Energy audits

Sector specific requirements for energy audits

(Revised, April 2015)

Tannery and footwear sectors

Contents

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1. Work done and sample description

The IND-ECO project is focused on energy efficiency of tanneries and footwear companies

The audit is the first step to identify which are the initial energy performances of companies.

According to the audit results, the companies are able to take appropriate decisions to reduce the energy consumption and CO_2 emissions.

The Energy audit is a systematic inspection and analysis of energy use and energy consumption of a system or organization with the object of identifying energy flows and the potential for energy efficiency improvements (definition provided by the CEI EN 15900:2010 norm).

The IND ECO project allowed to carry out the following audits:

Country	n. of companies
Italy	18 tanneries 1 footwear
Spain	5 tanneries 14 footwear
Romania	5 tanneries 10 footwear
Bulgaria	1 tannery 3 footwear
Portugal	1 tannery 7 footwear
UK	9 tanneries 1 footwear
TOTAL: 75	**39 tanneries** **36 footwear**

This document refers to audits carried out in companies of the TANNING and FOOWEAR sectors and reports some specific recommendations addressed to energy auditors referring to both sectors.

In both sectors, the major part of companies is made of small and medium companies but some large companies have been involved as well that are part of big groups in the fashion sector

The major part of tanneries has been involved in Italy that is the leader country in this sector. Other ones come from United Kingdom, Spain, Romania and Portugal

Footwear companies came mainly from Portugal, Spain and Romania and also from Italy and Bulgaria.

TIPOLOGIA AZIENDE. CICLO COMPLETO – LAVORAZIONI - DIMENSIONE

Tanneries

The sector has traditionally been composed of **small and medium sized enterprises** mainly, but big companies can be found as well. The average size of a EU tannery is currently 18 people per enterprise.
Also the sample of companies involved in the project is mainly made of SMEs but a significant number of large companies have been audited as well, mainly in Italy.
This is because of relevant energy consumptions in large companies with the full cycle process.
Most involved companies are performing full cycle process from raw hides/skins to finished leather/fur.
The major part of companies is processing bovine hides.
Products are leather for:

1. Automotive
2. Furniture
3. Shoes
4. Leather goods

Fashion is a relevant market the involved tanneries refer to being made of very large companies that are working hardly on sustainability, carbon footprint included.

Footwear companies

The visited companies produce much kind of shoes:

1. women's shoes
2. men's shoes
3. children shoes
4. others (i.e. occupational footwear such as industry, healthcare sector, tourism sector, etc.)

The first three typologies represent about 95%of the total audited sample.
The upper material used is leather.
The major part of shoes is bonded; secondarily they are stitched.

Energy consumption changes much without a clear relationship with the country, the process, etc.
Main indicators are kWh per pair and Kg CO_2e per pair. According to the benchmarking study made by the INDECO project they are mainly distributed between 0,7 and 3,9 kWh and 0,3 and 1,9 Kg of CO_2e respectively

The major part of companies includes all production phases: the cutting, upper closing and stitching, lasting and finishing and post-finishing operations.
In some cases only few phases are included in the production process such as "Lasting, finishing and post-finishing operations" or "cutting, upper closing/stitching and lasting".
The companies' size is small on the average and it's varied between 10 to 100 employees. Consumption also change a lot.

2. The energy audit

The energy auditing refers to the following norms:

- UNI EN ISO 19011:2012 "Guidelines for auditing management systems"
- UNI CEI EN 15900:2010 "Energy efficiency services – Definitions and requirements"
- UNI CEI EN 50001:2011 "Energy Management Systems – Requirements with guidance for use"

The first one is the main document that

The auditing activity has been carried out through off site and on site activities, organized as follows:

1) Request of relevant material to the companies (for example bills of electric and thermal sources consumption, technical description of processes, plants and buildings) – OFF SITE
2) Offsite data elaboration and audit planning
3) ON SITE AUDIT:
   - kick off meeting
   - walking through facilities, completion of the INDECO checklist
   - in depth analysis of collected information, data integration
   - interviews with involved staff
   - final meeting and comments
4) Offsite Report elaboration
5) On site Report presentation:

The reference documents for the audit activity in all project countries were the "Energy audit template" produced by Sogesca for the IND-ECO project.

The "Energy audit template" is aimed to:

- Provide the structure of a complete audit of the energy management
- Provide suggestions and recommendations to allow auditors to completely and soundly fill in the audit report
- Establish a shared audit report structure suitable to compare results of different energy audits, focusing the reporting to detailed energy performances indicators to be investigated during the audit

It is available in the "www.ind-ecoefficiency.eu" project web-site.

Being the INDECO audits the first ones carried out in the involved companies, the objectives were:

- *Identify and quantify energy uses and consumptions.*
- *Identify opportunities for improvement.*

According to the INDECO guidelines the indicators to which auditors paid attention were the following ones:

EnPIs for auditing a **tannery**		
Energy use / factory area	Variable influencing energy consumption	EnPI
Lighting	Square meters	kWhel / m^2
Process vapour / heat production – Total consumption	Production of web blue (m^2)	MJ methane / m^2
Process vapour /heat production – Total consumption	Production of finish hide (m^2)	MJ methane / m^2
Electric power	Production of web blue (m^2)	kWhel / m^2
Electric power	Production of finished hide (m^2)	kWhel / m^2
Electric power – total	**Production of finished hide (m^2)**	**kWhel / m^2**

EnPIs for auditing a **footwear company**		
Energy use / factory area	Variable influencing energy consumption	EnPI
Lighting	Square meters	kWhel / m^2
Electric power – total	**Production of finished pairs of shoes (n°)**	**kWhel / n° of pairs**

As final output of each audit, improvement areas and company specific suggestions have been pointed out.

Such suggestions have been exploited to provide energy auditors (both internal and external) with sector specific recommendations through this document.

Recommendations are listed and commented in the following pages.

3. Specific recommendations for the TANNING sector

General aspects

A key initial question is to characterise the company; leather producers undertake various parts of the process and there is a significant variation in energy use – for example between processing from raw to wet blue, and finishing.
A wet blue plant can have an energy use of less than 4 kWh per square metre (kWh/SqM) (primary energy), while a finishing plant would be around 15 (one specialist finisher was been reporting 30-35 kWh/SqM).
A second key factor is throughput – the overall energy efficiency measure in terms of kWh/SM is significantly affected by variations in throughput.

The accurate energy management is a general recommendation that is good for the footwear sector as well. Energy management can be supported by the use of electronic devices to avoid wasting energy when apparels and machines are not used and workplaces are empty (i.e. switch of/off devices, presence sensors, etc.).

Lighting

In relation to the total consumption of a tannery, that for the lighting of the workplace is not so relevant but the total energy consumption and costs are quite important.
Investments on led or form T8 to T5 can have a very short/short payback.
Thus check:

- the type of lights,
- the intensity required,
- the attendance of working environments for which you might use of presence detectors (eg. Warehouses),
- the possibility to separate lighting according to production sectors.

Building and work flow

The building is not the main focus of the energy audit in a tannery but tanneries are working frequently in old buildings that can be improved form the efficiency and comfort point of view.
So, good Housekeeping is suggested with particular reference to the walls, the roof, the windows, doors; insulation.

Work flow can be optimized improving the internal logistic and relative position of machines and plants (power needed could be dramatically reduced).

Boilers

Heat production is a critical point in tanneries. Some recommendations are pointed out.

- First of all, check whether the boilers' potential is correct dimensioned for the work needed, how old they are and which fuel they are using (oil or gas? is it the optimal fuel?).

- Verify whether operating temperatures of boilers are adequate for the processing temperature (for example we found water being produced at 80 degrees, when the processing temperature was 55).
- Evaluate whether the heat production is centralised or de-centralised (better).
- The heat distribution has to be linear, without long paths as it frequently happens because of layout modifications occurred during many years and well insulated.
- Verify what is distributed: water (more efficient) or steam?

Motors, pumps and compressors

These devices are frequently old. So

- Check how old they are (10 years old could a reference age) and which are the opportunities to install a high efficiency motors, pumps, compressors, etc. according the EU classifications.
- These devices are integrated with several processing machines (i.e. fleshing machines, splitting machines, buffing machines etc,) and the overall process is based on their efficiency and their use.
- Check their use and their power according to process cycles and needs.
- Check the load profile
- Verify the maintenance and operational conditions of such apparels to avoid inefficiencies due to air leaks, wrong environmental temperature, etc.

Process machines

Some specific recommendations can be outlined with regards process machines

- Evaluate in detail the production cycle (day and night load profile) of **drums** related to liming, tanning and drying phases. The electric motors integrated in the drums have to be equipped with inverters that control the rotational speed. Thus optimises power and electric consumption.
- Verify the following aspects in **spray machine**:
    - Operating pressure. Low pressure spray guns reduce the average load of air compressor reducing electric consumption.
    - Inverters. Inverters optimizes energy use during load and pause phases.
- Evaluate the following aspect in **drying chain**:
    - Thermal Isolation. Good thermal isolation reduces thermal consumption.
    - Assess and any options for heat recovery.
    - Reduce the drying time for each leather piece.
    - Setting more pieces of leather on the dryer.

  These measures could lead to a reduction of around 30% of total consumption.
- Assess the feasibility for the installation of hot air recirculation system on the milling drum.
- Evaluate the thermal and electrical loads for the sizing of a gas engine CHP (Combined Heat and Power) system.

4. Specific recommendations for the FOOTWEAR sector

Lighting

Lighting is a fundamental factor for footwear production.
In relation to the total consumption of the footwear industry, that for the lighting of the workplace is of some significance. Thus check:

- the type of lights,
- the intensity required
- the attendance of working environments for which you might use of presence detectors (eg. Warehouses).

Compressors

- Check the position of compressors: heat dissipation improves their efficiency. Check with adequate frequency, the maintenance status of the compressors in order to promptly identify air leaks.
- Verify the work cycles of the compressors in order to improve its use.
- Check the operating pressure of the compressors. A better adjustment can reduce energy consumption.
- Check the size of the system of compressors and individual compressors: It would be useful to establish smart control mechanisms that decide about the best compressor combination for each situation

Activators

The activators in the assembly line deserve special attention:

- Analyse their actual use and power to find improvements opportunities in the work sequence in order to optimise the heating needs of the process.
- Optimize the duty cycle to minimize need to heat.
- the addition of semi-closed upper casings, especially for dry activators, could reduce heat dissipation, having a positive effect on energy efficiency.

Conditioning

Conditioning air represents a very important part in the consumption. So you should verify:

- the actual need
- the energy efficiency class
- the set temperature
- the maintenance performed
- the insulation of the workplace
- the cool/heat distribution system