

Catalyzing market transformation for industrial energy efficiency and accelerate investments in best available practices and technologies in the Former Yugoslav Republic of Macedonia:

Steam System Energy Assessment and Optimization

Typically over 85% of the lifetime costs of a steam system are energy related. This case study reviews the optimization opportunities identified in the steam system of the Pivara Brewery Plant in Skopje, Republic of N. Macedonia, in order to address potential energy savings. The steam system energy assessment carried out revealed saving opportunities as follows: financial 27 973 USD/yr, fuel 65.378 Nm³/yr, energy 671.940 kWh/yr savings.

Pivara Skopje AD Snapshot

Pivara Skopje, founded in 1922 in Skopje, where its productive capacities still reside, consists of two production plants: a brewery and a bottling plant for non-alcoholic beverages. Pivara Skopje is the undisputed market leader in the production of beer and beverages in N. Macedonia.

Industry:

Production of beverages

Location:

Skopje, N. Macedonia

Product and Services:

Production of raw beer, filtration, pasteurization and packaging of the beer and production of non-alcoholic beverages.

Technology:

Natural gas, heavy fuel oil, fire-tube steam boiler

URL:

<https://polnacasa.mk/>

Energy System Assessed: Steam System

Identified Optimization Benefits:

Financial savings: 27 973 USD/yr

Fuel savings: 65.378 Nm³/yr

Energy savings: 671.940 kWh/yr

Optimization Benefits :

Potential GHG reduction: 121 tCO₂eq/yr

N. MACEDONIA

A Case Study of Pivara Skopje AD



Steam System Optimization (SSO) Project in Pivara Skopje AD

The GEF-UNIDO-REC Project aims to reduce greenhouse gas emissions (GHG) generated by industry in the R. N. Macedonia by accelerating the transformation of the local market for industrial energy efficiency (IEE) by addressing existing barriers, in particular through strengthening policy, regulatory and institutional frameworks for IEE and supporting increased diffusion of and investment in best available IEE practices and technologies. The Project is funded by the Global Environment Facility (GEF), implemented by UNIDO and executed by the REC Country Office Macedonia (REC COM) in collaboration with the Ministry of Environment and Physical Planning, the Ministry of Economy, the Energy Agency of the Republic of Macedonia and the Macedonian Bank for Development and Promotion. The project runs from February 2015 until December 2020.

Pivara Skopje AD joined the GEF-UNIDO-REC Project in November 2015. Top management of Pivara Skopje AD offered to serve as a host plant for the UNIDO Steam System Optimization (SSO) Expert training. This decision brought additional expertise to the staff included in the SSO training and equipped them with knowledge of new techniques and practices for achieving energy savings and financial benefits for the company through optimizing the operation of steam systems. The Energy Savings Assessment (ESA) focused on the Steam system identified 5(five) Energy Saving Opportunity (ESO) that if fully implemented would decrease current plant fuel use by about 4.5 %.

Table 1 - Summary of Steam System Optimization Measures

	Energy Saving Opportunity (ESO)	Energy Savings kWh/yr	Financial Savings (USD/yr)	Fuel Savings (l/yr)	Capital costs ^a (USD)	Simple Payback ^b (yrs)
	Identified ESO					
1	Improve boiler efficiency by optimizing excess air levels through Oxygen Trim Control ¹	143888	5944	14000	3086-6172	0.5 - 1.0
2	Recover wasted heat from the boiler stack to preheat the combustion air with a heat pipe of the type: AirPreheater (APH) ²	239995	8995	23351	26455-35273	3.0- 4.0
3	Improve the LP condensate recovery by another 5% ³	96110	4921	9351	7055-14991	1.5–3.0
4	Initiate steam trap and leak management program and reduce failures	113888	4797	11081	5291-11464	1.0 - 2.5
5	Insulate all the bare pipe and pipe fittings at 8 PRV stations in process floors	78059	3316	7595	5291-10582	1.5 - 3.0
	Total potential savings	671941	27973	65378		

¹ upgrading combustion control by decreasing excess air levels from 5,9% to 3% Oxy in flue gas, for high combustion efficiency , buy adding oxygen trim control

² installing heat pipe exchanger for preheating the inlet combustion air

³ improvement achieved by installing Spray-Jet Condenser

^aThe Estimated Project Costs have been roughly calculated using the estimated energy savings (as result of the assessment carried out) and the simple payback period (based on the USA experience)

^{bb} The indicated Simple Payback periods are based on extensive project experience in the United States, where the Simple Payback is equal to Total Investment/ Cost savings per annum

Case Description

The work presented herein is a result of a systems approach to energy performance analysis which resulted in identifying opportunities for optimization of the steam and condensate system of Pivara Skopje AD.

The boiler house steam system provides superheated steam that is used to power various steam consumers. The average steam generation at the plant is about 3 tons/hr. Saturated steam is generated at 6 bars pressure. The biggest steam consumers are the brew house and the packaging plant consuming it at 3-bars pressure, followed by dryers, the CO2 plant & the CIP (clean-in-place) that consume steam at lower pressures.

The main operational cost of the steam system is natural gas consumption. Thus, the focus was to implement a set of energy efficiency measures that would lead to reducing natural gas consumption, and in turn decrease the overall negative environmental impact of the plant.

The plant is equipped with the following primary equipment:

- 2 fire-tube (FT) steam boilers, both capable of consuming natural gas or heavy fuel oil (HFO), and the fuel currently used for steam generation is natural gas
 - 1st FT boiler is 6535 KW
 - 2nd FT boiler is 4100 KW
- Both boilers are capable of generating steam at 13 bars.
- The boiler house also operates one small hot water, condensed type boiler, currently fired by natural gas but can also use biogas

Optimization Measures & Results

The optimization measures identified through the steam system energy assessment at Pivara Skopje AD are presented in Table 1.

Lessons Learned

In addition to savings in energy, fuel and money, improving the efficiency of the steam system at Pivara Skopje AD identified ESO should contribute:

- To produce a quality product usually requires a lot of financial resources and when a visionary management is involved in this cost process reducing, the ESA optimization could have a high impact on profitability improvement
- ESA motivated staff working on the steam creation and distribution system to be more creative, to continue and sustain improvements, and to identify other potential energy waste reduction opportunities.
- Fuel savings (natural gas), resulting in less CO2 emissions
- Improving combustion efficiency, resulting in reduced emissions of greenhouse gases and cleaner environment
- Steam leak maintenance management program represents a significant percentage of the potential savings and should be considered as a regular practice in this systems

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