TEST case study

Meat processing company

Developed under the framework of Med TEST II

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

switchmed

The SwitchMed Programme is funded by the European Union

Meat processing company

SECTOR	Food Sector
SUBSECTOR:	Meat Production
SIZE	200 Full time employees
PRODUCTS	Cold Cuts – Mortadella, Roast, Luncheon
MARKET	Exceed the national dimension to regional ones.
CERTIFIED MANAGEMENT SYSTEMS	Implemented: ISO 22000, ISO 9001, ISO 14001, OHSAS 18001,FSSC22000 Planned: ISO 50001,ISO45000

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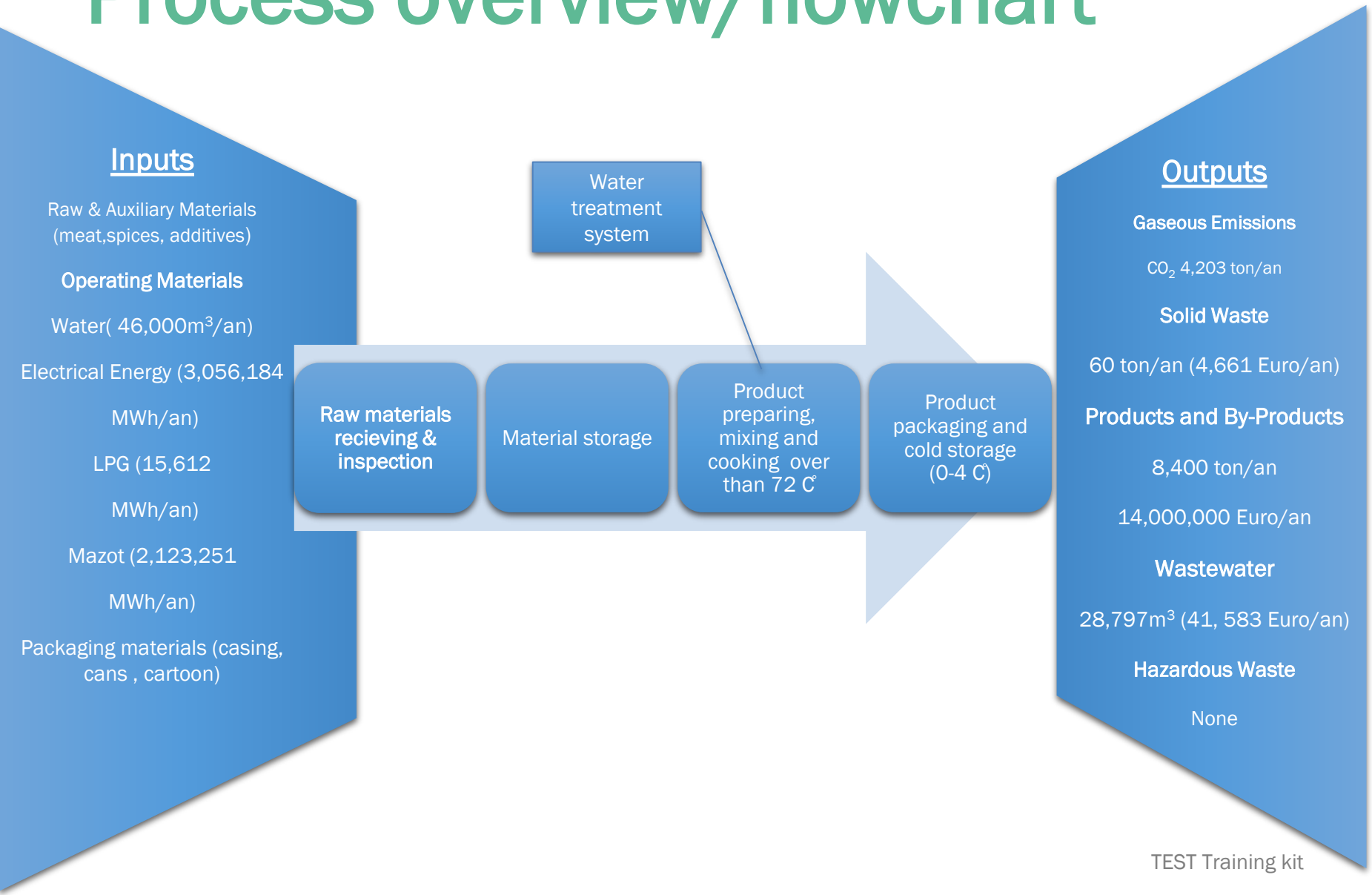
Company Key data

Joining TEST project due to its innovative and proactive approach.

YEAR 2016	Unit	Value
Production	Tonne/an	**8,400**
Electricity consumption	kWh/an	**3,056,184**
LPG consumption	kWh/an	**15,612**
Mazot consumption	kWh/an	**2,123,251**
Water consumption	m^3/an	**46,000**
CO2 emission	Tonne/an	**4203**
BOD5	mg/L	**1,200**
COD	mg/L	**2,500**
Total cost of sales	Euro	**14,000,000**
Total cost of inputs (Purchase value of raw materials, auxiliary materials, packaging energy and water)	Euro/an	**Raw and Auxiliary: 6,067,126** **Packaging: 2,782,003** **Energy: 513,007** **Water: 42,870**
	% vs. cost of sales	**= 9,405,006 / 14,000,000** **= 67%**
Estimated non-product output	Euro/an	**= 928,273**
	% vs. cost of sales	**=928,273 / 14,000,000** **= 6.6%**

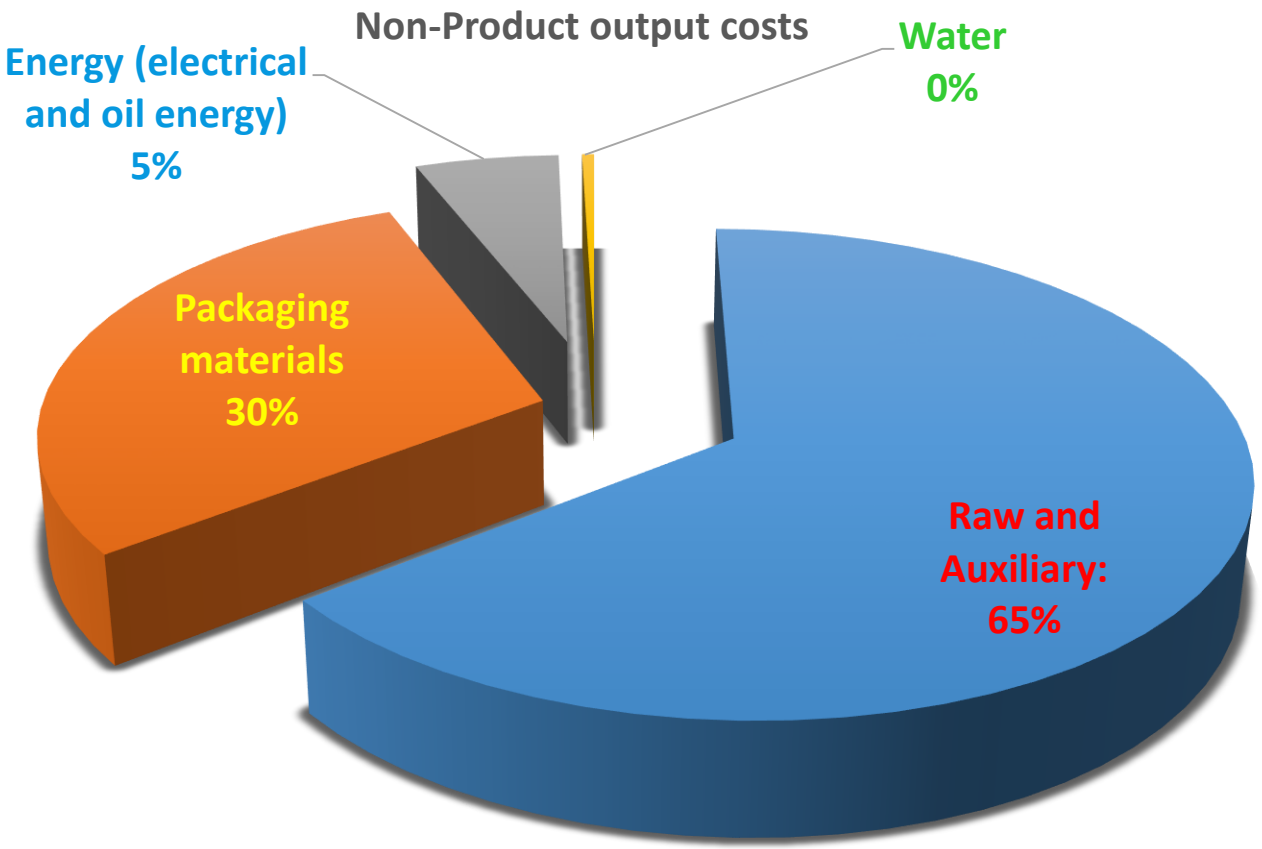
Process overview/flowchart



Benchmarking

Benchmark type	Unit	Company consumption 2016	Best Practice
Electrical Energy	kWh/ton	363.8	150-400
Water consumption	m^3/ton	5.47	2-20
Waste water generation	m^3/ton	3.42	NA
BOD5, Waste water	kg/kg	1.2	0.1-0.25
COD, Waste water	kg/kg	2.5	0.18-0.37
Solid waste	Kg/ton	7	.....

Non-Product output costs



Priority flows

1. WATER
2. ENERGY
3. PACKAGING

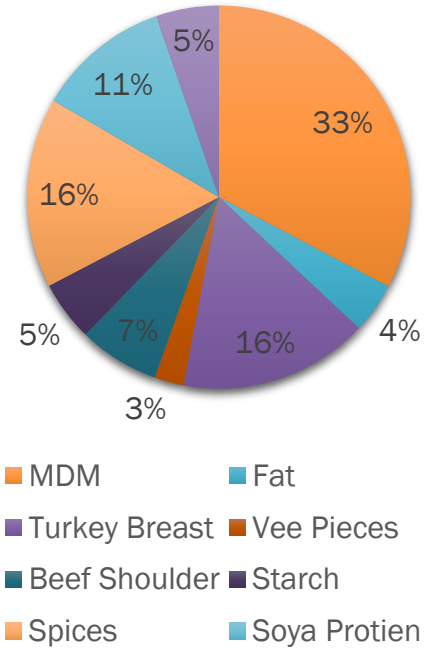
Selected on the basis of:

- Potential for improvement (e.g. vs. benchmarks)
- Environmental considerations (water scarcity)

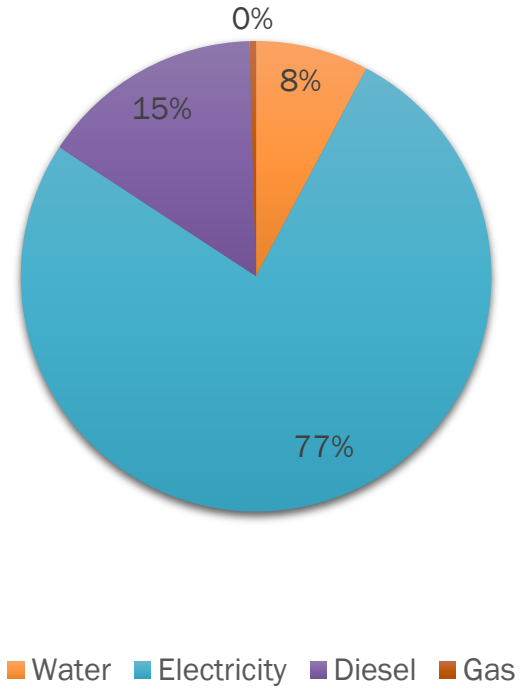
Remark: NPO costs were not considered here for specific company reasons (priorities of company management, water scarcity and low potential for raw material conservation given by technology used)

Focus areas

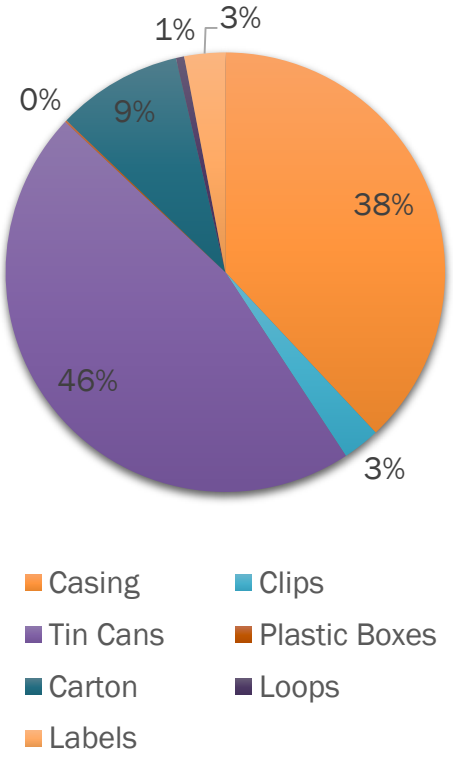
Raw and Auxiliary Materials



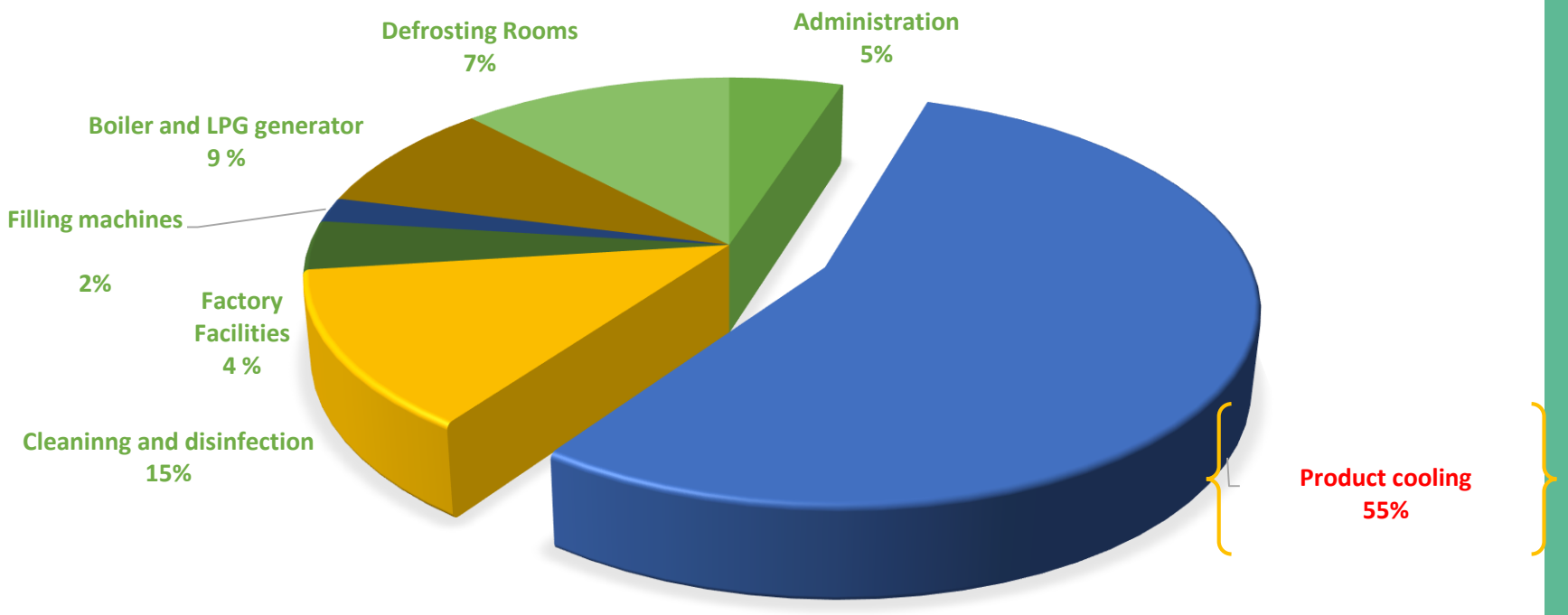
Water and Energy



Packaging Materials



Company water balance



Focus areas

WATER

- Products Cooling
- Cleaning Operations

ENERGY

- Compressed air
- Hot and cold surfaces and their insulation
- Lighting
- Refrigeration

PACKAGING

- Tins
- Carton boxes (selected based on potential for improvement)

Monitoring system for detailed analysis

- The company updated its information system using MFCA to get control over the flows with the highest NPO costs. Additional metering was suggested and partly implemented also for the focus areas which are responsible for the highest losses.
- The company will update procedure for reading electricity records in order to measure significant consumptions.
- The data on consumption of raw and auxiliary materials are being collected based on daily and monthly plans and operators records.
- The data on use of packaging materials are based on estimations only following recorded volume of production.
- Water meter was originally on the intake side only. As result of TEST there was installed a submeter at water cooling (it is further described as part of initiative No 3).

Saving catalogue

ID	Initiative	Cost saving [EUR/yr]	Investment [EUR]	Payback [years]	Reduced energy consumption [MWh/yrs]	Reduced water consumption [m^3/yr]	Reduced BOD5 & COD [kg/yr]	Reduced CO2 emission [tonnes/yr]	Reduced solid waste
1	Replace Air compressor	2,711	27,170	11	22.9			17	
2	Monitor important energy flows	21,216	9,720	0.5	179.1			134	
3	Reduce showering time within cooling of sausages	15,490	0	0		11,457			
4	Cover showering area with housing in order to reduce showering water for cooling of the sausages	5,160	440	0.1		3,744			
5	Use more efficient nozzles in water cooling of the sausages	2,580	1,770	0.8		1,872			

Saving catalogue

ID	INITIATIVE (measure)	Cost saving [EUR/yr]	Investment [EUR]	Payback [years]	Reduced energy consumption [MWh/yrs]	Reduced water consumption [m^3/yr]	Reduced BOD5 & COD [kg/yr]	Reduced CO2 emission [tonnes/yr]	Reduced solid waste
6	Circulation of water within cooling of the sausages	2,060				1,500			
7	More efficient and resistant lighting	11,220	12,220	1.1	94.5			71	
8	Better insulation within distribution of steam	2,65	300	1.1	2.2			1.5	
9	Replace one-time carton boxes with reusable plastic boxes	20,000	48,220	2.5					16.8
10	Adjust Summer / Winter settings for refrigerators	29,053	0	0	245.2			183	

Initiative 3 - Water efficient product cooling

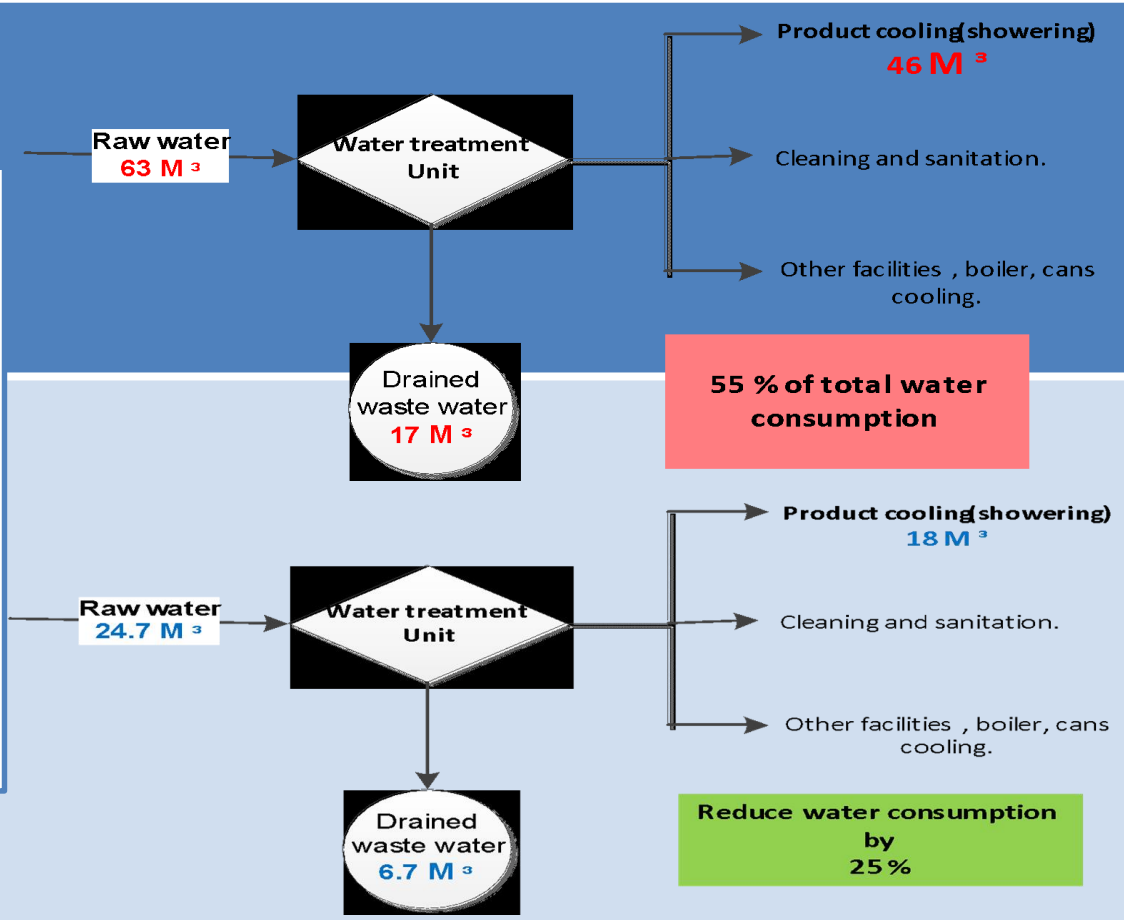
Initiative 3 - Water efficient product cooling

Description of the problem (Base scenario):	The cooked products are cooled down by water showers. Company-wide water balance showed that water consumption of the cooling showers amounts to 55% of the company total water consumption which is 106 m^3/day. The water used for cooling should be treated because the municipal water from the grid contains high amounts of salts like calcium and magnesium that would appear as white spots on the external surface of the products. Consequences of this water treatment for total losses of water are showed on the next slide.
Description of the solution	Company optimized the cooling process mainly by reducing the target temperature to which the goods are cooled down (from 30 to 60 degrees). This led to significant reduction of cooling time (depending on size of product) and reduction of water consumption. Company defined new target temperature for cooling its goods through repeated experiments without affecting the safety and quality of the product. This simple measure resulted in saving around 50% of total water consumed in the old cooling process which represents 25% saving in the total amount of water consumed by company. Also the amount of water which needs initial treatment at the company boundary will be reduced by factor 1.27 as a result of reducing water consumption for product cooling. This is explained in more detail in the following slide.

Initiative 3 - Water efficient product cooling

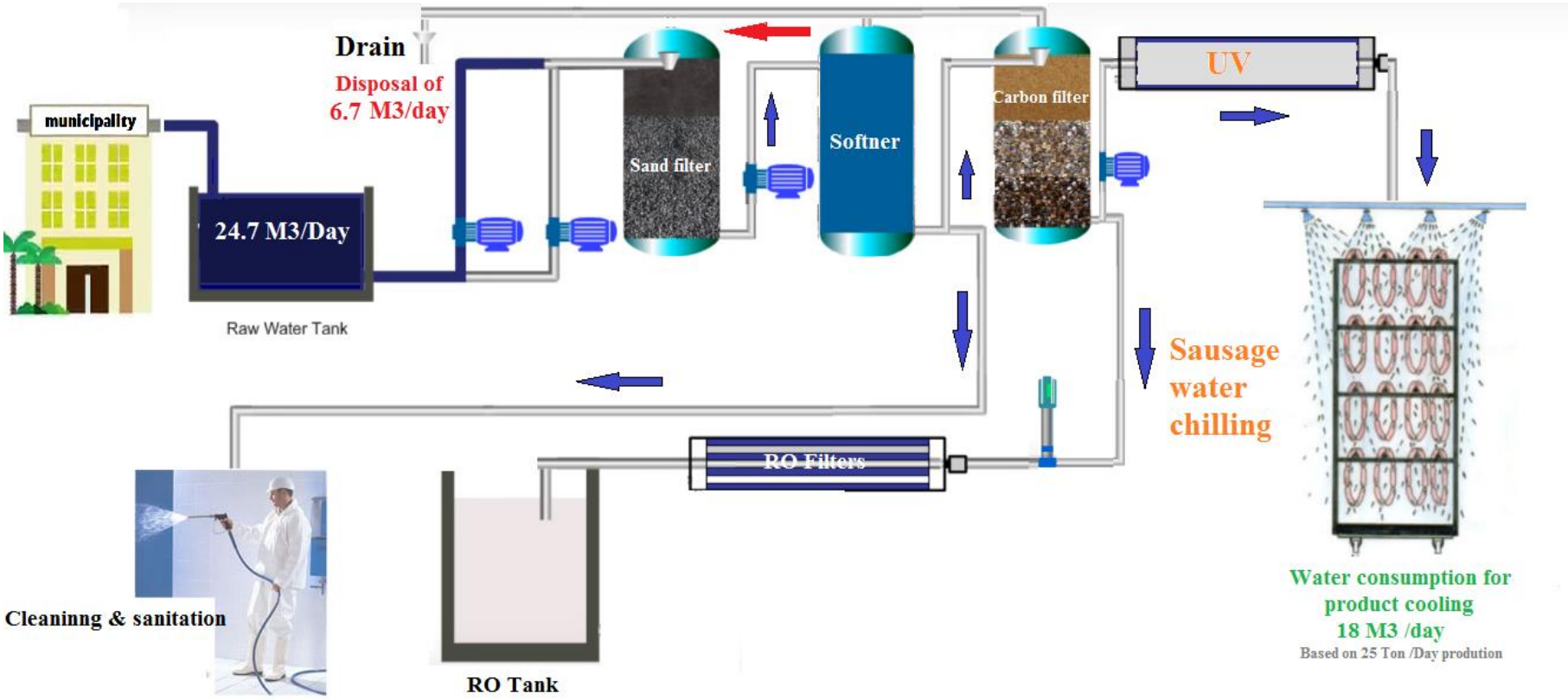
Description of the problem (Base scenario):

Due to the need for the initial water treatment company loose from each m^3 of treated water 270 l of water on the input to the company. This loss has to be considered in calculating NPO and it influences total water consumption related to each water uses in the company. This means that if the cooling showers originally consumed 46 m^3 per day, the total related water consumption was 63 m^3 per day (leading to waste water generated in the water treatment unit 17m^3/d). The same apply for water consumption after implementation of saving measures. For covering the reduced water consumption 18 m^3 per day is needed 24,7 m^3 per day treated water (and its loss in the water treatment unit is reduced to 6,7 m^3/d).



Scheme for company water blance

Numbers are after implementation of measure for water efficient product cooling



Initiative 3 - Water efficient product cooling

Economic Benefits	Specification of water savings : • the water consumption for cooling by showering was reduced from 46 m^3/day to 18 m^3/ day based on production of 25 ton/day of meet products • Total amount of water saved including losses in the water treatment unit represents 38.3 m^3/day or 11,457 m^3/year • This leads to operational savings: 15,490 EUR/year **TOTAL Savings: 15,490 EUR/year**
Environmental Benefits **Health and safety impact**	• Environmental saving of 11,457m3/year of water

Initiative 3 - Water efficient product cooling

Capital investments & financial indicators	• Zero Capital investment • Immediate Pay Back period
Suppliers	N.A

Other aspects	• **Increase of production capacity :**
	  • Improvement of movement of trolleys with product.
	  • Increase in cooking , holding and cooling capacity.

Initiative 3 - Water efficient product cooling

Implementation	Water consumption is also reduced by 25% from the total consumption in the company. As part of the saving measure there was installed flowmeter for monitoring water consumption in cooling the sausages. Sample of monitoring results is provided in the next slide. 

Monitoring water efficiency on daily basis

Examples of measurements of Operational Performace Indicator for water efficiency of cooling process using watermeter installed at the cooling proces (in cubic meters) and records of daily production (in tons)

Sep-17	Average daily consumption	24.54
	Average Daily production (ton)	24.9
	Total average daily water consumption in showering process (Cube/ ton)	0.99

Oct-17	Average daily consumption	21.2
	Average Daily production (ton)	24.9
	Total average daily water consumption in showering process (Cube/ ton)	0.85

Nov-17	Average daily consumption	16.3
	Average Daily production quantity (ton)	22.0
	Total average daily water consumption in showering process (Cube/ ton)	0.74

Dec-17	Average daily consumption	19.78
	Average Daily production quantity (ton)	21.72
	Total average daily water consumption in showering process (Cube/ ton)	0.91

Jan-18	Average daily consumption	17.04
	Average Daily production quantity (ton)	21.25
	Total average daily water consumption in showering process (Cube/ ton)	0.80

Remark:

These records show that the average water consumption during the 5 months was 0.86 m^3/ton. The variation of this indicator is given by the fact that the consumption ratio does not depend on the quantity only but it depends also on the type of products (their weigth, shape and surface).

Development of OPI for water efficiency of cooling showers

Objective: Increase water efficiency

OPI: Water consumption in m^3 per t of product (m^3/t)

Situation	Target Temp.	Water for cooling consumption (m^3/Day)	OPI: Total actual treated water consumption generated by the cooling process (m^3/ ton)	Total water consumption including water discharged from water treatment unit (m^3/Day)	OPI: Total water consumption generated by the cooling process (m^3/ ton)
Baseline situation before RECP	< 30 ℃	46	1.84	63	2,52
First Saving Project	< 50 ℃	30	1,20	41,1	1,64
Second Saving Project	< 60 ℃	18	0,72	24,7	1,0

Initiative 9 - Introducing reusable plastic boxes

Description of the problem (Base scenario):	Carton boxes used for transport of products from the company to the local market were used only once and become waste. In this way about 50,000 pieces of carton boxes were used and wasted per year.
Description of the solution	After quantifying the losses related to the use of single shot carton boxes the company asked a producer of plastic products to design a plastic box similar to the original carton box which would be reusable. Design of the new plastic box proved to be feasible and ready to replace the original carton boxes. Company ordered 6,000 new plastic boxes.

Initiative 9 - Introducing reusable plastic boxes

Economic Benefits	• Reduction of number of carton boxes used per year is 50,000 pieces (in volume 16,8 t/y) • This represents operational saving 20,000 EUR/year • Costs of cleaning plastic boxes is 2,000 EUR/year • There is saving on rejected products due to damage of carton boxes, however this was not quantified **TOTAL Saving: at least 18,000 EUR/year**
Environmental Benefits **Health and safety impact**	• Reduction of wasting 50,000 carton boxes / year • This represents 16.8 ton/y of solid waste • This corresponds with reduction of total solid waste produced by 2.8% N.A

Initiative 9 - Introducing reusable plastic boxes

Capital investments & financial indicators	• 48,220 Euro Capital investment into design and production of 6,000 new plastic boxes • 2.5 year Pay Back period • Expected lifetime of the plastic boxes is 5 years and company works with the supplier to further increase it
Suppliers	Imported
Other aspects	Other positive impacts: • Reduction of rejected products due to damage over the transport (carton boxes were more soft and were often damaged at the bottom of the transport container) This measure has also some negative impacts: • Cleaning the boxes • Extended storage area needed (already available in the plant)

Initiative 9 - Introducing reusable plastic boxes

Implementation	Company received pilot batch of plastic boxes for trial and after three month approved feasibility of their design. Another three months took design of the new mold. The company implemented this measure for the local market and found that it will actually save more than 18,000 Euro/year. The actual saving is calculated based on number of shipments of a plastic box to the customer (which would have to be done in carton box before). The table shows monitoring of shipments starting from number of containers per day (one container is shown on the picture). This calculation is based on monitoring number of new plastic boxes used by using at least 5 containers /day and each container containing 35 plastic boxes with the same capacity as the carton boxes. So the company is saving 175 carton boxes per day and 4,375 per month. This represents around 52,500carton boxes / year.

No of containers/day	Carton boxes / day	Saving carton boxes / month	Saving carton boxes / year	Cost savings / year
5	175	4,375	52,500	20,000 Eur/an

Initiative 10 - Adjust Summer / Winter settings for Refrigerators

Description of the problem (Base scenario):

Monitoring performance of refrigerators and freezers showed that the condensing temperature is between 25-30 °C in the period from November to April. The company is located at a relatively high altitude in a climate providing relatively low ambient temperatures. However, air flow to the condenser is not regular due to problems in operation of fans.
As second cause of losses was identified too high defrost temperature as setted up both for Summer and Winter in comparison with the best practice as shown in the tables below:

Defrost old setting values

Period of the year	Set temperature of defrost	Time for defrost
Summer	20 °C	30 min – 1 h
Winter	22 °C	45 min - 1 h

Description of the solution

The company achieved an electricity saving of 2-5% per Degree Celsius through adjusting condensing temperature and operating fans more frequently in order to keep the condensing temperature between 37-40° C.
The second identified measure was better regulation of the defrosting temperature by changing the temperature and defrost time as shown in the table below.
Implementation of these measures leads to saving of 16-20 % of energy consumed by refrigerators and freezers.

Defrost new setting vale

Period of the year	Set temperature of defrost	Time for defrost
Summer	16 °C	45 min - 1 h
Winter	20 °C	30 - 45 min

Initiative 10 - Adjust Summer / Winter settings for Refrigerators

Economic Benefits	Benefits after adjusting the settings for the refrigerators and freezers: • Operational Savings: 16-20% of energy consumed (appr. 245 MWh/year) **TOTAL Saving : 33,600 Euro/year**
Environmental Benefits	Reduced electricity consumption by appr. 245 MWh/y (16-20% chillers consumption) and CO2 emission by 183 ton/an
Health and safety impact	N.A

Initiative 10 - Adjust Summer / Winter settings for Refrigerators

Capital investments & financial indicators	Zero investment Immedeate payback
Suppliers	N.A
Other aspects	Problems faced: • Weather fluctuations • Lack of digital monitoring system - the company is using separate meters for monitoring electricity consumption by each unit

Initiative 10 - Adjust Summer / Winter settings for Refrigerators

Implementation	A number of low or no cost energy conservation measures which were already implemented by the company and their benefits were verified by installed sub-meters which become part of information system for monitoring of resource efficiency. This information system also showed that measures described in this best practice will save more than originally calculated € 33,600.

Summer winter setting temperature photos

Management system integration

- The company is having in place different management systems including: FSSC 2200, ISO 22000, ISO 9001, ISO 14001 and OHSAS 18001, and it is planning to adopt an Energy Management System based on the international standard ISO 50001.
- Adopting RECP helped the company in implementing ISO 14001 and in its upgrade to the new version of the system. New certificate was achieved for ISO 14001:2015
- The implementation of TEST approach goes in hand with the staff experience in implementing different management systems and it contributes to design of an integrated management system.

Performance Monitoring

As result of TEST was introduced monitoring of:

- Water consumption at level of focus areas
- Energy use at level of focus areas
- Packaging materials at company level
- Waste flows originating from the proces at the level of specific sources
- NPO costs

Results

- The MED TEST II project identified total annual savings of € 108,934 in energy, water and raw materials with an estimated investment of € 48,211 euro. The average pay back period is one year only. Out of a total 12 identified measures, 10 were accepted by the company's top management for implementation and 7 were already implemented at the end of TEST project.
- Energy consumption will be after implementation of all feasible measures reduced by approximately 556,000 kwh/y (18.2% from the total consumption of electric energy). This represents reduction by 395 tons/year of CO_2 equivalent. In addition reduction of solid waste is calculated at 7.8% of total solid waste produced. Water consumption is reduced by 18,573 m^3/year (40% from the total company water consumption) leading also to reduction of COD and BOD by 22 ton/year.
- Within the implementation of the project there was installed flow meter for monitoring water consumption in cooling the sausages. This confirmed calculations made within the feasibility study.

Capacity building

TEST project raised company awareness on the importance of water savings both from an economic as well as an environmental perspectives. The staff members of the company have a skill and guidelines how to achieve continuous increase of water efficiency in each work place in the plant. The results and experience from the project were shared in detail with Production, R&D and Maintenance departments.

Three company TEST team members won the CEO award for the water saving measure in cooling of products in form of certificate and money reward provided in a company festival.

CEO Award