



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.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Environmental Management Branch
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
E-mail: unido@unido.org, Internet: www.unido.org



CENTRE MAROCAIN DE PRODUCTION PROPRE (CMPP)
23 Boulevard Mohamed Abdou, Quartier Palmiers, Casablanca, Morocco
Telephone: (+212) 5 22 99 70 53, Fax: (+212) 5 2 29 815 31
Email: cmpp@cmpp.ma, Web: www.cmpp.ma





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 conductivity meter 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 conductivity 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 livestock 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.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Environmental Management Branch
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
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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.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
 Environmental Management Branch
 Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
 Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
 E-mail: unido@unido.org, Internet: www.unido.org



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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 Moghgha 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.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Environmental Management Branch
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
E-mail: unido@unido.org, Internet: www.unido.org



CENTRE MAROCAIN DE PRODUCTION PROPRE (CMPP)
23 Boulevard Mohamed Abdou, Quartier Palmiers, Casablanca, Morocco
Telephone: (+212) 5 22 99 70 53, Fax: (+212) 5 2 29 815 31
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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.

Pernanganate 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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Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
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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.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Environmental Management Branch
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
E-mail: unido@unido.org, Internet: www.unido.org



CENTRE MAROCAIN DE PRODUCTION PROPRE (CMPP)
23 Boulevard Mohamed Abdou, Quartier Palmiers, Casablanca, Morocco
Telephone: (+212) 5 22 99 70 53, Fax: (+212) 5 2 29 815 31
Email: cmpp@cmpp.ma, Web: www.cmpp.ma





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.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
 Environmental Management Branch
 Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
 Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
 E-mail: unido@unido.org, Internet: www.unido.org



CENTRE MAROCAIN DE PRODUCTION PROPRE (CMPP)
 23 Boulevard Mohamed Abdou, Quartier Palmiers, Casablanca, Morocco
 Telephone: (+212) 5 22 99 70 53, Fax: (+212) 5 2 29 815 31
 Email: cmpp@cmpp.ma, Web: www.cmpp.ma





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.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Environmental Management Branch
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
E-mail: unido@unido.org, Internet: www.unido.org



CENTRE MAROCAIN DE PRODUCTION PROPRE (CMPP)
23 Boulevard Mohamed Abdou, Quartier Palmiers, Casablanca, Morocco
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Email: cmpp@cmpp.ma, Web: www.cmpp.ma





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 V05 and BRC V05 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.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Environmental Management Branch
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
E-mail: unido@unido.org, Internet: www.unido.org



CENTRE MAROCAIN DE PRODUCTION PROPRE (CMPP)
23 Boulevard Mohamed Abdou, Quartier Palmiers, Casablanca, Morocco
Telephone: (+212) 5 22 99 70 53, Fax: (+212) 5 2 29 815 31
Email: cmpp@cmpp.ma, Web: www.cmpp.ma





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



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Environmental Management Branch
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
E-mail: unido@unido.org, Internet: www.unido.org



CENTRE MAROCAIN DE PRODUCTION PROPRE (CMPP)
23 Boulevard Mohamed Abdou, Quartier Palmiers, Casablanca, Morocco
Telephone: (+212) 5 22 99 70 53, Fax: (+212) 5 2 29 815 31
Email: cmpp@cmpp.ma, Web: www.cmpp.ma



Strategic Partnership for the Mediterranean Large Marine Ecosystem
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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.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Environmental Management Branch
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
E-mail: unido@unido.org, Internet: www.unido.org



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Email: cmpp@cmpp.ma, Web: www.cmpp.ma

