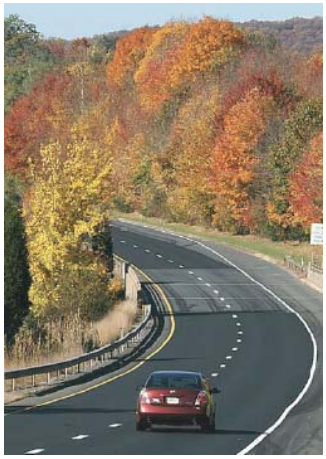

DENSO Manufacturing Hungary Ltd.

Saving Energy with Cleaner Production in the Car Parts Manufacturing Industry

Business Case Study. The United Nations Environment Programme (UNEP) initiated a worldwide project promoting Energy Efficiency (EE) in industrial organisations through the use of the principles of Cleaner Production (CP). As a part of this effort, the Hungarian Cleaner Production Centre conducted an energy efficiency audit at DENSO Manufacturing Hungary Ltd., located in Székesfehérvár, Hungary, an affiliate of one of the leading car parts manufacturing industries of the world.

The case of DENSO Ltd. demonstrates significant potentials of energy efficiency improvements in industrial facilities when leading technological solutions are combined with environmentally conscious management practices. The analysis of material and energy flows and the subsequent implementation of energy efficiency measures not only improved environmental performance, but also revealed a number of financially advantageous investment opportunities for the company.

THE COMPANY

DENSO Corporation is one of the world's biggest car component manufacturers and a subcontractor of Toyota, Honda, Mitsubishi, Suzuki, BMW, Volvo and the Volkswagen group, etc. The company was founded in December 1949 in Kariya, Japan with initial capital of 1.3 billion USD. The comany employs about 40 000 employees in 61 plants in Japan with an additional 45 000 in 87 plants in other countries. The products of the company include thermal systems, powertrain control systems, electronic systems, electric systems, motors and telecommunication devices.

DENSO Manufacturing Hungary Ltd. (DMHU) was established in July 1997 with a 75 million EUR investment as a member of the DENSO Corporation. The plant is located in Sóstó Industrial Park in Székesfehérvár.

DMHU has produced the ECD-V5 diesel injection pump - one of the most sophisticated products of its kind - since 1999 and started the production of Common Rail electrical diesel injection systems in 2003. Also in this year the Hungarian company started to produce DVSV (a vacuum-switch valve), which decreases the harmful emissons of engines by reusing evaporated fuel in the tank.

CONTEXT & OBJECTIVES

Analysis of data from the company's past records revealed that the company has significant potential for efficiemcy measures which can reduce both resource use and environmental pollution. After discussions with company management it was decided to concentrate on some of the most energy intensive processes of the company and implement the CP-EE process to uncover potential energy efficiency and cleaner production opportunities.

The objective of the assessment was set to minimize resource consumption and, as a result, reduce the emission of harmful substances with a special focus on Greenhouse Gas emissions.

APPROACH & ACTIVITIES

To complete the CP-EE assessment, the HCPC obtained the commitment of the top management and set up a team of experts, including energy specialists from the company and the HCPC. The team identified and analysed potential solutions to increase energy efficiency at the company as well as barriers to their implementation.

The methodlogy used during the assessment can be seen below. As a result, 4 potential CP-EE measures were identified and analysed in detail, taking their technical, environmental and economic aspects into account. Finally, options feasible both from an environmental and financial point of view were suggested to company management.

THE CP-EE PROJECT

To support efforts that integrate Cleaner Production and Energy Efficiency into private sector activities, UNEP's Division of Technology, Industry and Economics (DTIE) initiated the CP-EE Project.

Through a structured and integrated approach, the CP-EE Project aims to reduce industrial carbon-dioxide emissions by improving energy management practices and identifying new CP-EE investments for SMEs.

This business case was developed within this project, after a CP-EE assessment in the selected industry was conducted.

THE CP-EE METHODOLOGY

Cleaner Production (CP) and Energy Efficiency (EE) are established and powerful strategies that reduce costs and generate profits by reducing waste. Their integration supports synergies that broaden the scope of their application and gives more effective results, both environmentally and economically. Integration of these two powerful strategies can be facilitated using the structured methodology below.

THE CP-EE MANUAL

The Manual was developed under the framework of the CP-EE Project and presents an integrated Cleaner Production-Energy Efficiency (CP-EE) methodology based on proven CP methodology and combines this with factual information, technical data, worksheets, tools and resources that will allow both technical specialists and managers to take direct and effective action.

To download the manual visit:
www.unep.fr/energy/projects/cp-ee/manual.htm

PLANNING & ORGANIZATION

STEP 1
- Obtain commitment of top management
- Involve employees
- Organize CP-EE team
- Compile existing information
- Identify barriers/solutions to the assessment
- Decide the focus of the CP-EE-assessment

PRE-ASSESSMENT

STEP 2
- Prepare a process flow diagram
- Conduct a walkthrough
- Prepare material and energy input-output quantification and characterization
- Generate and finalize base data

ASSESSMENT

STEP 3
- Prepare a detailed material and energy balance with losses
- Conduct cause diagnosis
- Generate options
- Screen options

FEASIBILITY ANALYSIS

STEP 4
- Conduct technical, economic and environmental evaluation
- Select feasible options

IMPLEMENTATION & CONTINUATION

STEP 5
- Prepare CP-EE implementation plan
- Sustain CP-EE assessments

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IDENTIFIED OPTIONS

Equipment modification

As a result of the pre-assessment carried out according to the CP-EE methodology, the focus was put on the company's two boilers (both 1320 kWth), which utilize a significant amount of natural gas. Based on the team's assessment it was suggested to the company that they should **replace both of the boilers' gas-torches** with more efficient gas torches. This measure does not require any changes to the structure of the boilers and does not pose any technical problem. The calculations showed that by reducing the torches' power consumption to 800 kW it would be possible to supply the heat demand (which is approximately 0.7 MW), by using one single boiler during the summer months, while the second boiler would only be needed duriung peak loads to meet increased heat demands.
As a result, boilers would operate in the upper quarter of their efficiency curve, with an 80-85% load. Operational safety would increase and the efficiency of combustion would reach the theoretical value of 90-93%.
This solution does not require the company to modify its steam system (pipelines, pressure reducers, steam-traps, heat exchangers, etc.) thus it is also efficient from a financial point of view.

Housekeeping

Another possibility uncovered during the assessment aimed at the **downgrading of one of the boilers** from production of steam to hot water production. Also, as a result of the successive relocation of this hot water boiler to a new location near the steam/hot water heat exchanger, about 100 meters of steam pipeline would become unneccesary, and thus radiation, convection and condensation losses could be minimized.
Thus, at the new location of the boiler a smaller, hot-water heat-centre is set up which satisfies the heating and hot water demands of the processes.

DENSO

IMPLEMENTATION

DENSO Manufacturing Hungary Ltd. has been continuously growing since its foundation in 1997 and the number of employees has also continuously grown from around 600 employees to 4000 in 2006. In 2005 DMHU finished the thrid phase of the expansion of its facilities, which will be followed by phase four in 2007. Parallel to the expansion of the area, the number of production lines and technologies used is also increasing and production volumes are continuously growing.
Alongside this, energy and especially heat requirements also increased and the previously under-utilized boilers are now being used closer to their full capacity. With future development in sight, DMHU also installed an extra boiler (1320 kWth) in order to supply enough steam for technological and heating purposes which at the moment serves as a back-up boiler.

These developments mean that the downgrading of the boilers as recommended by the CP-EE team is not feasible, but suggestions related to the more rational use of boilers have been implemented by utilizing one of the boilers to its full capacity while using the other only in the winter time and in cases of intensive steam demand. As a result, **the company achieved a 25% reduction in energy consumption** compared to its business-as-usual scenario, which means a minimum reduction of 8,500 GJ/year. This reduction in energy use results in an approximate 672 tons of carbon-dioxide reduction, equivalent to about 10% of the total emissions of the company in 2004.

	Investment (USD)	Payback (years)	Energy saved (m3)
More rational use of boilers	-	-	250 000
Downgrading of boiler (not implemented)	63 000	1.7	-
Heat recovery at boilers	45 750	1.7	100 000
Recovery of compressor's waste heat	17 500	2.0	111 000

ENVIRONMENTAL AND FINANCIAL BENEFITS

Environmental and financial benefits of suggested and implemented options are shown in the table above.
As indicated earlier, the two boilers of the company were not downgraded, but the company operates them in a more rational way, which has resulted in significant reductions of both energy use and environmental impact.
The second identified option, namely the conversion of one of the boilers, has not yet been implemented.

However, the company implemented two related investments.
The 100,000 m3/year gas consumption reduction achieved by the installation of the heat recovery system resulted in a cost saving of 6,000,000 HUF/year (30,000 USD/year), while the new heat exchanger helps the company to recover about 3,780,000 MJ of heat energy.

The resulting yearly GHG emission reductions are shown in the table below.

GHG REDUCTION - TONS

No. 1	No. 3	No. 4	Total
672	190	212	1074

OTHER IMPLEMENTED MEASURES

Recovery

Parallel to these activities and utilizing the principles of the CP-EE project, DMHU installed a **heat recovery system** on the common flue-gas stack of its original two boilers. The TE-4 EU type equipment utilizes the heat content of the flue gases of the boilers by pre-heating the feedwater (from 70°C to 90°C). The overall efficiency of the boilers and the heat recovery system is 94.5% +/-0.5%. This option resulted in a savings of gas consumption of 100,000 m3/year.

New equipment

DMHU also installed a **new heat exchanger** in the cooling air duct of the air compressors. The thermal capacity of the equipment is 150 kW. The operation of the compressors is almost continuous, which means 7000 hours of operation in a year. The expected savings using the SPN 304120 EC industrial heat exchanger are about 1,050,000 kWh/year.
DENSO uses the recovered heat for heating purposes so the cost saving means a reduction in gas consumption which, according to calculations, amounts to 111,176 m3/year natural gas.

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