TEST case study

Processing of seafood

Developed under the framework of Med TEST II

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

switchmed

The SwitchMed Programme is funded by the European Union

Processing of seafood

SECTOR	Processing of seafood
SUBSECTOR	Tinned products
SIZE	300 employees
PRODUCTS	Tinned tuna, sardines, mackerel and anchovies
MARKET	Local and international
CERTIFIED MANAGEMENT SYSTEMS	ISO 9001, ISO 22000, CE, FDA, Russian certification

Table of contents

- Company key data
- Process flowchart
- Benchmarking
- Non-product output costs
- Focus areas and cause analysis
- Savings catalogue – Identified projects
- Examples of best practices (5 most significant)
- Management system integration
- Results
- Conclusions

Company key data

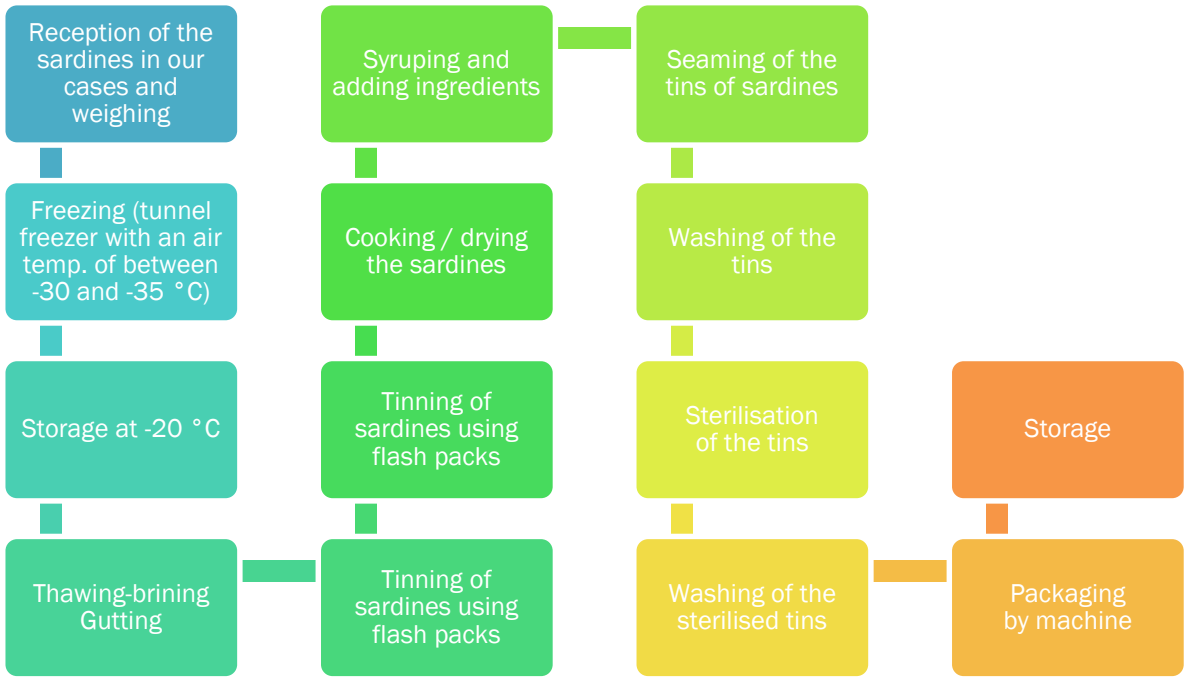
Anticipate the risks related to pollution and prevent them by minimising releases, and by improving our environmental and energetic performance while preserving resources

Year 2015	Unit	Value
Production	Tonnes/year	4,555
Electricity consumption	kWh/year	1,774,686
Fuel consumption	toe/year	716
Water consumption	m^3/year	397,310
CO_2 emissions	tonnes/year	4,023
BOD5	kg/year	532,395
COD	kg/year	1,307,150
Total cost of sales	€	9,600,000
Total cost of inputs (purchase value of raw materials, auxiliary materials, energy, packaging and water)	€/year	7,619,190
	% vs cost of sale	79%
Estimated non-product outputs	€/year	2,702,979
	% vs cost of sale	28%

Process overview/flowchart: Tinned sardines

INPUTS

- Fresh sardines
- Ingredients (oil or sauce or chillies…)
- Plastic case
- Refrigerating energy
- Steam
- Salt
- Sea water
- Municipal Water
- Metal tins
- Lids
- Compressed air
- Boxes
- Ink + solvent
- Metal trolleys
- Operating materials

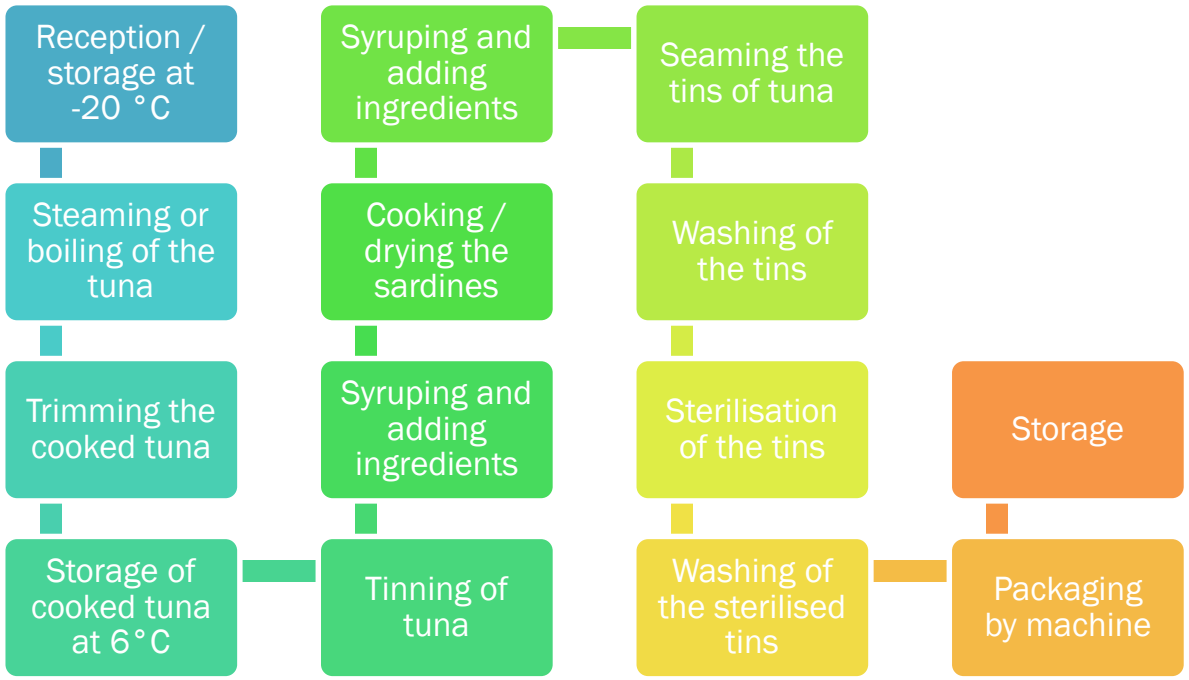


OUTPUTS

- Tinned sardines
- Waste from lids
- Sardines for recycling
- Waste from sardines
- Waste from tins
- Discharge of fluids (oil + water)
- Waste from ingredients
- Waste water
- Cases + plastic grills
- CO_2 emissions

Process overview/flowchart: Tinned tuna

INPUTS
- Frozen or fresh tuna
- Ingredients (oil/water etc.)
- Metal tins
- Lids
- Boxes
- Ink + solvents
- Cleaning products
- Plastic and metal trolleys
- Wooden pallets
- Salt
- Sea water
- Municipal Water
- Cooking basins
- Operating materials
- Refrigerating energy
- Steam
- Compressed air

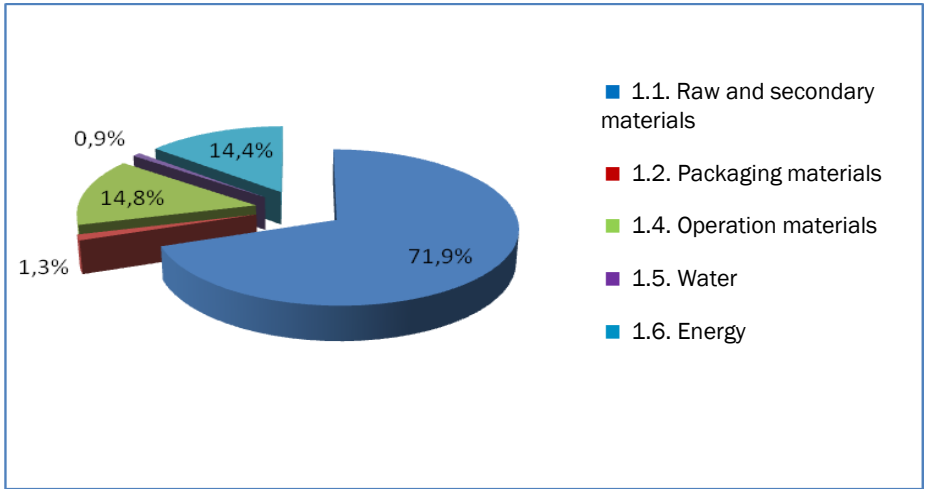


OUTPUTS
- Tinned tuna
- Tuna for recycling
- Waste from lids
- Waste from fish
- Waste of tins filled with tuna
- Waste of empty tins
- Discharge of fluids (oil + water)
- Waste from ingredients
- Wooden pallets
- Waste water
- CO_2 emissions

Benchmarking

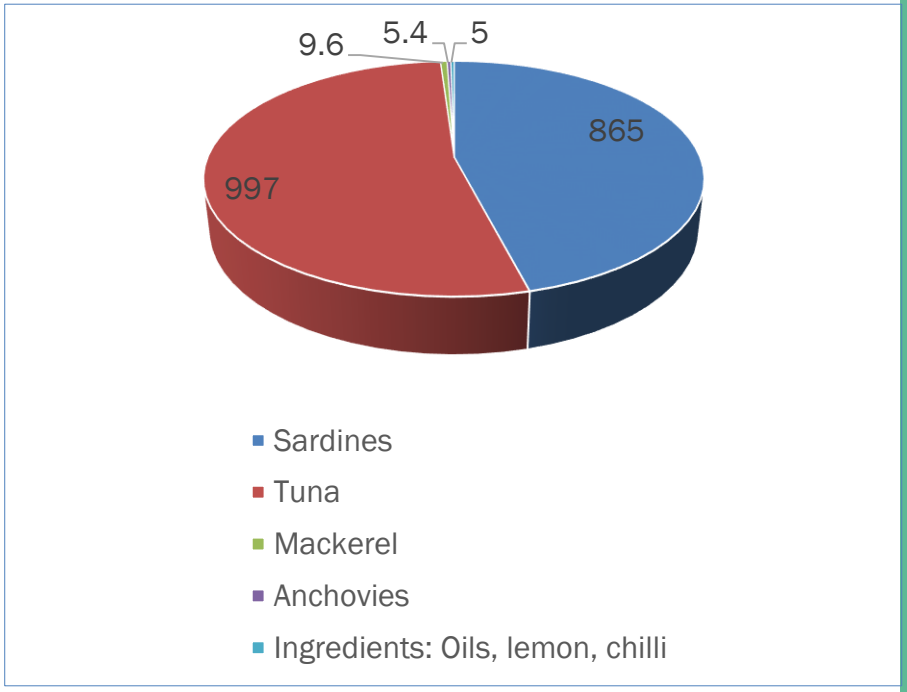
Benchmark type	Unit	Company	Best practice
Electric power	kWh_{elec} / tonne of finished product	419.15	
Thermal energy	kWh / tonne of finished product	1,978	Total: < 500 kWh / t
Water consumed	m^3 / tonne of finished product	93.97	Max. 35
Waste water	m^3 / tonne of finished product	93.97	Max. 35
BOD5, waste water	kg / tonne	0.09	Max. 0.075
COD, waste water	kg / tonne	0.03	Max. 0.01
Packaging	t / tonne of product	0.24	Not available
Solid waste	t / tonne of finished product	0.003	Not available

Non-product output (NPO)



Distribution of NPO per flow (%)

- raw and operation materials and energy are obvious priority flows



Distribution of NPO (raw material) per product flow (t)

Approximately 35% of the purchase value in 2015, equivalent to 2,702,979 euros, is lost in the form of NPOs.

Analysis of energy use

Class	Energy use	Energy consumed [kWh/year]	Percentage (%)
1	Large freezing tunnel (-30°C)	470,400	26.50%
2	Processing plant	327,600	18.50%
3	Refrigeration plant units 3 and 4	315,360	17.80%
4	Refrigeration plant units 1 and 2	269,370	15.20%
5	Other (administration, medium tunnel, purification site…)	206,886	11.70%

Focus areas and cause analysis

Focus areas	% in relation to NPO costs	Cause analysis
Trimming	46%	Process losses
Cooking	17%	Process losses
Utilities (including WWTP)	11%	
Gutting	7%	Losses due to gutting process
Steaming/syruping	6%	Losses due to recurrent malfunctions of the seaming machine
Tinning of fish	2%	Materials and packaging losses due to a malfunctioning of the equipment Water losses due to the process

WWTP – Waste Water Treatment Plant

Catalogue of identified measures

ID	Initiative
1	Recovery of waste from sardines
2	Optimisation of the thawing of sardines by using aerosol technology
3	Recovery of proteins from press water
4	Recovery of oil during the production process and after cooking
5	Optimisation of the freezing of sardines
6	Renovation (purchase of a new strainer) and maintenance of the waste water treatment plant
7	Purchase and implementation of an energy management system
8	Consider switching to a time-of-use rate plan / Revision of contractual demand
9	Repair compressed-air leaks
10	Improve the condition of the three compressors
11	Optimise the performance of the three compressors
12	Thermal isolation of the valves and flanges of the steam circuit
13	Regulate the combustion of boiler no. 2
14	Repair steam leaks
15	Regulate condensation temperature of the floating HP systems
16	Training on energy efficiency

Best practice 1:

(Recovery of waste from sardines) – Materials/water

Description of the solution 	A large portion of washing waste is lost when it is directed towards the waste water treatment plant, BOD / COD polluting loads do not comply with legislation. It is recommended to: • Recover all the waste to produce fishmeal • Redirect the water for washing the sardines for transporting waste • Collect and filter the water for washing the sardines prior to discharge, then re-use the waste from sardines for producing fishmeal

Economic benefits	Cost of sale of additional fishmeal (approx. 6 tonnes / year) Savings: **approx. 4,320 euros/ year**
Environmental benefits	28 t of waste/year 1,400 m³ of waste water / year 6 t BOD/year
Capital investments	1,200 euros / PBP: 3 months
Other barriers	Workforce awareness

Best practice 2:

(Recovery of proteins from press water) – Materials

Description of the solution	Prior to the drying of the fishmeal, the raw materials are pressed to recover the oil and to facilitate the process. Press water contains soluble protein, approx. 98 g/l. These proteins can be recovered using nano-filtration, which reduces BOD/COD and which makes it possible to produce high-quality fishmeal (minimum concentration of 30%). Installation of a nano-filtration system with a capacity of 100 l/h.
Economic benefits	N/A
Environmental benefits	18 tonnes of proteins per year 175 m³/year of waste water Reduction in BOD: approx. 18 t/year
Capital investments	80,000 euros
Other barriers	Nothing to report

Best practice 3:

(Regulation of the condensing temperature of floating High Pressure systems) – Energy

Description of the solution	Adapt the condensing temperature to the variation of the outside air temperature of floating High Pressure (HP) systems. This shall be carried out manually every month according to the variation of the outside air temperature (condensing temperature = outside air temperature + 7 °C).
Economic benefits	2,500 euros/year
Environmental benefits	Energy: 31 MWh /year 21 tonnes of CO_2/year
Capital investments	~
Other barriers	Nothing to report

Best practice 4:

(Optimisation of the thawing of sardines by using aerosol technology) – Energy/materials

Description of the solution	 The traditional thawing method of sardines occurs in two steps. The cases are first placed under water nozzles for approx. 3 hours to accelerate the thawing process. This step consumes a lot of water (9 m³/day) and has a negative impact on quality. e cases then are kept in cold storage to 4°C). This process consumes a lot of energy (15,840 kW per thawing cycle), d it lasts more than a day. osol technology or ultrasonic humidification technology is based on a piezoelectric phragm which vibrates to create a fine spray of water. This process causes the water evaporate by creating microscopic negatively-ionised water droplets. This new hnology accelerates the thawing process of the sardines, and consequently reduces e water and energy consumption. This project also makes it possible to improve the quality of the sardines, and to increase the company's productivity as the thawing time is reduced by half.
Economic benefits	**€25,000/year**
Environmental benefits	2,628 m³ of water per year 115 MWh of energy per year 20 t sardines per year Reduction of 6 t BOD per year
Capital investments	Investment: €6,500 / PBP: 4 months
Other barriers	Nothing to report

Best practice 5:

(Recovering oil after cooking of the tuna) – Waste

Description of the solution	The company cooks the tuna in the traditional manner in stainless steel tanks filled with boiling water. During this process, the oil from the tuna overflowing from the stainless steel tanks flows directly into the piping, and consequently ards the PSP, which affects the performance of the PSP. project consists in recovering the oil thanks to spill pans above each cooker, subsequently pumping it into another settling tank. e settled, the oil recovered can be sold in the form of fish oil.
Economic benefits	**€5,720 per year**
Environmental benefits	18.5 tonnes of oil per year Reduction of 17 t of BOD per year
Capital investments	Investment: €4,725/ PBP: 10 months
Other barriers	Raise awareness of personnel

Management system integration

- Set up an environmental policy
- Well-trained company TEST team, representing a driving force to ensure the efficiency of resources and sustainable production
- Implement the on-going ISO 50001 certification based on the energy auditing report carried out in the framework of the MED TEST II project
- Plan implementation of ISO 14001, v 2015
- Improve the cost accounting system to better reflect real environmental costs: complete adoption of the MFCA tool
- Improvement of the absolute ratios calculated at the end of the project

Results

Measure	Investment (euros)	Savings (euros /yr)	PBP (years)	Water and raw materials	Energy (MWh)	Environmental impacts
New technology for thawing sardines	6,500	25,000	0.3	2,628 m^3 of water 20 tonnes of sardines		632 tonnes of CO_2 47,300 kg BOD 4,028 m^3 of waste water 28 t of waste
Recovery of waste for fishmeal	85,926	10,040	8.5	1,400 m^3 of waste water 46.5 tonnes of materials		
Optimisation of energy consumption	20,000	26,727	0.7		924	
Setting up best practices	48,000	22,617	2.1		1,103	
TOTAL	**160,426**	**84,384**	**1.9**	**4,028 m^3 of water 66.5 tonnes of materials**	**2,027 MWh**	

Conclusion

- Implementation of 69% of measures, and 25% will be planned
- Economic savings amount to €84,384 with a PBP of 23 months
- Total annual water savings: 4,028 m^3/year (1.4%)
- Total energy savings: 2,027 MWh (22%)
- Total annual material savings: 66.5 t (1%)
- Reduction in CO_2 emissions: 632 t (10%)
- Reduction in water discharge volumes: 1%
- Reduction in solid waste: 41%
- Reduction in water pollution: 9% in terms of BOD5