# Energy and Water Conservation Program at a Textile Processing Plant in Bulgaria



**Project Title:** Energy and Water Conservation Program at a Textile Processing Plant in Bulgaria
**Leader:** Galatex AD, Cotton and Textile Processing Plant (Varna, Bulgaria)
**Partner:** EETEK Hungary - Energy Efficiency Technologies (Budapest, Hungary)
**Location:** Varna, Bulgaria
**Project Duration:** July 1999 – March 2000
**EcoLinks Project Investment:** Total EcoLinks Project Investment: $27,420; EcoLinks Grant Support: $17,370; Project Team Cost Share Contribution: $10,050.

# Best Practice: Transferable Solution

This project is an EcoLinks Best Practice because it demonstrates 1) a successful methodology for identifying and assessing energy efficiency measures, and 2) the benefits of working with an Energy Services Company (ESCO). The basic scheme and components of the project methodology, locally tested at a Textile Processing Plant in Bulgaria, can be easily transferred to many production facilities in the CEE/NIS region in which energy production is not the main activity.

# Project Summary

Galatex AD Cotton and Textile Processing Plant (est. 1905), located in Varna, Bulgaria, is a large, predominantly private, integrated facility that produces cotton yarn, dyed yarn, and crude and finished fabrics. Less than 30% of its shares are owned by the state. The production volume of the plant is six million meters of fabric per year. Over the past five years the production volume has been basically stable with a 5% increase last year. Galatex's energy and water consumption per unit of

production is exceptionally high. The plant uses large amounts of steam for fabric production and heating. Large amounts of water from the city water supply system are consumed mainly for steam generation and cooling. The plant consumes an average of 4,800 tons/yr of heavy fuel oil, 7,300 MWh/yr of electricity, and 700,000 cubic meters of water per year. As a result of this high energy and water usage, Galatex's average annual energy cost is approximately $1.5 million.

Galatex's energy and water usage is high for a number of reasons. There are long distances between buildings on the plant site (the plant covers 400,000 square meters). The nature of the production process requires multiple stages of wetting, drying, and heating. Efficient energy management practices are not followed. Galatex's daily energy consumption is constant over the entire year in spite of varying production volume and weather conditions.

The high energy and water consumption at Galatex are linked to environmental problems. Galatex's boiler house and power plant that supply the national power grid generate 12,000 to 15,000 tons of $CO_2$ each year. Partially pre-treated wastewater from dyeing and finishing procedures could be discharged into the city sewer and undergo further treatment. Approximately 50% of the wastewater, however, ends up being discharged directly into the Black Sea because of the huge total volume of discharged wastewater and the small diameter of the sewer-connecting pipeline.

Galatex recognized that improving its energy efficiency was essential for the success of its operations. With an EcoLinks Challenge Grant, Galatex partnered with a Hungarian environmental consulting company, EETEK Energy Efficiency Technologies, to develop an energy and water conservation program. The project team conducted energy audits, including technical and financial evaluations, to assess current energy consumption at Galatex. Based on the results, they proposed specific measures to improve energy efficiency in areas such as the boiler and heating systems and the water distribution system used for cooling. They also prepared an Energy Performance Contract that includes the terms and conditions for further cooperation between the organizations in implementing and financing the conservation program.

The project results indicate that implementation of the program will yield significant environmental and economic benefits. The project established the framework for achieving reductions in air emissions, water losses and wastewater discharge. In addition to these environmental benefits, Galatex can expect an annual cost savings of $800,000.

# Project Activities

In order to reduce energy and water consumption and air and water pollution and to lower production costs, the plant's management decided to identify and implement cost-effective energy and water conservation measures for various stages of the production process. The methods and materials used to achieve this goal are outlined in this section.

**1. Selected independent body for assessing energy consumption**

Action: Galatex selected a reputable and independent Energy Service Company (ESCO) for carrying out an extensive energy auditing process. The ESCO was chosen for several reasons including:

- The plant lacked the human resources to identify energy efficiency measures alone
- The project would be more attractive to outside investors (banks)
- The plant needed assistance in identifying the best financing options for project implementation
- The ESCO would provide a guarantee that the savings from energy conservation measures would not only cover investment costs but would also result in a profit
- The ESCO would assess the entire production process for energy savings potential

Product(s): Secure a reliable energy auditor

**2. Conducted preliminary energy audit**

Action: The plant's production process and management practices were assessed and areas requiring a detailed energy audit were identified. The specific tasks completed under this activity included:

- Established an Energy Council;
- Collected and assessed available energy and water consumption data;
- Identified and assessed the present condition of plant's production process, equipment, and installations;
- Identified main heat (steam) and water consumption points;
- Assessed existing measuring and flow control equipment;
- Started to measure heat and water consumption;
- Prepared preliminary heat, electricity, and water balances; and
- Identified areas to be analyzed in the detailed energy audit.

An important part of this stage of the project was establishing the Energy Council. The Council included representatives of different departments of the plant (energy, production, maintenance, sales, control and management) as well as representatives of the ESCO. The Council served to obtain shared ownership of the project, to keep everyone informed of project developments, to identify and solve problems, and to coordinate activities. This decision-making body met regularly and was chaired by Galatex's Chief Executive Officer.

Product(s): 1) Energy Council 2) Data on energy and water consumption 3) Assessment of the plant's production process, equipment including measuring and flow control equipment, and installations 4) Preliminary heat, electricity, and water balances 5) Focus areas for detailed energy audit

**3. Conducted detailed energy audit**

Action: Based on the findings and conclusions of the preliminary audit, a more detailed energy audit was conducted and included the following tasks:

- Conducted measurements and collected data regarding heat, electricity, and water consumption;
- Prepared complete energy and water balances;
- Identified possible malfunction of energy and water systems;
- Verified correlation between energy production and consumption;
- Identified necessary equipment to measure and control energy production and consumption; and
- Calculated potential energy and cost savings and investment needs.

Product(s): 1) Additional data on heat, electricity, and water consumption 2) Finalized energy and water balances 2) Financial analysis outlining energy and cost savings and investment needs

**4. Analyzed data from energy audits and identified energy and water conservation measures**

Action: The gathered data was analyzed from both a technical and financial perspective in order to identify possible energy and water conservation measures. The following main reasons for energy and water losses were identified:

1. Lack of energy and water management and monitoring system
   - Lack of institutionalized managerial support to save energy and water;
   - Working environment that tolerates inefficient use of energy and water; and
   - Lack of basic measuring equipment.

2. Obsolete or lack of proper equipment in the steam generation and supply system
   - Obsolete boiler house (poor control over burning process, no automatic control of steam pressure, obsolete burners, and no independent oil heating system);
   - No control over parameters of steam supplied to the production process; and
   - No proper control of space heating and ventilation systems.

3. Lack or poor insulation of tanks and of the steam pipelines as well as very long steam distribution system.

4. Poor or lack of energy and water recovery in various installations. For example, most of the condensate was being discharged directly into the sewage without any heat recovery.

5. Inefficient generation and usage of compressed air.

6. Large water losses and unnecessary generation of wastewater.

A set of energy conservation measures related to different energy systems was identified that address the above findings. The measures were directed at improving energy conservation with regards to the boiler house, the steam and condensate system, space heating and cooling systems, process heat recovery, the compressed air system, the variable speed drives for electric motors, and water and energy management. These measures were prioritized in terms of the plant's organizational and financial resources to implement them. The list of measures together with information on expected energy savings, necessary investment outlays, financial benefits, and the payback period were attached to the Final Report.

Of special attention is the first identified energy conservation measure – energy management. The objective of this measure is to establish an energy monitoring and control system. The system would be comprised of an energy policy, energy-use norms based on the production level and weather conditions, an assigned energy manager, a computer-based monitoring program, energy-utilization data reported on a weekly basis, a management system for quick reaction, and an energy-utilization reporting procedure. The total costs for implementation of the measure would be approximately $100 000 and it would result in a 5% reduction in energy consumption.

For each energy and water conservation measure, a separate comprehensive form was completed. The form included a description of the existing condition of the related energy production/utilizing system, recommended actions to improve the efficiency of the energy system, expected results (energy savings), and cost-benefit projections. The purpose of the form is to report each identified energy conservation measure in a consistent and clear manner and serve as a basis for financial analyses. An essential benefit of the form is that it communicates in an understandable manner the results of the analyses and assures credibility of the technical and financial information.

Product(s): 1) A list of short-term (low-cost) and long-term (higher-cost) energy conservation measures 2) An energy efficiency program that included a Proposal for Development of an Energy Efficiency Business Plan 3) Opportunities to further improve energy conservation in line with the plant's growth.

**5. Prepared an Energy Performance Contract**

Action: An Energy Performance Contract for services, to be further discussed and possibly signed between the two organizations (Galatex and EETEK), was prepared. In general, the contract sets out the terms and conditions for services to be provided in designing and implementing the energy conservation program. In particular, the contract includes a list of measures selected for technical evaluation; criteria for determining the viability of the measures; the scope and financing arrangements for undertaking further technical evaluation and preparing a business plan; the general provisions for implementing the agreement; the provisions for arranging financing of the measures; the provisions for investment costs calculation; terms for provision of guarantees for the services and allocation of savings; and the terms for maintenance, monitoring, and operations support.
The following main obligations arise from the contract:

(1) EETEK agrees to arrange financing from its own capital or debt for each selected and approved energy conservation measure, unless Galatex finances the measures from its own funds;

(2) EETEK agrees to provide a guarantee that the savings accrued from implementation of the program, or group of approved measures, will sufficiently cover the total annual debt service costs from financing or EETEK will pay the shortfall;

For the period of all principal and interest repayments to the lender (loan term), the value of saving above debt service costs will be split evenly (50%-50%) between both organizations.

Product(s): Draft of Energy Performance Contract

# Project Benefits

This project provides several benefits. It strengthened the capacity for achieving reliable assessments of water and energy consumption and promoting future collaboration amongst the team organizations. The implementation of the energy conservation program will lead to reductions in air pollution and water and energy consumption.

**Capacity Building Benefits**

Most notably this project established a framework for working with an ESCO. This strengthened Galatex's ability to achieve a reliable energy audit. In assessing the efficiency of resource use at Galatex, the project members gained experience in working with other organizations to identify and solve environmental problems. Developing the Energy Performance Contract established a clear basis upon which further collaboration between Galatex and EETEK is built.

**Environmental Benefits**

With implementation of the conservation program developed in this project, air pollution is reduced as follows:

| **Air pollutants** | **Current emissions (t/year)** | **Expected reductions (t/year)** |
|---|---|---|
| $CO_2$ | 9,391.3 | 3,117.9 |
| CO | 2.6 | 0.87 |
| $SO_2$* | 297.4 | 98.7 |
| $NO_x$ | 26.1 | 8.7 |
| Particulates | 14.3 | 4.8 |

* Assumed content of sulfur in heavy fuel oil: 3,0%

Note: All emissions are related only to consumption of heavy fuel oil in Galatex's boiler house

**Economic Benefits**

The conservation program would allow reductions in energy and water consumption as follows:

| | Consumption* | Expected reductions |
|---|---|---|
| Heavy fuel oil (t/year) | 4,800 | 33.2% |
| Electricity (MWh/year) | 7,300 | 18% |
| Water ($m^3$/year) | 700,000 | 44% |

* Average annual consumption for the period 1995-1999

This reduction in energy and water usage will result in an annual cost savings of $800,000.

A financial analysis of the program revealed the following:

| Economic indicators | Value |
|---|---|
| Total project investment costs (million USD) | 1.1 |
| Annual cost savings (million USD) | 0.8 |
| Overall project pay back time (years) | 1.4 |
| NPV (at 35% discount rate) (million USD) | 1.04 |
| IRR (%) | 77 |
| Loan term (years) | 4 |

If all energy efficiency measures are implemented, the EcoLinks grant of approximately $17,400 will foster environmental investment of $1.1 million (leverage ratio over 60).

# Lessons Learned

The following lessons were learned during project implementation.

- Selecting an independent and reliable Energy Service Company or a consulting company has significant advantages in the development of energy conservation programs.

- Establishing an Energy Council and working closely with the 'users' of the energy systems are a valuable way to obtain buy-in from the plant's employees and to coordinate the project.

- Providing sufficient time for systematic data collection and program development is a key success factor.

- The availability and condition of the plant's existing measuring equipment can have important implication on the costs for developing and implementing an energy conservation program.

# Contact Information

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