; improving technique of floors and equipments washing. The total water consumption could reach 42% reduction with a significant impact on the capacity of the WWTP that the company plans to install in the future. BOD and COD pollution load would decrease respectively by 1.2 tons/year (27%) and 1.8 tons/year (22%).

Upgrading packaging unit: Installing new automatic packaging machines could reduce 15% of product losses generated during the manual packaging and increase productivity of the site. The implementation of this high investment project could reduce solid waste generation and increase product recovery by 124 tons/year. This option would also reduce the discharge load of BOD by 1.1 tons/year (25%), COD by 0.4 tons/year (5%) and TSS by 0.5 tons/year (15%).



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MED TEST Case Study

CHEMICAL sector — EGYPT

Chemical industry — Solvay Alexandria Sodium Carbonate (SASC)

Company overview

SASC is a large size, chemical company owned by the multinational Solvay Belgium. The company produces light and dense sodium carbonate, pure sodium bicarbonate and calcium oxide.

The company joined the MED TEST project to identify opportunities for increasing resource efficiency through solving the existing problems which mainly include: high water consumption, and materials & energy losses.

At project's start the company was already certified ISO 9001 and had plans to establish a management system for environment and safety according to ISO14001/ OSHAS 18001 standards.

Benefits

The MED TEST project identified annual total savings of \$US 491,793 in water, raw materials, fuel and electricity with an estimated investment of \$US 55,383. The average simple payback period is less than 2 months. There are some identified measures being implemented by the company in 2011 and the remaining measures are planned to be implemented in 2012.

The implementation of cleaner production measures identified by MED TEST assisted the company to improve its performance reducing consumptions by almost: 10% electricity, 15% steam and 10% raw materials.

Water costs decrease by almost 20% through segregation and recycling of compressors cooling water and CO₂ gas washer effluent, and implementation of water consumption monitoring and controlling system. The company has also launched a steam survey and insulation project aiming at reducing 10% of its thermal energy consumption.

All the identified actions contribute to improve the environmental performance of the site.

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“Participating in the MED TEST project has allowed several departments of our company to look in a different way to the environmental aspects linked to our activity, generating important optimizations of several processes and impressive savings, finally decreasing the Non Product Output costs.”

Eng. Laila El GHAZALY, Managing Director

In parallel to the identification of saving opportunities, the site has plans to design an EMS system according to ISO 14001 standard, fully integrating resource efficiency into company policy, action plans and internal procedures. This will ensure sustainability of all the identified actions at company level as well as the development of new projects. New environmental management accounting (EMA) protocols have also been introduced into the existing internal accounting system for tracking and monitoring the most important environmental costs including those related to non product output costs.

Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, [m³]	Materials [t]
Recycling of CO ₂ gas washer effluent	36 500	20 833	0.6	99 000	
Water conservation	82 120	34 550	0.4	231 990	
Good housekeeping	348 173	-	-	463 978	9 643
Limestone recycling	25 000	-			
TOTAL	491 793	55 383	0.1	794 968	9 643

Recycling CO₂ gas washer effluent: Segregation and recycling of CO₂ gas washing effluent from two lime kilns has been implemented during the project. Part of the gas washing water is now reused within the gas washing process, while the other part is used in the lime slaking unit and in the sludge mixing tanks replacing fresh water intake. The implementation of this option leads to 2% reduction in water consumption.

Good housekeeping: The project identified good housekeeping measures for improving work environment and reducing pollution load. These included: regular maintenance programs, applying brine recirculation process, eliminating excessive floor washing and all sources of spillage and water leakages, closing/sealing running water taps, and taking measures to avoid blockages of the wastewater channels by using screens to prevent brine impurities and solids from entering the drains. The implementation of good housekeeping measures would save 10% of water consumption.

Water conservation: There are several measures identified by the project that overall reduce water consumption by more than 5%: closing the compressors' cooling water circuits, installation of water meters with effective monitoring plan; and the use of pressurized water for washing processes.

Limestone recycling: Two main projects were identified for reducing solid waste generation. The first project consists in the collection and reuse of limestone fines at the lime preparation unit for use in civil engineering works as filler material for roads, highways and cement manufacturing. The second project under evaluation consists in the reuse of grits from lime milk preparation unit as soil conditioner for pH correction. These projects aim at valorizing solid waste as by-products avoiding their accumulation on the company ground and eliminating their disposal cost.



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MED TEST Case Study

MECHANICAL and METALLURGICAL sector — MOROCCO

Aluminium industry — Aluminium du Maroc Company

Company overview

Aluminium du Maroc, founded in 1976, is the first Moroccan company specialized in the manufacture of aluminium alloy profiles. It is located in the industrial zone of Tangiers and employs 450 people.

Most of its production (85%) is intended for the construction market, the rest for other industrial sectors (mechanical, electrical, electronics, transportation, street furniture, air conditioning, telecommunications, etc.), while 25% is destined for exportation.

The company joined the MED TEST in order to identify opportunities to reduce energy and production costs, improve productivity, recycle solid waste and minimize wastewater pollution loads.

This project is perfectly in line with the environmental policy and the EMS of Aluminium du Maroc, established in 2002. The company was certified ISO 9001:2000, ISO 14001 and OHSAS 18001 in December 2004.

Benefits

The actions identified thanks to MED TEST will enable the company to achieve \$US 370,431 annual savings in energy (electricity and propane), water and raw material, against an estimated investment of \$US 262,164, resulting in an average payback period of 8 months. Over half of these actions were implemented in 2011 and the rest is planned for first-quarter 2012.

The energy saving potential amounts to 11% of the annual energy bill. Several actions have already been implemented: insulation of hot and cold surfaces, adjustment of furnaces burners, installation of an energy and production management software that allows continuous real-time monitoring of operating costs. The company is also planning to recover flue gases energy to heat water used in the process and in sanitary facilities.



“The MED TEST project falls within our environmental policy, and we are very pleased with the opportunities which it has revealed and enabled to implement.”

Nizar OUAFI, QSE Manager

Monitoring and optimizing consumption in terms of anodizing and painting processes, repairing leaks in various facilities, installing a management system for consumption monitoring represent a potential for reducing water consumption by 7%.

Economic and environmental gains will be generated by the recovery of waste such as coating, alumina powder and the caustic soda used for cleaning aluminium tools. Their valorization is being studied under the “Industrial Waste Exchange” framework launched by CMPP.

In addition to the identified saving opportunities, the company has established an EMS by integrating all the aspects (environmental policy, operational procedures, document control and recording, action plans with environmental goals).

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Preventive maintenance and production management	154 914	37,352	0.2		1 312
Process optimization: Anodizing and coating	41 658	6 250	0.2	Water : 2 140 m ³	320
Cleaning of tools for extrusion presses	75 000	93 750	1.3	Soda: 150 tons	
Waste valorization	TBD(*)	—	-	—	
Heat recovery	98 859	12 4375	1.3		695
TOTAL	370 431	262 164	0.7		2 327

(*) To Be Determined

Preventive maintenance and production management:

Several measures have been implemented: reduction of electrical power consumption by increasing power factor, optimization of air compressors, start-up of a software system for real-time management of electrical and thermal energy, adjustment of the chillers COP. Thermal energy will be reduced through the optimal setting of furnace burners, the optimization of coating and anodizing processes, the thermal insulation of pipes, as well as by sealing joints at doors level and improving extrusion presses productivity.

Process optimization of anodizing and coating: Among optimization actions are: improvement of anodizing parameters (time of glazing, degreasing time), reduction of water losses, efficiency improvement at anodic oxidation, continuous pH measurement for a better monitoring of discharges baths. For the coating process, the optimization measures include: improvement of process parameters and of coating efficiency through electrostatic optimization conditions, reduction of the amount of dust recovered and elimination of openings in the vertical coating furnace thanks to removable insulation panels.

Cleaning of tools for extrusion presses: The company plans to recover the caustic soda used to clean the aluminium residues in the extrusion tools (about 150 tons/year of soda). The project to regenerate caustic soda for multiple reuse will also engender a reduction in the liquid effluent pollution load.

Waste valorization: The main solid waste generated by the company consists in painting powder from the thermo coating, aluminium powder and sludge from wastewater treatment plant, which contains heavy metals and alumina. CMPP is currently in contact with industrial manufacturers likely to use the resource waste as secondary raw material under the “Industrial Waste Exchange” framework: www.bourse-cmpp.ma.

Heat recovery: The energy analysis showed that the billets furnace chimney is responsible for a consequent loss of energy. The project will consist in using this energy to heat glazing treatment baths and sanitary water. The company is also planning to install solar panels for hot water needs.



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MED TEST Case Study

FOOD sector — MOROCCO

Dairy industry — COLAINORD Cooperative

Company overview

COLAINORD, a dairy cooperative located in Tétouan, employs 580 persons and produces about 55,000 tons/year of dairy products and derivatives. The main products are: pasteurized milk, UHT milk, yoghurt, fermented milk, butter and cheese.

COLAINORD has joined the MED TEST project in order to identify opportunities regarding the rational use of resources (water and energy), the valorization of by-products, the reduction of production costs and the minimization of pollution loads.

At project start-up, the company was already engaged in a wastewater treatment plant project: the construction work started in early 2011 (pre-treatment phase).

Benefits

The actions identified by MED TEST will enable the company to achieve annual savings of about \$US 381,436 in terms of energy (electricity and heat), water and raw material, against an estimated investment of \$US 117,929, resulting in a payback time of 3.6 months. Over half of these actions were carried out in 2011 and the rest is planned in Q1 2012.

The energy saving potential represents 13% of the annual energy bill (electricity and fuel): it can be achieved by optimizing the chillers operation, improving the electrical power factor, implementing hot and cold surfaces thermal insulation and installing variable speed drivers at the compressors. The CO₂ emissions reduction potential amounts to 551 tons/year.

Water consumption can be reduced by 23% by optimizing cleaning techniques (e.g. introducing spraying nozzles), repairing leakages in various equipments, eliminating on-site washing of the tank trucks and using well water for cleaning annexes.



“MED TEST project has been instrumental for our company, in light of all the realized improvements and the associated economic benefits”

Youness EL OUAHABI, Director General

Further savings will be generated through the valorization of by-products: buttermilk, whey and fat. These actions will also reduce investments and operating costs concerning the on-going wastewater treatment plant project.

They will also help to achieve environmental benefits including a reduction of industrial wastewater pollution loads through a better management of customers' returns, a recovery and recycling of products and a better monitoring of material losses at the plant. These actions will therefore reduce the annual pollution loads by 19% for BOD₅ and by 12% for COD.

In addition, COLAINORD initiated an EMS implementation process. The medium-term objective is to obtain ISO 14001 and ISO 22000 certifications.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Electrical system and compressed air	33 003	16 801	0.5		338
Reduction of water, chemicals and liquid effluent	71 041	15 550	0.2	Water: 36,940 m ³ Chemicals: 8.2 tons	
Valorization of by-products	218 750	68 750	0.3	Whey: 50 tons Milk: 55 tons Buttermilk: 700 tons	
Steam system	24 462	14 328	0.5		617
Chillers	34 180	2 500	<0.1		364
TOTAL	381 436	117 929	0.3		1 319

Electrical system and compressed air: A reduction of the electrical power consumption has been obtained by improving the power factor (cosQ), optimizing lighting and installing variable speed drivers on compressors. As for the compressed air distribution system, measures include: installation of air tank storage and of a distribution network with pressure gauges and isolation valves.

Reduction of water, chemicals and liquid waste: The site has implemented several measures to improve water consumption levels, including the optimization of cleaning in place (CIP) by installing a conductivimeter and recycling rinse water etc., the reduction of water consumption for washing soil and equipment by using spraying nozzles, the elimination of on-site tanker trucks washing and the installation of workshop meters. The potential reduction represents about 20% of the annual water bill (\$US 38,700).

Steam systems: Several measures have already been implemented, including: insulation of hot surfaces (steam pipes, valves), recovery of steam condensate and combustion optimal setting. Other measures are planned, including energy recovery from the boilers steam traps and installation of a conductive meter on the boilers. The total annual saving is estimated at 617 MWh.

Valorization of by-products: The production of cheese generates about 2 tons/day of whey: it was formally discharged to drain though it contains 70% lactose and can be used as live-stock feed. The company has decided to valorise it by distributing it to the farmers, so as to avoid treating 50 tons/year of dry whey in the wastewater treatment plant. Buttermilk is also recovered after the transformation of cream into butter (about 1,400 m³ buttermilk on 2 sites) and will be incorporated in products such as “leben” and in the formulation of new creams and custards. This action will generate a net gain (since it is rich in protein and fat) and will help to reduce the size of the new treatment plant. These measures will reduce the BOD of liquid waste by 51 tons/year and the COD of 107 tons/year.

Chillers: The cold unit represents the primary energy consumer (53%). Several actions have been undertaken to reduce this consumption, including: setting of the chillers high and low pressure, reduction of cold losses in cold pipes and room doors, limitation of chillers use during peak hours. The annual saving is estimated at \$US 34,180.



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MED TEST Case Study

FOOD sector — MOROCCO

Dairy industry — Fromagerie BEL Maroc

Company overview

Fromagerie BEL Maroc is a subsidiary of the international group BEL, the world leader for processed cheese. Located in Tangier since 1977, it employs 1,300 people including 40 managers and produces about 39,000 tons/year of processed cheese (more than 40% of which is destined for export), mainly marketed under the following brands: la Vache qui rit, Kiri, Les Enfants.

The company has joined the MED TEST project in order to identify opportunities for an effective use of resources (water and energy), to improve facilities performance, to minimize waste, in particular liquid effluents, and consequently to reduce the investment and operating costs of the designed wastewater treatment plant.

At project start-up, the company was already certified ISO 9001 and ISO 22001. It was certified OHSAS 18001 at the end of 2010 and ISO 14001 in July 2011.

Benefits

The actions identified by MED TEST will enable the company to achieve annual savings of about \$US 333,830 in energy (electricity and heat), water and raw material against an estimated investment of \$US 280,328, with a 10-month payback period. Over half of these actions were implemented in 2011 and the rest are scheduled for Q1 2012.

The energy cost savings represent 6.6% (about \$US 134,616) of the actual annual bill (electricity and fuel).

Water costs should be reduced by 20% through optimizing cleaning in place (CIP), recycling white water, repairing water leaks, using adequate equipment for floor and production machines cleaning, and implementing automatic closing of cooling water at vacuum pumps.



“MED TEST has helped us to implement an adequate system to optimize our energetic and environmental performance.”

Mrs. Ibtissam NEJJAR, QSE Manager

These actions will also help to achieve environmental benefits including: reduction of wastewater pollution loads by limiting process losses, product recovery during equipment cleaning (transfer tanks, tri-blender, cutter, etc.) and recycling of white water. The reduction of product losses, for instance, will decrease the BOD and COD pollution loads by 2.7% and 3.5%, respectively.

The environmental benefits will also produce economic gains such as a reduction of investment and operating costs of the wastewater treatment plant, the construction of which is scheduled for the first half of 2012.

The company has also benefited from MED TEST technical assistance to establish an environmental management system (EMS) and integrate the identified actions into its environmental policy. These efforts were rewarded with the ISO 14001 certification obtained in July 2011.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Boiler and steam system	41 565	56 500	1.28		1 688
Water and chemicals reductions	74 947	135 350	1.80	water 29 930 m ³	
Electrical system, compressors and lighting	93 051	52 500	0.56		1 094
Product recovery, management of waste and of returns from clients	87 042	2 228	0	product 16 tons	
Energy recovery (chillers)	37 225	33 750	0.90		720
TOTAL	333 830	280 328	0.87		3 502

Boiler and steam system: Several measures have been implemented: insulation of hot surfaces with a \$US 24,000 budget, recovery of steam condensate, and the optimal adjustment of burners' combustion. Other options are scheduled, including energy recovery from the boiler's blow-down and installation of an automatic blow-down system. The overall potential saving of fuel amounts to about 11%.

Water and chemicals reduction: Several measures have been implemented to reduce water and chemicals consumption, including: NEP optimization (with a frequency decrease from 4 to 2 times a week), recovery and reuse of rinse water, use of spraying nozzles and cleaning guns (more efficient and economic), and automatic closing of cooling water circuits for equipments, like pumps. Vacuum pumps will also be replaced by dry multi-stage pumps.

Energy recovery from chillers: Recovering heat from the freezing groups' condensers, the company is using it to defrost the butter stock before use. Recovered heat from other cold rooms will be used to heat sanitary and washing water. The total energy saving is estimated at 720 MWh/year.

Electrical system, compressors, lighting: A series of actions have been established to reduce electrical consumption, including power factor increase, optimization of site lighting and installation of a variable speed drive on an air compressor (that had a loading rate of 51%). As for compressed air, the identified actions are primarily related to leaks repair, minimization of compressors' idle operations, installation of automatic solenoid valves on packing machines, and of pressure gauges on the air network. The total savings are estimated at 1,094 MWh/year.

Product recovery, management of waste and of returns from clients: As for process equipments (tri-blenders, paste transfer tanks), the identified measures include dry scraping (more efficient to recover the maximum amount of product before cleaning) and recycling of white water in production. The reduction of processing and packing losses will decrease BOD by 6.4 tons/year and COD by 12 tons/year. The company has reduced the amount of returns from clients by analyzing root causes and implementing a set of corrective monitoring and management procedures.



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MED TEST Case Study

FOOD sector — MOROCCO

Fish canning — Conserverie des 2 Mers

Company overview

Conserverie des 2 Mers is a Moroccan fish canning industry. The company was established in 1988, is located in the industrial zone of Moghogha in Tangier, employs 350 people and generates an annual turn over of \$US 6 millions. All the production volumes are exported and the main products are salty and marinated anchovies.

The company has joined the MED TEST project in order to identify opportunities to implement an efficient use of resources (water and energy), improve production processes, valorize fish solid waste and minimize liquid effluents in light of reducing the investment and operational costs of the future wastewater treatment plant.

The company is certified ISO 22001, IFS 5 and plans to obtain ISO 14001 certification in the medium term.

Benefits

The identified actions within MED TEST project correspond to annual savings of approximately \$US 73,970 in energy, water and raw materials with an investment estimated at \$US 120,175 and a return of investment of 19 months. Half of the actions have been realized in 2011, the rest are planned for the first semester of 2012.

Energy savings represent 65% of the total annual energy bill, corresponding to \$US 43,750.

The reduction of water costs is 22%, as a result of the optimization of the cleaning of cans and pots, the minimization of overflowing during fish washing operations, utilization of adequate equipment for cleaning in place and floors, and automatic control of cooldown valves of the machines when they are not in operation.



“As of our participation in the MED TEST project, the management of C2M has integrated environmental responsibility into the company policy, and all the company staff has adhered.”

LAMRINI Jihane, Director Quality Management

Environmental benefits are expected in terms of reductions of the wastewater pollution load, due to minimized material losses entering the drain system and recovery of edible oils within the process. The company is planning to install a wastewater treatment plant; CMPP is currently finalizing the feasibility study and the technical specifications.

The company has also benefited from the technical assistance through the introduction of an environmental management system (EMS) and the integration all the identified resource efficiency measures into its environmental policy. They plan to obtain certified ISO 14001 in the medium term.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Chillers and cold storage rooms	34 443	26 550	0.8		290
Consumption of water and chemicals	4 911	4 125	1	Water: 3740m ³ Chemicals: 740 kg	
Electrical system, compressors, lighting	11 181	18 875	2		63
Valorization of fish waste and edible oils	14 695	64 375	4	Fish waste: 190 tons Oils 1.9 tons	
Heat recovery	8 739	6 250	0.7		69
TOTAL	73 970	120 175	1.6		422

Chillers and cold storage rooms: Several actions have been implemented: insulation of cold storage rooms (walls and ceiling), insulation of pipes, optimization of COP via regulation of high and low pressure of the chillers, limitation of chillers operation during peak hours, unloading of cold storage in case of exceeding the installed power, increase in the capacity of the chillers' condensers and reduction of the number of the chillers' compressors, replacement of the refrigerant R22 with R404 conform to regulations.

Consumption of water and chemicals: The implemented actions are: installation of water meters, reduction of overflowing at the level of the fish washing tanks, utilization of nozzles and spray guns for floor cleaning and recycling of cans cleaning water. By controlling the use of chemicals at the level of each work station, soda consumption has been reduced by 400 kg/year, disinfectant by 290 kg/year and detergent by 50 kg/year.

Electrical system, compressors, lighting: Measures to reduce electricity consumption include: adjustment/increase of the power factor, energy saving lighting system at the level of the entire site, and installation of electricity sub-metering system. The compressed air system has been optimized through a leak

inspection programme, reduction of idle operations of compressors and limitation of their usage during peak hours, and installation of regulation valves and of pressure probes on the air distribution network and on the air balloons.

Valorization of fish waste and edible oils: Valorization of fish waste has been studied for producing fish meals or for extracting the proteins. A procedure to handle non conformities and minimize waste at the source has been put in place and integrated in the existing IFS and ISO 22001 systems. The company will put in place a system for segregating edible oils losses generated during conditioning and packaging of anchovies and during cleaning of cans. This system will consist of an oil separator with a coalescing filter and a collection basin.

Heat recovery: The company utilizes hot water at 90°C, heated with propane gas, for the cleaning of anchovies. A cost effective alternative would be to pre-heat the cleaning water at 60°C through heat recovery either from the boiler flue gas, or from the chillers' compressors. The company has selected the second alternative for implementation, since it is more viable from an economical point of view.



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MED TEST Case Study

TEXTILE sector — MOROCCO

Textile finishing — ECOLORENTEL

Company overview

Ecolorentel is a medium size, textile company, located in the industrial area of Moghora in Tangier. It specializes in dyeing, jeans washing and special effects in fabrics. The company is a joint-venture between Moroccan and Spanish shareholders. It employs 400 people and has an average turnover of \$US 8.5 million.

The company joined the MED TEST project in order to identify opportunities for effective use of resources (water, energy and chemicals), reducing production costs, and minimizing waste in particular liquid effluents.

In addition, the company has shown interest in setting up a wastewater treatment plant. The company has not implemented a management system (including environmental). This is one of its medium-term objectives.

Benefits

The actions identified in the MED TEST project will enable the company to achieve an annual gain of about \$US 242,041 through savings in energy (electrical and thermal), water and chemicals with an estimated investment of \$US 324,327, resulting in a payback period of 16 months. Over half of the actions (66%) were performed in 2011, with the remainder scheduled for 2012.

Energy savings correspond to approximately 7% of the current annual energy bill (electricity and fuel). The annual consumption of water will be reduced by about 4% through changing water intense processes with more rational ones, recycling of process water and recovery of steam condensate.



“Our experience participating in the MED TEST project is very positive. The technical assistance received helped us to sensitize our staff and to comply with environmental norms and environmental requirements of our international customers.”

Mohamed CHAKER, General Manager

To improve its environmental performance, the company has installed ozone technology for jeans washing, with no wastewater discharges, has modified the permanganates spraying unit and has replaced the sand blasting with a laser process.

These actions will generate substantial savings especially for chemicals, in addition to reducing the environmental impact generated by the use of these products.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Boiler and steam system	43 263	16 000	0.4	Water: 4 093 m ³	982
Electrical system, compressors and lighting	8 935	23 952	2.7		63
Washing with ozone	26 551	125 000	4.7	Water: 3 750 m ³	
				Chemicals: 43 tons	
Chemicals management	31 666	18 750	0.6	Chemical product: 9.7 tons	
Process change: sand blasting and finishing	131 625	140 625	1.1	Sand: 180 tons	
TOTAL	242 041	324 327	1.3		1 045

Electrical system, compressors, lighting: The company has established a set of actions to reduce the energy consumption such as: increasing power factor, optimization of the site lighting, and the introduction of inverters on air compressors motors. For compressed air: the repair of air leaks, the establishment of an air tank and the installation of a distribution system with pressure gauges and valves. These actions will reduce the annual consumption by about 63 MWh.

Production system and distribution of steam: Several measures were identified including: the insulation of hot surfaces, the recovery of steam condensate, the optimal regulation of the boiler, and drying indirectly with steam. An option is being considered to recover the heat from hot baths discharge. The total savings is estimated at 982 MWh and \$US 43,263.

Washing with ozone: This is a new process that allows fading degradation of indigo by ozone instead of using the hypochlorite (extremely hazardous and aggressive acid). The advantage of this method is that it does not use water and chemicals, so therefore it does not generate liquid effluents, and its energy consumption is very efficient.

Process change: sanding and finishing. The company has changed some processes in the units for special treatments. Among these changes are:

Blasting unit: Ecolorentel has stopped using this technology due to environmental and health problems for the staff. New laser machines have replaced this old and not ecological technology.

Permanganate treatment unit (spray): The special treatment process with permanganate has been relocated outside the unit, emissions of permanganate are conveyed into a water film and recycled back to the process.

Chemicals management: Several actions have been implemented for better management of chemicals, including: The establishment of procedures for handling and weighing of chemicals, construction and development of a new laboratory for preparing and weighing the chemicals, optimization of the receipts at the laboratory before launching the production batches. Also the company has replaced some hazardous or toxic chemicals with biodegradable and less harmful products to the environment.



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MED TEST Case Study

METAL sector — MOROCCO

Manufacturing of steel pipes — company INDUSTUBE

Company overview

Industube is a Moroccan company located in the industrial area of Moghara à Tanger, producing black, galvanized or surface treated welded steel pipes. The enterprise was established in 1979, employs 65 people, and has an average annual turnover of more than \$US 13 millions.

The company joined the MED TEST project in order to identify opportunities to implement an efficient use of resources (water, energy and chemicals), reduce production costs and minimize waste, in particular liquid effluents.

Industube is certified ISO 9001, and has the medium term objective to establish an environmental system and put in place a wastewater treatment plant.

Benefits

The opportunities identified through the MED TEST project will enable the company to achieve annual savings of around \$US 327,357 in energy, raw materials, water and chemicals with an investment estimated at \$US 85,800, corresponding to a return on investment of 4 months. Approximately half of the actions have been implemented in 2011, the rest are planned in 2012.

The economic gains in electricity and steam production and distribution system are estimated at 1,207 MWh/an, which represents approximately 12% reduction of the total energy bill. The most important project concerned heat recovery from flue gas at the galvanization's furnace, which is used for (a) drying zinc powder, instead of using a dedicated furnace; and (b) pre-heating steel pipes before their introduction in the galvanization furnace.



“Through our participation in the project, we have started an internal reflection on how to reduce production costs. This process resulted in the identification of measures to put in place in order to reach this objective.”

M. FERNANDEZ, General Manager

Savings in the water bill will be achieved through recycling of condensate and boiler blowdown and good housekeeping such as closing of cooldown valves of the machines when they are not in operation.

A reduction of chemicals usage is expected as a result of good housekeeping measures such as: quality control at product delivery, procedure for storage, handling and use of chemicals, regular monitoring and recording of the parameters in the surface treatments baths.

The company has put in place an action plan to optimize its processes to reduce scrap rate, which has decreased from 13% to 8%.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Preventive maintenance	51 270	38 425	0.7		522
Water, chemicals and galvanization process	3 146	2 500	0.8	water: 100 m ³ HC: 2.6 tons Soda: 1 ton	
Compressors, lighting	32 808	24 875	0.8		341
Heat recovery	43 686	11 250	0.3		344
Process optimization, scrap rate	196 446	8 750	-	Steel scraps: 195 Pipes: 3000 ml	
TOTAL	327 357	85 800	0.3		1 207

Preventive maintenance: Several measures have been implemented: insulation of hot surfaces (furnace for zinc powder treatment, steam pipes, valves, etc.), elimination of leakages in the compressed air circuit, regulation of boiler efficiency. Other actions being conducted include the reduction of subscribed electric power, recovery of steam condensate, reduction of compressed air used for cleaning and the establishment of an energy management system. All these actions will bring about a reduction of approximately 522 MWh/year.

Water, chemicals and galvanization process: Water savings can be achieved by installing automatic closing of cooling down valves of machines when they are not in operation, installation of water meters at production units and good housekeeping at the company level. Chemicals consumption will decrease by better control of concentrations at reception, procedures for storage and handling, regular monitoring and recording of the parameters of the galvanization baths.

Compressors, lighting: A total saving of of 341 MWh/year will be achieved by installation of variable speed driver at one air compressor and the replacement of the existing lamps of 500 W with energy-efficient ones of 250 W.

Heat recovery: The energy audit revealed an important heat loss at the level of flue gas, which could be used as a source to reduce the head demand of the process, saving 344 MWh/year. It is planned that the recovered heat will be used within two processes:

- * drying of the zinc powder, which is actually done using a secondary furnace of 232 KW. This will reduce gas consumption by approximately 8.1 tons/year.

- * preheat pipes at the level of the galvanization furnace, which are currently heated with a dedicated furnace.

Process optimization, scrap rate: The company has put in place an action plan to optimize its production processes to reduce the scrap rate, resulting in a reduction by 5%. For instance, the installation of a cooling pump on the M2 cutting machine has allowed to considerably reduce its stopping, which was causing a loss of 12 ml of pipes at each stop.



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MED TEST Case Study

TEXTILE sector — MOROCCO

Textile finishing — LAVESMA

Company overview

LAVESMA is a medium-size textile unit located in the Gueznaya industrial area in the south of Tangier and specialized in dyeing, jeans bleaching and special effects treatments. Founded in 2003, it employs 300 persons and has an average turnover of over \$US 5 million.

The company has joined the MED TEST project in order to identify opportunities to implement an efficient use of resources (water, energy and chemicals), reduce production costs and minimize waste, in particular liquid effluents.

Moreover, LAVESMA has shown an interest in setting up a wastewater treatment plant. Implementing a management system (including an environmental one) represents one of its medium-term objectives.

Benefits

Several identified actions will enable the company to achieve annual savings of \$US 474,615 in electrical and thermal energy, as well as in water and chemicals, with an estimated investment of \$US 250,911, corresponding to a 6-month payback period. Over half of these measures were implemented in 2011 and the rest are scheduled for Q1 2012.

Savings on steam distribution systems and electricity are estimated at \$US 265,876, which corresponds to a reduction of annual energy consumption by 27%. The actions taken to achieve this are detailed on the following page.

The annual consumption of water will be reduced through a hunt for leaks, water and condensate drains



“Our participation in the MED TEST project has enabled us to implement resource efficiency, improve process productivity, achieving our strategic goals.”

Mr Mohcine EL-JAMAL, General Director

recycling and the servo control of water softening unit feeding the boilers.

To improve its environmental performance, the company has also introduced several measures, including:

- Recovery and recycling of permanganate solution;
- Improved dosing of chemicals;
- Elimination of the sand blasting process;
- Improved management and handling of chemical products.

These actions will reduce the chemicals consumption by about 5%, and the associated environmental impact generated by the use of these products.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Steam production and distribution system	252 200	56 650	0.2		1 920
Electrical system, compressors, lighting	13 676	13 812	1		145
Chemicals management	19 477	500	0.3	Chemicals: 22.65 tons	
Water and effluent reduction	3 962	1 875	0.5	Water: 3,400 m ³	
Biomass boiler	185 300	178 074	1	Propane: 221 m ³	
TOTAL	474 615	250 911	0.5		2 065

Steam production and distribution system: Several measures have been implemented by the company, including: insulation of hot surfaces, recovery of steam condensate, combustion control of the boiler burners, use of indirect steam for drying, heating of dyeing and bleaching baths. The company is currently studying the possibility of installing a heat exchanger to recover calories from machine outlet water for pre-heating the machine inlet water. All these measures will reduce the annual energy consumption by about 1,920 MWh.

Electrical system, compressors, lighting: The company has implemented a set of actions to reduce electricity consumption, including the optimization of lighting and of the contract power (after the power factor improvement); the company is also planning an energy management system. As for compressed air, measures include: repair of air leakage, installation of an air tank, and implementation of an air distribution network with insulation valves.

Biomass boiler: LAVESMA has installed a biomass boiler using olivepomace as fuel instead of propane. The boiler feed is automatic operating with a variable speed drive. This action has reduced the thermal energy annual bill by about \$US 178,074.

Optimal chemicals management: Several actions have been implemented for a better management of chemicals, including handling and weighing procedures, retrofitting of the chemicals weighing room, and optimization of the receipts at the laboratory before launching production batches. Moreover, the company has replaced some polluting chemicals by biodegradable and environmental products. Permanganate is now completely recycled, and the sandblasting treatment has been abandoned for reasons of personnel safety and environmental protection.

Water saving and emissions reduction: The following measures have enabled the company to reduce its annual water consumption by 3,400 m³: Elimination of water leaks, installation of water meters to better monitor consumption, recycling of water and steam condensate that are sent back to the boiler feeding tank, and servo control of water softeners to minimize water and resin losses.



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MED TEST Case Study

FOOD sector — MOROCCO

Meat industry — Boyauderie de l'Atlas

Company overview

Boyauderie de l'Atlas is a Moroccan company in the agro-food sector specialized in the production of salted and tubular casings in various calibres. The production unit, installed since 1994 in the industrial area of Moghogha near Tangier, employs 320 people and generates a turnover of about \$US 5 million (100% for export).

The company has joined MED TEST in order to identify opportunities for resource efficiency (water and energy), water recycling, recovery of production waste, and minimization and treatment of liquid effluents.

It already has the HACCP standard, currently prepares for ISO 22001, and plans to obtain the ISO 14001 certification in the medium term.

Benefits

The actions identified by the MED TEST project will enable the company to achieve annual savings of about \$US 133,500 in energy, water and raw materials against an investment estimated at \$US 79,125 with an average payback period of 7 months. Half of these actions were carried out in 2011 and the remaining is planned for the first half of 2012.

Energy savings represent 26% of the annual energy bill, while the water costs reduction amounts to 48% of the annual consumption. The latter will be achieved through recycling wastewater from the calibration and soaking processes, optimizing the washing of floors and crates, and better monitoring water consumption per production unit.



“A very interesting experience, worthy of being further promoted.”

Luc MATHET, Technical Director

These actions will reduce the consumption of salt and material losses within process, as well as the wastewater pollution load and therefore the capital investment and the operational costs of the wastewater treatment plant which the company is planning to install in the medium term.

The company has also benefited from technical assistance to set up an Environmental Management System (EMS) and has integrated the identified actions within its environmental policy. It plans to get the ISO 14001 certification in the medium term.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Chillers and cold storage room	10 191	6 875	0.7		78
Electrical consumption, compressed air, lighting	6 559	26 750	4.1		27
Water consumption	55 888	33 000	0.6	Water: 30 840 m ³	
Valorization of process waste	56 250	5 625	0.1	Fat: 225 tons Guts: 187 tons	
Heat recovery	4 612	6 875	1.5		47
TOTAL	133 500	79 125	0.6		152

Chillers and cold storage room: The company has implemented several actions: insulation of cold surfaces, optimization of chillers' COP by regulating pressure, limitation of chillers operation during peak hours, downloading cold storage rooms to avoid exceeding the subscribed power, regulation of chillers' condensers evaporation temperature, and replacement of R22 refrigerant with R404. The annual potential savings of these actions amount to 78 MWh.

Electrical system, compressors, lighting: The company has established a set of actions to reduce energy consumption, these include: improving the power factor and optimizing the subscribed power, improving site lighting, and implementing an electricity metering system. For compressed air, the improvement actions concern leaks repair, reduction of compressors' idle operations, limitation of compressors operation during peak hours, and installation of insulation valves on the air distribution network. The company has also launched a procedure to phase out the transformer contaminated with polychlorinated biphenyls (PCBs).

Water consumption: The company has installed water meters at each production unit and reduced water consumption in process and in crates washing through a workstation

reorganization. It also plans to purchase an automatic washing machine for the crates and to set up procedures in order to reduce the use of water for floor washing. CMPP is studying the feasibility of recycling wastewater from calibration and soaking operation, which is very rich in salt.

Recovery of organic waste and fats: The production process generates significant amounts of fat (0.7 tons/day), and guts waste (1.2 tons/day). These products, rich in fat and proteins, can be valorized. Within the initiative "platform for industrial waste exchange", CMPP is currently in contact with manufacturers likely to use these waste resources as secondary raw material. As part of the implementation of HACCP, the company has developed procedures for managing non-compliance and waste reduction at source.

Heat recovery from chillers: The company uses 60°C water heated with electricity for production process and sanitary facilities. A cost effective solution is to recover energy from the chillers' compressor to heat process water. This will require the installation of a heat exchanger at the outlet of the compressor with permanent circulation, loop and buffer tank. The potential energy saving is about 47 MWh/year.



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MED TEST Case Study

FOOD sector — MOROCCO

Fish canning industry — CUMAREX

Company overview

Cumarex is a Moroccan company operating in the fish canning sector. The production site, established in 1992, is located in the industrial area of Martil in Tétouan, employing 320 people and generating a turn over of approximately \$US 25M. The main products are canned tuna, mackerel, and melva, which are 90% destined to export.

The company joined the MED TEST project in order to identify opportunities to implement an efficient use of resources (water and energy), improve production processes, valorize fish solid waste and minimize liquid effluents in light of reducing the investment and operational costs of the future wastewater treatment plant.

At the beginning of the project the company was certified ISO9001, it has obtained the IFS Vo5 and BRC Vo5 certifications during the course of the project, and is planning to obtain ISO 14001 by the end of 2012.

Benefits

The measures identified within the framework of the MED TEST project will enable the company to save \$US 153,000 in energy, water and raw materials with an investment of approximately \$US 68,000. Moreover, the company has also planned an important project to valorize fish waste extracting proteins and producing fish meal. This project has an investment of \$US 3,8 Millions and a PBP of approximately 3.5 years.

Energy cost savings represent 20% of the annual bill for fuel and electricity, while water cost reduction is approximately 10% of annual costs.

Environmental benefits are expected in terms of reductions of the wastewater pollution load, due to minimized



“Thanks to the MED TEST experience our company has taken a step to implement cleaner production and improve our environmental performance”

Hassan EL BOUZIDI, Director General

material losses entering the drain system and recovery of edible oils from the cleaning of process's equipment. These benefits will reduce the investment and operation costs of the future wastewater treatment plant.

The company has also benefitted from the technical assistance through the introduction of an environmental management system (EMS) and the integration of all the identified resource efficiency measures into its environmental policy, which will enable the company to achieve the ISO14001 certification in the medium short-term. The company has also received a dedicated assistance to introduce an environmental management accounting (EMA) system at its production site.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Electrical system, compressed air, lighting	58 047	39 580	0.68		389
Savings of water and chemicals	18 601	6 864	0.37	Water: 3 031m ³ Soda: 4.6 tons Acid: 1.9 tons Oil: 2.7 tons	
Chillers and cold storage rooms	37 962	10 000	0.28		540
Boiler and steam system	38 177	11 531	0.30	Water: 2 782m ³	1 147
Fish waste valorization	1 099 778	3 875 825	3.5	6 500 tons fish waste	
TOTAL	1 252 565	3 943 800	3.14		2 076

Electrical system, compressed air, lighting: Measures to reduce electricity consumption include: adjustment/increase of the power factor, energy saving lighting system at the level of the entire site, and installation of electricity sub-metering system. The compressed air system has been optimized through a leak inspection programme, reduction of idle operations of compressors and limitation of their usage during peak hours, and installation of regulation valves and of pressure probes on the air distribution network and on the air reservoirs.

Savings of water and chemicals: The implemented actions include: installation of water sub-metering at each process, reduction of overflowing at the level of the fish washing tanks, recovery of steam condensate, use of nozzles and spray guns for floor cleaning, and a leak detection programme for the water softening unit and equipment. The use of chemicals has been reduced by implementing a monitoring system at each workstation.

Chillers and cold storage rooms: Electricity savings will be achieved by regulating high and low pressures of the chillers, insulating cold distribution pipes and surfaces, limiting the use

of chillers during peak hours, installation of air curtains at the entrance of the fish freezing room, and downloading of cold storage rooms in case of exceeding the installed power. The company has installed a heat recovery system on the chiller's condenser; the COP has improved by 50% and water preheated at 30°C is generated to be used in the sanitary and other applications within the process.

Boiler and steam system: Several actions have been identified including insulation of the hot surfaces, closing of the steam condensate system, regulation of boiler and installation of an automatic blowdown system with heat recovery. The company has installed a new system at the boiler's chimney to reduce the air flow. The total of these actions will entail savings of 1,147 MWh/year.

Fish waste valorization: The company has decided to realize a large investment project to extract proteins and produce fish meal from fish waste, which roughly represent 60% of the incoming raw material. A procedure to handle non-conformities and minimize waste generation at source has also been put in place within the existing ISO 9001 et IFS management systems.



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MED TEST Case Study

CERAMIC sector — MOROCCO

Ceramic manufacturing industry— Ceramica Dersa

Company overview

Ceramica Dersa is located in the industrial area of Martil in Tetouan. It has as its main activity the production of ceramic tiles of various designs and patterns. The company was established in 1988, employs 100 people and has an average turnover of \$US 5 million.

The company joined the MED TEST project in order to identify opportunities for effective use of resources (heat, water, electricity and chemicals), reduction of production costs, recovery of solid waste and minimization of waste water effluents.

The company is certified ISO 9001 and has medium term plans to obtain ISO 14001 certification.

Benefits

The actions identified through the MED TEST project will enable the company to save annually \$US 205,305 in the purchase of energy, raw materials and chemicals with an estimated investment of \$US 87,125, corresponding to a payback time of 5 months. Half of the actions were implemented in 2011; the rest are scheduled for 2012.

The potential savings on the optimization of electrical systems, furnaces and gas systems represent a cost reduction of 12% on the annual energy bill. The most significant part of these savings are due to the heat recovery projects for using the flue gas from the cooking furnace for preheating inlet air of the drying furnace and of the raw material grinder. There are expected savings also in terms of productivity and product quality.

All the effluents are recycled on site, as well as all residues of enamels and dyes are recovered and recycled within



“This project has been an enriching experience for our company, and it has enabled us to include environmental protection as a priority within the company’s development strategy.”

Mohamed ESGHIAR, Director General

the process. The company has implemented several measures of best practice to improve the management of the solid waste (cardboard, plastic and scrap metal) and their valorization in the recycling chain.

In addition to the savings opportunities identified, the company also benefited from technical assistance in the introduction of an environmental management system by integrating all aspects (environmental policy, operational procedures, etc.). The company is already certified ISO 9001, and plans to obtain ISO 14001 certification in medium term.

The company has also launched a consultation to obtain the label for Corporate Social Responsibility (CSR) of the General Confederation of Moroccan Enterprises (CGEM).

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Electrical system, compressed air	105 993	58 875	0.6		359
Furnace and gas system	19 875	2 250	0.1		852
Waste valorization, effluent recycling	3 188	1 000	0.3	Water: 3 000 m ³ Various waste	
Heat recovery	76 250	25 000	0.3		511
TOTAL	205 305	87 125	0.4		1 722

Electrical system, compressed air: The Company has established a set of actions to reduce power consumption, including: improving the power factor and the contracted power, installation of electricity sub meters, and installation of variable speed drivers at the grinder and on fans of drying furnace. The company plans to set up a system for online monitoring of electrical energy consumptions. On compressed air part, the actions performed are: detection and repair of air leaks, better management of compressors, and installation of isolation valves and air storage reservoir.

Furnace and gas system: The company has implemented the thermal insulation of enamelled and cooking furnaces by using ceramic fibre, and has planned the optimum adjustment of the burners of the cooking and drying furnaces. A management system for online gas consumption will also be put in place. All these actions will generate a potential energy saving of 852 MWh/year.

Waste valorization, effluent recycling:

- The grinding balls and the aluminium tubes of the furnaces are recovered and stored until being reused as raw material

by an interested customer (the company has signed up to the Industrial Waste Exchange platform).

- Cardboard waste, plastic and scrap is separated, baled and sold to the recycling industries
- Dyes and enamels residues are recovered, filtered and reused within the first treatment layer of the tiles
- All the effluents are collected in a decantation pit, filtered, and reused for cleaning and within the process (watering).

Heat recovery: Energy analysis has revealed that there is a significant amount of energy at high temperature which is lost in the atmosphere. Two projects are planned to recover 511 MWh of thermal energy, these are:

- The energy recovery from the flue gases of cooking furnace into the drying furnace. The gain represents 50% of current consumption of the dryer in addition to an increase in productivity
- Use of energy recovery from biscuit furnace at the raw material grinder, which will improve productivity and quality of the final product



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MED TEST Case Study

CERAMIC sector — MOROCCO

Ceramic manufacturing industry — Ghorghiz Cerame Company

Company overview

Ghorghiz Cerame is an industrial unit, located in the industrial area of Oued Laou in Tetouan. It has as its main activity the production of ceramic tiles of various designs and patterns. The company was established in 2003, employs 205 people and has an average turnover of \$US 8 million.

The company joined the MED TEST project in order to identify opportunities for effective use of resources (heat, water, electricity and chemicals), reducing production costs, recovery of solid waste and minimization of wastewater.

The company was certified ISO 9001 in 2008, the product is certified with the Moroccan norm NM, and the medium term plan is to obtain ISO 14001 certification.

Benefits

The actions identified through the MED TEST project will enable the company to achieve annual saving of \$US 433,180 from the economy of energy, raw materials and chemicals with an estimated investment of \$US 347,583, and a payback period of 9 months. Half of the actions were carried out in 2011; the rest are scheduled for 2012.

The economic savings due the optimization of electrical systems, furnaces and gas systems represent a cost reduction in the annual energy bill of 4%. The most significant part of these savings is in the thermal energy, with the heat recovery project from the flue gas of the cooking furnace and from the atomisation tower. Besides energy savings, these measures will entail increase of productivity and product quality.



“While receiving MED TEST technical assistance, we have realised how important environmental protection is, and how this can also help the company to improve its overall performance.”

Redouane MERROUNI, Director General

All the effluents are recycled on site, as the residues of enamels and dyes are recovered and recycled within the process. The company has implemented several best practice to better manage the solid waste (cardboard, plastic and scrap metal) and their valorization through the recycling chain.

In addition to the savings opportunities, the company also benefited from technical assistance in the introduction of an environmental management system, which integrated both environmental policy and operational procedures. The company is already certified ISO 9001, and in the medium term plan to obtain ISO 14001 certification.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Electrical system, compressed air, chillers	153 620	64 875	0.4		653
Furnaces and gas system	144 260	179 583	1.2		723
Waste valorization, effluent recycling	41 800	3 125	0.3	Water: 30 000 m ³ Various waste	
Heat recovery	93 500	100 000	1.1		731
TOTAL	433 180	347 583	0.8		2 107

Electrical systems, compressed air, chillers: The Company has put in place a set of actions to reduce electricity consumption, including:

Improving the power factor and subscribed power, installation of electricity sub meters, and installation of variable speed drivers on the air compressor.

The company plans to set up an on line monitoring system for energy consumption as well as variable speed drivers at the grinders. The company has replaced the chillers serving the production line n°2 with a cooling tower in order to reduce the electrical consumption: this action will be replicated on the production line n°1.

Furnaces and gas system: The company has insulated the cooking furnace using ceramic fibres, and has adjusted the burners to the optimum by adjusting the fuel pipe feeding the burner of the spraying tower. The company is planning to install a new generation burner with an injection system to optimize the fuel consumption at the atomiser and to implement a management system online to control the gas consumption. All these actions will generate a potential energy saving of 723 MWh/year.

Waste valorization and recycling of effluent:

- The grinding balls and alumina tubes of the furnace are currently being recovered, crushed and recycled; a certain percentage of this material is used within the product formulation
- Cardboard waste, plastic, wood and scraps are separated, baled and sold to recycling industries
- Dyes and enamels residues are recovered, filtered and reused in the first treatment layer of tiles
- The entire effluent generated is collected in a decantation pit, filtered, and reused in the preparation of the ceramic slip

Heat recovery: Two projects for energy recovery from flue gas have been identified:

- Installation of a heat exchanger to recover heat from the hot air of the atomization tower, to then preheat the inlet air to the furnace burner, raising the air temperature from 60 to 200°C.
- Energy recovery from the cooking furnace into the drying furnace. The gain represents 50% of current consumption of the drying furnace in addition to an increase in productivity

These actions have been implemented on the new production line recently installed in the company.



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MED TEST Case Study

FOOD sector — TUNISIA

Milk and dairy product industry — CLC

Company overview

Cap-Bon milk company (CLC) is part of the DELICE group, the market leader for dairy products in the Tunisian food industry. The site produces about 1,696,744 hl/year of milk beverages and 3 tons/year of butter.

Among the company's main incentives for joining the MED TEST was the opportunity to find ways of reducing and reusing the generated waste, as well as the rationalization of raw material consumption.

At the beginning of the project, the company was in a preparatory phase for obtaining the ISO 22000 certificate, a goal reached over the course of 2011; the company then took steps to implement an environmental management system in line with ISO 14001.



“The economic and environmental benefits the project has generated have reinforced the management's commitment to maintain a preventive environmental approach.”

Mr. Karim BELOUARDA, Energy and Environment Director

Benefits

The MED TEST project has generated annual financial gains of \$US 546,903 in raw materials, products, water and electricity with an overall investment of \$US 484,945. The average payback period is estimated at 10 months. Most of the identified measures have been implemented in 2011.

Energy costs have been reduced by 19% through the implementation of an efficient action plan: optimization of compressed air consumption, boiler upgrade, improved regeneration capacity of pasteurizers and sterilizers, adjustment of the chillers' coefficient of performance (COP). Measures were also identified to reduce water consumption, such as closed-circuit equipment cooling, which led to a 13% reduction in the costs of water purchases.

Further environmental benefits have been achieved at the level of wastewater pollution loads. The company

has achieved annual reductions of 22% in BOD₅ and 28% in COD through the reduction of product losses, as well as the research for valorization measures regarding waste and by-products. Moreover, this spectacular improvement will allow the company to renegotiate its wastewater processing fees with the communal treatment plant in Sthial, also member of the DELICE group and situated nearby.

During the implementation of the MED TEST project, CLC has been provided with the tools necessary to ensure strong linkages between the Clean Production process and the ISO 14001 environmental management system, so as to allow for the good management of all implemented measures and the sustainability of the method. Indeed the environmental policy has been documented and communicated, so as to initiate the implementation of all necessary procedures, as well as of a suitable environmental management scheme.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Reduction of product losses	237 021	123 304	0.5	414 m ³ milk 7.5 tons butter	-
Water savings	32 993	77 750	2.3	35 500 m ³ water	-
COP of NH ₃ chillers	153 606	35 731	0.2	3 142 m ³ water	1 666
Efficacy of pasteurizers and sterilizers	65 442	71 918	1.1	5 846 m ³ water	2 858
Boiler regulation	21 576	86 306	4	-	459
Compressed air production	36 265	89 936	2.5	-	376
TOTAL	546 903	484 945	0.88		5 359

Reduction of product losses: The installation of transmitters integrated into the control system of selected workstations, as well as the retrieval of residual milk and butter before the cleaning stage will entail product gains of 414 m³/year and 7.5 tons/year respectively. Moreover, the company has launched a collaboration with a research unit so as to develop a procedure facilitating the elimination of fat from centrifuges and of non-compliant milk. As a consequence, COD and BOD₅ levels have been reduced to the minimums of 295 and 144 tons/year respectively.

Water savings: The company has implemented several measures aiming to reduce water consumption. These measures include a closed-circuit equipment for cooling as well as the replacement of existing vacuum pumps with closed-circuit pumps. These initiatives will reduce the volume of water used by 35,500 m³/year.

COP of NH₃ chillers: Ammoniac-based chillers are the site's foremost electricity consumer. The optimisation of the coefficient of performance via condenser and evaporator temperature regulation will improve the current chillers' performance by 27%. As a further direct effect of the measures regarding electricity consumption (gains of 1,660 MWh/year and 883 tons/year of CO₂), less heat will be transferred to the cooling towers,

which will result in water gains of 3,142 m³ (cooling tower makeup water).

Efficiency of pasteurizers and sterilizers: The regeneration efficiency of heat exchangers between heating and cooling sections should be higher than 90%. This is feasible through the installation of additional plates (heat exchangers). Besides limiting the thermal energy consumption, this initiative will reduce CO₂ emissions by 629 tons/year and water consumption by 5,846 m³/year.

Boiler regulation: This action consisted of installing an online oxygen analyser on the heater chimney, facilitating the real-time regulation of air/gas debit and therewith the optimization of boiler house efficiency. In addition to energy gains (459 MWh/year), this initiative will cut CO₂ emissions by 153 tons/year.

Compressed air production: Several measures have been initiated in order to optimise compressor performance: insulation of hot air sheaths inside the air compressors, acquisition of a lubricated compressor, reduced compressor solicitation achieved through an increase of storage capacity and the installation of an air debit meter on the exit to the factory. These actions have reduced electricity consumption by 376 MWh/year.



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MED TEST Case Study

TEXTILE sector — TUNISIA

GARTEX

Company overview

GARTEX is a jeans production and bleaching company fully focused on exports. The company has a working capacity of 2,800,000 items per year. It carries out washing and special treatment processes.

At the start of MED TEST, the company was already certified ISO 14001 but was aware of a lack of know-how in resource management and implementation of good environmental practices.

Thus, its participation in the project allowed the company to revise its environmental policy in order to integrate the concept of clean production and to enrich and implement its action plan.

Presently, the company is oriented towards the use of the most eco-friendly chemical products so as to adopt the Oeko-Tex STANDARD 100.

Benefits

The MED TEST project has recorded net annual savings amounting to \$US 67,200 from electricity, gas, water, and chemical product consumption with an estimated investment of \$US 76,200. The pay-back period is estimated between 5 and 18 months.

Energy costs have been reduced by 15% installing an economizer at the boiler, leading to the recovery of heat from the boiler emissions through a heat exchange with water, and by the use of machinery monitoring systems.

Water costs have decreased by 19% through implementing a rinse water recovery and reuse system, as well as monitoring systems.

Chemicals costs have been reduced by 11% introducing a machinery monitoring system and a chemicals



“Our ISO 14001 certification cannot fully respond to our expectations in terms of resource saving and environmental protection. For us, the MED TEST integrated approach is more complete and effective.”

Nabil BEN HAMMOUDA, Washing Department Manager

management system in terms of storage, maintenance and handling.

Other environmental advantages have been achieved by revising the environmental policy and integrating the clean production concept, by identifying new significant environmental aspects such as preventive maintenance, water and energy recycling, as well as orientation towards the use of eco-friendly chemical products. Thus, new work procedures were installed such as chemicals management and comparative monitoring of water, energy and chemicals consumption.

A measuring and monitoring system for water, electricity, gas and chemicals consumption is being implemented in the washing department, with a benchmarking tool, in order to control consumption and follow up performance indicators.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Recovery of rinsing water of washing unit	12 800	15 700	1.3	Water: 11,250 m ³	-
Boiler, economizer	18 400	25 000	1.4		930
Management of dyes and chemical products	11 000	5 500	0.5	Chemicals: 5%	
Usage of washing machine monitoring system	25 000	30 000	1.2	Chemicals: 6% Water: 3,500 m ³	162
TOTAL	67 200	76 200			1 092

Recovery of rinsing and washing water: The AVANTEC washing machines are equipped with double water exits. This option facilitates the implementation of a system for reuse of rinse water, which requires the installation of gutters wired to the washing machines, pipes from the gutter to the recovery basin with a 60 m³ capacity, a return pipe (equipped with branching system) leading back to the machines as well as water pumps in the retrieval and supply blocks. The quantities of reused water amount to 11,250 m³/year.

Boiler, economizer: The temperature of air emanating from the boiler is very high and can be used to heat water over the installation of water/air heat exchangers or economizer at the exits. The annual gas consumption amounts to 545 TEP/year, and the installation of the economizer will allow for savings of 930 MWh/year.

Management of dyes, chemicals etc: The management and reorganization of the storage facilities for chemical products has been achieved thanks to the processing of technical forms and Safety Data Sheets, to a purchasing policy that takes into

account the ecological characteristics of products when choosing among similar products, and to the application of best practices regarding the compatibility of products when stored and of necessary precautions such as retentions to prevent leaks and compliance with height standards in storage.

A system for monitoring product consumption was implemented in the storage areas and procedures for handling and maintenance were developed and applied. These changes have resulted in 5% savings of chemical products.

Use of washing machine monitoring system (advanced programming options): The washing machines have programming systems that are set manually by the machine operator. The advanced programming consists in establishing general washing and drying programmes and adding subprogrammes for facilitating adjustments, thereby eliminating manual interference and reducing error risk. The achieved gains concern time of process, now reduced by 25%, water consumption (3,500 m³/year), thermal energy (162 MWh/year) and chemical products (6%).



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MED TEST Case Study

TEXTILE sector — TUNISIA

Textile finishing – Garment Dyeing Service (GDS)

Company overview

GDS is an export-reliant dye-works company specialised in jeans and knits. Its production amounts to 10,000 pieces a day (reference year: 2010), divided into jeans (80%) and knits (20%).

At project start-up, the company had no certification and was aware that its financial competitiveness was jeopardized by an excessive consumption of resources. MED TEST enabled the company to launch measures in order to reduce over-consumption as well as process losses.

The company is currently heading for the use of the most eco-friendly chemicals and the adoption of a product ecolabel such as Oeko-Tex standard 100.



“This project is very timely because we have to cope with an important amount of waste and have to control consumptions. Our goal is to solve our problems linked with resource efficiency and environment.”

Mr. Dany LALLEMAND, Manager

Benefits

The MED TEST project has identified an opportunity for annual financial savings of \$US 91,000 in electricity, gas, water and chemical products against an investment estimated at \$US 139,000. The payback period varies between four months and three years.

Energy costs were reduced by 7% through an intervention on process facilitating a better lab-workshop correlation and the reduction of the dye bath ratio for several procedures.

The costs of water and chemicals are reduced by 24% and about 25% through these actions on production process, together with an improved preventive maintenance management system (an efficient good practice tool) and the installation of an automated dosing system for chemical products.

The company has set up an environmental policy that integrates the clean production concept. The ecological aspect has been taken care of by adopting Oeko-Tex standard 100, which implies that the company is orienting itself towards the most eco-friendly and least toxic chemicals.

Moreover, the measures taken by the company to improve and better manage production processes, such as the age and manual use of machines or the diversity of dyeing procedures, have helped to reduce the environmental and financial impact of process losses generated by the company's activity.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Lab-workshop correlation	36 000	22 000	0.6	8,100 m ³ water Chemicals: 8%	770
Liquor ratio reduction for 6 machines	3 800	3 000	0.8	2,500 m ³	142
Preventive maintenance	6 000	2 000	0.3	1,600 m ³ water Chemicals: 2%	55
Recovery and reuse of water in wool dyeing process	13 500	12 000	0.9	22,500 m ³ water	
Automated chemicals dosing in cotton section (11 machines)	32 000	100 000	3	Chemicals: 15%	
TOTAL	91 300	139 000	1.5		967

Liquor ratio reduction for 6 machines: This measure consists of liquor ratio switching from 1:12 to 1:8 for rinsing and softening baths, while pre-serving quality standards in all machines. This measure enables water and electricity savings of 2,500 m³/year and 142 MWh/year.

Preventive maintenance: This option implies the implementation of a tracking system for failures and machines consumption in consumables and spare parts. Preventive maintenance consists in the establishment of an intervention schedule aiming to eliminate water and steam leaks, as well as malfunctions engendering electricity overconsumptions or quality problems that result in losses of material or process input. This project generates savings in water (1,500 m³/year), energy (55 MWh/year) and chemicals (2%).

Automated chemicals dosing in cotton section (11 machines): The creation of a centralized station for dye dissolution, preparation of auxiliary products and distribution towards the 11 dyeing machines in the cotton workshop generates substantial

savings through an improved use of products and a reduction of their consumption by 15%.

Lab-workshop correlation: This measure consists of controlling the correlation rate between laboratory and workshop, facilitating the optimization of dye recipes in the laboratory in order to improve this ratio and prevent adjusting and redoing, which cause a waste of time, electricity, water, chemical products and therefore of productivity. The option has been implemented in one dyeing process (the “old” label, 80% of the whole cotton production) and has entailed a 30% improvement of the lab-workshop correlation and therewith savings in terms of water and electricity input (15%) and products (8%).

Recovery and reuse of water in wool dyeing process: This measure consisting in the retrieval of water used in certain wool dye-baths facilitates the retrieval and reuse of 15% of all process water. The rinsing baths will be reused within the preparatory stage. Water savings amount to 22,500 m³ while financial gains add up to 19,000 DT.



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MED TEST Case Study

FOOD sector — TUNISIA

Oil and fat industry — General Industrial Food Corporation Slama (CSM - GIAS)

Company overview

GIAS, one of the protagonists of the Tunisian economy, was founded in 1983. With a € 30 million annual turnover and some 500 employees, the company manages innovative and top brands, producing about 50 different products (margarine, ingredients for pastry shops or bakeries). The company has signed a partnership deal with CSM, the world market leader and top supplier for bakery products. This joint venture provides GIAS access to a wide distribution network throughout a large number of countries.

The company's incentive for joining the MED TEST project was to identify new ways of reducing energy consumption, as well as material losses in each production site.

Before the MED TEST project started, the company already had an integrated management system for safety, quality and environment in conformity with ISO 9001, ISO 22000, ISO 14001 and OHSAS 18001 standards.

Benefits

The MED TEST project has identified opportunities for annual savings of \$US 137,700 in raw materials, semi-finished products, water, electricity and steam, against an overall investment of \$US 191,200. The payback period is estimated at 1.2 years. Most identified projects have been implemented in 2011.

Optimizing the cleaning in place (CIP) process has reduced water costs by 12%, mostly through the replacement of chemicals previously utilized with one single-phase ecological product at the margarine production site GIAS 1. Energy costs have been reduced by 17% through the implementation of an action plan based on a diagnostic review of steam and compressed air leaks, as well as in NH₃ chillers and CIP optimization.

“The MED TEST method links up with the sustainable development axis of the 2015 Strategy adopted by CSM–GIAS. Intent on being a ‘green company’, CSM–GIAS has initiated a company culture based on cleaner production.”

Zouhaier SAOUDI, Operational Director

Further environmental benefits have been achieved in terms of reduction of wastewater pollution, corresponding to 93% of annual COD (Chemical Oxygen Demand < 500 mgO₂/L), through the implementation of three projects which have allowed for a better recovery of product losses in production (215 tons), an improved quality control of water flows entering the wastewater plant and a rigorous follow-up on the wastewater plant performance.

CSM-GIAS's integrated management system has been reinforced during the implementation of the project. Indeed, the quality policy has been updated to adopt a CP strategy. Certain procedures and instructions have also been created and/or updated; an example is the creation of a working instruction for the analysis of oil and grease contents in the wastewater stream. In addition, the OHSAS 18001 system has been updated to include new projects aiming at the improvement of operators' health and working conditions (for instance, local fume hoods for mixing powders, GIAS 35/5 planned for 2012).

The company, which has benefitted from skills training in Environmental Management Accounting, has been able to determine and implement several measures allowing for a 2.5% reduction of raw material losses in production site GIAS 4, formerly identified as the main cost centre. The company has adopted EMA practices and implemented a system for weekly follow-ups in each production site.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Product losses	25 000	-	-	120 tons products	
Optimization of CIP, GIAS1	11 200	7 700	0.7	2,300 m ³ water	50
Optimization of wastewater treatment	14 000	28 000	2		-
Preventive maintenance	10 500	3 500	0.3	1,000 m ³ water	830
Optimization of NH ₃ chillers	70 000	138 000	1.9	95 tons product 700 m ³ water	632
Sustainable design of new cold storage at GIAS 2	7 000	14 000	2		100
TOTAL	137 700	191 200	1.4		1 612

Product losses: CSM-GIAS has adopted a method for reducing product loss in different production sites, mainly in the topping and icing site GIAS 4. This measure has allowed for the recovery of 33% of products lost during production starts and for their reintegration into the process, which has consequently reduced COD charges by 28%, an achievement in compliance with the national water discharge regulations.

CIP optimization at GIAS1: After obtaining satisfying results during one month testing of a single-phase product for CIP of the pasteurizer, chemical cleaning products used at GIAS1 have been replaced; which has allowed for water savings worth 12% of the total volume of water consumption in the company. COD charge and electricity consumption were reduced respectively by 7% and 1%.

Wastewater treatment optimization: Equipment purchases have allowed for very satisfying results (DCO < 500 mg O₂/L), bringing sewage treatment into compliance with national wastewater regulations and reducing COD by 57%.

Preventive maintenance: The implementation of the action plan has contributed to a 3% reduction in the overall water consumption, a 10% reduction in thermal energy and 4.2% in electricity. The achieved financial gains have an immediate payback period (<1 month). Currently, a leak inspection programme is included in the weekly maintenance schedules.

NH₃ chillers optimization: The acquisition of a new compressor with variable speed drivers and an evaporative condenser has facilitated the optimization of the NH₃-based cooling circuit for margarine crystallization, which has reduced inactivity periods due to low temperatures, thereby facilitating the recovery of 95 tons of product losses, the decrease of electricity consumption by 632 MW/year, corresponding to 12% of total electricity consumption, as well as 2% savings in water.

Sustainable design of new cold storage (GIAS 2): This project is a reference case for the application of CP principles when investments are at planning stage. The revision of the initial project design for a new cold storage room has highlighted the opportunity of moving the evaporators originally situated at the two ends of site GIAS 2 to the site's corridor, so as to facilitate the homogeneous circulation of cold air. As a consequence, the energy demand of the new cold group should decrease by 5%.



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MED TEST Case Study

TEXTILE sector — TUNISIA

MEGASTONE

Company overview

MEGASTONE is specialized in jeans bleaching, dye-works and special effects treatments. It has a washing capacity of 12,000 pieces a day and exports 100% of its production.

At project start-up, the company, no longer meeting the environmental standards for wastewater, had lost its ISO 14001 certification. It was aware of a know-how deficit in terms of resources management and implementation of good practices; energy costs, for instance, had risen by 40% between 2007 and 2009.

Thanks to MED TEST, the company was able to revise its environmental policy and aspect register, so as to integrate cleaner production principles and good practices. The company is currently striving to make use of more environmentally friendly chemicals, in order to become certified Oeko-Tex Standard 100.

Benefits

MED TEST has identified annual savings opportunities of \$US 55,600 in electricity, gas, water and chemicals against an investment estimated at \$US 76,500. The pay-back period is expected between 4 and 26 months.

Energy costs have been reduced by 30% by installing an economizer at the boiler, operating the machines in automatic mode and insulating steam pipes.

The costs of water and chemicals have fallen off respectively by 10% and 12%. The preliminary improvement of the lab-workshop correlation will generate savings in water, chemicals and energy, by optimizing the laboratory recipes in order to directly reproduce them in production, by bettering automation level and batching precision, and by raising awareness among operators.



“As we are facing tough price competition, we are forced to keep our costs under control to remain on the market. MED TEST has given us insights on our hidden costs and helped us move towards significant saving opportunities, in order to maintain competitiveness.”

Abdelkader SOUALEH, General Director

Further environmental benefits have been achieved through revising the environmental policy to include cleaner production and identify new significant environmental aspects such as preventive maintenance, maintenance management for machines and enhancement of the implementation plan for efficient energy management.

Currently, a benchmarking system for tracking and measuring the consumption of water, electricity, gas and chemicals of the washing department is being installed in order to monitor consumption and follow up on performance indicators.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Preventive Maintenance	1 000	3 000	0.3	Water: 900 m ³ Chemicals: 2%	30
Boiler economizer	20 600	4 000	2.2	-	1 042
Insulation of steam pipe network	9 500	11 400	1.6		482
Upgrades of the automation system of washing and drying machines	24 500	17 100	0.7	Chemicals: 10% Water: 3 000 m ³	304
TOTAL	55 600	35 500	1.4		1 858

Preventive maintenance: This measure consists of implementing a monitoring system for machine breakdowns and related consumption of spare parts and consumables. Preventive maintenance includes intervention planning for maintenance operations, aiming at the elimination of water or steam leaks and of operational problems that cause energy overconsumption or quality lapses inducing losses of materials and process inputs. This project allows for savings in water (900 m³/year), energy (30 MWh/year) and chemicals (2%).

Boiler economizer: The significant boiler flue gas temperature can be exploited to heat up water through the installation of heat exchangers (or economizers). The latter allow for energy savings of 1,042 MWh/year. This measure has been studied but not implemented yet.

Insulation of steam pipes: The steam network causes losses due to a lack of thermal insulation of the pipes, that add up to

5.71 therms/hour. In order to eliminate them, the plan is to insulate the steam pipes with rock wool subsequently covered by an aluminium duct. Energy savings will add up to 482 MWh/year, corresponding to about 7% of thermal energy consumption.

Upgrades of the automation system of washing and drying machines: The company plans to replace the washing and drying machines programmer, to change or repair the water levels of the washing machines and to install individual water meters as well as humidity control phials in the tumble dryers. Furthermore, centrifuges are to be equipped with time-out mechanisms, broken time-out hardware shall be repaired and the degree of residual humidity controlled, all to adjust centrifuging and drying times. The economic savings relate to a reduction per year of process duration (15%), consumption of water (3,000 m³), thermal energy (304 MWh) and chemical products (10%).



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MED TEST Case Study

FOOD sector — TUNISIA

Beverage industry — Cap-Bon Beverage Company (SBC)

Company overview

The Cap-Bon Beverage Company (SBC) is part of DELICE, the leading group in the Tunisian dairy industry. The site produces approximately 286,382 hl/year of beverages, divided among local brands and Coca-Cola.

To rationalize water and energy consumption, and to position itself as an environmentally responsible company towards competitors, were among the company's primary motivations for taking part in the MED TEST project.

At project start, the company did not have an environmental and safety management system, however a health and security committee was operational. The site is currently implementing the Total Coca-Cola Quality System standard, which includes an environmental facet.



“In subscribing to the MED TEST project, SBC has committed to maintaining its image as an environment-friendly company.”

Karim BELOUARDA, Chief of the Energy and Environment Section

Benefits

The MED TEST project has generated annual financial gains worth \$US 75,454 in raw materials, semi-finished products, water and electricity, against an overall investment of \$US 56,331. The payback period is estimated at 9 months. Most of the identified measures have been implemented in 2011.

The cost of electricity has been cut by 21%. Among the measures for electricity savings, the optimization of compressed air production yielded the highest gains. As a matter of fact, the company installed a management system and variable speed drivers that considerably reduced the electricity demand of the 40 bar compressors. The company has achieved gains of 22% on water costs through the implementation of several projects: the most relevant one was the recovery of rejects from reverse osmosis (RO) to supply a secondary RO unit.

In terms of wastewater treatment, the company achieved annual reductions of 25% in BOD₅ and 32% in COD. The improvement was a logical consequence of the reduction of product losses, especially for sugar and concentrate. This improvement will enable the company to renegotiate the wastewater treatment cost, currently charged by another company STIAL belonging to the group DELICE.

During the implementation of the MED TEST project, SBC has been provided with the necessary tools to ensure a good linkage between its Cleaner Production programme and an environmental management system (EMS) based on ISO 14001, that will contribute to the good management of all implemented measures and their sustainability. Within its EMS framework, the company has come to define its environmental policy and has implemented operational procedures, as well as an adequate environmental management scheme.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Water conservation	17 602	29 738	1.7	18 310 m ³ water	-
Heating ventilation and air conditioning (HVAC)	15 887	6 562	0.4	-	191
Reduction of product losses	20 170	1 381	< 0.1	16 tons sugar 300 m ³ water	-
Air compressed circuit, compressors	21 795	18 650	0.8	199 m ³ water	709
TOTAL	75 454	56 331	0.8		900

Water conservation: Several measures facilitating a reduction of water consumption have been implemented. Among them is the installation of a system that allows adjusting the rinsing water volume according to the size of contents and end products. This water can therefore be reused after filtration. Recycling reject water from reverse osmosis (RO) unit into a secondary RO unit will increase the efficiency of the water treatment process. Although this raised electricity consumption by 0.9%, the overall implemented measures have led to significant gains of 18,310 m³ water.

Heating ventilation and air conditioning (HVAC): The company has brought about a loads reduction on the air-conditioning system through the removal of a cooling unit of the blower outside the workshop, as well as the installation of heat exhaust hoods on some machines. As a consequence, the electricity consumption has been reduced by 191 MWh, which has brought about a reduction of 95 tons in CO₂ emissions.

Reduction of product losses: 4.8% of sugar, corresponding to 16 tons/year, has been recovered from the rinsing of the syrup residues between batches, as well as its reuse as supplement for subsequent fabrications. Moreover, the company has opted for using CO₂ instead of water for pushing product between pipes and equipment, thereby recovering 6.8 tons of concentrate. These measures have also reduced wastewater loads BOD₅ and COD by 32 tons/year and 60 tons/year respectively.

Air compressed circuit, compressors: The 40 bar compressors use 35% of the annual electricity consumption. These machines were running in on/off mode with a 500 litre buffer balloon, which led to a reduced performance due to frequent starts and stops. This problem has been solved by installing variable speed drivers on the compressors motors. This has cut down electricity consumption by 15% and chilled water demand to cool compressors. Moreover, flow meters and KWh meters have been installed at compressors allowing for real-time detection of malfunctions and helps to prevent their return. This good practices measure has had a positive environmental impact, also engendering electricity savings of 48 MWh.



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MED TEST Case Study

FOOD sector — TUNISIA

Canned food production — Company Cap-Bon (SCAPCB)

Company overview

Founded more than half a century ago, SCAPCB has a production capacity to process 1,200 tons of fresh tomatoes daily. It is the first exporter of harissa on the international market, including France, Italy, Germany, Belgium, Qa-tar, Algeria, Libya, etc.

The company was motivated to join the TEST MED programme in order to identify possibilities to increase efficiency in resource management and productivity, reduce the pollution costs and minimize investments and operational costs of the used waters processing plant.

At the beginning of the project, the company already had ISO 9001 and ISO 22000 certificates; in 2009, out of concern for environment, it voluntarily set about to implement a system of environmental management, security, and health on the workplace in accordance with ISO 14001 and B.S OSHAS 18001 standards.

Benefits

The MED TEST project has identified an annual financial gain of \$US 73,639 in terms of raw materials, semi-finished products, water and steam with a total investment of \$US 98,139. The return on the investment is expected within one year. Most of the identified saving opportunities deal with water conservation, as this aspect is one of the company's main priorities. Part of the identified projects have been implemented throughout 2011; others are planned for the first half of 2012

The costs of water were cut by 44% through the recovery of water and its subsequent reuse in the pre-washing of tomatoes, the optimization of the tomato washing transporter belts, and the installation of a buffer water tank to improve the water distribution system.

The energy costs in terms of steam were reduced by 9% after the implementation of actions designed to reduce steam consumption within tomato pre-heating process.

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“The TEST approach supports the hunt for squandering and the efficient use of resources, thereby facilitating financial and environmental gains which reinforce company performance.”

Sofiane GASTLI, Manager

The implementation of certain projects (especially the recovery of tomato waste) will allow the company to achieve other environmental advances that will in turn facilitate a reduction of pollution costs (BOD₅ and COD) by 80% in comparison with the previous year.

The integrated management system SCAPCB was enforced throughout the implementation of the project. In fact, the company reviewed its quality and environment policy, integrating the aspect of cleaner production (CP). Furthermore, certain procedures and instruction manuals were created, such as the procedure for water reuse. As a part of the implementation of an environmental management system, SCAPCB conducted its own environmental analysis. An environmental programme was undertaken, including all CP measures identified during the implementation of the TEST project. The company plans to achieve the ISO 14001 standard within the second half of 2012.

Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Reuse of tomato washing water for pre-washing	2 071	2 142	1	50,000 m ³ water	
Optimization of water sprinkling on conveyor belts used for tomato washing	9 800	715	<0.1	16,737 m ³ water	
Pre-heating process	23 000	2 140	<0.1		761
Conception of a buffer water tank	24 000	93 000	4	60,000 m ³ water	
Process water treatment unit	1 768	142	<0.1	3,000 m ³ water	
Valorization of tomato marc	13 000	-	-	900 tons tomatoes	-
TOTAL	73 639	98 139	1.3	-	761

Reuse of tomato washing water for pre-washing: This refers to the retrieval of 50,000 m³ of well water previously discharged, and its reuse for the pre-washing of fresh tomatoes. This has facilitated a 12% reduction in the overall water consumption on the site, which consequently contributes to the reduction of the hydraulic load of the wastewater treatment plant.

Optimization of water sprinkling on conveyor belts used for tomato washing: After a modification of the nozzle (company design) used for pre-rinsing and final rinsing of fresh tomatoes, the company could reduce its overall water consumption by 40%. This has also permitted the overall improvement of the quality of finished products in comparison to the previous year.

Valorization of tomato marc: This project consists in the sale of 900 tons of waste from tomato refinement to the farmers who use it to enrich animal fodder. Thus a timely waste disposal is facilitated and the cleanliness of the company site is ensured. Moreover, in the future the company will seek to valorize tomato marc for the extraction of lycopene or essential oils for cosmetic usage.

Pre-heating process: The company has implemented several measures seeking to reduce thermal energy. These measures include the installation of a continuous control system for steam debit and pressure upstream the block valve, a pressure meter after the hub and the insulation of all non-insulated parts on steam piping (switch latches, valves, etc.). These measures have allowed for a 40% reduction in thermal energy consumed at the pre-heating stage, corresponding to 761 MWh/year.

Conception of a buffer water tank: The conception of a water tank with a 300 m³ capacity has allowed for a more efficient distribution and a more economical use of drilling water, as well as the protection of submerged pumps against water currents. A total 15% reduction of the overall water consumption has been achieved, corresponding to 60,000 m³.

Process water treatment unit: The company has carried out physiochemical and bacteriological analyses of the wastewater from the regeneration of the resin (reject) at the process water treatment unit. The achieved preliminary results were satisfying. A quantity of 3,000 m³/year could be reused for second grade applications and generate gains of 7% relative to the total water consumption.



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MED TEST Case Study

LEATHER sector — TUNISIA

Tannery industry — Société Moderne des Cuirs et Peaux (SMCP)

Company overview

SMCP is a leather company founded in Sfax in 1965. The tannery's production is distributed in ovine skins (57%, 525 tons/year), goat skins (10%, 90 tons/year) and bovine skins (33%, 300 tons/year). It produces for both local and international market.

The company joined the MED TEST project in order to identify opportunities for improvement regarding the pollution linked to its activity and to improve its environmental performance, which will in turn help it to conform to regulations and facilitate access of its goods to the international market.

While the company is already in the process of implementing an ISO 9001 standard, its adhesion to MED TEST represents an opportunity to integrate in the near future an Environmental Management System (EMS) in line with ISO 14001 standards.

Benefits

The MED TEST project has identified an opportunity for \$US 97,200 of annual savings in electricity, water and chemicals, against a \$US 287,000 investment with a three-year payback period. The identified cleaner production measures are under implementation.

The gains resulting from the minimization of chemicals use are mainly as a result of substantial reductions in the volume of chrome (up to 77%) as well as of auxiliary products (e.g. salt), which are estimated at 15%.

Water consumption has been reduced by 22% through the installation of new systems for dosing and control water in the drums, hide splitting and recycling of pickle liquors.

Insulating steam and hot water pipes has reduced energy costs. The tannery plans to cut down its thermal energy



“Opting for finished leather export, SMCP has adopted the TEST approach in order to improve its environmental performance and raise its international market share.”

Amine BEN ARABE, Director

consumption by 10% in the coming years, when the tannery's industrial area will be connected to the public natural gas network.

As for environmental improvements, the company has focused on a reduction of its wastewater loads and an improvement of the existing water treatment plant, to achieve 80% reduction in COD, corresponding to annual financial gains of \$US 14,000. Taking into account all the measures adopted by the company, substantial environmental gains have been achieved, corresponding to approximately 40% reduction of chlorides discharges.

Parallel to the identification of minimization opportunities, the company has outlined its own environmental policy and begun to look for further areas of potential improvements.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Hide splitting	26 000	72 000	2.5	1,850 m ³ water	-
Water savings, dosing and control in the drums	17 000	35 000	2	5,500 m ³ water	68
Hot water/steam pipes insulation	1 700	5 000	3	-	31
Drumming and salt reduction	17 000	43 000	2.5	72 tons of Cl	-
Reuse of recovered chromium	24 000	107 000	5	24 tons of Cr	-
Recycling of pickle liquors	11 500	25 000	3	2,250 m ³ water	-
TOTAL	97 200	287 000	3		99

Hide splitting: This option limits the consumption of chemicals (15 tons/year of chrome) and water (1,850 m³/year, i.e. 4% of the global process water), thus minimizing the environmental impact of the site.

Water savings – dosing and water control in the drums: In addition to using drums with low water consumption, already installed some years ago, the tannery has proceeded to install an on line metering system for water flow and bath temperature in the drums, which has led to savings in water (10%) and thermal energy (7%).

Insulation of hot water and steam pipes: Heat dispersion through the hot water and steam pipes causes a significant loss in thermal energy. Their insulation allows for a reduction of thermal energy consumption (3%), as well as of CO₂ (10 tons).

Reduced use of salt in skin and leather drumming before soaking: The tannery's equipment, with a perforated shaking

drum, facilitates the elimination of salt from the salted hides before the soaking stage, which results in the elimination of 120 tons/year of salt, in a 40% reduction of chlorides in wastewater, and in lowering COD and BOD₅ loads.

Reuse of recovered chromium: The chromium sulphate recovered after precipitation and filtering can replace 46% of the new chromium with no impact on the quality of finished leather. This technique allows for the reuse 24 tons/year of recovered chromium otherwise discharged as sludge, and for \$US 24,000/year savings, taking into account the additional electricity costs.

Recycling of pickle liquors: Pickle liquors can be recycled in the pickling process or reused in the tanning process, allowing for a reduction of the quantities of salt and effluents discharged into the sewer. As a result, the lower demand for chemicals entails a reduction of 45 tons/year of salt; of 5% of the annual water consumption within the production process; and of wastewater pollution loads, especially in sulphur acids, formic acids and COD.



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MED TEST Case Study

FOOD sector — TUNISIA

Beverage industry — Société Nouvelle de Boissons (SNB)

Company overview

SNB, a leading carbonated soft drinks producer, it is part of the Tunisian holding “Société Frigorifique et Brasserie de Tunis (SFBT)”. The company produces approx. 635,000 hl/year of its own brands and Coca-Cola licensed beverages for the local market and for export (50%).

The company was motivated to join the MED TEST project to identify opportunities for increasing resource efficiency and productivity, reduce pollution loads in order to minimize investment/operational costs of the planned wastewater treatment plant.

At project start-up the company was already certified ISO 9001, ISO 22000 and had completed the design of its EMS according to the ISO 14001 and of its occupational health and safety system in line with OSHAS 18001 standards.

Benefits

The MED TEST project identified annual total savings of \$US 194,600 in electricity, natural gas, water, raw materials and product savings with an investment of \$US 29,200. The simple pay-back period is less than 2 months. All the measures have been implemented by the company in 2011.

Energy costs have been reduced by 14% by implementing heat recovery at syrup preparation unit, installing a frequency variator on compressors and a compressed air recovery system at PET bottle blowing machine. CO₂ emissions were reduced by 464 tons/year.

Water costs decreased by 12% through optimizing Cleaning in Place (CIP) and applying several conservation measures to reuse high-grade rinsing water into second-grade applications (e.g. washing of sand and carbon filters at the water treatment unit).



“MED TEST has enabled SNB to implement a culture of rationalization of the use of natural resources for the good of the company and of the environment.”

Lasaad MZEH, Director General

Additional environmental benefits have been achieved in terms of wastewater pollution loads reductions, corresponding respectively to 17% BOD₅ and 10% COD annual loads, mainly resulting from improved management of return goods from clients and online product recovery. These have reduced the investment and operational costs of the wastewater treatment plant at design stage.

In parallel to the identification of saving opportunities, the site has designed an EMS system according to ISO 14001 standard, fully integrating resource efficiency into company policy, action plans and internal procedures. This will ensure the sustainability of all identified actions at company level, as well as the development of new projects. Top management already started to capitalize on the experience gained by engaging its own internal team in replicating TEST at manufacturing sites within the holding group.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Expired, damaged and out of specs products	66 000	-	-		
CO ₂ supply and distribution system	35 000	2 700	< 0.1	80 tons CO ₂	99
CIP and water savings	53 400	10 000	0.2	9 300 m ³ water	
Heat recovery in syrup preparation	6 600	3 300	0.5		338
PET bottle blowing	1 100	-	-		8
Distribution pumps, compressed air	32 500	13 200	0.4		359
TOTAL	194 600	29 200	0.1		804

Expired, damaged and out of specs products: The implementation of a management system for on-time sorting of returned goods from clients has recovered 0.4% of product and has reduced by 95% the volumes of non conforming products sent to drain. As a result COD and BOD₅ loads were reduced respectively by 27 tons/year and by 21 tons/year. An on-site segregation procedure and a storage system have been put in place to valorize expired/damaged products as animal feed.

CIP and water savings: The site implemented several measures for optimizing the levels of water and chemical consumptions and recover product (0.15%). These included: recovery of final CIP rinse of the filling machine and of rinsing PET bottles/cans into the water treatment system for washing of sand and carbon filters and for production of softened water; installation of on-line conductivity/pH transmitters for product recovery during in-line transfer between tanks and equipment; soda recovery after cleaning of the PET and can lines. These measures resulted in reduction of 9.7 tons/year COD and 7.6 tons/year BOD.

CO₂ supply system: 10% of the CO₂ consumption corresponding to 80 tons/year has been recovered and reused at the cans filling lines. In addition, the evaporation of liquid CO₂ has been performed using heat recovery from the water inlet (40°C) to the cooling tower, by installing a company designed heat exchanger.

Heat recovery in syrup preparation: Water with sugar mixture is pasteurized at 85°C before filtering and cooling down to 22°C. Chilled water used for cooling has been replaced by process water installing a heat exchanger to recover calories into the next batch and reduce cooling demand. This option will increase production capacity and reduce 10% of total gas consumption.

PET bottle blowing: Manufacturing of PET bottles is a key electricity consumer with multi stadium compressors at 40 bars. Part of the compressed air had already been recovered by the company at the PET blowing line in the pre-blowing stage. The project identified a significant saving opportunity for recovering excess compressed air back to the compressors that would reduce electricity consumption of the line by 40%. This option requires some investments for modifying the compressors. In the meantime the company started to recover the excess compressed air into the utility circuit at 7 bars, without any investment.

Distribution pumps, compressed air: Implementing variable speed drivers at two 7 bars compressors and in the cooling tower will reduce electricity consumption by 338 MWh/year. Reducing the pressure level at distribution systems of compressed air from 36 to 32 bars and from 7 to 6.7 bars, has resulted in saving additional 21 MWh/year.



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MED TEST Case Study

TEXTILE sector — TUNISIA

Textile finishing – STARWASH

Company overview

STARWASH is a fully export-oriented company for jeans fabrics dyeing and bleaching. Its production amounts to 2,000 pieces a day (reference year: 2010), divided into washing (80%) and dyeing (20%).

At project start-up, the company had no certification and was aware that its financial competitiveness was jeopardized by a poor environmental performance in terms of resources consumption and cost structure.

The project implementation enabled to single out several measures that allow saving substantial percentages of production inputs. Moreover, good practices were implemented to optimize chemicals consumption and reduce wastes.

Benefits

The MED TEST project has identified opportunities for annual financial savings of \$US 28,000 in electricity, gas, water and chemical products against an investment estimated at \$US 37,000. The payback period varies between 14 and 17 months.

Energy costs were reduced by 14% through a process intervention setting up a better lab-workshop correlation and the reduction of the dye bath ratio for some procedures.



“Our company needs assistance to gain control over its consumptions and therewith its production costs. The project fully matches our expectations.”

Habib JEBRI, Manager

The costs of water and chemicals are reduced respectively by 30% and about 17% through these actions on production process and the establishment of an improved preventive maintenance management system and of an automatic dosing system for chemicals.

The company has set up an environmental policy that integrates the cleaner production concept.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Machines advanced programme control	8 800	10 000	1.2	2 600 m ³ water chemicals: 5%	110
Preventive maintenance	2 000	1 500	1.5	500 m ³ water chemicals: 2%	20
Partial reuse of rinsing waters	8 000	12 000	1.3	3 700 m ³ water	-
Lab-workshop correlation	10 000	14 000	1.4	1 000 m ³ water chemicals: 10%	220
TOTAL	28 800	37 500	1.3		350

Machines advanced programme control: Within the production cycle, the washing machines are equipped with programming control devices used in a manual mode through the operator's direct intervention. Advanced programming consists in setting up principal washing or drying programmes combined with sub-programmes for additions or adjustments, thus eliminating manual intervention and reducing error risk. This measure requires control valves, meters, probes, etc., to check the machines parameters. The gains concern a reduction of process time (by 25%), water consumption (by 2,600 m³/year), thermal energy (by 110 MWh/year) and chemicals (by 5%).

Preventive maintenance: The company has installed a tracking system for failures and machines consumption in consumables and spare parts. It also has set up an intervention schedule aiming to eliminate water and steam leaks as well as malfunctions engendering electric overconsumption or quality problems that result in losses of material or process input. This project thus facilitates savings in water (500 m³/year), energy (20 MWh/year) and chemicals (2%).

Partial reuse of rinsing waters: The washing machines are equipped with a double water exit. This option requires the installation of a rinsing water recycling system consisting in a gutter connected to the washing machines, a pipe connecting the gutter to a 40 m³ capacity water recovery basin, a return pipe leading to the washing machines with a feed-in and feed-out branching system and water pumps. The water recovery amounts to 4,700 m³/year.

Lab-workshop correlation: This measure consists in controlling the correlation rate between laboratory and process and the optimization of dye recipes in the laboratory in order to prevent adjusting and redoing, which cause a loss of time, electricity, water, chemical products and therefore competitiveness. This action has achieved a 25% improvement of the lab-workshop correlation and therefore annual savings in terms of chemicals (10%), electricity (220 MWh) and water (14,800 m³).



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MED TEST Case Study

TEXTILE sector — TUNISIA

Teinturerie Finissage Méditerranéenne (TFM)

Company overview

TFM is a company specialized in textile dyeing and finishing. Its business field covers bleaching, dyeing and finishing. The company exports 70% of its production. Over the year 2010, it achieved an annual production of 6 million linear metres of fabric.

TFM has been among the first companies to implement the MED TEST project in order to improve productivity, resource efficiency and waste minimization, and ultimately to reduce waste treatment costs.

At project start-up, the company had no certified management system but it is now certified Oeko-Tex standard 100 and is setting up an ISO 14001-based environmental management system.

Benefits

The MED TEST project has identified improvement options worth \$US 491,860 of annual savings in electricity, gas, water and chemical products, against an investment estimated at \$US 1,264,645. The pay-back period varies between 6 months and 5 years.

Energy costs have been reduced by 10% thanks to the implementation of heat exchangers in the mercerizing and washing units, to the thermal isolation of steam conducts, to the installation of special regulators on the PTZ gas hubs (because it depends on gas pressure, on the temperature and nature of the gas used) and by the installation of economic bulbs for lighting.

The cost of water will decrease by 56% thanks to the installation of a treatment and recycling system for wastewater, which subsequently will be reused in the process at a rate of 80%. This project is in the study phase.



“Our company needs assistance to gain control over its consumptions and therewith its production costs. The project fully matches our expectations.”

M. MOTTA, Director General of TFM

The cost of chemical products will decrease by 25% through the installation of a system for recovering caustic soda at the mercerization stage.

Other environmental advantages have been achieved through improvement in the management of chemical products storage and handling, and optimization of use in lab works, leading to a substantial reduction in the pollution load of waste water. In addition, the implementation of Oeko-Tex standard 100 improved the choice of products based on their ecological merit.

Environmental management accounting has been taken up by the company; currently, department-specific means for the measurement of different process input will be installed, which in the near future will allow for real-time monitoring of consumptions and costs by centre of costs, as well as for data integration into the environmental management accounting system.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Heat recovery at mercerizing unit	8 000	7 500	1		551
Caustic soda recovery in mercerizing unit	285 000	430 000	1.5	600 tons NaOH	
Insulation of steam pipe network	17 500	19 285	1.1		976
Treatment and reuse of wastewater	175 000	800 000	5	135 000 m ³ water	
Installation of regulators on the PTZ gas hub	3 930	5 000	1.3		197
Lightening, installation of energy-saving bulbs	2 430	2 860	1.2		88
TOTAL	491 860	1 264 645			1 812

Heat recovery at mercerizing unit: The energy recovery project consists in the installation of a heat exchanger at the machine exit in order to recover calories for fresh water feeding the machine. The annual water consumption is about 130,300 m³, the heat exchange occurs between 90°C discharged water and fresh water with an average temperature of 20°C. Therefore thermal gains amount to about 45 th/m³, implying a total annual gain of 551 MWh/year.

Insulation of the steam pipe network: The steam network generates losses over the exchange with fresh air and over the lack of thermal isolation of the pipes. The losses incurred due to the complete absence of isolation on the network in question amount to 5,71 Th/h. To eliminate these losses, the project is to install isolation so as to insulate the steam pipes against heat. The isolation material opted for is rockwool, to be covered with an aluminium casing produced on the premises. The energy gains will be of 976 MWh/year (about 7% of the thermal energy consumption).

Lighting, installation of energy-saving bulbs: The project is to widely introduce economical lighting over 36W neon tubes, providing an annual gain of 88 MWh/year.

Caustic soda recovery in mercerizing unit: In the mercerization block, TFM annually consumes about 800 tons of caustic soda. The system in question is based on an advanced technology for thermal separation of soda and water. This allows for the retrieval of soda with a lower concentration, to be reused in the mercerization cycle. The caustic soda retrieval system allows to save up to 600 tons/year.

Treatment and reuse of wastewater: TFM consumes water of an average of 650 m³/d. The objective is to reprocess used water until its quality enables its reuse in the process. The treatment process therefore includes three stages: physicochemical reprocessing, biological reprocessing and tertiary cleaning: a filter system. This project, which will allow for the reuse of 500 m³/d, is still at the design stage.

Installation of regulators on the PTZ gas hub: Fuelled with natural gas under a pressure of 20 bar over the national STEG network, TFM is equipped with a 4 bar counting hub. The installation of a PTZ-type debit regulator (pressure, temperature, nature of gas) allows for the regulation of the remedial factor related to the varying temperature, which represents gains worth 197 MWh/year.



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MED TEST Case Study

LEATHER sector — TUNISIA

Tannery industry — Tanneries Mégisseries du Maghreb (TMM)

Company overview

TMM, founded in 1976, is part of a Tunisian holding company. Heavily export-reliant, it operates in the leather sector and annually produces about 20 million square feet of ovine and bovine leather.

The company joined MED TEST in order to identify opportunities for improvement, reduce pollution and integrate Best Technologies Available (BTA) and Good Environmental Practices (GEP) into the production process.

The company was already certified ISO 9001 at project's start. Taking advantage of its participation in MED TEST, it has initiated an Environmental Management System (EMS) in conformity with ISO 14001 and plans to implement Corporate Social Responsibility (CSR) in the near future, following ISO 26000 standards.

Benefits

The MED TEST project has identified an opportunity for \$US 446,800 of annual savings in electricity, gas, water and chemical products against an investment estimated at \$US 523,000. The return on investment is expected within a little more than one year. The identified cleaner production measures are under implementation.

Energy costs have been reduced by 15% through fuel switch to natural gas, insulation of steam and hot water distribution systems, installation of an economizer at the boiler, recovery of compressors heat losses into the dryer section, as well as the adjustment of the power factor.

The financial gains resulting from the reduced use of chemical products (e.g. chrome) and auxiliary products such as salt in the production process are estimated at 10%.

Water costs have been reduced by 14% thanks to the optimization of water consumption in the drums and



“Aiming at the principle of ‘Ecological Tanning’, TMM has adopted TEST for a profitable environmental management approach.”

Mr Sofiène BEN AMMAR, Deputy CEO

according to the hourly tariffs, the reuse of vacuum dryer condensates as well as the retrieval of process bathwaters (soaking baths) and their reuse.

Other environmental improvements have been achieved in terms of reduction of wastewater pollution loads, corresponding to approximately: 50% of chlorides through the use of punched drums and the installation of a refrigerated chamber for fresh hides storage, 39% of BOD₅ and 25% of COD in comparison to the annual loads, resulting mainly from the separation and retrieval of hairs before the process, the processing of sulphide and chrome baths, and the softening of process water (dyeing). These measures have cut operating costs of the wastewater treatment plant and improved its efficiency through annual reductions of 100 tons COD and 35 tons of nitrogen.

Parallel to the identification of minimization opportunities, the company has charted its own environmental policy and is implementing an EMS in conformity with ISO 14001 standards, thanks to the identification of further areas of improvement.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Reduced use of salt through drumming and cold conservation of skins	75 000	92 000	1.2	965 tons salt	-
Water savings	47 000	150 000	3.2	Water 46 000 m ³	-
Steam system and compressors	222 800	46 000	0.2	-	1 705
Valorization of splits	55 000	110 000	2	1 500 tons waste	-
Reuse of retrieved chrome	30 000	100 000	3.3	150 tons chrome	-
Hair retrieval	17 000	25 000	1.5	-	9
TOTAL	446 800	523 000	1.2		1 714

Reduced use of salt, drumming and cold conservation of skins:

The installation of a cold chamber for fresh hides storage helps minimize or even completely eliminate salt as a conservation agent. This option provides for net savings of \$US 50,000/year, taking into account additional electricity costs. Moreover, the company acquired a punched drum facilitating the elimination of all conservation salt stuck on the skins before the soaking process. It allows for a 50% reduction of salt in all liquid effluents, and therefore of chloride, COD and BOD₅ loads.

Water savings: The tannery has implemented several measures to cut down water consumption, which include the optimization of water consumption in the drums, the recycling of soaking and rinsing baths from tanning and post-tanning processes and their reuse in similar processes. The installation of submeters at each process enables an increased consumption control as well as the easy detection of possible overconsumption.

Steam system and compressors: The tannery has focussed its efforts to cut down energy consumption through: the installation of a boiler economizer, the insulation of steam and hot water pipes, the recovery of heat losses from the compressor into the dryer, and the fuel switch to natural gas.

Valorization of splits waste: The tannery has put in place an equipment to process splits resulting from the fleshing processes valorizing 1,500 tons/year of this kind of waste. The splits are ground then heated up to 75°C. The obtained liquid is separated in 2 phases: one proteinaceous phase valorized as fertiliser and retanning agent, and one fat phase valorized in the soap industry and as leather nourishment product.

Reuse of retrieved chrome: This technique allows replacing 30% of the new chrome with no effect on quality, thus saving 150 tons/year of chrome otherwise disposed of with the sludge.

Hair retrieval: The retrieval of intact hair from the drum through the installation of a filtering and recirculation system of the liming baths permits to reduce wastewater pollution loads by approximately 40% of TSS, 30% of BOD₅, 25% of COD and 50% of sulphides. This allows for electricity savings within the sewage treatment plant of about \$US 8,000/year, corresponding to 48 tons of CO₂ per year and a 300 tons/year reduction of TSS.



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MED TEST Case Study

LEATHER sector — TUNISIA

Tannery industry — Tannerie du Nord Utique (TNU)

Company overview

Based in the Utique industrial zone, TNU is a Tunisian company operating in the leather sector and producing for both local and international markets. Its total production amounts to 1.385 tons/year, segmented into different kinds of skins: bovine (58%), ovine (27%) and goat (15%).

The company joined the MED TEST project in order to identify opportunities for improvement regarding pollution linked to its activity and introduce Best Available Technologies (BATs) and Best Environmental Practices (BEPs).

Taking advantage of its adhesion to MED TEST, TNU has become familiar with EMS in line with the ISO 14001 standard and plans to implement it in the company.

Benefits

MED TEST has identified an opportunity for \$US 126,585 of annual savings in electricity, water and chemicals against an investment of \$US 186,150 with a payback period of less than two years. The identified cleaner production measures are under implementation.

Energy costs are expected to be reduced by 70% by switching boiler fuel to gas once the industrial area is connected to the public natural gas network, installing a boiler economizer, a insulating steam and hot water pipes, and demineralizing well water used for boiler feed.

The financial gains resulting from the reduction of chemicals are estimated at 5% for finishing products, 30% for chrome and 10% for auxiliary products such as salt.

Water costs have been cut down by 8% through the installation of a high volume/low pressure pistol in the



“Prioritising the pollution control principle, TNU has adopted the TEST approach to improve its environmental performance and comply with regulations.”

Imed MALEK, Manager

finishing process; the use of a trial drum for testing purposes to improve quality and splitting of bovine hides.

Further environmental benefits, especially through drumming before soaking, have been achieved in terms of reduction of wastewater pollution loads, corresponding to about 10% of chlorides and 5% of annual COD flux. These measures have minimized the operating costs of the water treatment plant and allowed for annual reductions of 130,000 kg of COD and 65,000 kg of BOD₅.

In parallel with the identification of cost minimization opportunities, the company is in the process of elaborating its own environmental policy so as to undertake the implementation of EMS in conformity with the ISO 14001 standard.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Using a test drum to improve quality	10 715	21 150	2	1,500 m ³ water	-
Drumming before soaking and salt reduction	8 570	25 000	3	170 tons salt	-
Hot water/steam generation and distribution system	63 000	64 000	1	-	1,197
Installation of high volume/ low pressure pistol for finishing	2 150	2 500	1	5% finishing chemicals 300 m ³ water	-
Hide splitting	42 150	73 500	1.7	28 tons Cr 2,100 m ³ water	-
TOTAL	126 585	186 150	1.5		1,197

Using a test drum to improve quality: The use of the tannery's equipment with a test drum will make it possible to diversify production without squandering raw materials and auxiliary products and renew it by following fashion trends. It will also reduce COD (3%), as well as total water consumption, and most of all facilitate substantial gains in hides.

Hot water/steam generation and distribution system: Insulating hot water and steam pipes allows for a reduction of thermal energy consumption by 4%. Installing a boiler economiser, a softener for boiler water and switching fuel to natural gas will bring forth very substantial financial and environmental benefits, adding up to 70% of total annual thermal energy consumption.

Drumming before soaking and salt reduction: The installation of a punched drum enables the elimination of salt from the salted hides before the soaking stage, which results in the elimination of 170 tons/year of salt, a 10% reduction of wastewater chlorides and lower COD and BOD₅ loads.

Hide splitting: This option limits consumption of chemicals (28 tons/year of chrome) and water (1,800 m³/year, i.e. 4% of the global process water), thus minimizing the end-of-pipe environmental impact.

Installation of a high volume/low pressure pistol for finishing: About 50-70% of COV emissions are released by pistol finishing machines. Installing this equipment in the finishing stage will bring about reductions in consumption of finishing products (5%), water (300 m³) and COD (2 tons) and moreover cut down VOC emissions by about 40%.



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MED TEST Case Study

TEXTILE sector — TUNISIA

TRAITEX

Company overview

TRAITEX is a textile finishing company that provides services for tubular stitches exclusively, both in cotton and polyester cotton, and also processes denim-washing articles with special effects.

Concerning stitches finishing products, the company works exclusively for the local market, whereas washed jeans products are exported. Its annual production in 2010 was estimated at 400 tons.

Aware since 2007 that its production costs were increasing because of utilities costs (water and energy), TRAITEX looked for a means to reduce them. The MED TEST project represented an opportunity to achieve this goal.

At the beginning of the project, TRAITEX had no cost accounting in place and no management system. Today, the company has engaged an Oeko-Tex certification programme and developed indicators for water, energy and material consumption.

Benefits

The MED TEST project has identified opportunities for annual savings worth \$US 111,836 in electricity, gas, water and chemicals, through an investment of about \$US 181,800. The average return on investment ranges between 6 months and 2 years. The identified measures are within the financing capacities of the company.

Energy costs have been reduced by 39% through the automation of the production process, the optimization of the correlation between laboratory and workshop, the installation of economisers on the boilers and of PTZ for regulating the gas pressure feeding the company. These actions had a direct positive effect upon water consumption (reduced by 19%) and chemical product consumption (reduced by 15%).



“We would like to have more control over our production costs, mainly for water, energy and production materials; the TEST methodology helped us to achieve this goal.”

M. SABBAGH, Director General of TRAITEX

Other environmental advantages have been achieved in terms of reduction of the wastewater pollution load by diminishing the consumption of chemical products. The optimization of product and dyestuff storage and the efficient management of preventive maintenance have allowed for an improvement in the production performance, in turn leading to a reduction of process losses and the realization of economic gains. These options are now under implementation in the company.

The implementation of the Oeko-Tex ecolabel standard 100, aimed at improving the choice of products based on their ecological merit, is underway.

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Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Optimization of laboratory activity	14 800	6 800	0.5	1,500 m ³ 5% chemicals	244
Installation of a boiler economizer	18 216	32 000	1.7		658
Automation of production machines	61 500	120 000	2	8,040 m ³ 10% chemicals	941
Installation of PTZ regulator on gas hub	2 320	5 000	2.2		114
Productivity optimization	15 000	18 000	1.2	4,500 m ³	436
TOTAL	111 836	181 800	1.6		2 393

Optimization of laboratory activity: The project is to reactivate the spectrophotometer used for determining the colour nuances to be developed on the basis of the receipts, and for verifying the conformity of nuances. Optimization also concerns the small dyeing machines, by changing the alkali introduction system in order to allow the progressive introduction of alkali, thus passing from an all-in method that does not support the reproducibility in production to a system similar to that of the workshop. These changes allowed an annual gain of 1,500 m³ in water, 244 MWh in energy and 5% in chemical products.

Productivity optimization: The project consists in working continuously in three shifts on a reduced number of machines (those considered the best). This will improve productivity for each machine, as well as the boiler efficiency, and will result in a productivity improvement (by 30%), and a reduction of energy and water consumption (respectively by 5% and 6%). The company has decided not to implement this action for the time being, due to resistance of its employees, who are not very favourable to change their actual working conditions.

Automation of production machines: Currently, dyeing machines are operated in a manual mode, and the functioning

parameters such as temperature, pressure, water volume and time are not well under control, which leads to problems in the dyeing process in terms of quality, costs and reproducibility. The automation of the process consists in installing monitoring mechanisms such as valves and temperature control instruments, and in automating them through the installation of microprocessors for better control. These works allow annual savings in water by 8,040 m³, in energy (941 MWh) and in chemicals (around 10%).

Installation of regulators on the PTZ gas hub: Fuelled with natural gas under a pressure of 20 bar over the national STEG network, the company is equipped with a 4 bar counting hub. The installation of a PTZ-type throughput regulator (pressure, temperature, nature of the gas) allows for the regulation of the corrective factor due to the varying temperature, which represents gains of 114 MWh/year.

Boiler economizer: The high temperature of boiler exhaust can be used to heat water over the installation of water/air heat exchangers (economizer) at the exits. The installation of the economizer will allow for savings of 658 MWh/year. The company will subsequently consider the implementation of this action.



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MED TEST Case Study

FOOD sector — TUNISIA

Milk and dairy industry — Tunisie Lait

Company overview

Tunisie Lait is a dairy producer established in 1974. Its activities include the production and marketing of a wide range of beverages and other fresh products based on milk.

It annually produces about 73,316 hl for the local market and about 10% of its production is for export.

Among the key objectives that pushed the company to join the MED TEST project were the opportunities to learn how to reduce product losses, increase resource efficiency (water and energy) and improve the performance of the existing wastewater treatment plant.

At project start-up, the company was already certified ISO 9001, ISO 22000 and ISO 14001, but it currently plans to improve these systems in order to enhance environmental and economic performance.

Benefits

The implementation of measures identified within the MED TEST project has led to substantial financial gains of about \$US 746,638, with an investment amounting to \$US 827,410, resulting in reduced total water and energy consumption of 16% and 13% respectively.

Moreover, the company's efforts to minimize production losses have enabled to cut them down by 1.3% (from 4.5% to 3.2%), which corresponds to annual financial gains of about \$US 369,310.

Further environmental benefits have been achieved in terms of decrease of pollution loads in wastewater, corresponding to 33% of annual loads of BOD₅ and 90% COD respectively.



“MED TEST has contributed to the implementation of an efficient strategy to simultaneously reduce production losses and the environmental impact of our activities.”

Imed GHARBI, General Manager

The company's integrated management system has been strengthened as well throughout the implementation of the project. Indeed, the quality policy has been modified to include commitment to preventive measures; the environment management programme has integrated an action plan for cleaner production, which involves projects to reduce energy and water as well as the minimization of material losses in the production process.

MED TEST is a UNIDO green industry initiative to promote sustainability and competitiveness in the private sector in Egypt, Morocco and Tunisia. TEST integrated approach includes tools like resource efficiency and cleaner production, environmental management system and accounting, cleaner technology transfer and CSR.

Learn more about TEST approach at www.unido.org

MED TEST is sponsored by the Global Environment Facility, the Italian Government and the MedPartnership.

Saving opportunities

Measure	Economic key figures			Resource savings per year	
	Savings [USD/yr]	Investment [USD]	PBP [yr]	Water, Chemicals	Energy [MWh]
Flushing time of cream and germ separators	8 700	5 140	0.6	10,000 m ³ water	
Reception and pasteurization rehabilitation	434 000	490 000	1.1	19,000 m ³ water, 8,500 Hl milk	910
CIP optimization, product push and crate washing	94 900	77 570	0.8	86,580 m ³ water	220
Chilled water production	10 5000	160 000	1.5	-	1 130
Elimination of direct cooling at the sterilizer	52 900	51 700	1	59,904 m ³ water	1 292
Electrical system, preventive maintenance	51 138	43 000	0.8	10,000 m ³ water	613
TOTAL	746 638	827 410	1.1		4 165

Flushing time of cream and germ separators: This project essentially consists in a five-minute extension of the flushing time (time interval between the cleaning of cream separator and germ separator). This measure has entailed the reduction of water consumption by 2% and therewith of annual loads of BOD₅ by 3% and of COD by 12%.

Reception and pasteurization rehabilitation: The new project's approach consists of an on-line standardization of the semi-skimmed milk production, based on a system of densimetric scales. It will enable a total retrieval of the cream and its precise dosage into the skimmed milk. The implementation of this project will facilitate reductions of:

- milk losses resulting from product transfers by 1,3%, corresponding to 8,500 hl/year.
- water consumption by 4%, BOD₅ by 10% , COD by 29% and total energy consumption by 3%.

CIP optimization, product push and crate washers: Optimizing the time for pushing product between pipes and equipment at the milk and fresh dairy products lines, as well as a 50% reduction in the cleaning time of the cream and germ separators, have permitted reductions in water consumption (17%) as well as in BOD₅ (20%) and COD (59%). In addition, a closed system for water recovery has been installed at the crate washer to avoid

the previous open circuit. These measures have allowed for reductions in water and thermal energy (2% and 1% respectively).

Chilled water production: The installation of a control unit that regulates the chilled water flows according to the temperature of return waters has allowed for an 11% electricity reduction, equivalent to 1,130 MWh.

Elimination of direct cooling at the sterilizer: The installation of a closed loop in the bottle sterilizer line has made it possible to eliminate direct cooling with a shower system and to achieve the most substantial water and energy gain: the company has achieved reductions in water and thermal energy (13% and 5% respectively), equivalent to 600 MWh.

Electrical system/preventive maintenance: The installation of batteries of capacitors on the electrical panels of the main energy consumers (chillers, air compressor, sterilizer) has enabled to raise the power factor from 0.8 to 0.94 and to reduce the electricity consumption by 4%, corresponding to 500 MWh. A periodical inspection programme checking for leaks has also been devised by the technical maintenance office so as to come up with a maintenance schedule. As a result the company has achieved reductions in water (2%) and in total energy (about 1%).



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