CASE STUDY
STEP BY STEP IMPLEMENTATION OF TEST IN A BEVERAGE COMPANY

The experience of implementing the complete TEST methodology in a medium-sized food enterprise is illustrated here.

The company in question is located in the Middle East and is producing carbonated soft drinks for the local and regional markets.

The company was assisted by external consultants (service providers) during its first application of TEST. Based on the successes of that first application, it has decided to continue using the tools and the methodology, using the internal capacity that was built during the TEST project.

The costs for the company's materials, water and energy inputs are about 66% of total expenditures. Any improvement of resource efficiency will thus also significantly improve overall economic performance.

STEP 1.1 - SITUATION AT THE START OF TEST PROJECT

The initial screening of the company did not highlight any immediate potential for RECP improvement, as the company already:

- had state-of-the-art and well operated technology in line with international standards in place, as well as an environmental management system certified against ISO 1400;
- had engaged with CSR for a decade, with an annual sustainability report published and audited regularly;
- had its CO_2 emissions verified according to ISO 14064-1 by SGS.

The company had also introduced a sophisticated information system for resource management and planning. Thus, the company's only driver to join the MED TEST II project in 2016 was the top management's strong commitment towards continuous improvement and search for new approaches on how to achieve it.

STEP 1.2 - DRAFTING THE RECP POLICY STATEMENT

The company already had in place an environmental policy adopted in the framework of the ISO 14001 system, which included a clear commitment to continuous improvement of the company's environmental performance. Nevertheless, the company decided to use the TEST project to upgrade its system to the levels required by the latest version of ISO 14001, ISO 14001:2015.
A new policy statement was therefore elaborated, focusing on incorporating resource efficiency.

The top management signed the new policy and distributed it to all departments of the plant, from administration to production.

STEP 1.3 - SETTING UP THE TEST TEAM

A company TEST team was established in the company. It was led by the production and maintenance manager and included the quality manager, the HSE manager, and some technicians; an important member of the team was also the Acting Financial Controller, who represented the company's financial department.

An external TEST team of service providers was also formed, including national RECP and energy efficiency experts and an expert on management systems, all under the coaching of international experts. The company TEST team was trained during the project, both as part of common training sessions with other companies as well as by in-company specific workshops, such as one on MFCA.

STEP 1.4 - IDENTIFYING THE PRIORITY FLOWS AND LAYING DOWN THE FOUNDATION OF THE RECP INFORMATION SYSTEM

The initial input-output analysis at the company boundary was completed through a data collection process, which set up the basis for a good cooperation between the internal and external TEST teams. Company members were very cooperative, providing needed data based on mutual trust.

The company has very good information systems in place. It applies a financial and cost accounting system and records all material inputs via stock management in addition to using a Production Planning and Enterprise Monitoring System. However, most material inputs are recorded only in units in the stock management. It was recommended to consistently record raw materials, packaging materials, and operating materials in kg in order to be able to aggregate. The company recalculated the units into volumes and within a couple of days a quite consistent material and energy balance was available.

The concept of non-product output (NPO) was new to the staff. The assessment was done based on the list of accounts for the financial year 2015. The MFCA analysis highlighted that approximately 7% of the value of purchased inputs was lost as NPO costs. Their distribution is shown in figure 1.

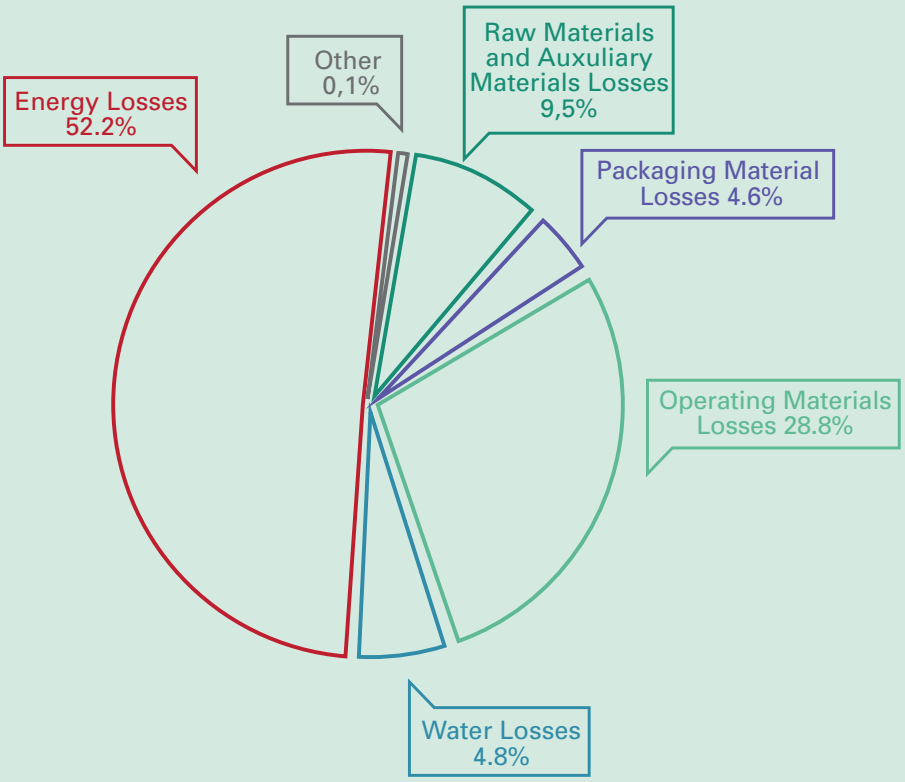

FIGURE 1: Distribution of NPO costs in producer of soft drinks

Energy was identified as the main priority, representing more than half the total NPOs. Since operating materials were responsible for 28% of NPO costs, it was recommended to improve stock management and cost accounting for this material group. End-of-Pipe treatment and disposal costs were only responsible for 0.1% of NPO costs.

A more detailed analysis of material NPOs highlighted the negative financial consequences of the loss of material deriving from products returned by customers and the important financial losses of operating materials such as chemicals used for cleaning operations. In general, the MFCA tool was essential to define the NPOs, leading the TEST Team to identify the following priority flows: Energy (electricity and thermal); Water; Chemicals; Packaging materials (Cans & Preform); Sugar; Concentrate.

STEP 1.5 - IDENTIFYING THE FOCUS AREAS

The NPO costs associated to the selected priority flows were distributed among the main company cost centres using the MFCA tool; an overview of the result is presented in figure 28. The figure supports the conclusion reached by the TEST Team that further detailed analysis for material and water flows should focus mainly on production lines (including syrup preparation), but also the store for chemicals used in cleaning operations, which represent 48% of the total NPOs from the HSEQ department. Energy measurements conducted in the production lines showed that there was

limited potential to save energy there, as the production lines were already meeting very high energy efficiency standards. For this reason, production lines were not identified as a focus area for energy and detailed analysis focused on utilities (whose NPO costs are distributed to specific production lines in figure 2).

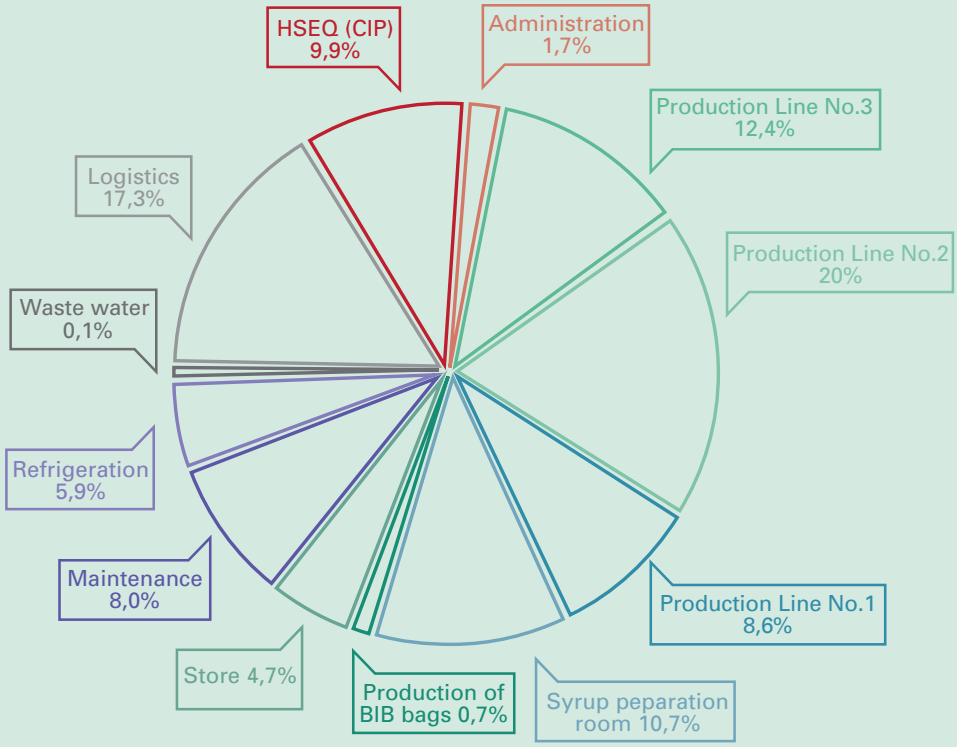

FIGURE 2: Distribution of NPO costs per company cost centres

For each priority flow the identified focus areas are provided in Table 1.

PRIORITY FLOW	FOCUS AREAS
Energy	Utilities (energy measurements showed low potential for improvement within the production lines)
Water	Production lines (CIP, washing of cans and bottles) Refrigeration (Cooling towers)
Sugar	Syrup preparation room (sugar bags handling and loading process)
Chemicals	HSEQ and maintenance (Stock management) of chemicals used in CIP (cleaning operations)
Cans	Store (damaged products caused by handling) Production lines
Concentrates	Production lines (Filling operations)

TABLE 1: Identification of focus areas for specific flows

The distribution of NPO costs to the main cost centres of the company was first estimated and then gradually refined. It showed that one production line in particular had a significantly high share of total NPO costs. This outcome encouraged the company to reduce the operating hours of this line by 50% in 2017, leading to significant savings as further described in step 1.7.

STEP 1.6 - IDENTIFICATION OF SOURCES AND CAUSES OF LOSSES

To identify specific sources and root causes of losses, the TEST Teams used detailed diagrams of the processes as well as observations of the use of the priority flows and balances. Additional data from the monitoring of specific energy and water flows and expert estimates were also used. Examples of identified causes of inefficiency for one focus area (CIP) are provided in the left-hand column of table 2.

STEP 1.7 - OPTIONS GENERATION & PREFEASIBILITY ANALYSIS

The TEST Teams conducted brainstorming sessions to generate RECP options, focusing on the most important sources of losses. Service providers brought in their expertise, and the company TEST team cooperated not only in discussing the proposed options but also in sharing their own ideas. These meetings were opened up to other members of the company staff. The right-hand column of table 2 provides an example of the results of such sessions for the improvement of water efficiency during the Clean-In-Place (CIP) step.

FOCUS AREA/ROOT CAUSES	POTENTIAL OPTIONS TO THINK ABOUT
Clean In-Place (CIP): Manpower: Manual control is poor (including the rinsing time or dosing of caustic solution). Management: Design of production plan, marketing strategy is causing the need for frequent cleaning. Technology: No recycling of the rinse water. Input materials: Using caustic solution that needs large amounts of water afterwards for rinsing. Product: Drinks flavours are changed 3-4 times a day, which affects water usage due to changes from one flavour to the other.	• Last rinse can be saved and used for another rinse. Use the existing pre-rinse tank which currently is not functional. • Ensure proper dosing of chemicals, use an automatic dosing system. • Optimise operation parameters of the existing CIP system. • Better scheduling product changeovers; try to change to 2 flavours per day instead of 3 or 4. • Introduce a 'pigging' system to push out product from the pipelines before washing them. • Investigate the use of activated oxygen cleaning (ozone cleaning) or Electro Chemical Activation (ECA). • Use transmitters (pH or conductivity meters) to determine if content of tanks or pipes is product or not. • Recycle the hot water (80-95oC) for cans and some other lines.

TABLE 2: Identified causes of losses and options generated for CIP focus area

The feasibility analysis was conducted for the identified options. For example, for the option already mentioned in the step 1.5, the feasibility study can be summarized as follows. The idea was very simple - to cut down the operating hours of line No. 2 which generated high NPO costs. It was found to be technically feasible to operate line No. 2 for 78 days per year in 2017 instead of 3 days a week (this represents 50 % reduction ((3*52-78)/(3*52) = 0.5). As shown by the MFCA tool, shifting production from line No. 2 to another line will reduce overall NPO costs by 4.25%, which represents savings of 125,000 €/year. Difference in pollution generation can be calculated based on difference of losses and pollution produced by the two relevant lines. These are, for example, 74.4 m^3/d of water use or 833 kWh/d of energy use. Multiplying these savings by 78 days provides environmental benefits of this no-investment measure (in our example water use will be reduced by 5,800 m^3/year and energy consumption by 965,000 kWh/year, leading to , among other things, reduction of CO_2 emissions by 270 t/year).

STEP 1.9 & STEP 2 – ACTION PLAN, IMPLEMENTATION AND MANAGEMENT SYSTEM INTEGRATION

A total of 25 feasible RECP measures were identified. These were inserted into the savings catalogue and presented to the top management for its approval. The top management approved 21 of these measures and these were included in the TEST Action Plan. By the end of the first TEST cycle, 16 measures were already implemented, 2 were being subjected to more detailed feasibility studies, and 3 were planned for implementation.

New resource efficiency procedures were integrated into the company's EMS adding new aspects, objectives, measures and action plans. For example, in line with the objective of reducing water consumption, several new water meters were planned for installation in addition to the existing ones to provide data for calculating the OPIs and KPIs at the level of the company. Where and how to collect and process these data is specified in a new water conservation procedure, with guidelines describing, among other things, how to process and document information, and what employees must do to develop, implement and maintain water conservation measures including, for example, development of a leak prevention program. The latter specify to whom and how to provide needed training and information, what is the division of responsibilities and how performance and achievement of particular targets, etc., is controlled.

An EMS upgrade guide was prepared as part of the TEST project; it describes, for example, the steps that the company should take to use the technical TEST report or how the company can use TEST for an upgrade of its EMS to the levels required by ISO 14001:2015. And as mentioned above, new aspects; water consumption and energy consumption, were added to the company's EMS.

STEP 3 - PERFORMANCE EVALUATION

At the start of the TEST project, the company had the billing meters for energy and water as well as some sub-meters for electricity and water consumption with manual reading.

After completion of the MFCA analysis, a new approach to the management of resource efficiency was integrated into the existing company-wide information system, linking the monetary information system with the monitoring of priority flows. New objectives, KPIs and targets for improvement were set up for the priority flows for the duration of the first TEST cycle as shown with some examples in table 2. For each objective, three KPI values are provided: a baseline (original performance based on data from fiscal year 2015), a target for 2017, and the actual performance in 2017 as monitored in the information system.

PRIORITY FLOW	TARGET	KPI	MONI-TORING PERIOD	EVALUATION	BASELINE 2015	TARGET 2017	PERFOR-MANCE 2017
Electricity	Increase energy efficiency	kWh / hl of beverage produced	Per day	Weekly technical meetings Quarterly top ma-nagement meetings	8.2	7.8	6.4
Water	Increase water effi-ciency	l of water / l of beverage produced	Per day	Weekly technical meetings Quarterly top ma-nagement meetings	2.2	1.9	1.6

TABLE 2: Example of objectives for continuous improvement and related key performance indicators (KPIs)

STEP 4 - IMPROVEMENT

The TEST project and its results were presented in a meeting organised by the holding company. Company members were very proud of the results achieved. For its part, the holding company decided to spread the good practice of TEST to its other companies in the Middle East.

Existing resource efficiency objectives were reconfirmed and more ambitious targets were set for the longer term. The company's TEST team will continue to perform in-depth analysis of those focus areas which could not be assessed during the first TEST cycle. Regular meetings with top management will also continue, to discuss progresses and new priorities.

It was also decided to install additional water meters, create a permanent monitoring program and use new data for further expansion of the water balance.

MFCA analysis was crucial for quantifying the NPO costs and for pointing out the right priorities at the beginning. However the top management decided to restrict the use of the defined MFCA accounts (and repetition of the detailed MFCA analysis every year) due to the perceived high labour intensity of this work.

The company information system is based on work with priority flows, KPIs, OPIs and specific targets to guide and monitor achievements of continuous improvement. The company will continue to monitor selected NPO costs also within the next TEST cycles.

The company also decided to share its experience with the systematic application of RECP with its stakeholders; in addition to harvesting the economic and environmental benefits of RECP, this decision led to increasing the company's broader social capital.