D2.3 Electric Key Performance Indicators (KPIs)

Prepared by:

UPM

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About this document

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 695985.

This deliverable corresponds to **D 2.3 Electric KPIs** of the SCOoPE project. It gathers the Key Performance Indicators on electric energy consumption in the agro-industries.

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1. Introduction

In this task of the SCOoPE project, 50 average electrical Key Performance Indicators (KPIs) and 50 best electrical Key Performance Indicators have been selected. The Extended Value Stream Mapping previously delivered for each sector has been used to identify the electric energy consuming processes, mainly cold storage, refrigeration, freezing, cutting, handling, aspiration and ventilation. The “average” KPI is the mean value; the “best” KPI is the most favourable value of the indicator found in the sector or industry, and the reference for benchmarking.

Bibliography has been consulted in reference technical and scientific publications. In a second stage, experts in the involved sectors have been enquired, and finally, companies working for these sectors have been consulted.
These electrical KPIs have been set up at 4 levels: industry level; product level; process level; and equipment level. They are structured in the following groups:

The first 14 KPIs are indicators of industry level; they reflect the general electrical performance. They include the consumption of all the industry, including auxiliary and horizontal activities:

- Electricity cost (KPIs 1-2; respectively, average and best KPI).
- Load factor (KPIs 3-4).
- Minimum demand (KPIs 5-6).
- Power factor (KPIs 7-8).
- Standing charges (KPIs 9-10).
- Source electricity use (KPIs 11-12).
- Sustainability index (KPIs 13-14).

The next 6 KPI are devoted to the electrical consumption of three typical horizontal processes: air conditioning in rooms and spaces, lighting, and compressed air.

- Lighting (KPIs 15-16).
- Compressed air (KPIs 17-18).
- Air conditioning (KPIs 19-20).

Six additional KPIs are devoted to the electrical consumption of the processes of cold storage, cooling, refrigeration and freezing of products. Typically these activities are the main electrical consumption in three considered sectors (dairy, meat, and fruits/vegetables) and can be significant in the fourth sector (drying).

- Usage of cold rooms (KPIs 21-22).
- Power per cold room volume (KPIs 23-24).
- Consumption per cold room volume (KPIs 25-26).

Ten additional KPIs are devoted to the efficiency of the equipment: heat pumps, chillers, air conditioning units, compressors and electrical engines.

- Efficiency of air conditioning unit (KPIs 27-28).
- Chiller efficiency (KPIs 29-30).
- Heat pump efficiency (KPIs 31-32).
- Compressor efficiency (KPIs 33-34).
- Electrical motor efficiency (KPIs 35-36).

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These previous KPIs are used in all sectors of the project. The rest of KPIs correspond to the electrical consumption of products and specific processes of only one sector. 16 KPIs belong to products of the dairy sector:

- UHT milk (KPIs 37-38).
- Pasteurized milk (KPIs 39-40).
- Skimmed and semi-skimmed milk (KPIs 41-42).
- Condensed milk (KPIs 43-44).
- Milk powder (KPIs 45-46).
- Yoghourt (KPIs 47-48).
- Cheese (KPIs 49-50).
- Butter (KPIs 51-52).

14 KPIs belong to the drying sector:

- Consumption per mass water removed in dried corn (KPIs 53-54).
- Consumption per mass water removed in dried rice (KPIs 55-56).
- Consumption per mass water removed in dried winter cereals (KPIs 57-58).
- Consumption per mass water removed in dried fodder (KPIs 59-60).
- Aspiration consumption in drying (KPIs 61-62).
- Handling consumption in drying (KPIs 63-64)
- Ventilation consumption in drying (KPIs 65-66)

20 KPIs belong to the fruit/vegetables sector:

- Tomato concentrates (KPIs 67-68).
- Diced tomatoes (KPIs 69-70).
- Fresh tomato (KPIs 71-72).
- Orange juice (KPIs 73-74).
- Fruit juice (KPIs 75-76).
- Canned fruit (KPIs 77-78).
- Frozen concentrated juice (KPIs 79-80).
- Frozen fruit (KPIs 81-82).
- Frozen potato (KPIs 83-84).
- Fruit purées (KPIs 85-86).

Finally, 14 KPIs belong to the meat sector:

- Pig carcass (KPIs 87-88).
- Bovine carcass (KPIs 89-90).
- Sheep carcass (KPIs 91-92).
- Poultry carcass (KPIs 93-94).
- Rabbit carcass (KPIs 95-96).
- Cured ham (KPIs 97-98).
- Frozen meat (KPIs 99-100).

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2. All sectors

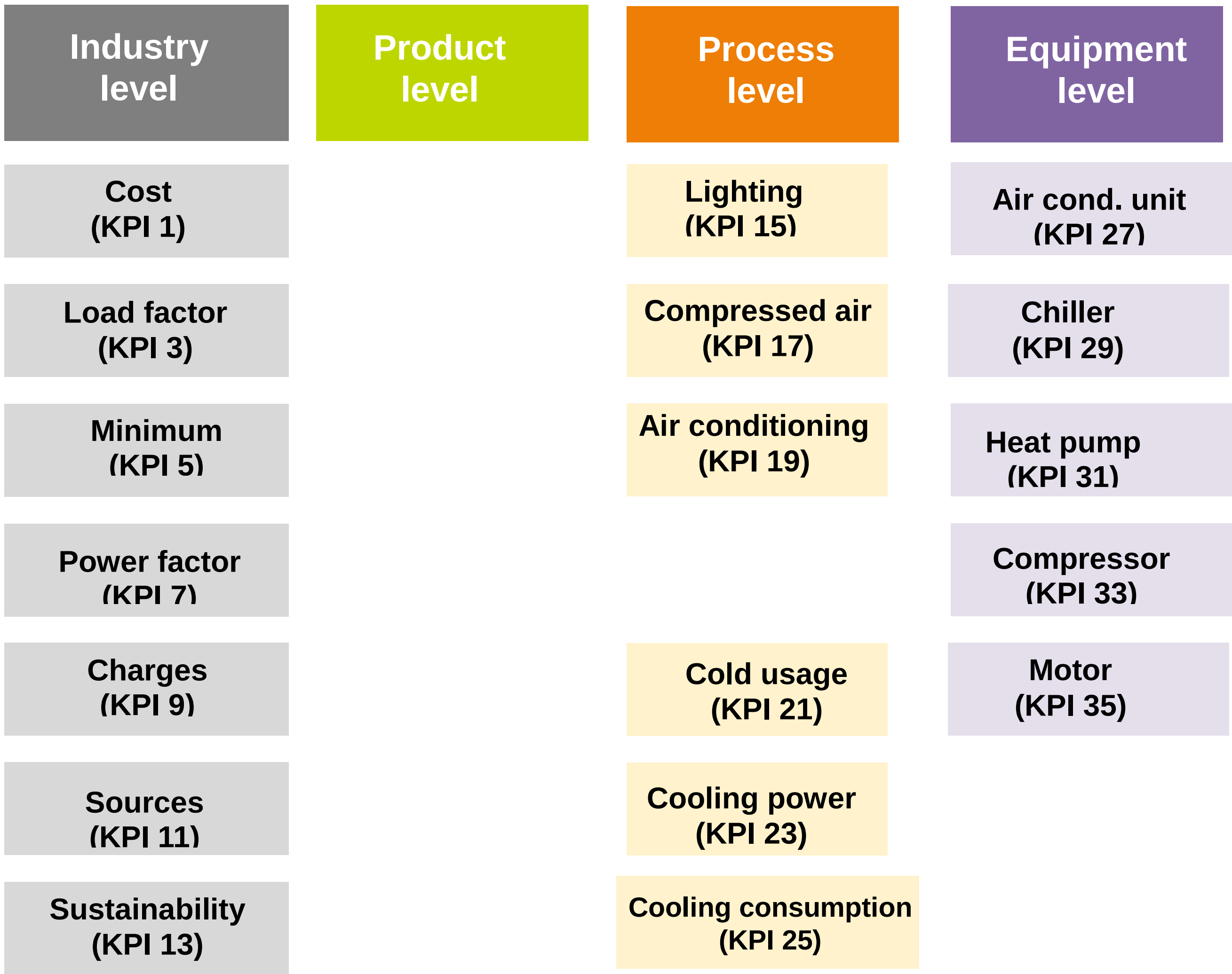

Figure 1. Scheme of the electric KPIs used in the four industrial sectors studied in the SCOoPE project: dairy, meat elaboration, cereal drying, and fruit and vegetables. Each KPI can be directly visualized on the scheme, according to the four levels, which are the following: industry level, product level, process level, and equipment level. In the scheme, only electrical processes are considered. For each of these KPIs, there is the “average KPI” version and the “best KPI” version.

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2.1. Electrical average KPI-1. Average electricity cost.

<table>
<tr><td>INDICATOR</td><td colspan="4">Average electricity cost</td></tr>
<tr><td>Sector (NACE code)</td><td>All sectors</td><td>Subsector</td><td colspan="2">All subsectors</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Industry level</td></tr>
<tr><td colspan="4">The indicator includes all the electrical energy consumption, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">Average electricity cost of a company, in Euros per kWh. This cost includes all aspects and taxes. This indicator can be easily calculated with a full annual set of electricity bills.
Data available about the cost of the electrical energy can be found (Eurostat, 2016).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">-</td></tr>
<tr><td>Lower level</td><td colspan="4">Product level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>Euros/kWh</td><td>Name</td><td>E aKPI L1 NA average electricity cost</td></tr>
<tr><td colspan="4">This data usually depends on the size of the industry. Big facilities normally show lower values.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">0.12 euros/kWh</td></tr>
<tr><td>Source</td><td colspan="4">Electricity production, consumption and market overview. Eurostat 2016.
http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_price_statistics

Managing energy using key performance indicators. White Paper, June 2014. Siemens Retail & Commercial Systems
http://w3.usa.siemens.com/buildingtechnologies/us/en/energy-efficiency/retail-and-commercial-systems/pages/manage-energy-using-kpi.aspx</td></tr>
</table>

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2.2. Electrical best KPI-2. Best electricity cost.

INDICATOR	Best electricity cost			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Industry level			
	The indicator includes all the electrical energy consumption, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	Electricity cost of a company, in Euros per kWh. This cost includes all aspects and taxes. This indicator can be easily calculated with a full annual set of electricity bills. Data available about the cost of the electrical energy can be found (Eurostat, 2016).			
Upper Lever	-			
Lower level	Product level			
Associated Variables	**Unit**	Euros/kWh	**Name**	E bKPI L1 NA best electricity cost
	This data usually depends on the size of the industry. Big facilities normally show lower values.			
Best or Average KPI	Best	**KPI Value**	0.05 euros/kWh	
Source	Electricity production, consumption and market overview. Eurostat 2016. http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_price_statistics Managing energy using key performance indicators. White Paper, June 2014. Siemens Retail & Commercial Systems http://w3.usa.siemens.com/buildingtechnologies/us/en/energy-efficiency/retail-and-commercial-systems/pages/manage-energy-using-kpi.aspx			

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2.3. Electrical average KPI-3. General load factor.

<table>
<tr><td>INDICATOR</td><td colspan="4">General load factor</td></tr>
<tr><td>Sector (NACE code)</td><td>All sectors</td><td>Subsector</td><td colspan="2">All subsectors</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Industry level</td></tr>
<tr><td colspan="4">The indicator includes all the electrical energy consumption, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The load factor is a term used by utilities to express the amount of electricity used over a period of time compared to how much electricity could have been used at peak demand. Expressed as a %, this KPI is average demand (kW) divided by peak demand (kW).
Typically, the load factor is calculated for monthly time blocks. The formula for calculating the load factor requires only a simple division and multiplication, from data of the electricity bill. In the month required, firstly it is necessary to obtain the electrical energy consumption, in kWh/month. Then the peak demand (kW) must be obtained, again from the electrical bill. The energy that could have been used at peak demand, in kWh/month, can be calculated as the peak demand (kW) multiplied by the number of hours of the month. Finally, the electrical energy consumption (kWh/month) divided by the energy that could have been used at peak demand (kWh/month) is the general load factor in this month. The annual value can be calculated as average of the monthly values.</td></tr>
<tr><td>Upper Lever</td><td colspan="4">-</td></tr>
<tr><td>Lower level</td><td colspan="4">Product level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>%, average demand (kW) divided by peak demand (kW)</td><td>Name</td><td>E aKPI L1 NA general load factor</td></tr>
<tr><td colspan="4">This indicator, load factor, quantifies behavioural changes at a location, both good and bad. The values of this indicator can be useful for the calculation of the optimum contracted power.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">50%</td></tr>
<tr><td>Source</td><td colspan="4">Managing energy using key performance indicators. White Paper, June 2014. Siemens Retail & Commercial Systems
http://w3.usa.siemens.com/buildingtechnologies/us/en/energy-efficiency/retail-and-commercial-systems/pages/manage-energy-using-kpi.aspx</td></tr>
</table>

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2.4. Electrical best KPI-4. General load factor.

INDICATOR	General load factor			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Industry level			
	The indicator includes all the electrical energy consumption, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The load factor is a term used by utilities to express the amount of electricity used over a period of time compared to how much electricity could have been used at peak demand. Expressed as a %, this KPI is average demand (kW) divided by peak demand (kW). Typically, the load factor is calculated for monthly time blocks. The formula for calculating the load factor requires only a simple division and multiplication, from data of the electricity bill. In the month required, firstly it is necessary to obtain the electrical energy consumption, in kWh/month. Then the peak demand (kW) must be obtained, again from the electrical bill. The energy that could have been used at peak demand, in kWh/month, can be calculated as the peak demand (kW) multiplied by the number of hours of the month. Finally, the electrical energy consumption (kWh/month) divided by the energy that could have been used at peak demand (kWh/month) is the general load factor in this month. The annual value can be calculated as average of the monthly values.			
Upper Lever	-			
Lower level	Product level			
Associated Variables	**Unit**	%, average demand (kW) divided by peak demand (kW)	**Name**	E bKPI L1 NA general load factor
	This indicator, load factor, quantifies behavioural changes at a location, both good and bad. The values of this indicator can be useful for the calculation of the optimum contracted power.			
Best or Average KPI	Best	**KPI Value**	80%	
Source	Managing energy using key performance indicators. White Paper, June 2014. Siemens Retail & Commercial Systems http://w3.usa.siemens.com/buildingtechnologies/us/en/energy-efficiency/retail-and-commercial-systems/pages/manage-energy-using-kpi.aspx			

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2.5. Electrical average KPI-5. General average minimum demand.

<table>
<tr><td>INDICATOR</td><td colspan="4">General average minimum demand</td></tr>
<tr><td>Sector (NACE code)</td><td>All sectors</td><td>Subsector</td><td colspan="2">All subsectors</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Industry level</td></tr>
<tr><td colspan="4">The indicator includes all the electrical energy consumption, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">This indicator seeks to identify the minimum power requirements of a site at its lowest point of utilization. For some industries this may be at 2 A.M., or for others at 11 P.M.
It is calculated in %, in kW of minimum demand with respect to kW of average demand.
Expressed in %, this indicator seeks to identify the minimum power requirements of a site at its lowest point of utilization. For some buildings this may be at 2 A.M., or for others at 11 P.M. Regardless of the time of day, it serves as a leading indicator of opportunities to gain control over the specific load profile of that location and to over time reduce electrical consumption.
This indicator usually requires specific measurements of electrical power demand at 2 A.M., or at 11 P.M., unless these data are available in the industry. These measurements can be made with electrical digital energy analyzers or similar technologies. Measurement periods must ensure representative results.</td></tr>
<tr><td>Upper Lever</td><td colspan="4">-</td></tr>
<tr><td>Lower level</td><td colspan="4">Product level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>%, kW of minimum demand with respect to kW of average demand</td><td>Name</td><td>E aKPI L1 NA general average minimum demand</td></tr>
<tr><td colspan="4">This indicator depends on the systems of the industry working out of the periods of production, in some cases auxiliary processes.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">30%</td></tr>
<tr><td>Source</td><td colspan="4">Managing energy using key performance indicators. White Paper, June 2014. Siemens Retail & Commercial Systems
http://w3.usa.siemens.com/buildingtechnologies/us/en/energy-efficiency/retail-and-commercial-systems/pages/manage-energy-using-kpi.aspx</td></tr>
</table>

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2.6. Electrical best KPI-6. General average minimum demand.

<table>
<tr><td>INDICATOR</td><td colspan="4">General average minimum demand</td></tr>
<tr><td>Sector (NACE code)</td><td>All sectors</td><td>Subsector</td><td colspan="2">All subsectors</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Industry level</td></tr>
<tr><td colspan="4">The indicator includes all the electrical energy consumption, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">This indicator seeks to identify the minimum power requirements of a site at its lowest point of utilization. For some industries this may be at 2 A.M., or for others at 11 P.M.
It is calculated in %, in kW of minimum demand with respect to kW of average demand.
Expressed in %, this indicator seeks to identify the minimum power requirements of a site at its lowest point of utilization. For some buildings this may be at 2 A.M., or for others at 11 P.M. Regardless of the time of day, it serves as a leading indicator of opportunities to gain control over the specific load profile of that location and to over time reduce electrical consumption.
This indicator usually requires specific measurements of electrical power demand at 2 A.M., or at 11 P.M., unless these data are available in the industry. These measurements can be made with electrical digital energy analyzers or similar technologies. Measurement periods must ensure representative results.</td></tr>
<tr><td>Upper Lever</td><td colspan="4">-</td></tr>
<tr><td>Lower level</td><td colspan="4">Product level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>%, kW of minimum demand with respect to kW of average demand</td><td>Name</td><td>E bKPI L1 NA general average minimum demand</td></tr>
<tr><td colspan="4">This indicator depends on the systems of the industry working out of the periods of production, in some cases auxiliary processes.</td></tr>
<tr><td>Best or Average KPI</td><td>Best</td><td>KPI Value</td><td colspan="2">0%</td></tr>
<tr><td>Source</td><td colspan="4">Managing energy using key performance indicators. White Paper, June 2014. Siemens Retail & Commercial Systems http://w3.usa.siemens.com/buildingtechnologies/us/en/energy-efficiency/retail-and-commercial-systems/pages/manage-energy-using-kpi.aspx</td></tr>
</table>

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2.7. Electrical average KPI-7. Average power factor.

<table>
<tr><td>INDICATOR</td><td colspan="4">Average power factor</td></tr>
<tr><td>Sector (NACE code)</td><td>All sectors</td><td>Subsector</td><td colspan="2">All subsectors</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Industry level</td></tr>
<tr><td colspan="4">The indicator includes all the consumption of the industry, including auxiliary processes.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The indicator is the ratio of the real power flowing to the industry to the apparent power in the industry.
The annual average can be usually calculated with a complete sequence of annual electricity bills. Firstly it is necessary to calculate the total annual electrical consumption (EC, in kWh), and the total annual reactive energy consumption (REC, in kVArh) using the information of the bills. Then the ratio REC/EC is the value of a trigonometric function, characteristic of the electrical system (REC/EC is the tangent of the angle characteristic of the system; so the angle can be also calculated). The cosine of this angle is the annual average power system.
Installation of capacitor banks is economically feasible if their installation compensates the increase in the electricity bill produced by the reactive power; so reactive power must be measured and must be present in the electricity bill. If reactive power is not measured, the capacitor banks have no economical interest.
The methodology of calculation can be found in the Reference Document on Best Available Techniques for Energy Efficiency, of the European Commission (February 2009) and other sources.</td></tr>
<tr><td>Upper Lever</td><td colspan="4">-</td></tr>
<tr><td>Lower level</td><td colspan="4">Product level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>Dimensionless</td><td>Name</td><td>E aKPI L1 NA average power factor</td></tr>
<tr><td colspan="4">This indicator depends mainly on the installation of capacitor banks. Technically it depends on the ratio between the industry power in kW, and the installed power capacitor in kVAr.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">0.95</td></tr>
<tr><td>Source</td><td colspan="4">Reference Document on Best Available Techniques for Energy Efficiency. European Commission, February 2009
http://eippcb.jrc.ec.europa.eu/reference/BREF/ENE_Adopted_02-2009.pdf
Power factor correction (page 190-192)</td></tr>
</table>

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2.8. Electrical best KPI-8. Average power factor.

<table>
<tr><td>INDICATOR</td><td colspan="4">Average power factor</td></tr>
<tr><td>Sector (NACE code)</td><td>All sectors</td><td>Subsector</td><td colspan="2">All subsectors</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Industry level</td></tr>
<tr><td colspan="4">The indicator includes all the consumption of the industry, including auxiliary processes.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The indicator is the ratio of the real power flowing to the industry to the apparent power in the industry.
The annual average can be usually calculated with a complete sequence of annual electricity bills. Firstly it is necessary to calculate the total annual electrical consumption (EC, in kWh), and the total annual reactive energy consumption (REC, in kVArh) using the information of the bills. Then the ratio REC/EC is the value of a trigonometric function, characteristic of the electrical system (REC/EC is the tangent of the angle characteristic of the system; so the angle can be also calculated). The cosine of this angle is the annual average power system.
Installation of capacitor banks is economically feasible if their installation compensates the increase in the electricity bill produced by the reactive power; so reactive power must be measured and must be present in the electricity bill. If reactive power is not measured, the capacitor banks have no economical interest.
The methodology of calculation can be found in the Reference Document on Best Available Techniques for Energy Efficiency, of the European Commission (February 2009) and other sources.</td></tr>
<tr><td>Upper Lever</td><td colspan="4">-</td></tr>
<tr><td>Lower level</td><td colspan="4">Product level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>Dimensionless</td><td>Name</td><td>E bKPI L1 NA average power factor</td></tr>
<tr><td colspan="4">This indicator depends mainly on the installation of capacitor banks. Technically it depends on the ratio between the industry power in kW, and the installed power capacitor in kVAr.</td></tr>
<tr><td>Best or Average KPI</td><td colspan="2">Best</td><td>KPI Value</td><td>1</td></tr>
<tr><td>Source</td><td colspan="4">Reference Document on Best Available Techniques for Energy Efficiency. European Commission, February 2009
http://eippcb.jrc.ec.europa.eu/reference/BREF/ENE_Adopted_02-2009.pdf

Power factor correction (page 190-192)</td></tr>
</table>

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2.9. Electrical average KPI-9. Electricity standing charges.

INDICATOR	Electricity standing charges			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Industry level			
	The indicator includes all the electrical energy consumption, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	Percentage of standing charges -fixed costs, excluding taxes- with respect to total electricity costs -standing charges + energy costs + taxes-, in %. This indicator can be easily calculated with a full annual set of electricity bills. The information needed -standing charges, energy costs and taxes- is included in the bill.			
Upper Lever	-			
Lower level	Product level			
Associated Variables	**Unit**	%, fixed costs with respect to total electricity costs	**Name**	E aKPI L1 NA electricity standing charges
	This indicator strongly depends on the contracted power of the industry with the electrical supply company. An excessive contracted power is a typical problem which increases this KPI.			
Best or Average KPI	Average	**KPI Value**	15%	
Source	Managing energy using key performance indicators. White Paper, June 2014. Siemens Retail & Commercial Systems http://w3.usa.siemens.com/buildingtechnologies/us/en/energy-efficiency/retail-and-commercial-systems/pages/manage-energy-using-kpi.aspx			

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2.10. Electrical best KPI-10. Electricity standing charges.

INDICATOR	Electricity standing charges			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Industry level			
	The indicator includes all the electrical energy consumption, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	Percentage of standing charges -fixed costs, excluding taxes- with respect to total electricity costs -standing charges + energy costs + taxes-, in %. This indicator can be easily calculated with a full annual set of electricity bills. The information needed -standing charges, energy costs and taxes- is included in the bill.			
Upper Lever	-			
Lower level	Product level			
Associated Variables	**Unit**	%, fixed costs with respect to total electricity costs	**Name**	E bKPI L1 NA electricity standing charges
	This indicator strongly depends on the contracted power of the industry with the electrical supply company. An excessive contracted power is a typical problem which increases this KPI.			
Best or Average KPI	Best	**KPI Value**	8%	
Source	Managing energy using key performance indicators. White Paper, June 2014. Siemens Retail & Commercial Systems http://w3.usa.siemens.com/buildingtechnologies/us/en/energy-efficiency/retail-and-commercial-systems/pages/manage-energy-using-kpi.aspx			

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2.11. Electrical average KPI-11. Source electricity use.

INDICATOR	Source electricity use		
Sector (NACE code)	All sectors	**Subsector**	All subsectors
Level of indicator	Industry level The indicator indicates the percentage of site electrical energy with respect to source electrical energy, in %.		
Thermal or Electrical process	Electrical process		
Energy source	Calculated considering the sources		
Description of the INDICATOR	The indicator is the percentage of site electrical energy with respect to source electrical energy, in %. This KPI usually requires specific measurements of electrical supply from different sources, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies. Measurement periods must ensure representative results. Once the distribution of the electrical supply from different sources is determined, it is possible to calculate the percentage of site electrical energy with respect to source electrical energy, taking into account the efficiency of this concept for the different electrical sources. Data available about the percentage of site electrical energy with respect to source electrical energy, for the different electrical sources, can be found (Eurostat, 2016).		
Upper Lever	-		
Lower level	Product level		
Associated Variables	**Unit**	%	**Name**: E aKPI L1 NA source electricity use
	This KPI depends on the sources of electrical energy of the industry. It is necessary to identify and quantify these sources in %, usually every year.		
Best or Average KPI	Average	**KPI Value**	30%
Source	Electricity production, consumption and market overview. Eurostat 2016. http://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_production,_consumption_and_m		

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2.12. Electrical best KPI-12. Source electricity use.

INDICATOR	Source electricity use		
Sector (NACE code)	All sectors	**Subsector***	All subsectors
Level of indicator	Industry level The indicator indicates the percentage of site electrical energy with respect to source electrical energy, in %.		
Thermal or Electrical process	Electrical process		
Energy source	Calculated considering the sources		
Description of the INDICATOR	The indicator is the percentage of site electrical energy with respect to source electrical energy, in %. This KPI usually requires specific measurements of electrical supply from different sources, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies. Measurement periods must ensure representative results. Once the distribution of the electrical supply from different sources is determined, it is possible to calculate the percentage of site electrical energy with respect to source electrical energy, taking into account the efficiency of this concept for the different electrical sources. Data available about the percentage of site electrical energy with respect to source electrical energy, for the different electrical sources, can be found (Eurostat, 2016).		
Upper Lever	-		
Lower level	Product level		
Associated Variables	**Unit** %	**Name**	E bKPI L1 NA source electricity use
	This KPI depends on the sources of electrical energy of the industry. It is necessary to identify and quantify these sources in %, usually every year.		
Best or Average KPI	Best	**KPI Value**	100%
Source	Electricity production, consumption and market overview. Eurostat 2016. http://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_production,_consumption_and_market_overview		

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2.13. Electrical average KPI-13. Sustainability index.

INDICATOR	Sustainability index			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Industry level The indicator includes all the electrical energy consumption, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Calculated considering the sources			
Description of the INDICATOR	Percentage of site electrical energy from sustainable sources with respect to total site electrical energy, in %. This KPI usually requires specific measurements of electrical supply from different sources, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies. Measurement periods must ensure representative results. With respect to the electrical supply from the grid, the relative importance of renewable energy sources in relation to EU-28 net electricity generation grew between 2004 and 2014 from 13.5 % to 24.9 %. Data available about the relative importance of renewable energy sources in relation to EU-28 net electricity generation can be found (Eurostat, 2016).			
Upper Lever	-			
Lower level	Product level			
Associated Variables	**Unit**	%	**Name**	E aKPI L1 NA sustainability index
	This KPI depends on the sources of electrical energy of the industry. It is necessary to identify and quantify these sources in %, usually every year.			
Best or Average KPI	Average	**KPI Value**	24.9%	
Source	Electricity production, consumption and market overview. Eurostat 2016. http://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_production,_consumption_and_market_overview			

2.14. Electrical best KPI-14. Sustainability index.

INDICATOR	Sustainability index			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Industry level The indicator includes all the electrical energy consumption, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Calculated considering the sources			
Description of the INDICATOR	Percentage of site electrical energy from sustainable sources with respect to total site electrical energy, in %. This KPI usually requires specific measurements of electrical supply from different sources, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies. Measurement periods must ensure representative results. With respect to the electrical supply from the grid, the relative importance of renewable energy sources in relation to EU-28 net electricity generation grew between 2004 and 2014 from 13.5 % to 24.9 %. Data available about the relative importance of renewable energy sources in relation to EU-28 net electricity generation can be found (Eurostat, 2016).			
Upper Lever	-			
Lower level	Product level			
Associated Variables	**Unit**	%	**Name**	E bKPI L1 NA sustainability index
	This KPI depends on the sources of electrical energy of the industry. It is necessary to identify and quantify these sources in %, usually every year.			
Best or Average KPI	Best	**KPI Value**	100%	
Source	Electricity production, consumption and market overview. Eurostat 2016. http://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_production,_consumption_and_mar			

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2.15. Electrical average KPI-15. Electrical consumption in lighting.

INDICATOR	Electrical consumption in lighting (ACC)			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Process level (lighting)			
	The indicator includes the electrical energy, consumed in this specific process of lighting, consumed per square meter of spaces with lighting, and year. The indicator does not include the consumption of other auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	This indicator is determined by the equation: ACC = E / LS (kWh/m^2) where E represents the annual electrical energy consumption of the process (lighting) in kWh, and LS designates the surface (m^2) of spaces. This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies; measurement periods must ensure representative results. With the information obtained, annual consumption must be calculated or estimated. Additionally, it is necessary to determine the area of spaces with lighting to determine the indicator per unit of area. The methodology is based in experiments referred in the paper of Atkinson et al. (1995).			
Upper Lever	Product level			
Lower level	Equipment level			
Associated Variables	**Unit**	kWh/m^2 area of spaces with lighting	**Name**	E aKPI L3 NA electrical consumption in lighting
	This indicator depends on the lighting needs of the involved spaces.			
Best or Average KPI	Average	**KPI Value**	40 kWh/ m^2	
Source	B.A. Atkinson, J. McMahon, J. Lin, D.C. Fisher, S.J. Pickle. 1995. Modeling U.S. Industrial Lighting Energy Consumption and Savings Potential. Lawrence Berkeley Laboratory, University of California. A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich).			

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2.16. Electrical best KPI-16. Electrical consumption in lighting.

<table>
<tr><td>INDICATOR</td><td colspan="4">Electrical consumption in lighting (ACC)</td></tr>
<tr><td>Sector (NACE code)</td><td>All sectors</td><td>Subsector</td><td colspan="2">All subsectors</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Process level (lighting)</td></tr>
<tr><td colspan="4">The indicator includes the electrical energy, consumed in this specific process of lighting, consumed per square meter of spaces with lighting, and year. The indicator does not include the consumption of other auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">This indicator is determined by the equation:
$ACC = E / LS$ (kWh/m^2)
where E represents the annual electrical energy consumption of the process (lighting) in kWh, and LS designates the surface (m^2) of spaces.
This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies; measurement periods must ensure representative results. With the information obtained, annual consumption must be calculated or estimated. Additionally, it is necessary to determine the area of spaces with lighting to determine the indicator per unit of area.
The methodology is based in experiments referred in the paper of Atkinson et al. (1995).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Product level</td></tr>
<tr><td>Lower level</td><td colspan="4">Equipment level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/m^2 area of spaces with lighting</td><td>Name</td><td>E bKPI L3 NA electrical consumption in lighting</td></tr>
<tr><td colspan="4">This indicator depends on the lighting needs of the involved spaces.</td></tr>
<tr><td>Best or Average KPI</td><td>Best</td><td>KPI Value</td><td colspan="2">10 kWh/m^2</td></tr>
<tr><td></td><td colspan="4">B.A. Atkinson, J. McMahon, J. Lin, D.C. Fisher, S.J. Pickle. 1995. Modeling U.S. Industrial Lighting Energy Consumption and Savings Potential. Lawrence Berkeley Laboratory, University of California.
A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich).</td></tr>
</table>

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2.17. Electrical average KPI-17. Specific Electrical Consumption in compressed air (CAC) per ton of product.

INDICATOR	Specific Electrical Consumption in compressed air (CAC) per ton of product			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Process level (compressed air) The indicator includes the electrical energy, consumed in this specific process (production of compressed air), per ton of product. The indicator does not include the consumption of other auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	This indicator is determined by the equation: CAC = E / PT (kWh/t) where E represents the electrical energy consumption of the process (compressed air) in kWh, and PT designates the tons of product processed. This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies; measurement periods must ensure representative results. With the information obtained, annual or monthly consumption must be calculated or estimated. Additionally, it is necessary to determine the corresponding tons of product processed in this period. The methodology is based in the work of the California Energy Commission (2013).			
Upper Lever	Product level			
Lower level	Equipment level			
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L3 NA specific electrical consumption in compressed air per ton of product
	This indicator depends on the compressed air needs of considered process or industry.			
Best or Average KPI	Average	**KPI Value**	5 kWh/ t	
Source	A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich). California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. California Energy Commission. 2013. California´s Food Industry. Compressed Air Challenge. http://www.cifar.ucdavis.edu/projects/media/Californias_Compressed_Air_Challenge_Final_Report.pdf			

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2.18. Electrical best KPI-18. Specific Electrical Consumption in compressed air (CAC) per ton of product.

INDICATOR	Specific Electrical Consumption in compressed air (CAC) per ton of product		
Sector (NACE code)	All sectors	**Subsector**	All subsectors
Level of indicator	Process level (compressed air) The indicator includes the electrical energy, consumed in this specific process (production of compressed air), per ton of product. The indicator does not include the consumption of other auxiliary processes of the industry.		
Thermal or Electrical process	Electrical process		
Energy source	Any source		
Description of the INDICATOR	This indicator is determined by the equation: CAC = E / PT (kWh/t) where E represents the electrical energy consumption of the process (compressed air) in kWh, and PT designates the tons of product processed. This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies; measurement periods must ensure representative results. With the information obtained, annual or monthly consumption must be calculated or estimated. Additionally, it is necessary to determine the corresponding tons of product processed in this period. The methodology is based in the work of the California Energy Commission (2013).		
Upper Lever	Product level		
Lower level	Equipment level		
Associated Variables	**Unit** kWh/t	**Name**	E bKPI L3 NA specific electrical consumption in compressed air per ton of product
	This indicator depends on the compressed air needs of considered process or industry.		
Best or Average KPI	Best	**KPI Value**	2 kWh/ t
Source	A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich). California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. California Energy Commission. 2013. California´s Food Industry. Compressed Air Challenge. http://www.cifar.ucdavis.edu/projects/media/Californias_Compressed_Air_Challenge_Final_Report.pdf		

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2.19. Electrical average KPI-19. Electrical consumption in air conditioning.

INDICATOR	Electrical consumption in air conditioning (ACC)
Sector (NACE code)	All sectors | **Subsector** | All subsectors
Level of indicator	Process level (air conditioning) The indicator includes the electrical energy, consumed in this specific process of air conditioning, consumed per square meter of air conditioned spaces and year. The indicator does not include the consumption of other auxiliary processes of the industry.
Thermal or Electrical process	Electrical process
Energy source	Any source
Description of the INDICATOR	This indicator is determined by the equation: ACC = E / CS (kWh/m^2) where E represents the annual electrical energy consumption of the process (air conditioning) in kWh, and CS designates the surface (m^2) of air conditioned spaces. This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies; measurement periods must ensure representative results. With the information obtained, annual consumption must be calculated or estimated. Additionally, it is necessary to determine the area of air conditioned spaces to determine the indicator per unit of area. The methodology is based in experiments referred in the paper of Carlsson-Kanyama and Faist (2000).
Upper Lever	Product level
Lower level	Equipment level
Associated Variables	**Unit** | kWh/m^2 surface of air conditioned spaces | **Name** | E aKPI L3 NA electrical consumption in air conditioning This indicator depends on outside temperatures and other weather conditions, and on the temperatures required in the air conditioned spaces.
Best or Average KPI	Average | **KPI Value** | 30 kWh/ m^2
Source	A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich). D. Kaya and H. Alidrisi. 2016. Energy savings potential in air conditioners and chiller systems. Turkish Journal of Electrical Engineering & Computer Sciences 24: 935-945.

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2.20. Electrical best KPI-20. Electrical consumption in air conditioning.

INDICATOR	Electrical consumption in air conditioning (ACC)			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Process level (air conditioning)			
	The indicator includes the electrical energy, consumed in this specific process of air conditioning, consumed per square meter of air conditioned spaces and year. The indicator does not include the consumption of other auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	This indicator is determined by the equation: $ACC = E \ / \ CS$ (kWh/m^2) where E represents the annual electrical energy consumption of the process (air conditioning) in kWh, and CS designates the surface (m^2) of air conditioned spaces. This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies; measurement periods must ensure representative results. With the information obtained, annual consumption must be calculated or estimated. Additionally, it is necessary to determine the area of air conditioned spaces to determine the indicator per unit of area. The methodology is based in experiments referred in the paper of Carlsson-Kanyama and Faist (2000).			
Upper Lever	Product level			
Lower level	Equipment level			
Associated Variables	**Unit**	kWh/m^2 surface of air conditioned spaces	**Name**	E bKPI L3 NA electrical consumption in air conditioning
	This indicator depends on outside temperatures and other weather conditions, and on the temperatures required in the air conditioned spaces.			
Best or Average KPI	Best	**KPI Value**	10 kWh/ m^2	
Source	A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich). D. Kaya and H. Alidrisi. 2016. Energy savings potential in air conditioners and chiller systems. Turkish Journal of Electrical Engineering & Computer Sciences 24: 935-945.			

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2.21. Electrical average KPI-21. Usage of cold rooms volume.

<table>
<tr><td>INDICATOR</td><td colspan="4">Usage of cold rooms volume (UCR)</td></tr>
<tr><td>Sector (NACE code)</td><td>All sectors</td><td>Subsector</td><td colspan="2">All subsectors</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Process level (cooling)</td></tr>
<tr><td colspan="4">The indicator shows the annual production (refrigerated in cold rooms) per volume unit of the cold rooms.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The UCR value is determined by the equation:
UCR = RM / Vtotal (t/m^3)
where RM represents the annual amount of refrigerated product (t), and Vtotal is the total volume of cold rooms (m^3).
Annual production (tons) can be obtained from industry recordings; it is necessary to check if all this production was refrigerated in the considered cold rooms.
The inner dimensions (m^3) of the cold rooms can be determined with infrared rangefinders as described in the study of Nunes et al. (2016).
The methodology is based in audits referred in the paper of Nunes et al. (2016).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Product level</td></tr>
<tr><td>Lower level</td><td colspan="4">Equipment level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>t/m^3 volume of cold rooms</td><td>Name</td><td>E aKPI L3 NA usage of cold rooms volume</td></tr>
<tr><td colspan="4">This UCR depends on the stock management of the industry. Partially loaded cold rooms will decrease the value of the indicator; and the use of partially loaded cold rooms promotes energy waste.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">0.7 t/m^3</td></tr>
<tr><td>Source</td><td colspan="4">J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016 . Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411</td></tr>
</table>

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2.22. Electrical best KPI-22. Usage of cold rooms volume.

INDICATOR	Usage of cold rooms volume (UCR)			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Process level (cooling)			
	The indicator shows the annual production (refrigerated in cold rooms) per volume unit of the cold rooms.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The UCR value is determined by the equation: UCR = RM / Vtotal (t/m^3) where RM represents the annual amount of refrigerated product (t), and Vtotal is the total volume of cold rooms (m^3). Annual production (tons) can be obtained from industry recordings; **it is necessary to check if all this production was refrigerated in the considered cold rooms.** The inner dimensions (m^3) of the cold rooms can be determined with infrared rangefinders as described in the study of Nunes et al. (2016). The methodology is based in audits referred in the paper of Nunes et al. (2016).			
Upper Lever	Product level			
Lower level	Equipment level			
Associated Variables	**Unit**	t/m^3 volume of cold rooms	**Name**	E bKPI L3 NA usage of cold rooms volume
	This UCR depends on the stock management of the industry. Partially loaded cold rooms will decrease the value of the indicator; and the use of partially loaded cold rooms promotes energy waste.			
Best or Average KPI	Best	**KPI Value**	2.5 t/m^3	
Source	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411.			

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2.23. Electrical average KPI-23. Cooling installed power per unit of cold room volume.

INDICATOR	Cooling installed power per unit of cold room volume (NPC)			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Process level (cooling)			
	The indicator shows the average measured power of all refrigeration compressors, P_{total}, per cold rooms volume, Vtotal.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The NPC value is determined by the equation: NPC = P_{total} / Vtotal (kW/m^3) where P_{total} represents the average measured power of all refrigeration compressors (kW), and Vtotal is the total volume of cold rooms (m^3). The power of all refrigeration compressors (P_{total}) can be measured in an audit with digital power analyzers, obtaining a final average value in the measurement period, which should be a good estimation of the annual mean value. Therefore, it is advisable that the measurement period be a representative period. This electrical power (P_{total}) can be also determined with a digital multimeter and a clamp meter, measuring: voltage (V), electrical current (C) and power factor (PF). In the usual three-phase electrical supply systems, P_{total} can be calculated with the equation: P_{total} = 1.732 * V * C * PF The inner dimensions of the cold rooms can be determined with infrared rangefinders as described in the study of Nunes et al. (2016). The methodology is based in audits referred in the paper of Nunes et al. (2016).			
Upper Lever	Product level			
Lower level	Equipment level			
Associated Variables	**Unit**	kW/m^3 volume of cold rooms	**Name**	E aKPI L3 NA cooling power per unit of cold room volume
	This indicator depends on the temperature of the cold rooms, and other technical factors, including local weather and room maintenance.			
Best or Average KPI	Average	**KPI Value**	0.1 kW/m^3	
Source	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411			

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2.24. Electrical best KPI-24. Cooling installed power per unit of cold room volume.

INDICATOR	Cooling installed power per unit of cold room volume (NPC)				
Sector (NACE code)	All sectors	**Subsector**	All subsectors		
Level of indicator	Process level (cooling)				
	The indicator shows the average measured power of all refrigeration compressors, P_{total}, per cold rooms volume, Vtotal.				
Thermal or Electrical process	Electrical process				
Energy source	Any source				
Description of the INDICATOR	The NPC value is determined by the equation: NPC = P_{total} / Vtotal (kW/m^3) where P_{total} represents the average measured power of all refrigeration compressors (kW), and Vtotal is the total volume of cold rooms (m^3). The power of all refrigeration compressors (P_{total}) can be measured in an audit with digital power analyzers, obtaining a final average value in the measurement period, which should be a good estimation of the annual mean value. Therefore, it is advisable that the measurement period be a representative period. This electrical power (P_{total}) can be also determined with a digital multimeter and a clamp meter, measuring: voltage (V), electrical current (C) and power factor (PF). In the usual three-phase electrical supply systems, P_{total} can be calculated with the equation: P_{total} = 1.732 * V * C * PF The inner dimensions of the cold rooms can be determined with infrared rangefinders as described in the study of Nunes et al. (2016). The methodology is based in audits referred in the paper of Nunes et al. (2016).				
Upper Lever	Product level				
Lower level	Equipment level				
Associated Variables	**Unit**	kW/m^3 volume of cold rooms	**Name**	E bKPI L3 NA cooling power per unit of cold room volume	
	This indicator depends on the temperature of the cold rooms, and other technical factors, including local weather and room maintenance.				
Best or Average KPI	Best	**KPI Value**	0.032 kW/m^3		
Source	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411				

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2.25. Electrical average KPI-25. Specific Electrical Consumption (SEC) per volume unit of the cold rooms.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per volume unit of the cold rooms</td></tr>
<tr><td>Sector (NACE code)</td><td>All sectors</td><td>Subsector</td><td colspan="2">All subsectors</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Process level (cooling)</td></tr>
<tr><td colspan="4">The indicator shows the annual electrical energy spent in cold rooms per volume unit of the cold rooms.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
$SEC = E / Vtotal$ (kWh/m^3)
where E represents the annual electrical energy consumption of cold rooms (kWh), and Vtotal is the total volume of cold rooms (m^3).
The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. It is necessary to disaggregate the annual consumption of the cold rooms, or to take measurements of the electrical consumption, with digital power analyzers (or grid analyzers), to extrapolate the annual consumption of the cold rooms.
The inner dimensions of the cold rooms can be determined with infrared rangefinders as described in the study of Nunes et al. (2016).
The methodology is based in audits referred in the paper of Nunes et al. (2016).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Product level</td></tr>
<tr><td>Lower level</td><td colspan="4">Equipment level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/m^3 volume of cold rooms</td><td>Name</td><td>E aKPI L3 NA specific electrical consumption per volume unit of the cold rooms</td></tr>
<tr><td colspan="4">This SEC depends on the temperature of the cold rooms, and other technical factors, including local weather and room maintenance.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">350 kWh/m^3</td></tr>
<tr><td>Source</td><td colspan="4">J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411</td></tr>
</table>

This project, has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 695985

2.26. Electrical best KPI-26. Specific Electrical Consumption (SEC) per volume unit of the cold rooms.

INDICATOR	Specific Electrical Consumption (SEC) per volume unit of the cold rooms			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Process level (cooling)			
	The indicator shows the annual electrical energy spent in cold rooms per volume unit of the cold rooms.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / Vtotal (kWh/m^3) where E represents the annual electrical energy consumption of cold rooms (kWh), and Vtotal is the total volume of cold rooms (m^3). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. It is necessary to disaggregate the annual consumption of the cold rooms, or to take measurements of the electrical consumption, with digital power analyzers (or grid analyzers), to extrapolate the annual consumption of the cold rooms. The inner dimensions of the cold rooms can be determined with infrared rangefinders as described in the study of Nunes et al. (2016). The methodology is based in audits referred in the paper of Nunes et al. (2016).			
Upper Lever	Product level			
Lower level	Equipment level			
Associated Variables	**Unit**	kWh/m^3 volume of cold rooms	**Name**	E bKPI L3 NA specific electrical consumption per volume unit of the cold rooms
	This SEC depends on the temperature of the cold rooms, and other technical factors, including local weather and room maintenance.			
Best or Average KPI	Best	**KPI Value**	120 kWh/m^3	
Source	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016 . Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411			

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2.27. Electrical average KPI-27. Efficiency of air conditioning unit.

INDICATOR	Efficiency of air conditioning unit (ACEER)
Sector (NACE code)	All sectors | **Subsector** | All subsectors
Level of indicator	Equipment level (air conditioning unit) The indicator shows the energy efficiency ratio (EER) of an air conditioning unit.
Thermal or Electrical process	Electrical process
Energy source	Any source
Description of the INDICATOR	The indicator value is determined by the equation: ACEER = Thermal energy supplied (kWh) / Electrical energy consumed (kWh). The energy efficiency ratio (EER) of the air conditioning units can be measured in an audit with digital power analyzers, obtaining the electrical energy consumed, and the thermal energy supplied, that can be calculated with the temperatures of the process. It is advisable that the measurement period be a representative period. In some cases the EER can be estimated with the age of the equipment. The methodology is based in experiments referred in the work of Carlsson-Kanyama and Faist (2000).
Upper Lever	Process level
Lower level	-
Associated Variables	**Unit** | Dimensionless | **Name** | E aKPI L4 NA efficiency of air conditioning unit This SEC depends on several factors: among them, on the temperatures of the inlet and outlet fluid, and on the age of the air conditioning unit.
Best or Average KPI	Average | **KPI Value** | 4 (dimensionless)
Source	California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich). D. Kaya and H. Alidrisi. 2016. Energy savings potential in air conditioners and chiller systems. Turkish Journal of Electrical Engineering & Computer Sciences 24: 935-945.

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2.28. Electrical best KPI-28. Efficiency of air conditioning unit.

INDICATOR	Efficiency of air conditioning unit (ACEER)				
Sector (NACE code)	All sectors	**Subsector**	All subsectors		
Level of indicator	Equipment level (air conditioning unit)				
	The indicator shows the energy efficiency ratio (EER) of an air conditioning unit.				
Thermal or Electrical process	Electrical process				
Energy source	Any source				
Description of the INDICATOR	The indicator value is determined by the equation: ACEER = Thermal energy supplied (kWh) / Electrical energy consumed (kWh). The energy efficiency ratio (EER) of the air conditioning units can be measured in an audit with digital power analyzers, obtaining the electrical energy consumed, and the thermal energy supplied, that can be calculated with the temperatures of the process. It is advisable that the measurement period be a representative period. In some cases the EER can be estimated with the age of the equipment. The methodology is based in experiments referred in the work of Carlsson-Kanyama and Faist (2000).				
Upper Lever	Process level				
Lower level	-				
Associated Variables	**Unit**	Dimensionless	**Name**	E bKPI L4 NA efficiency of air conditioning unit	
	This SEC depends on several factors: among them, on the temperatures of the inlet and outlet fluid, and on the age of the air conditioning unit.				
Best or Average KPI	Best	**KPI Value**	6 (dimensionless)		
Source	California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich). D. Kaya and H. Alidrisi. 2016. Energy savings potential in air conditioners and chiller systems. Turkish Journal of Electrical Engineering & Computer Sciences 24: 935-945.				

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2.29. Electrical average KPI-29. Efficiency of chiller.

<table>
<tr><td>INDICATOR</td><td colspan="4">Efficiency of chiller</td></tr>
<tr><td>Sector (NACE code)</td><td>All sectors</td><td>Subsector</td><td colspan="2">All subsectors</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Equipment level (chiller)</td></tr>
<tr><td colspan="4">The indicator shows the energy efficiency ratio (EER) of a chiller.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The indicator value is determined by the equation:
CEER = Thermal energy supplied (kWh) / Electrical energy consumed (kWh)
The energy efficiency ratio (EER) of the chillers can be measured in an audit with digital power analyzers, obtaining the electrical energy consumed, and the thermal energy supplied, that can be calculated with the temperatures of the process. It is advisable that the measurement period be a representative period.
In some cases the EER can be estimated with the age of the equipment.
The methodology is based in experiments referred in the work of Carlsson-Kanyama and Faist (2000).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Process level</td></tr>
<tr><td>Lower level</td><td colspan="4">-</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>Dimensionless</td><td>Name</td><td>E aKPI L4 NA efficiency of chiller</td></tr>
<tr><td colspan="4">This SEC depends on several factors: among them, on the temperatures of the inlet and outlet fluid, and on the age of the chiller.</td></tr>
<tr><td>Best or Average KPI</td><td colspan="2">Average</td><td>KPI Value</td><td>4 (dimensionless)</td></tr>
<tr><td>Source</td><td colspan="4">California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices.
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf.
A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey.
Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich).
D. Kaya and H. Alidrisi. 2016. Energy savings potential in air conditioners and chiller systems. Turkish Journal of Electrical Engineering & Computer Sciences 24: 935-945.</td></tr>
</table>

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2.30. Electrical best KPI-30. Efficiency of chiller.

INDICATOR	Efficiency of chiller			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Equipment level (chiller) The indicator shows the energy efficiency ratio (EER) of a chiller.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The indicator value is determined by the equation: CEER = Thermal energy supplied (kWh) / Electrical energy consumed (kWh) The energy efficiency ratio (EER) of the chillers can be measured in an audit with digital power analyzers, obtaining the electrical energy consumed, and the thermal energy supplied, that can be calculated with the temperatures of the process. It is advisable that the measurement period be a representative period. In some cases the EER can be estimated with the age of the equipment. The methodology is based in experiments referred in the work of Carlsson-Kanyama and Faist (2000).			
Upper Lever	Process level			
Lower level	-			
Associated Variables	**Unit**	Dimensionless	**Name**	E bKPI L4 NA efficiency of chiller
	This SEC depends on several factors: among them, on the temperatures of the inlet and outlet fluid, and on the age of the chiller.			
Best or Average KPI	Best	**KPI Value**	6 (dimensionless)	
Source	California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich). D. Kaya and H. Alidrisi. 2016. Energy savings potential in air conditioners and chiller systems. Turkish Journal of Electrical Engineering & Computer Sciences 24: 935-945.			

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2.31. Electrical average KPI-31. Efficiency of heat pump.

INDICATOR	Efficiency of heat pump			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Equipment level (heat pump)			
	The indicator shows the energy efficiency ratio (EER) of a heat pump.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The indicator value is determined by the equation: HPEER = Thermal energy supplied (kWh) / Electrical energy consumed (kWh) The energy efficiency ratio (EER) of the heat pumps can be measured in an audit with digital power analyzers, obtaining the electrical energy consumed, and the thermal energy supplied, that can be calculated with the temperatures of the process. It is advisable that the measurement period be a representative period. In some cases the EER can be estimated with the age of the equipment. The methodology is based in experiments referred in the work of Carlsson-Kanyama and Faist (2000).			
Upper Lever	Process level			
Lower level	-			
Associated Variables	**Unit**	Dimensionless	**Name**	E aKPI L4 NA efficiency of heat pump
	This SEC depends on several factors: among them, on the temperatures of the inlet and outlet fluid, and on the age of the heat pump.			
Best or Average KPI	Average	**KPI Value**	4 (dimensionless)	
Source	California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich). D. Kaya and H. Alidrisi. 2016. Energy savings potential in air conditioners and chiller systems. Turkish Journal of Electrical Engineering & Computer Sciences 24: 935-945.			

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2.32. Electrical best KPI-32. Efficiency of heat pump.

INDICATOR	Efficiency of heat pump
Sector (NACE code)	All sectors | **Subsector** | All subsectors
Level of indicator	Equipment level (heat pump) The indicator shows the energy efficiency ratio (EER) of a heat pump.
Thermal or Electrical process	Electrical process
Energy source	Any source
Description of the INDICATOR	The indicator value is determined by the equation: HPEER = Thermal energy supplied (kWh) / Electrical energy consumed (kWh) The energy efficiency ratio (EER) of the heat pumps can be measured in an audit with digital power analyzers, obtaining the electrical energy consumed, and the thermal energy supplied, that can be calculated with the temperatures of the process. It is advisable that the measurement period be a representative period. In some cases the EER can be estimated with the age of the equipment. The methodology is based in experiments referred in the work of Carlsson-Kanyama and Faist (2000).
Upper Lever	Process level
Lower level	-
Associated Variables	**Unit** | Dimensionless | **Name** | E bKPI L4 NA efficiency of heat pump This SEC depends on several factors: among them, on the temperatures of the inlet and outlet fluid, and on the age of the heat pump.
Best or Average KPI	Best | **KPI Value** | 6 (dimensionless)
Source	California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich). D. Kaya and H. Alidrisi. 2016. Energy savings potential in air conditioners and chiller systems. Turkish Journal of Electrical Engineering & Computer Sciences 24: 935-945.

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2.33. Electrical average KPI-33. Efficiency of electrical compressor.

INDICATOR	Efficiency of electrical compressor (EEC)			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Equipment level (electrical compressor)			
	The indicator shows the efficiency of an electrical compressor.			
Mechanical or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The isentropic efficiency of a compressor or pump is defined as the ratio of the work input to an isentropic process, to the work input to the actual process between the same inlet and exit pressures. The efficiency of the electrical compressors can be measured with specific measurements. It is advisable that the measurement period be a representative period. In some cases the efficiency can be estimated with the age of the equipment. The methodology is based in experiments referred in the work of Carlsson-Kanyama and Faist (2000).			
Upper Lever	Process level			
Lower level	-			
Associated Variables	**Unit**	Dimensionless	**Name**	E aKPI L4 NA efficiency of electrical compressor
	This indicator depends on several factors: among them, on the temperatures of the inlet and outlet fluid, and on the age of the electrical compressor.			
Best or Average KPI	Average	**KPI Value**	0.8 (dimensionless)	
Source	California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich).			

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2.34. Electrical best KPI-34. Efficiency of electrical compressor.

INDICATOR	Efficiency of electrical compressor (EEC)				
Sector (NACE code)	All sectors	**Subsector**	All subsectors		
Level of indicator	Equipment level (electrical compressor)				
	The indicator shows the efficiency of an electrical compressor.				
Mechanical or Electrical process	Electrical process				
Energy source	Any source				
Description of the INDICATOR	The isentropic efficiency of a compressor or pump is defined as the ratio of the work input to an isentropic process, to the work input to the actual process between the same inlet and exit pressures. The efficiency of the electrical compressors can be measured with specific measurements. It is advisable that the measurement period be a representative period. In some cases the efficiency can be estimated with the age of the equipment. The methodology is based in experiments referred in the work of Carlsson-Kanyama and Faist (2000).				
Upper Lever	Process level				
Lower level	-				
Associated Variables	**Unit**	Dimensionless	**Name**	E bKPI L4 NA efficiency of electrical compressor	
	This indicator depends on several factors: among them, on the temperatures of the inlet and outlet fluid, and on the age of the electrical compressor.				
Best or Average KPI	Best	**KPI Value**	0.9 (dimensionless)		
Source	California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich).				

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2.35. Electrical average KPI-35. Efficiency of electrical motor.

INDICATOR	Efficiency of electrical motor			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Equipment level (electrical motor)			
	The indicator shows the efficiency of an electrical motor.			
Mechanical or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The indicator value is determined by the equation: EME = Mechanical energy supplied (kWh) / Electrical energy consumed (kWh) The efficiency of the electrical motors can be measured in an audit with digital power analyzers, obtaining the electrical energy consumed, and the mechanical energy supplied. It is advisable that the measurement period be a representative period. In some cases the efficiency can be estimated with the age of the equipment. The methodology is based in experiments referred in the work of Carlsson-Kanyama and Faist (2000).			
Upper Lever	Process level			
Lower level	-			
Associated Variables	**Unit**	Dimensionless	**Name**	E aKPI L4 NA efficiency of electrical motor
	This indicator depends on several factors: among them, on the age of the electrical motor.			
Best or Average KPI	Average	**KPI Value**	0.85 (dimensionless)	
Source	California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich).			

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2.36. Electrical best KPI-36. Efficiency of electrical motor.

INDICATOR	Efficiency of electrical motor			
Sector (NACE code)	All sectors	**Subsector**	All subsectors	
Level of indicator	Equipment level (electrical motor) The indicator shows the efficiency of a electrical motor.			
Mechanical or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The indicator value is determined by the equation: EME = Mechanical energy supplied (kWh) / Electrical energy consumed (kWh) The efficiency of the electrical motors can be measured in an audit with digital power analyzers, obtaining the electrical energy consumed, and the mechanical energy supplied. It is advisable that the measurement period be a representative period. In some cases the efficiency can be estimated with the age of the equipment. The methodology is based in experiments referred in the work of Carlsson-Kanyama and Faist (2000).			
Upper Lever	Process level			
Lower level	-			
Associated Variables	**Unit**	Dimensionless	**Name**	E bKPI L4 NA efficiency of electrical motor
	This indicator depends on several factors: among them, on the age of the electrical motor.			
Best or Average KPI	Best	**KPI Value**	0.99 (dimensionless)	
Source	California Energy Commission. 2008. California's Food Processing Industry. Energy Efficiency Initiative: Adoption of Industrial Best Practices. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.183.9144&rep=rep1&type=pdf. A. Carlsson-Kanyama and M. Faist. 2000. Energy Use in the Food Sector: A data survey. Stockholm University, and Swiss Federal Institute of Technology (ETH Zürich).			

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3. MILK sector

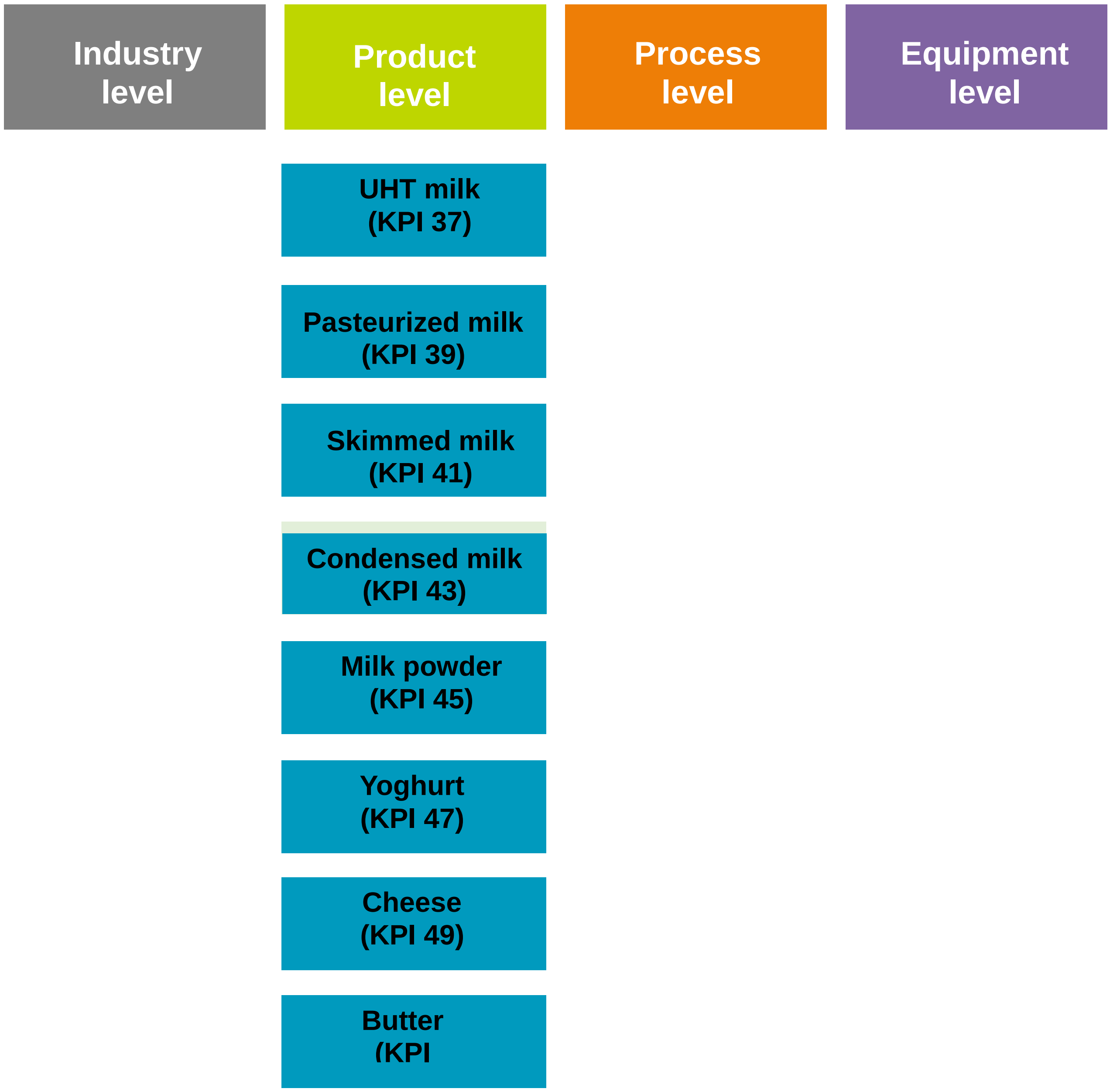

Figure 2. Scheme of the electric KPIs selected in the milk sector. For each of these KPIs, there is the “average KPI” version and the “best KPI” version.

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3.1. Electrical average KPI-37. Specific Electrical Consumption (SEC) per volume unit of UHT milk.

INDICATOR	Specific Electrical Consumption (SEC) per volume unit of UHT milk			
Sector (NACE code)	NACE 10.5	**Subsector**	Milk	
Level of indicator	Product level (UHT milk)			
	The indicator includes all the electricity necessary to produce one m^3 of UHT milk, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / UHT (kWh/m^3) where E represents the annual electrical energy consumption (kWh), and PM designates the annual volume of UHT milk produced (m^3). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the UHT milk, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the UHT milk. Specific electrical requirement of UHT milk is already characterized in FAO documents in 1992, with values around 325 MJ/t (90 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 55 and 60 kWh/m^3.			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/m^3	**Name**	E aKPI L2 N3 specific electrical consumption per volume unit of UHT milk
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	60 kWh/m^3. Density considered: 1.03 kg/l	
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf			

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3.2. Electrical best KPI-38. Specific Electrical Consumption (SEC) per volume unit of UHT milk.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per volume unit of UHT milk</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.5</td><td>Subsector</td><td colspan="2">Milk</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (UHT milk)</td></tr>
<tr><td colspan="4">The indicator includes all the electricity necessary to produce one m³ of UHT milk, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
$SEC = E / UHT$ (kWh/m³)
where E represents the annual electrical energy consumption (kWh), and PM designates the annual volume of UHT milk produced (m³).
The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the UHT milk, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the UHT milk.
Specific electrical requirement of UHT milk is already characterized in FAO documents in 1992, with values around 325 MJ/t (90 kWh/m³). Present references (2014) indicate a range of specific electrical consumption from 55 and 60 kWh/m³.</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/m³</td><td>Name</td><td>E bKPI L2 N3 specific electrical consumption per volume unit of UHT milk</td></tr>
<tr><td colspan="4">This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.</td></tr>
<tr><td>Best or Average KPI</td><td>Best</td><td>KPI Value</td><td colspan="2">55 kWh/m³. Density considered: 1.03 kg/l</td></tr>
<tr><td>Source</td><td colspan="4">Energy requirements in food processing. 1992. FAO Corporate Document Repository.
http://www.fao.org/docrep/004/t0515e/T0515E03.htm

Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency).
http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf</td></tr>
</table>

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3.3. Electrical average KPI-39. Specific Electrical Consumption (SEC) per volume unit of pasteurized milk.

INDICATOR	Specific Electrical Consumption (SEC) per volume unit of pasteurized milk			
Sector (NACE code)	NACE 10.5	**Subsector**	Milk	
Level of indicator	Product level (pasteurized milk)			
	The indicator includes all the electricity necessary to produce one m^3 of pasteurized milk, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PM (kWh/m^3) where E represents the annual electrical energy consumption (kWh), and PM designates the annual volume of pasteurized milk produced (m^3). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the pasteurized milk, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the pasteurized milk. Specific electrical requirement of pasteurized milk is already characterized in FAO documents in 1992, with values around 200 MJ/t (55 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 25 and 30 kWh/m^3.			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/m^3	**Name**	E aKPI L2 N3 specific electrical consumption per volume unit of pasteurized milk
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	30 kWh/m^3. Density considered: 1.03 kg/l	
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf			

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3.4. Electrical best KPI-40. Specific Electrical Consumption (SEC) per volume unit of pasteurized milk.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per volume unit of pasteurized milk</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.5</td><td>Subsector</td><td colspan="2">Milk</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (pasteurized milk)</td></tr>
<tr><td colspan="4">The indicator includes all the electricity necessary to produce one m^3 of pasteurized milk, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / PM (kWh/m^3)
where E represents the annual electrical energy consumption (kWh), and PM designates the annual volume of pasteurized milk produced (m^3).
The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the pasteurized milk, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the pasteurized milk.
Specific electrical requirement of pasteurized milk is already characterized in FAO documents in 1992, with values around 200 MJ/t (55 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 25 and 30 kWh/m^3.</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/m^3</td><td>Name</td><td>E bKPI L2 N3 specific electrical consumption per volume unit of pasteurized milk</td></tr>
<tr><td colspan="4">This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.</td></tr>
<tr><td>Best or Average KPI</td><td>Best</td><td>KPI Value</td><td colspan="2">25 kWh/m^3. Density considered: 1.03 kg/l</td></tr>
<tr><td>Source</td><td colspan="4">Energy requirements in food processing. 1992. FAO Corporate Document Repository.
http://www.fao.org/docrep/004/t0515e/T0515E03.htm
Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency).
http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf</td></tr>
</table>

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3.5. Electrical average KPI-41. Specific Electrical Consumption (SEC) per volume unit of skimmed and semi-skimmed milk.

INDICATOR	Specific Electrical Consumption (SEC) per volume unit of skimmed and semi-skimmed milk			
Sector (NACE code)	NACE 10.5	**Subsector**	Milk	
Level of indicator	Product level (skimmed and semi-skimmed milk)			
	The indicator includes all the electricity necessary to produce one m^3 of skimmed and semi-skimmed milk, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / SM (kWh/m^3) where E represents the annual electrical energy consumption (kWh), and SM designates the annual volume of skimmed and semi-skimmed milk produced (m^3). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the skimmed and semi-skimmed milk, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the skimmed and semi-skimmed milk. Specific electrical requirement of skimmed and semi-skimmed milk is already characterized in FAO documents in 1992, with values around 325 MJ/t (90 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 60 and 80 kWh/m^3.			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/m^3	**Name**	E aKPI L2 N3 specific electrical consumption per volume unit of skimmed and semi-skimmed milk
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	70 kWh/m^3. Density considered: 1.04 kg/l	
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf			

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3.6. Electrical best KPI-42. Specific Electrical Consumption (SEC) per volume unit of skimmed and semi-skimmed milk.

INDICATOR	Specific Electrical Consumption (SEC) per volume unit of skimmed and semi-skimmed milk
Sector (NACE code)	NACE 10.5 — **Subsector**: Milk
Level of indicator	Product level (skimmed and semi-skimmed milk) The indicator includes all the electricity necessary to produce one m^3 of skimmed and semi-skimmed milk, including auxiliary processes of the industry.
Thermal or Electrical process	Electrical process
Energy source	Any source
Description of the INDICATOR	The SEC value is determined by the equation: $SEC = E / SM$ (kWh/m^3) where E represents the annual electrical energy consumption (kWh), and SM designates the annual volume of skimmed and semi-skimmed milk produced (m^3). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the skimmed and semi-skimmed milk, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the skimmed and semi-skimmed milk. Specific electrical requirement of skimmed and semi-skimmed milk is already characterized in FAO documents in 1992, with values around 325 MJ/t (90 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 60 and 80 kWh/m^3.
Upper Lever	Industry level
Lower level	Process level
Associated Variables	**Unit**: kWh/m^3 — **Name**: E bKPI L2 N3 specific electrical consumption per volume unit of skimmed and semi-skimmed milk This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.
Best or Average KPI	Best — **KPI Value**: 60 kWh/m^3. Density considered: 1.04 kg/l
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf

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3.7. Electrical average KPI-43. Specific Electrical Consumption (SEC) per volume unit of condensed milk.

INDICATOR	Specific Electrical Consumption (SEC) per volume unit of condensed milk			
Sector (NACE code)	NACE 10.5	**Subsector**	Milk	
Level of indicator	Product level (condensed milk)			
	The indicator includes all the electricity necessary to produce one m^3 of condensed milk, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / CM (kWh/m^3) where E represents the annual electrical energy consumption (kWh), and CM designates the annual volume of condensed milk produced (m^3). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the condensed milk, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the condensed milk. Specific electrical requirement of condensed milk is already characterized in FAO documents in 1992, with values around 220 MJ/t (60 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 77 and 82 kWh/m^3.			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/m^3	**Name**	E aKPI L2 N3 specific electrical consumption per volume unit of condensed milk
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	77 kWh/m^3. Density considered: 1.30 kg/l	
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf			

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3.8. Electrical best KPI-44. Specific Electrical Consumption (SEC) per volume unit of condensed milk.

INDICATOR	Specific Electrical Consumption (SEC) per volume unit of condensed milk		
Sector (NACE code)	NACE 10.5	**Subsector**	Milk
Level of indicator	Product level (condensed milk) The indicator includes all the electricity necessary to produce one m^3 of condensed milk, including auxiliary processes of the industry.		
Thermal or Electrical process	Electrical process		
Energy source	Any source		
Description of the INDICATOR	The SEC value is determined by the equation: $SEC = E / CM$ (kWh/m^3) where E represents the annual electrical energy consumption (kWh), and CM designates the annual volume of condensed milk produced (m^3). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the condensed milk, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the condensed milk. Specific electrical requirement of condensed milk is already characterized in FAO documents in 1992, with values around 220 MJ/t (60 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 77 and 82 kWh/m^3.		
Upper Lever	Industry level		
Lower level	Process level		
Associated Variables	**Unit** kWh/m^3	**Name**	E bKPI L2 N3 specific electrical consumption per volume unit of condensed milk
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.		
Best or Average KPI	Best	**KPI Value**	60 kWh/m^3. Density considered: 1.30 kg/l
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf		

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3.9. Electrical average KPI-45. Specific Electrical Consumption (SEC) per ton of full cream milk powder.

INDICATOR	Specific Electrical Consumption (SEC) per ton of full cream milk powder				
Sector (NACE code)	NACE 10.5	**Subsector**	Milk		
Level of indicator	Product level (milk powder) The indicator includes all the electricity necessary to produce a ton of milk powder, including auxiliary processes of the industry.				
Thermal or Electrical process	Electrical process				
Energy source	Any source				
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / MP (kWh/t) where E represents the annual electrical energy consumption (kWh), and MP designates the annual production of milk powder produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the milk powder, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the milk powder. Specific electrical requirement of milk powder is already characterized in FAO documents in 1992, with values around 290 MJ/t (80 kWh/t). Present references (2014) indicate a range of specific electrical consumption from 425 and 450 kWh/t.				
Upper Lever	Industry level				
Lower level	Process level				
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L2 N3 specific electrical consumption per ton of milk powder	
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.				
Best or Average KPI	Average	**KPI Value**	425 kWh/t		
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf				

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3.10. Electrical best KPI-46. Specific Electrical Consumption (SEC) per ton of full cream milk powder.

INDICATOR	Specific Electrical Consumption (SEC) per ton of full cream milk powder			
Sector (NACE code)	NACE 10.5	**Subsector**	Milk	
Level of indicator	Product level (milk powder)			
	The indicator includes all the electricity necessary to produce a ton of milk powder, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / MP (kWh/t) where E represents the annual electrical energy consumption (kWh), and MP designates the annual production of milk powder produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the milk powder, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the milk powder. Specific electrical requirement of milk powder is already characterized in FAO documents in 1992, with values around 290 MJ/t (80 kWh/t). Present references (2014) indicate a range of specific electrical consumption from 425 and 450 kWh/t.			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E bKPI L2 N3 specific electrical consumption per ton of milk powder
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Best	**KPI Value**	400 kWh/t	
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf			

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3.11. Electrical average KPI-47. Specific Electrical Consumption (SEC) per volume unit of yoghourt.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per volume unit of yoghourt</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.5</td><td>Subsector</td><td colspan="2">Yoghourt</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (yoghourt)</td></tr>
<tr><td colspan="4">The indicator includes all the electricity necessary to produce one m^3 of yoghourt, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / Y (kWh/m^3)
where E represents the annual electrical energy consumption (kWh), and Y designates the annual volume of yoghourt produced (m^3).
The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the yoghourt, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the yoghourt.
Specific electrical requirement of yoghourt is already characterized in FAO documents in 1992, with values around 270 MJ/t (75 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 50 and 55 kWh/m^3.</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/m^3</td><td>Name</td><td>E aKPI L2 N3 specific electrical consumption per volume unit of yoghourt</td></tr>
<tr><td colspan="4">This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">55 kWh/m^3. Density considered: 1.03 kg/l</td></tr>
<tr><td>Source</td><td colspan="4">Energy requirements in food processing. 1992. FAO Corporate Document Repository.
http://www.fao.org/docrep/004/t0515e/T0515E03.htm
Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency).
http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf</td></tr>
</table>

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3.12. Electrical best KPI-48. Specific Electrical Consumption (SEC) per volume unit of yoghourt.

INDICATOR	Specific Electrical Consumption (SEC) per volume unit of yoghourt			
Sector (NACE code)	NACE 10.5	**Subsector**	Yoghourt	
Level of indicator	Product level (yoghourt)			
	The indicator includes all the electricity necessary to produce one m^3 of yoghourt, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: $SEC = E / Y$ (kWh/m^3) where E represents the annual electrical energy consumption (kWh), and Y designates the annual volume of yoghourt produced (m^3). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the yoghourt, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the yoghourt. Specific electrical requirement of yoghourt is already characterized in FAO documents in 1992, with values around 270 MJ/t (75 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 50 and 55 kWh/m^3.			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/m^3	**Name**	E bKPI L2 N3 specific electrical consumption per volume unit of yoghourt
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Best	**KPI Value**	50 kWh/m^3. Density considered: 1.03 kg/l	
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf			

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3.13. Electrical average KPI-49. Specific Electrical Consumption (SEC) per ton of cheese.

INDICATOR	Specific Electrical Consumption (SEC) per ton of cheese			
Sector (NACE code)	NACE 10.5	**Subsector**	Cheese	
Level of indicator	Product level (cheese) The indicator includes all the electricity necessary to produce a ton of cheese, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / CH (kWh/t) where E represents the annual electrical energy consumption (kWh), and CH designates the annual production of cheese produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the cheese, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the cheese. Specific electrical requirement of cheese is already characterized in FAO documents in 1992, with values around 360 MJ/t (100 kWh/t). Present references (2014) indicate a range of specific electrical consumption from 265 and 285 kWh/t.			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L2 N3 specific electrical consumption per ton of cheese
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	265 kWh/t	
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf			

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3.14. Electrical best KPI-50. Specific Electrical Consumption (SEC) per ton of cheese.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per ton of cheese</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.5</td><td>Subsector</td><td colspan="2">Cheese</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (cheese)</td></tr>
<tr><td colspan="4">The indicator includes all the electricity necessary to produce a ton of cheese, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / CH (kWh/t)
where E represents the annual electrical energy consumption (kWh), and CH designates the annual production of cheese produced (t).
The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the cheese, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the cheese.
Specific electrical requirement of cheese is already characterized in FAO documents in 1992, with values around 360 MJ/t (100 kWh/t). Present references (2014) indicate a range of specific electrical consumption from 265 and 285 kWh/t.</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t</td><td>Name</td><td>E bKPI L2 N3 specific electrical consumption per ton of cheese</td></tr>
<tr><td colspan="4">This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.</td></tr>
<tr><td>Best or Average KPI</td><td>Best</td><td>KPI Value</td><td colspan="2">250 kWh/t</td></tr>
<tr><td>Source</td><td colspan="4">Energy requirements in food processing. 1992. FAO Corporate Document Repository.
http://www.fao.org/docrep/004/t0515e/T0515E03.htm
Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency).
http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf</td></tr>
</table>

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3.15. Electrical average KPI-51. Specific Electrical Consumption (SEC) per volume unit of butter.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per volume unit of butter</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.5</td><td>Subsector</td><td colspan="2">Butter</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (butter)</td></tr>
<tr><td colspan="4">The indicator includes all the electricity necessary to produce one m^3 of butter, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / B (kWh/m^3)
where E represents the annual electrical energy consumption (kWh), and B designates the annual volume of butter produced (m^3).
The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the butter, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the butter.
Specific electrical requirement of butter is already characterized in FAO documents in 1992, with values around 325 MJ/t (90 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 220 and 240 kWh/m^3.</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/m^3</td><td>Name</td><td>E aKPI L2 N3 specific electrical consumption per volume unit of butter</td></tr>
<tr><td colspan="4">This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">220 kWh/m^3. Density considered: 0.91 kg/l</td></tr>
<tr><td>Source</td><td colspan="4">Energy requirements in food processing. 1992. FAO Corporate Document Repository.
http://www.fao.org/docrep/004/t0515e/T0515E03.htm
Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency).
http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf</td></tr>
</table>

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3.16. Electrical best KPI-52. Specific Electrical Consumption (SEC) per volume unit of butter.

INDICATOR	Specific Electrical Consumption (SEC) per volume unit of butter		
Sector (NACE code)	NACE 10.5	**Subsector**	Butter
Level of indicator	Product level (butter) The indicator includes all the electricity necessary to produce one m^3 of butter, including auxiliary processes of the industry.		
Thermal or Electrical process	Electrical process		
Energy source	Any source		
Description of the INDICATOR	The SEC value is determined by the equation: $SEC = E / B$ (kWh/m^3) where E represents the annual electrical energy consumption (kWh), and B designates the annual volume of butter produced (m^3). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the butter, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the butter. Specific electrical requirement of butter is already characterized in FAO documents in 1992, with values around 325 MJ/t (90 kWh/m^3). Present references (2014) indicate a range of specific electrical consumption from 220 and 240 kWh/m^3.		
Upper Lever	Industry level		
Lower level	Process level		
Associated Variables	**Unit**: kWh/m^3	**Name**	E bKPI L2 N3 specific electrical consumption per volume unit of butter
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.		
Best or Average KPI	Best	**KPI Value**	90 kWh/m^3. Density considered: 0.91 kg/l
Source	Energy requirements in food processing. 1992. FAO Corporate Document Repository. http://www.fao.org/docrep/004/t0515e/T0515E03.htm Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf		

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4. CEREAL DRYING sector

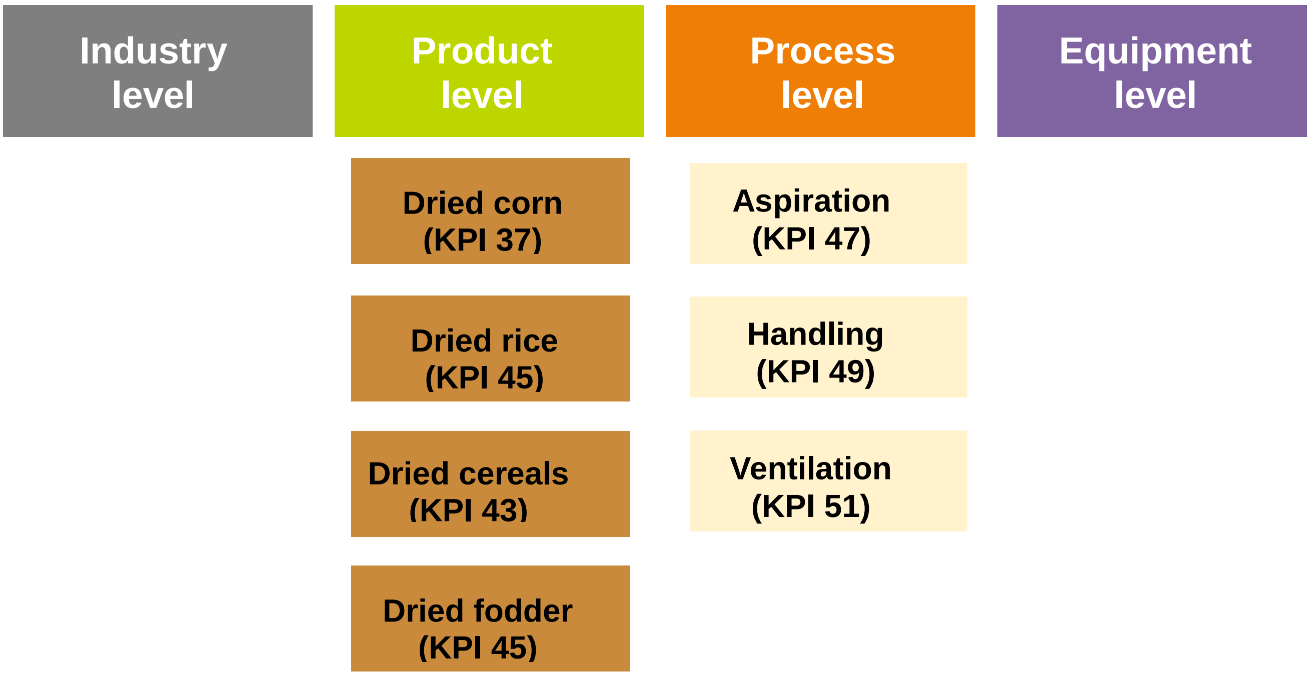

Figure 3. Scheme of the electric KPIs selected in the cereal drying sector. For each of these KPIs, there is the “average KPI” version and the “best KPI” version.

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4.1. Electrical average KPI-53. Specific Electrical Consumption (SEC) per ton of water removed in dried corn.

INDICATOR	Specific Electrical Consumption (SEC) per ton of water removed in dried corn		
Sector (NACE code)	NACE 10.6	**Subsector**	Corn drying
Level of indicator	Product level The indicator includes all the electrical energy necessary per unit mass water removed in the process of corn drying, including auxiliary processes of the industry. Heating needs in this process are considered as been generated by a fuel boiler, so this indicator only includes electric energy for managing the products.		
Thermal or Electrical process	Electrical process		
Energy source	Indicator highly depending on the energy source of the process.		
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / WR (kWh/t) where E represents the annual electrical energy consumption (kWh), and WR designates the annual tons of water removed (t) in the corn drying process. For the values of the indicator, it is considered that the heat is generated with a fuel boiler; electrical consumption includes aspiration, lighting, ventilation, conveyors, elevators, and other processes. The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from corn drying, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to corn drying. Annual production of dried corn (tons) can be obtained from industry recordings. If data include, in addition, the annual average moisture content of the corn at the beginning and at the end of the drying process, water removed in the corn drying process can be calculated. The mass of water removed (m_W) can be related to the mass of dried corn (m_r) with the equation: $m_W = m_r * (MCi-MCf) / (100-MCf)$ being MCi the average moisture content of the corn entering a drying run (%, w.b.) and MCf the average moisture content of the corn exiting a drying run (%, w.b.) The methodology is based on experiments referred in the paper of Billiris and Siebenmorgen (2014).		
Upper Lever	Industry level		
Lower level	Process level		

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Associated Variables	**Unit**	kWh/t water removed (kWh of electricity consumption.	**Name**	E aKPI L2 N1 specific electrical consumption per ton of water removed in dried corn
	With this indicator, it is advisable to include, in addition, the annual average moisture content of the corn at the beginning and at the end of the drying process. With this additional information it is possible to calculate the electrical energy necessary per ton of dried corn. The value of this electrical indicator is obviously different depending on the energy source of the process and the technology of heat generation. If heat is generated in a fuel boiler, electrical consumption usually includes fan operating to produce the warm air flow, and auxiliary processes.			
Best or Average KPI	Average	**KPI Value**	130 kWh/t water removed (kWh of electricity consumption)	
Source	M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226 S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486 Kudra, T. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572			

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4.2. Electrical best KPI-54. Specific Electrical Consumption (SEC) per ton of water removed in dried corn.

<table>
<tr><td>INDICATOR</td><td colspan="3">Specific Electrical Consumption (SEC) per ton of water removed in dried corn</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.6</td><td>Subsector</td><td>Corn drying</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="3">Product level</td></tr>
<tr><td colspan="3">The indicator includes all the electrical energy necessary per unit mass water removed in the process of corn drying, including auxiliary processes of the industry. Heating needs in this process are considered as been generated by a fuel boiler, so this indicator only includes electric energy for managing the products.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="3">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="3">Indicator highly depending on the energy source of the process.</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="3">The SEC value is determined by the equation:
SEC = E / WR (kWh/t)
where E represents the annual electrical energy consumption (kWh), and WR designates the annual tons of water removed (t) in the corn drying process. For the values of the indicator, it is considered that the heat is generated with a fuel boiler; electrical consumption includes aspiration, lighting, ventilation, conveyors, elevators, and other processes.
The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from corn drying, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to corn drying. Annual production of dried corn (tons) can be obtained from industry recordings. If data include, in addition, the annual average moisture content of the corn at the beginning and at the end of the drying process, water removed in the corn drying process can be calculated.
The mass of water removed (m_W) can be related with the mass of dried corn (m_r) with the equation:
$m_W = m_r * (MCi-MCf) / (100-MCf)$
being MCi the average moisture content of the corn entering a drying run (%, w.b.) and MCf the average moisture content of the corn exiting a drying run (%, w.b.)
The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).</td></tr>
<tr><td>Upper Lever</td><td colspan="3">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="3">Process level</td></tr>
</table>

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<table>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t water removed (kWh of electricity consumption)</td><td>Name</td><td>E bKPI L2 N1 specific electrical consumption per ton of water removed in dried corn</td></tr>
<tr><td colspan="4">With this indicator, it is advisable to include, in addition, the annual average moisture content of the corn at the beginning and at the end of the drying process. With this additional information it is possible to calculate the electrical energy necessary per ton of dried corn.
The value of this electrical indicator is obviously different depending on the energy source of the process and the technology of heat generation. If heat is generated in a fuel boiler, electrical consumption usually includes fan operating to produce the warm air flow, and auxiliary processes.</td></tr>
<tr><td>Best or Average KPI</td><td colspan="2">Best</td><td>KPI Value</td><td>80 kWh/t water removed (kWh of electricity consumption)</td></tr>
<tr><td>Source</td><td colspan="4">M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226
S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486
Kudra, T. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572</td></tr>
</table>

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4.3. Electrical average KPI-55. Specific Electrical Consumption (SEC) per ton of water removed in dried rice.

INDICATOR	Specific Electrical Consumption (SEC) per ton of water removed in dried rice		
Sector (NACE code)	NACE 10.6	**Subsector**	Rice drying
Level of indicator	Product level		
	The indicator includes all the electrical energy necessary per unit mass water removed in the process of rice drying, including auxiliary processes of the industry. Heating needs in this process are considered as been generated by a fuel boiler, so this indicator only includes electric energy for managing the products.		
Thermal or Electrical process	Electrical process		
Energy source	Indicator highly depending on the energy source of the process.		
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / WR (kWh/t) where E represents the annual electrical energy consumption (kWh), and WR designates the annual tons of water removed (t) in the rice drying process. For the values of the indicator, it is considered that the heat is generated with a fuel boiler; electrical consumption includes aspiration, lighting, ventilation, conveyors, elevators, compressors, cleaners, and other processes. The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from rice drying, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to rice drying. Annual production of dried rice (tons) can be obtained from industry recordings. If data include, in addition, the annual average moisture content of the rice at the beginning and at the end of the drying process, water removed in the rice drying process can be calculated. The mass of water removed (m_W) can be related with the mass of dried rice (m_r) with the equation: $m_W = m_r * (MCi-MCf) / (100-MCf)$ being MCi the average moisture content of the rice entering a drying run (%, w.b.) and MCf the average moisture content of the rice exiting a drying run (%, w.b.) The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).		
Upper Lever	Industry level		
Lower level	Process level		

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	Unit	kWh/t water removed (kWh of electricity consumption)	**Name**	E aKPI L2 N1 specific electrical consumption per ton of water removed in dried rice
Associated Variables	With this indicator, it is advisable to include, in addition, the annual average moisture content of the rice at the beginning and at the end of the drying process. With this additional information it is possible to calculate the electrical energy necessary per ton of dried rice. The value of this electrical indicator is obviously different depending on the energy source of the process and the technology of heat generation. If heat is generated in a fuel boiler, electrical consumption usually includes fan operating to produce the warm air flow, and auxiliary processes.			
Best or Average KPI	Average	**KPI Value**	130 kWh/t water removed (kWh of electricity consumption)	
Source	M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226 S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486 Kudra, T. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572			

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4.4. Electrical best KPI-56. Specific Electrical Consumption (SEC) per ton of water removed in dried rice.

<table>
<tr><td>INDICATOR</td><td colspan="3">Specific Electrical Consumption (SEC) per ton of water removed in dried rice</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.6</td><td>Subsector</td><td>Rice drying</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="3">Product level</td></tr>
<tr><td colspan="3">The indicator includes all the electrical energy necessary per unit mass water removed in the process of rice drying, including auxiliary processes of the industry. Heating needs in this process are considered as been generated by a fuel boiler, so this indicator only includes electric energy for managing the products.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="3">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="3">Indicator highly depending on the energy source of the process.</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="3">The SEC value is determined by the equation:
SEC = E / WR (kWh/t)
where E represents the annual electrical energy consumption (kWh), and WR designates the annual tons of water removed (t) in the rice drying process. For the values of the indicator, it is considered that the heat is generated with a fuel boiler; electrical consumption includes aspiration, lighting, ventilation, conveyors, elevators, compressors, cleaners, and other processes.
The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from rice drying, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to rice drying. Annual production of dried rice (tons) can be obtained from industry recordings. If data include, in addition, the annual average moisture content of the rice at the beginning and at the end of the drying process, water removed in the rice drying process can be calculated.
The mass of water removed (m_W) can be related with the mass of dried rice (m_r) with the equation:
$m_W = m_r * (MCi-MCf) / (100-MCf)$
being MCi the average moisture content of the rice entering a drying run (%, w.b.) and MCf the average moisture content of the rice exiting a drying run (%, w.b.)
The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).</td></tr>
<tr><td>Upper Lever</td><td colspan="3">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="3">Process level</td></tr>
</table>

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Associated Variables	**Unit**	kWh/t water removed (kWh of electricity consumption)	**Name**	E bKPI L2 N1 specific electrical consumption per ton of water removed in dried rice
	With this indicator, it is advisable to include, in addition, the annual average moisture content of the rice at the beginning and at the end of the drying process. With this additional information it is possible to calculate the electrical energy necessary per ton of dried rice. The value of this electrical indicator is obviously different depending on the energy source of the process and the technology of heat generation. If heat is generated in a fuel boiler, electrical consumption usually includes fan operating to produce the warm air flow, and auxiliary processes.			
Best or Average KPI	Best	**KPI Value**	80 kWh/t water removed (kWh of electricity consumption)	
Source	M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226 S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486 Kudra, T. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572			

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4.5. Electrical average KPI-57. Specific Electrical Consumption (SEC) per ton of water removed in dried winter cereals.

<table>
<tr><td>INDICATOR</td><td colspan="3">Specific Electrical Consumption (SEC) per ton of water removed in dried winter cereals</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.6</td><td>Subsector</td><td>Winter cereals drying</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="3">Product level</td></tr>
<tr><td colspan="3">The indicator includes all the electrical energy necessary per unit mass water removed in the process of winter cereals drying, including auxiliary processes of the industry. Heating needs in this process are considered as been generated by a fuel boiler, so this indicator only includes electric energy for managing the products.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="3">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="3">Indicator highly depending on the energy source of the process.</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="3">The SEC value is determined by the equation:
SEC = E / WR (kWh/t)
where E represents the annual electrical energy consumption (kWh), and WR designates the annual tons of water removed (t) in the winter cereals drying process. For the values of the indicator, it is considered that the heat is generated with a fuel boiler; electrical consumption includes aspiration, lighting, ventilation, conveyors, elevators, compressors, cleaners and other processes.
The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from winter cereals drying, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to winter cereals drying. Annual production of dried winter cereals (tons) can be obtained from industry recordings. If data include, in addition, the annual average moisture content of the winter cereals at the beginning and at the end of the drying process, water removed in the winter cereals drying process can be calculated.
The mass of water removed (m_W) can be related with the mass of dried winter cereals (m_r) with the equation:
$m_W = m_r * (MCi-MCf) / (100-MCf)$
being MCi the average moisture content of the winter cereals entering a drying run (%, w.b.) and MCf the average moisture content of the winter cereals exiting a drying run (%, w.b.)
The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).</td></tr>
</table>

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<table>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t water removed (kWh of electricity consumption)</td><td>Name</td><td>E aKPI L2 N1 specific electrical consumption per ton of water removed in dried winter cereals</td></tr>
<tr><td colspan="4">With this indicator, it is advisable to include, in addition, the annual average moisture content of the winter cereals at the beginning and at the end of the drying process. With this additional information it is possible to calculate the electrical energy necessary per ton of dried winter cereals.
The value of this electrical indicator is obviously different depending on the energy source of the process and the technology of heat generation. If heat is generated in a fuel boiler, electrical consumption usually includes fan operating to produce the warm air flow, and auxiliary processes.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">130 kWh/t water removed (kWh of electricity consumption)</td></tr>
<tr><td>Source</td><td colspan="4">M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226
S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486
Kudra, T. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572</td></tr>
</table>

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4.6. Electrical best KPI-58. Specific Electrical Consumption (SEC) per ton of water removed in dried winter cereals.

INDICATOR	Specific Electrical Consumption (SEC) per ton of water removed in dried winter cereals		
Sector (NACE code)	NACE 10.6	**Subsector**	Winter cereals drying
Level of indicator	Product level The indicator includes all the electrical energy necessary per unit mass water removed in the process of winter cereals drying, including auxiliary processes of the industry. Heating needs in this process are considered as been generated by a fuel boiler, so this indicator only includes electric energy for managing the products.		
Thermal or Electrical process	Electrical process		
Energy source	Indicator highly depending on the energy source of the process.		
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / WR (kWh/t) where E represents the annual electrical energy consumption (kWh), and WR designates the annual tons of water removed (t) in the winter cereals drying process. For the values of the indicator, it is considered that the heat is generated with a fuel boiler; electrical consumption includes aspiration, lighting, ventilation, conveyors, elevators, compressors, cleaners and other processes. The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from winter cereals drying, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to winter cereals drying. Annual production of dried winter cereals (tons) can be obtained from industry recordings. If data include, in addition, the annual average moisture content of the winter cereals at the beginning and at the end of the drying process, water removed in the winter cereals drying process can be calculated. The mass of water removed (m_W) can be related with the mass of dried winter cereals (m_r) with the equation: $m_W = m_r * (MCi-MCf) / (100-MCf)$ being MCi the average moisture content of the winter cereals entering a drying run (%, w.b.) and MCf the average moisture content of the winter cereals exiting a drying run (%, w.b.) The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).		

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Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t water removed (kWh of electricity consumption)	**Name**	E bKPI L2 N1 specific electrical consumption per ton of water removed in dried winter cereals
	With this indicator, it is advisable to include, in addition, the annual average moisture content of the winter cereals at the beginning and at the end of the drying process. With this additional information it is possible to calculate the electrical energy necessary per ton of dried winter cereals. The value of this electrical indicator is obviously different depending on the energy source of the process and the technology of heat generation. If heat is generated in a fuel boiler, electrical consumption usually includes fan operating to produce the warm air flow, and auxiliary processes.			
Best or Average KPI	Best	**KPI Value**	80 kWh/t water removed (kWh of electricity consumption)	
Source	M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226 S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486 Kudra, T. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572			

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4.7. Electrical average KPI-59. Specific Electrical Consumption (SEC) per ton of water removed in dried fodder.

INDICATOR	Specific Electrical Consumption (SEC) per ton of water removed in dried fodder		
Sector (NACE code)	NACE 10.6	**Subsector**	Fodder drying
Level of indicator	Product level The indicator includes all the electrical energy necessary per unit mass water removed in the process of fodder drying, including auxiliary processes of the industry. Heating needs in this process are considered as been generated by a fuel boiler, so this indicator only includes electric energy for managing the products.		
Thermal or Electrical process	Electrical process		
Energy source	Indicator highly depending on the energy source of the process.		
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / WR (kWh/t) where E represents the annual electrical energy consumption (kWh), and WR designates the annual tons of water removed (t) in the fodder drying process. For the values of the indicator, it is considered that the heat is generated with a fuel boiler; electrical consumption includes aspiration, lighting, ventilation, conveyors, elevators, and other processes. The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from fodder drying, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to fodder drying. Annual production of dried fodder (tons) can be obtained from industry recordings. If data include, in addition, the annual average moisture content of the fodder at the beginning and at the end of the drying process, water removed in the fodder drying process can be calculated. The mass of water removed (m_W) can be related with the mass of dried fodder (m_r) with the equation: $m_W = m_r * (MCi-MCf) / (100-MCf)$ being MCi the average moisture content of the fodder entering a drying run (%, w.b.) and MCf the average moisture content of the fodder exiting a drying run (%, w.b.)		

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	The methodology is based in experiments referred in the paper of Pöllinger (2014).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t water removed (kWh of electricity consumption)	**Name**	E aKPI L2 N1 specific electrical consumption per ton of water removed in dried fodder
	With this indicator, it is advisable to include, in addition, the annual average moisture content of the fodder at the beginning and at the end of the drying process. With this additional information it is possible to calculate the electrical energy necessary per ton of dried fodder. The value of this electrical indicator is obviously different depending on the energy source of the process and the technology of heat generation. If heat is generated in a fuel boiler, electrical consumption usually includes fan operating to produce the warm air flow, and auxiliary processes.			
Best or Average KPI	Average	**KPI Value**	100 kWh/t water removed (kWh of electricity consumption)	
Source	T. Kudra. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572 A. Pöllinger. 2014. Comparison of different hay drying techniques. International Conference of Agricultural Engineering, Ageng 2014, Zurich http://www.geyseco.es/geystiona/adjs/comunicaciones/304/C07110001.pdf			

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4.8. Electrical best KPI-60. Specific Electrical Consumption (SEC) per ton of water removed in dried fodder.

INDICATOR	Specific Electrical Consumption (SEC) per ton of water removed in dried fodder		
Sector (NACE code)	NACE 10.6	**Subsector**	Fodder drying
Level of indicator	Product level The indicator includes all the electrical energy necessary per unit mass water removed in the process of fodder drying, including auxiliary processes of the industry. Heating needs in this process are considered as been generated by a fuel boiler, so this indicator only includes electric energy for managing the products.		
Thermal or Electrical process	Electrical process		
Energy source	Indicator highly depending on the energy source of the process.		
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / WR (kWh/t) where E represents the annual electrical energy consumption (kWh), and WR designates the annual tons of water removed (t) in the fodder drying process. For the values of the indicator, it is considered that the heat is generated with a fuel boiler; electrical consumption includes aspiration, lighting, ventilation, conveyors, elevators, and other processes. The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from fodder drying, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to fodder drying. Annual production of dried fodder (tons) can be obtained from industry recordings. If data include, in addition, the annual average moisture content of the fodder at the beginning and at the end of the drying process, water removed in the fodder drying process can be calculated. The mass of water removed (m_W) can be related with the mass of dried fodder (m_r) with the equation: $m_W = m_r * (MCi-MCf) / (100-MCf)$ being MCi the average moisture content of the fodder entering a drying run (%, w.b.) and MCf the average moisture content of the fodder exiting a drying run (%, w.b.) The methodology is based in experiments referred in the paper of Pöllinger (2014).		
Upper Lever	Industry level		
Lower level	Process level		

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<table>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t water removed (kWh of electricity consumption)</td><td>Name</td><td colspan="2">E bKPI L2 N1 specific electrical consumption per ton of water removed in dried fodder</td></tr>
<tr><td colspan="5">With this indicator, it is advisable to include, in addition, the annual average moisture content of the fodder at the beginning and at the end of the drying process. With this additional information it is possible to calculate the electrical energy necessary per ton of dried fodder.
The value of this electrical indicator is obviously different depending on the energy source of the process and the technology of heat generation. If heat is generated in a fuel boiler, electrical consumption usually includes fan operating to produce the warm air flow, and auxiliary processes.</td></tr>
<tr><td>Best or Average KPI</td><td colspan="2">Best</td><td colspan="2">KPI Value</td><td>40 kWh/t water removed (kWh of electricity consumption)</td></tr>
<tr><td>Source</td><td colspan="5">T. Kudra. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572
A. Pöllinger. 2014. Comparison of different hay drying techniques. International Conference of Agricultural Engineering, Ageng 2014, Zurich
http://www.geyseco.es/geystiona/adjs/comunicaciones/304/C07110001.pdf</td></tr>
</table>

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4.9. Electrical average KPI-61. Specific Electrical Consumption (SEC) in aspiration per ton of product.

INDICATOR	Specific Electrical Consumption (SEC) in aspiration per ton of product			
Sector (NACE code)	NACE 10.6	**Subsector**	All subsectors of drying	
Level of indicator	Process level (aspiration)			
	The indicator includes the electrical energy, consumed in this specific process of aspiration, necessary per ton of product. The indicator does not include auxiliary processes of the drying industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PT (kWh/t) where E represents the electrical energy consumption of the process (aspiration) in kWh, and PT designates the tons of product processed. This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies. Additionally, it is necessary to determine the tons of product processed in the period considered. Measurement periods must ensure representative results. The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).			
Upper Lever	Product level (all drying subsectors)			
Lower level	Equipment level			
Associated Variables	**Unit**	kWh/t dried product	**Name**	E aKPI L3 N1 specific electrical consumption in aspiration per ton of product
	This indicator depends on outside temperatures and other weather conditions, and on the temperatures required in the process.			
Best or Average KPI	Average	**KPI Value**	2 kWh/t	
Source	M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226 S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486 T. Kudra. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572 A. Pöllinger. 2014. Comparison of different hay drying techniques. International Conference of Agricultural Engineering. Ageng 2014. Zurich http://www.geyseco.es/geystiona/adjs/comunicaciones/304/C07110001.pdf			

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4.10. Electrical best KPI-62. Specific Electrical Consumption (SEC) in aspiration per ton of product.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) in aspiration per ton of product</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.6</td><td>Subsector</td><td colspan="2">All subsectors of drying</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Process level (aspiration)</td></tr>
<tr><td colspan="4">The indicator includes the electrical energy, consumed in this specific process of aspiration, necessary per ton of product. The indicator does not include auxiliary processes of the drying industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / PT (kWh/t)
where E represents the electrical energy consumption of the process (aspiration) in kWh, and PT designates the tons of product processed.
This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies. Additionally, it is necessary to determine the tons of product processed in the period considered. Measurement periods must ensure representative results.
The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Product level (all drying subsectors)</td></tr>
<tr><td>Lower level</td><td colspan="4">Equipment level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t dried product</td><td>Name</td><td>E bKPI L3 N1 specific electrical consumption in aspiration per ton of product</td></tr>
<tr><td colspan="4">This indicator depends on outside temperatures and other weather conditions, and on the temperatures required in the process.</td></tr>
<tr><td>Best or Average KPI</td><td>Best</td><td>KPI Value</td><td colspan="2">1 kWh/t</td></tr>
<tr><td>Source</td><td colspan="4">M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226
S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486
T. Kudra. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572
A. Pöllinger. 2014. Comparison of different hay drying techniques. International Conference of Agricultural Engineering, Ageng 2014, Zurich.
http://www.geyseco.es/geystiona/adjs/comunicaciones/304/C07110001.pdf</td></tr>
</table>

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4.11. Electrical average KPI-63. Specific Electrical Consumption (SEC) in handling per ton of product.

INDICATOR	Specific Electrical Consumption (SEC) in handling per ton of product			
Sector (NACE code)	NACE 10.6	**Subsector**	All subsectors of drying	
Level of indicator	Process level (handling)			
	The indicator includes the electrical energy, consumed in this specific process of handling, necessary per ton of product. The indicator does not include auxiliary processes of the drying industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PT (kWh/t) where E represents the electrical energy consumption of the process (handling) in kWh, and PT designates the tons of product processed. This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies. Additionally, it is necessary to determine the tons of product processed in the period considered. Measurement periods must ensure representative results. The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).			
Upper Lever	Product level (all drying subsectors)			
Lower level	Equipment level			
Associated Variables	**Unit**	kWh/t dried product	**Name**	E aKPI L3 N1 specific electrical consumption in handling per ton of product
	This indicator depends on outside temperatures and other weather conditions, and on the temperatures required in the process.			
Best or Average KPI	Average	**KPI Value**	2 kWh/t	
Source	M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226 S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486 T. Kudra. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572 A. Pöllinger. 2014. Comparison of different hay drying techniques. International Conference of Agricultural Engineering, Ageng 2014, Zurich. http://www.geyseco.es/geystiona/adjs/comunicaciones/304/C07110001.pdf			

4.12. Electrical best KPI-64. Specific Electrical Consumption (SEC) in handling per ton of product.

INDICATOR	Specific Electrical Consumption (SEC) in handling per ton of product			
Sector (NACE code)	NACE 10.6	**Subsector**	All subsectors of drying	
Level of indicator	Process level (handling)			
	The indicator includes the electrical energy, consumed in this specific process of handling, necessary per ton of product. The indicator does not include auxiliary processes of the drying industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PT (kWh/t) where E represents the electrical energy consumption of the process (handling) in kWh, and PT designates the tons of product processed. This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies. Additionally, it is necessary to determine the tons of product processed in the period considered. Measurement periods must ensure representative results. The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).			
Upper Lever	Product level (all drying subsectors)			
Lower level	Equipment level			
Associated Variables	**Unit**	kWh/t dried product	**Name**	E bKPI L3 N1 specific electrical consumption in handling per ton of product
	This indicator depends on outside temperatures and other weather conditions, and on the temperatures required in the process.			
Best or Average KPI	Best	**KPI Value**	1 kWh/t	
Source	M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226 S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486 T. Kudra. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572 A. Pöllinger. 2014. Comparison of different hay drying techniques. International Conference of Agricultural Engineering, Ageng 2014, Zurich http://www.geyseco.es/geystiona/adjs/comunicaciones/304/C07110001.pdf			

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4.13. Electrical average KPI-65. Specific Electrical Consumption (SEC) in ventilation per ton of product.

INDICATOR	Specific Electrical Consumption (SEC) in ventilation per ton of product			
Sector (NACE code)	NACE 10.6	**Subsector**	All subsectors of drying	
Level of indicator	Process level (ventilation)			
	The indicator includes the electrical energy, consumed in this specific process of ventilation, necessary per ton of product. The indicator does not include auxiliary processes of the drying industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PT (kWh/t) where E represents the electrical energy consumption of the process (ventilation) in kWh, and PT designates the tons of product processed. This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies. Additionally, it is necessary to determine the tons of product processed in the period considered. Measurement periods must ensure representative results. The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).			
Upper Lever	Product level (all drying subsectors)			
Lower level	Equipment level			
Associated Variables	**Unit**	kWh/t dried product	**Name**	E aKPI L3 N1 specific electrical consumption in ventilation per ton of product
	This indicator depends on outside temperatures and other weather conditions, and on the temperatures required in the process.			
Best or Average KPI	Average	**KPI Value**	4 kWh/t	
Source	M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226 S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486 T. Kudra. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572 A. Pöllinger. 2014. Comparison of different hay drying techniques. International Conference of Agricultural Engineering, Ageng 2014, Zurich http://www.geyseco.es/geystiona/adjs/comunicaciones/304/C07110001.pdf			

4.14. Electrical best KPI-66. Specific Electrical Consumption (SEC) in ventilation per ton of product.

INDICATOR	Specific Electrical Consumption (SEC) in ventilation per ton of product			
Sector (NACE code)	NACE 10.6	**Subsector**	All subsectors of drying	
Level of indicator	Process level (ventilation)			
	The indicator includes the electrical energy, consumed in this specific process of ventilation, necessary per ton of product. The indicator does not include auxiliary processes of the drying industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PT (kWh/t) where E represents the electrical energy consumption of the process (ventilation) in kWh, and PT designates the tons of product processed. This KPI usually requires specific measurements of electrical consumption of the process, unless these data are available in the industry. These measurements can be made with electrical energy analyzers or similar technologies. Additionally, it is necessary to determine the tons of product processed in the period considered. Measurement periods must ensure representative results. The methodology is based in experiments referred in the paper of Billiris and Siebenmorgen (2014).			
Upper Lever	Product level (all drying subsectors)			
Lower level	Equipment level			
Associated Variables	**Unit**	kWh/t dried product	**Name**	E bKPI L3 N1 specific electrical consumption in ventilation per ton of product
	This indicator depends on outside temperatures and other weather conditions, and on the temperatures required in the process.			
Best or Average KPI	Best	**KPI Value**	2 kWh/t	
Source	M.A. Billiris and T.J. Siebenmorgen. 2014. Energy use and efficiency of rice drying systems II. Commercial, cross-flow dryer measurements. Applied Engineering in Agriculture 30(2): 217-226 S. Gunasekaran and T.L. Thompson. 1986. Optimal energy management in grain drying. Critical Reviews in Food Science and Nutrition, 25(1), 1-486 T. Kudra. 2004. Energy aspects in drying. Drying Technology 2(5), 917-932. doi:http://dx.doi.org/10.1081/DRT-120038572 A. Pöllinger. 2014. Comparison of different hay drying techniques. International Conference of Agricultural Engineering, Ageng 2014, Zurich http://www.geyseco.es/geystiona/adjs/comunicaciones/304/C07110001.pdf			

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5. FRUIT AND VEGETABLES sector

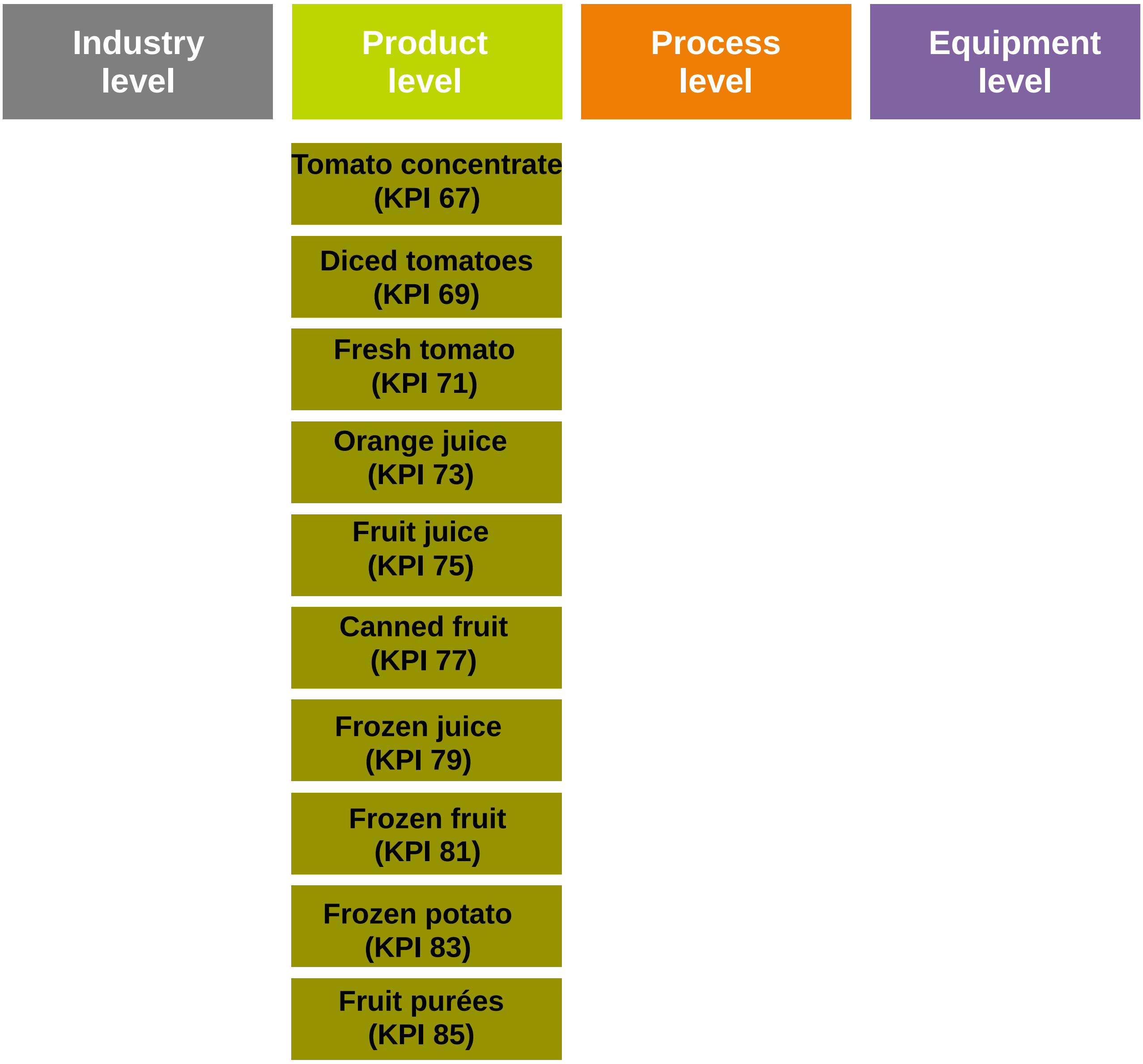

Figure 4. Scheme of the electric KPIs selected in the fruit and vegetables sector. For each of these KPIs, there is the "average KPI" version and the "best KPI" version.

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5.1. Electrical average KPI-67. Specific Electrical Consumption (SEC) per ton of tomato concentrate.

INDICATOR	Specific Electrical Consumption (SEC) per ton of tomato concentrate			
Sector (NACE code)	NACE 10.3	**Subsector**	Tomato concentrate	
Level of indicator	Product level (tomato concentrate) The indicator includes all the electricity necessary to produce a ton of tomato concentrate, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / TC (kWh/t) where E represents the annual electrical energy consumption (kWh), and TC designates the annual mass of tomato concentrate produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the tomato concentrate, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the tomato concentrate. Specific electrical requirement of tomato concentrate was already characterized in documents of the Extremadura energy agency in 2014, with values around 0.0131 toe/t (150 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L2 N4 specific electrical consumption per ton of tomato concentrate
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	150 kWh/t	
Source	Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf			

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5.2. Electrical best KPI-68. Specific Electrical Consumption (SEC) per ton of tomato concentrate.

<table>
<tr><td>INDICATOR</td><td colspan="5">Specific Electrical Consumption (SEC) per ton of tomato concentrate</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.3</td><td colspan="2">Subsector</td><td colspan="2">Tomato concentrate</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="5">Product level (tomato concentrate)</td></tr>
<tr><td colspan="5">The indicator includes all the electricity necessary to produce a ton of tomato concentrate, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="5">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="5">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="5">The SEC value is determined by the equation:
SEC = E / TC (kWh/t)
where E represents the annual electrical energy consumption (kWh), and TC designates the annual mass of tomato concentrate produced (t).
The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the tomato concentrate, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the tomato concentrate.
Specific electrical requirement of tomato concentrate was already characterized in documents of the Extremadura energy agency in 2014, with values around 0.0131 toe/t (150 kWh/t).</td></tr>
<tr><td>Upper Lever</td><td colspan="5">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="5">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t</td><td colspan="2">Name</td><td>E bKPI L2 N4 specific electrical consumption per ton of tomato concentrate</td></tr>
<tr><td colspan="5">This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.</td></tr>
<tr><td>Best or Average KPI</td><td colspan="2">Best</td><td colspan="2">KPI Value</td><td>100 kWh/t</td></tr>
<tr><td>Source</td><td colspan="5">Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency).
http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf</td></tr>
</table>

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5.3. Electrical average KPI-69. Specific Electrical Consumption (SEC) per ton of diced tomatoes.

INDICATOR	Specific Electrical Consumption (SEC) per ton of diced tomatoes			
Sector (NACE code)	NACE 10.3	**Subsector**	Tomato	
Level of indicator	Product level (diced tomatoes) The indicator includes all the electricity necessary to produce a ton of diced tomatoes, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / DT (kWh/t) where E represents the annual electrical energy consumption (kWh), and DT designates the annual mass of diced tomatoes produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the diced tomatoes, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the diced tomatoes. Specific electrical requirement of diced tomatoes was already characterized in documents of the Extremadura energy agency in 2014, with values around 0.0035 toe/t (40 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L2 N4 specific electrical consumption per ton of diced tomatoes
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	40 kWh/t	
Source	Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf			

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5.4. Electrical best KPI-70. Specific Electrical Consumption (SEC) per ton of diced tomatoes.

INDICATOR	Specific Electrical Consumption (SEC) per ton of diced tomatoes		
Sector (NACE code)	NACE 10.3	**Subsector**	Tomato
Level of indicator	Product level (diced tomatoes) The indicator includes all the electricity necessary to produce a ton of diced tomatoes, including auxiliary processes of the industry.		
Thermal or Electrical process	Electrical process		
Energy source	Any source		
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / DT (kWh/t) where E represents the annual electrical energy consumption (kWh), and DT designates the annual mass of diced tomatoes produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the diced tomatoes, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the diced tomatoes. Specific electrical requirement of diced tomatoes was already characterized in documents of the Extremadura energy agency in 2014, with values around 0.0035 toe/t (40 kWh/t).		
Upper Lever	Industry level		
Lower level	Process level		
Associated Variables	**Unit** | kWh/t | **Name** | E bKPI L2 N4 specific electrical consumption per ton of diced tomatoes This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.		
Best or Average KPI	Best	**KPI Value**	30 kWh/t
Source	Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf		

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5.5. Electrical average KPI-71. Specific Electrical Consumption (SEC) per ton of fresh tomato.

INDICATOR	Specific Electrical Consumption (SEC) per ton of fresh tomato
Sector (NACE code)	NACE 10.3 — **Subsector**: Tomato
Level of indicator	Product level (fresh tomato) The indicator includes all the electricity necessary to produce a ton of fresh tomato, including auxiliary processes of the industry.
Thermal or Electrical process	Electrical process
Energy source	Any source
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / FT (kWh/t) where E represents the annual electrical energy consumption (kWh), and FT designates the annual mass of fresh tomato produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the fresh tomato, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the fresh tomato. Specific electrical requirement of fresh tomato was already characterized in documents of the Extremadura energy agency in 2014, with values around 0.0024 toe/t (28 kWh/t).
Upper Lever	Industry level
Lower level	Process level
Associated Variables	**Unit**: kWh/t — **Name**: E aKPI L2 N4 specific electrical consumption per ton of fresh tomato This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.
Best or Average KPI	Average — **KPI Value**: 28 kWh/t
Source	Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf

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5.6. Electrical best KPI-72. Specific Electrical Consumption (SEC) per ton of fresh tomato.

INDICATOR	Specific Electrical Consumption (SEC) per ton of fresh tomato		
Sector (NACE code)	NACE 10.3	**Subsector**	Tomato
Level of indicator	Product level (fresh tomato) The indicator includes all the electricity necessary to produce a ton of fresh tomato, including auxiliary processes of the industry.		
Thermal or Electrical process	Electrical process		
Energy source	Any source		
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / FT (kWh/t) where E represents the annual electrical energy consumption (kWh), and FT designates the annual mass of fresh tomato produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the fresh tomato, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the fresh tomato. Specific electrical requirement of fresh tomato was already characterized in documents of the Extremadura energy agency in 2014, with values around 0.0024 toe/t (28 kWh/t).		
Upper Lever	Industry level		
Lower level	Process level		
Associated Variables	**Unit**	kWh/t	**Name**: E bKPI L2 N4 specific electrical consumption per ton of fresh tomato
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.		
Best or Average KPI	Best	**KPI Value**	20 kWh/t
Source	Eficiencia energética en empresas del sector agroalimentario (Energy efficiency in agri-food companies). 2014. Agencia extremeña de la energía (Extremadura energy agency). http://www.agenex.net/guias-altercexa/2_EF_ENERG_EN_EMPRESAS_DEL_SECTOR_AGROALIMENTARIO.pdf		

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5.7. Electrical average KPI-73. Specific Electrical Consumption (SEC) per ton of orange juice.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per ton of orange juice</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.3</td><td>Subsector</td><td colspan="2">Orange juices</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (orange juice)</td></tr>
<tr><td colspan="4">The indicator includes all the electricity necessary to produce a ton of orange juice, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / OJ (kWh/t)
where E represents the annual electrical energy consumption (kWh), and OJ designates the annual mass of orange juice produced (t).
The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the orange juice, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the orange juice.
Electrical requirement of several types of canned juice was already characterized in documents of the University of California in 2008, with values around 75 BTU/lb (48 kWh/t). Specific results for orange juice can be found in documents of the SENSE Project Number 288974, with values around 0.15 kWh/l (185 kWh/t) considering a density of 0.8 kg/l. Other studies for orange juice showed values around 60 kWh/t (Waheed et al., 2008).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t</td><td>Name</td><td>E aKPI L2 N4 specific electrical consumption per ton of orange juice</td></tr>
<tr><td colspan="4">This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">135 kWh/t</td></tr>
<tr><td>Source</td><td colspan="4">Harmonised Environmental Sustainability in the European food and drink chain. 2013. ESU-services Ltd. Document co-funded by European Commission within the Seventh Framework Programme, SENSE Project Number 288974.
M.A. Waheed, S.O. Jekayinfa, J.O. Ojediran, O.E. Imeokparia. 2008. Energetic analysis of fruit juice processing operations in Nigeria. Energy 33: 35–45
Energy Efficiency Improvement and Cost Saving Opportunities for the Fruit and Vegetable Processing Industry. 2008. Lawrence</td></tr>
</table>

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	Berkeley National Laboratory, University of California. https://www.energystar.gov/ia/business/industry/Food-Guide.pdf

5.8. Electrical best KPI-74. Specific Electrical Consumption (SEC) per ton of orange juice.

INDICATOR	Specific Electrical Consumption (SEC) per ton of orange juice			
Sector (NACE code)	NACE 10.3	**Subsector**	Orange juices	
Level of indicator	Product level (orange juice) The indicator includes all the electricity necessary to produce a ton of orange juice, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / OJ (kWh/t) where E represents the annual electrical energy consumption (kWh), and OJ designates the annual mass of orange juice produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the orange juice, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the orange juice. Electrical requirement of several types of canned juice was already characterized in documents of the University of California in 2008, with values around 75 BTU/lb (48 kWh/t). Specific results for orange juice can be found in documents of the SENSE Project Number 288974, with values around 0.15 kWh/l (185 kWh/t) considering a density of 0.8 kg/l. Other studies for orange juice showed values around 60 kWh/t (Waheed et al., 2008).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L2 N4 specific electrical consumption per ton of orange juice
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Best	**KPI Value**	60 kWh/t	
Source	Harmonised Environmental Sustainability in the European food and drink chain. 2013. ESU-services Ltd. Document co-funded by European Commission within the Seventh Framework Programme, SENSE Project Number 288974. M.A. Waheeda, S.O. Jekayinfab, J.O. Ojediranb, O.E. Imeokparia. 2008. Energetic analysis of fruit juice processing operations in Nigeria. Energy 33: 35–45 Energy Efficiency Improvement and Cost Saving Opportunities			

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	for the Fruit and Vegetable Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California. https://www.energystar.gov/ia/business/industry/Food-Guide.pdf

5.9. Electrical average KPI-75. Specific Electrical Consumption (SEC) per ton of fruit juice.

INDICATOR	Specific Electrical Consumption (SEC) per ton of fruit juice			
Sector (NACE code)	NACE 10.3	**Subsector**	Fruit juices	
Level of indicator	Product level (fruit juice) The indicator includes all the electricity necessary to produce a ton of fruit juice, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / CJ (kWh/t) where E represents the annual electrical energy consumption (kWh), and CJ designates the annual mass of fruit juice produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the fruit juice, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the fruit juice. Specific electrical requirement of fruit juice was already characterized in documents of the University of California in 2008, with values around 75 BTU/lb (48 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L2 N4 specific electrical consumption per ton of fruit juice
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	48 kWh/t	
Source	Energy Efficiency Improvement and Cost Saving Opportunities for the Fruit and Vegetable Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California. https://www.energystar.gov/ia/business/industry/Food-Guide.pdf			

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5.10. Electrical best KPI-76. Specific Electrical Consumption (SEC) per ton of fruit juice.

INDICATOR	Specific Electrical Consumption (SEC) per ton of fruit juice			
Sector (NACE code)	NACE 10.3	**Subsector**	Fruit juices	
Level of indicator	Product level (fruit juice)			
	The indicator includes all the electricity necessary to produce a ton of fruit juice, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / CJ (kWh/t) where E represents the annual electrical energy consumption (kWh), and CJ designates the annual mass of fruit juice produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the fruit juice, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the fruit juice. Specific electrical requirement of fruit juice was already characterized in documents of the University of California in 2008, with values around 75 BTU/lb (48 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E bKPI L2 N4 specific electrical consumption per ton of fruit juice
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Best	**KPI Value**	30 kWh/t	
Source	Energy Efficiency Improvement and Cost Saving Opportunities for the Fruit and Vegetable Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California. https://www.energystar.gov/ia/business/industry/Food-Guide.pdf			

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5.11. Electrical average KPI-77. Specific Electrical Consumption (SEC) per ton of canned fruit (or vegetable).

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per ton of canned fruit (or vegetable)</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.3</td><td>Subsector</td><td colspan="2">Canned F&V</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (canned fruit)</td></tr>
<tr><td colspan="4">The indicator includes all the electricity necessary to produce a ton of canned fruit (or vegetable), including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / CF (kWh/t)
where E represents the annual electrical energy consumption (kWh), and CF designates the annual mass of canned fruit (or vegetable) produced (t).
The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the canned fruit (or vegetable), or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the canned fruit.
Specific electrical requirement of canned fruit was already characterized in documents of the University of California in 2008, with values around 87 BTU/lb (56 kWh/t).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t</td><td>Name</td><td>E aKPI L2 N4 specific electrical consumption per ton of canned fruit (or vegetable)</td></tr>
<tr><td colspan="4">This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">56 kWh/t</td></tr>
<tr><td>Source</td><td colspan="4">Energy Efficiency Improvement and Cost Saving Opportunities for the Fruit and Vegetable
Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California.
https://www.energystar.gov/ia/business/industry/Food-Guide.pdf</td></tr>
</table>

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5.12. Electrical best KPI-78. Specific Electrical Consumption (SEC) per ton of canned fruit (or vegetable).

INDICATOR	Specific Electrical Consumption (SEC) per ton of canned fruit (or vegetable)			
Sector (NACE code)	NACE 10.3	**Subsector**	Canned F&V	
Level of indicator	Product level (canned fruit)			
	The indicator includes all the electricity necessary to produce a ton of canned fruit (or vegetable), including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / CF (kWh/t) where E represents the annual electrical energy consumption (kWh), and CF designates the annual mass of canned fruit (or vegetable) produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the canned fruit (or vegetable), or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the canned fruit. Specific electrical requirement of canned fruit was already characterized in documents of the University of California in 2008, with values around 87 BTU/lb (56 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E bKPI L2 N4 specific electrical consumption per ton of canned fruit (or vegetable)
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Best	**KPI Value**	40 kWh/t	
Source	Energy Efficiency Improvement and Cost Saving Opportunities for the Fruit and Vegetable Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California. https://www.energystar.gov/ia/business/industry/Food-Guide.pdf			

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5.13. Electrical average KPI-79. Specific Electrical Consumption (SEC) per ton of frozen concentrated juice.

INDICATOR	Specific Electrical Consumption (SEC) per ton of frozen concentrated juice			
Sector (NACE code)	NACE 10.3	**Subsector**	Frozen concentrate juice	
Level of indicator	Product level (frozen concentrated juice)			
	The indicator includes all the electricity necessary to produce a ton of frozen concentrated juice, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: $SEC = E / FCJ$ (kWh/t) where E represents the annual electrical energy consumption (kWh), and FCJ designates the annual mass of frozen concentrated juice produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the frozen concentrated juice, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the frozen concentrated juice. Specific electrical requirement of frozen concentrated juice was already characterized in documents of the University of California in 2008, with values around 800 BTU/lb (515 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L2 N4 specific electrical consumption per ton of frozen concentrated juice
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	515 kWh/t	
Source	Energy Efficiency Improvement and Cost Saving Opportunities for the Potato and Vegetable Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California. https://www.energystar.gov/ia/business/industry/Food-Guide.pdf			

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5.14. Electrical best KPI-80. Specific Electrical Consumption (SEC) per ton of frozen concentrated juice.

<table>
<tr><td>INDICATOR</td><td colspan="5">Specific Electrical Consumption (SEC) per ton of frozen concentrated juice</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.3</td><td>Subsector</td><td colspan="3">Frozen concentrate juice</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="5">Product level (frozen concentrated juice)</td></tr>
<tr><td colspan="5">The indicator includes all the electricity necessary to produce a ton of frozen concentrated juice, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="5">Electrical process</td></tr>
<tr><td>Energy source</td><td colspan="5">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="5">The SEC value is determined by the equation:
SEC = E / FCJ (kWh/t)
where E represents the annual electrical energy consumption (kWh), and FCJ designates the annual mass of frozen concentrated juice produced (t).
The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the frozen concentrated juice, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the frozen concentrated juice.
Specific electrical requirement of frozen concentrated juice was already characterized in documents of the University of California in 2008, with values around 800 BTU/lb (515 kWh/t).</td></tr>
<tr><td>Upper Lever</td><td colspan="5">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="5">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t</td><td>Name</td><td colspan="2">E bKPI L2 N4 specific electrical consumption per ton of frozen concentrated juice</td></tr>
<tr><td colspan="5">This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.</td></tr>
<tr><td>Best or Average KPI</td><td colspan="2">Best</td><td colspan="2">KPI Value</td><td>400 kWh/t</td></tr>
<tr><td>Source</td><td colspan="5">Energy Efficiency Improvement and Cost Saving Opportunities for the Potato and Vegetable Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California.
https://www.energystar.gov/ia/business/industry/Food-Guide.pdf</td></tr>
</table>

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5.15. Electrical average KPI-81. Specific Electrical Consumption (SEC) per ton of frozen fruit.

INDICATOR	Specific Electrical Consumption (SEC) per ton of frozen fruit			
Sector (NACE code)	NACE 10.3	**Subsector**	Frozen fruit	
Level of indicator	Product level (frozen fruit)			
	The indicator includes all the electricity necessary to produce a ton of frozen fruit, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / FF (kWh/t) where E represents the annual electrical energy consumption (kWh), and FF designates the annual mass of frozen fruit produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the frozen fruit, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the frozen fruit. Specific electrical requirement of frozen fruit was already characterized in documents of the University of California in 2008, with values around 650 BTU/lb (420 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L2 N4 specific electrical consumption per ton of frozen fruit
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	420 kWh/t	
Source	Energy Efficiency Improvement and Cost Saving Opportunities for the Fruit and Vegetable Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California. https://www.energystar.gov/ia/business/industry/Food-Guide.pdf			

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5.16. Electrical best KPI-82. Specific Electrical Consumption (SEC) per ton of frozen fruit.

INDICATOR	Specific Electrical Consumption (SEC) per ton of frozen fruit			
Sector (NACE code)	NACE 10.3	**Subsector**	Frozen fruit	
Level of indicator	Product level (frozen fruit)			
	The indicator includes all the electricity necessary to produce a ton of frozen fruit, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / FF (kWh/t) where E represents the annual electrical energy consumption (kWh), and FF designates the annual mass of frozen fruit produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the frozen fruit, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the frozen fruit. Specific electrical requirement of frozen fruit was already characterized in documents of the University of California in 2008, with values around 650 BTU/lb (420 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E bKPI L2 N4 specific electrical consumption per ton of frozen fruit
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Best	**KPI Value**	300 kWh/t	
Source	Energy Efficiency Improvement and Cost Saving Opportunities for the Fruit and Vegetable Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California. https://www.energystar.gov/ia/business/industry/Food-Guide.pdf			

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5.17. Electrical average KPI-83. Specific Electrical Consumption (SEC) per ton of frozen potato.

INDICATOR	Specific Electrical Consumption (SEC) per ton of frozen potato			
Sector (NACE code)	NACE 10.3	**Subsector**	Frozen potato	
Level of indicator	Product level (frozen potato)			
	The indicator includes all the electricity necessary to produce a ton of frozen potato, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / FP (kWh/t) where E represents the annual electrical energy consumption (kWh), and FP designates the annual mass of frozen potato produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the frozen potato, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the frozen potato. Specific electrical requirement of frozen potato was already characterized in documents of the University of California in 2008, with values around 635 BTU/lb (410 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L2 N4 specific electrical consumption per ton of frozen potato
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	410 kWh/t	
Source	Energy Efficiency Improvement and Cost Saving Opportunities for the Potato and Vegetable Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California. https://www.energystar.gov/ia/business/industry/Food-Guide.pdf			

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5.18. Electrical best KPI-84. Specific Electrical Consumption (SEC) per ton of frozen potato.

INDICATOR	Specific Electrical Consumption (SEC) per ton of frozen potato			
Sector (NACE code)	NACE 10.3	**Subsector**	Frozen potato	
Level of indicator	Product level (frozen potato) The indicator includes all the electricity necessary to produce a ton of frozen potato, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / FP (kWh/t) where E represents the annual electrical energy consumption (kWh), and FP designates the annual mass of frozen potato produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the frozen potato, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the frozen potato. Specific electrical requirement of frozen potato was already characterized in documents of the University of California in 2008, with values around 635 BTU/lb (410 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E bKPI L2 N4 specific electrical consumption per ton of frozen potato
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Best	**KPI Value**	300 kWh/t	
Source	Energy Efficiency Improvement and Cost Saving Opportunities for the Potato and Vegetable Processing Industry. 2008. Lawrence Berkeley National Laboratory, University of California. https://www.energystar.gov/ia/business/industry/Food-Guide.pdf			

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5.19. Electrical average KPI-85. Specific Electrical Consumption (SEC) per ton of fruit purées.

INDICATOR	Specific Electrical Consumption (SEC) per ton of fruit purées			
Sector (NACE code)	NACE 10.3	**Subsector**	Fruit purées	
Level of indicator	Product level (fruit purées) The indicator includes all the electricity necessary to produce a ton of fruit purées, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical process			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / FP (kWh/t) where E represents the annual electrical energy consumption (kWh), and FP designates the annual mass of fruit purées produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the fruit purées, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the fruit purées. Specific electrical requirement of fruit purées was already characterized in documents of the Northwest Food Processors Association in 2010, with values around 1850 BTU/lb (1200 kWh/t).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t	**Name**	E aKPI L2 N4 specific electrical consumption per ton of fruit purées
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.			
Best or Average KPI	Average	**KPI Value**	1200 kWh/t	
Source	Energy Intensity Baseline of the Northwest Food Processing Industry. 2010. Northwest Food Processors Association. http://www.nwfpa.org/_legacy/images/pdfs/energy_intensity_nwfp_industry.pdf			

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5.20. Electrical best KPI-86. Specific Electrical Consumption (SEC) per ton of fruit purées.

INDICATOR	Specific Electrical Consumption (SEC) per ton of fruit purées		
Sector (NACE code)	NACE 10.3	**Subsector**	Fruit purées
Level of indicator	Product level (fruit purées) The indicator includes all the electricity necessary to produce a ton of fruit purées, including auxiliary processes of the industry.		
Thermal or Electrical process	Electrical process		
Energy source	Any source		
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / FP (kWh/t) where E represents the annual electrical energy consumption (kWh), and FP designates the annual mass of fruit purées produced (t). The global electrical energy consumption of the industry can be obtained from the electrical bill of the industry. If several products are included, it is necessary to disaggregate the annual electrical consumption of the fruit purées, or to take measurements of this specific consumption over a representative period, to extrapolate the consumption of the fruit purées. Specific electrical requirement of fruit purées was already characterized in documents of the Northwest Food Processors Association in 2010, with values around 1850 BTU/lb (1200 kWh/t).		
Upper Lever	Industry level		
Lower level	Process level		
Associated Variables	**Unit**	kWh/t	**Name**: E bKPI L2 N4 specific electrical consumption per ton of fruit purées
	This SEC usually depends on the size of the industry. Big facilities normally show lower values of specific electrical consumption.		
Best or Average KPI	Best	**KPI Value**	800 kWh/t
Source	Energy Intensity Baseline of the Northwest Food Processing Industry. 2010. Northwest Food Processors Association. http://www.nwfpa.org/_legacy/images/pdfs/energy_intensity_nwfp_industry.pdf		

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6. MEAT AND POULTRY sector

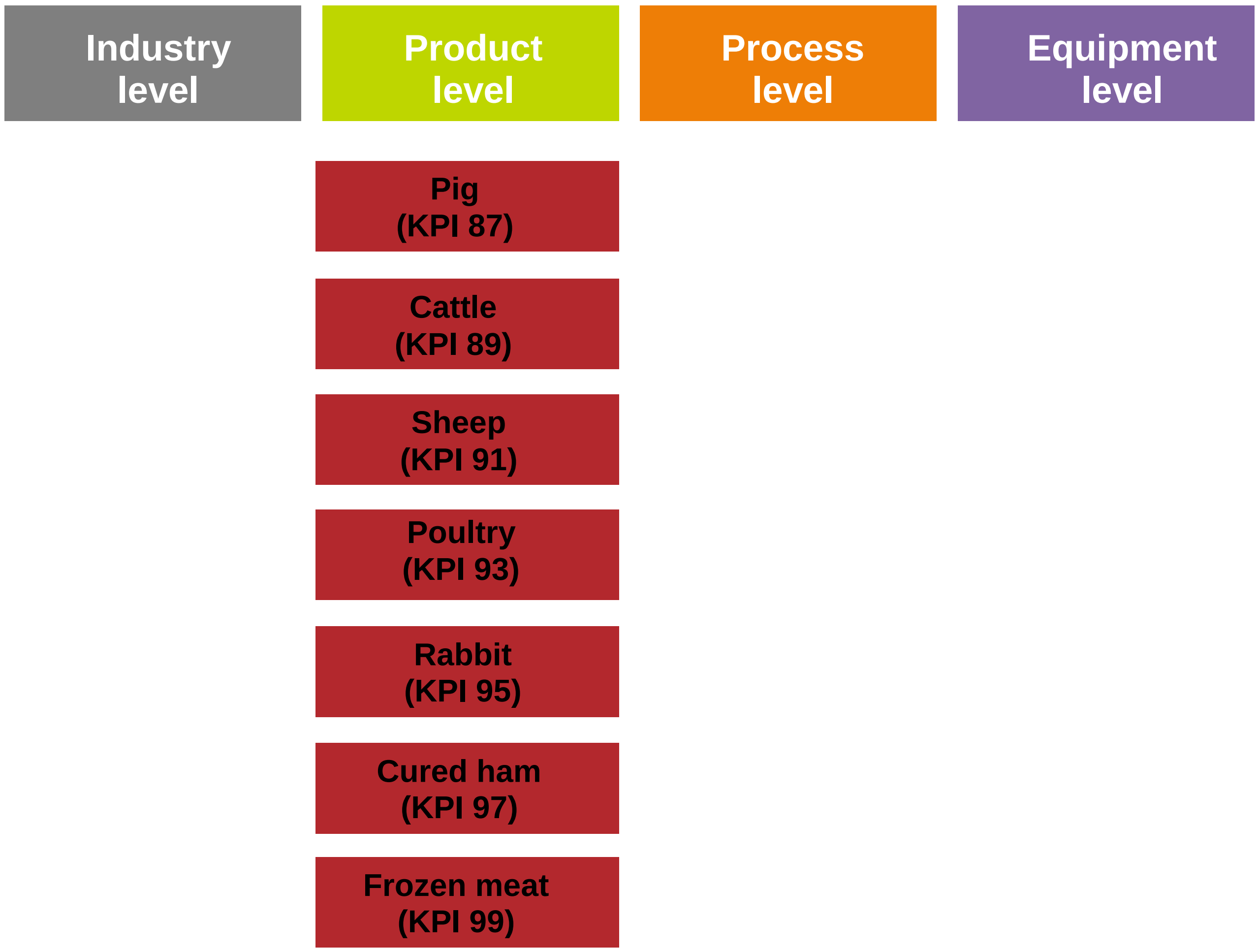

Figure 5. Scheme of the electric KPIs selected in the meat sector. For each of these KPIs, there is the “average KPI” version and the “best KPI” version.

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6.1. Electrical average KPI-87. Specific Electrical Consumption (SEC) per carcass ton of pig.

INDICATOR	Specific Electrical Consumption (SEC) per carcass ton of pig
Sector (NACE code)	NACE 10.1 | **Subsector** | Pig slaughtering
Level of indicator	Product level (pig) The indicator includes all the electricity necessary to produce a ton of carcass, including auxiliary processes of the industry.
Thermal or Electrical process	Electrical process
Energy source	Any source
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PC (kWh/t) where E represents the annual electrical energy consumption (kWh), and PC designates the annual tons of pig carcass produced (t). The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of pig carcass, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of pig carcass. Annual production (tons of carcass) is obtained from industry recordings. The methodology is based in audits referred in the paper of Nunes et al. (2016).
Upper Lever	Industry level
Lower level	Process level
Associated Variables	**Unit** | kWh/t carcass | **Name** | E aKPI L2 N2 specific electrical consumption per carcass ton of pig The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.
Best or Average KPI	Average | **KPI Value** | 155 kWh/t carcass
Source	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411

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6.2. Electrical best KPI-88. Specific Electrical Consumption (SEC) per carcass ton of pig.

INDICATOR	Specific Electrical Consumption (SEC) per carcass ton of pig			
Sector (NACE code)	NACE 10.1	**Subsector**	Pig slaughtering	
Level of indicator	Product level (pig)			
	The indicator includes all the electricity necessary to produce a ton of carcass, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PC (kWh/t) where E represents the annual electrical energy consumption (kWh), and PC designates the annual tons of pig carcass produced (t). The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of pig carcass, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of pig carcass. Annual production (tons of carcass) is obtained from industry recordings. The methodology is based in audits referred in the paper of Nunes et al. (2016).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t carcass	**Name**	E bKPI L2 N2 specific electrical consumption per carcass ton of pig
	The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.			
Best or Average KPI	Best	**KPI Value**	36 kWh/t carcass	
Source	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411			

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6.3. Electrical average KPI-89. Specific Electrical Consumption (SEC) per carcass ton of cattle.

INDICATOR	Specific Electrical Consumption (SEC) per carcass ton of cattle			
Sector (NACE code)	NACE 10.1	**Subsector**	Cattle slaughtering	
Level of indicator	Product level (cattle) The indicator includes all the electricity necessary to produce a ton of carcass, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / BC (kWh/t) where E represents the annual electrical energy consumption (kWh), and BC designates the annual tons of cattle carcass produced (t). The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of cattle carcass, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of cattle carcass. Annual production (tons of carcass) is obtained from industry recordings. The methodology is based in audits referred in the paper of Nunes et al. (2016).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t carcass	**Name**	E aKPI L2 N2 specific electrical consumption per carcass ton of cattle
	The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.			
Best or Average KPI	Average	**KPI Value**	150 kWh/t carcass	
Source	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016 . Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411			

6.4. Electrical best KPI-90. Specific Electrical Consumption (SEC) per carcass ton of cattle.

INDICATOR	Specific Electrical Consumption (SEC) per carcass ton of cattle
Sector (NACE code)	NACE 10.1 — **Subsector**: Cattle slaughtering
Level of indicator	Product level (cattle) The indicator includes all the electricity necessary to produce a ton of carcass, including auxiliary processes of the industry.
Thermal or Electrical process	Electrical
Energy source	Any source
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / BC (kWh/t) where E represents the annual electrical energy consumption (kWh), and BC designates the annual tons of cattle carcass produced (t). The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of cattle carcass, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of cattle carcass. Annual production (tons of carcass) is obtained from industry recordings. The methodology is based in audits referred in the paper of Nunes et al. (2016).
Upper Lever	Industry level
Lower level	Process level
Associated Variables	**Unit**: kWh/t carcass — **Name**: E bKPI L2 N2 specific electrical consumption per carcass ton of cattle The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.
Best or Average KPI	Best — **KPI Value**: 36 kWh/t carcass
Source	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016 . Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411

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6.5. Electrical average KPI-91. Specific Electrical Consumption (SEC) per carcass ton of sheep.

INDICATOR	Specific Electrical Consumption (SEC) per carcass ton of sheep			
Sector (NACE code)	NACE 10.1	**Subsector**	Sheep slaughtering	
Level of indicator	Product level (sheep) The indicator includes all the electrical energy necessary to produce a ton of carcass, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / LC (kWh/t) where E represents the annual electrical energy consumption (kWh), and LC designates the annual tons of sheep carcass produced (t). The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of sheep carcass, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of sheep carcass. Annual production (tons of carcass) is obtained from industry recordings. The methodology is based in audits referred in the paper of Nunes et al. (2016).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t carcass	**Name**	E aKPI L2 N2 specific electrical consumption per carcass ton of sheep
	The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.			
Best or Average KPI	Average	**KPI Value**	155 kWh/t carcass	
Source	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411			

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6.6. Electrical best KPI-92. Specific Electrical Consumption (SEC) per carcass ton of sheep.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per carcass ton of sheep</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.1</td><td>Subsector</td><td colspan="2">Sheep slaughtering</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (sheep)</td></tr>
<tr><td colspan="4">The indicator includes all the electrical energy necessary to produce a ton of carcass, including auxiliary processes of the industry.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / LC (kWh/t)
where E represents the annual electrical energy consumption (kWh), and LC designates the annual tons of sheep carcass produced (t).
The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of sheep carcass, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of sheep carcass. Annual production (tons of carcass) is obtained from industry recordings.
The methodology is based in audits referred in the paper of Nunes et al. (2016).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t carcass</td><td>Name</td><td>E bKPI L2 N2 specific electrical consumption per carcass ton of sheep</td></tr>
<tr><td colspan="4">The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.</td></tr>
<tr><td>Best or Average KPI</td><td>Best</td><td>KPI Value</td><td colspan="2">36 kWh/t carcass</td></tr>
<tr><td>Source</td><td colspan="4">J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411</td></tr>
</table>

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6.7. Electrical average KPI-93. Specific Electrical Consumption (SEC) per carcass ton of poultry.

INDICATOR	Specific Electrical Consumption (SEC) per carcass ton of poultry			
Sector (NACE code)	NACE 10.1	**Subsector**	Poultry slaughtering	
Level of indicator	Product level (poultry)			
	The indicator includes all the electricity necessary to produce a ton of carcass, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PC (kWh/t) where E represents the annual electrical energy consumption (kWh), and PC designates the annual tons of poultry carcass produced (t). The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of poultry carcass, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of poultry carcass. Annual production (tons of carcass) is obtained from industry recordings. The methodology is based in audits referred in the paper of Nunes et al. (2016). There are values of reference in the study "Guía de la producción limpia para el Sector de matadero y transformación de carne avícola de la Comunidad Valenciana", IMPIVA, 2009.			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t carcass	**Name**	E aKPI L2 N2 specific electrical consumption per carcass ton of poultry
	The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.			
Best or Average KPI	Average	**KPI Value**	100 kWh/t carcass	
Source	IMPIVA. 2009. Guía de la producción limpia para el Sector de matadero y transformación de carne avícola de la Comunidad Valenciana. J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016 . Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411			

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6.8. Electrical best KPI-94. Specific Electrical Consumption (SEC) per carcass ton of poultry.

INDICATOR	Specific Electrical Consumption (SEC) per carcass ton of poultry			
Sector (NACE code)	NACE 10.1	**Subsector**	Poultry slaughtering	
Level of indicator	Product level (poultry)			
	The indicator includes all the electricity necessary to produce a ton of carcass, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PC (kWh/t) where E represents the annual electrical energy consumption (kWh), and PC designates the annual tons of poultry carcass produced (t). The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of poultry carcass, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of poultry carcass. Annual production (tons of carcass) is obtained from industry recordings. The methodology is based in audits referred in the paper of Nunes et al. (2016). There are values of reference in the study "Guía de la producción limpia para el Sector de matadero y transformación de carne avícola de la Comunidad Valenciana", IMPIVA, 2009.			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t carcass	**Name**	E bKPI L2 N2 specific electrical consumption per carcass ton of poultry
	The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.			
Best or Average KPI	Best	**KPI Value**	60 kWh/t carcass	
Source	IMPIVA. 2009. Guía de la producción limpia para el Sector de matadero y transformación de carne avícola de la Comunidad Valenciana. J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411			

6.9. Electrical average KPI-95. Specific Electrical Consumption (SEC) per carcass ton of rabbit.

INDICATOR	Specific Electrical Consumption (SEC) per carcass ton of rabbit			
Sector (NACE code)	NACE 10.1	**Subsector**	Rabbit slaughtering	
Level of indicator	Product level (rabbit) The indicator includes all the electricity necessary to produce a ton of carcass, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PC (kWh/t) where E represents the annual electrical energy consumption (kWh), and PC designates the annual tons of rabbit carcass produced (t). The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of rabbit carcass, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of rabbit carcass. Annual production (tons of carcass) is obtained from industry recordings. The methodology is based in audits referred in the paper of Nunes et al. (2016).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t carcass	**Name**	E aKPI L2 N2 specific electrical consumption per carcass ton of rabbit
	The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.			
Best or Average KPI	Average	**KPI Value**	100 kWh/t carcass	
	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016 . Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411			

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6.10. Electrical best KPI-96. Specific Electrical Consumption (SEC) per carcass ton of rabbit.

INDICATOR	Specific Electrical Consumption (SEC) per carcass ton of rabbit			
Sector (NACE code)	NACE 10.1	**Subsector**	Rabbit slaughtering	
Level of indicator	Product level (rabbit)			
	The indicator includes all the electricity necessary to produce a ton of carcass, including auxiliary processes of the industry.			
Thermal or Electrical process	Electrical			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / PC (kWh/t) where E represents the annual electrical energy consumption (kWh), and PC designates the annual tons of rabbit carcass produced (t). The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of rabbit carcass, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of rabbit carcass. Annual production (tons of carcass) is obtained from industry recordings. The methodology is based in audits referred in the paper of Nunes et al. (2016).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t carcass	**Name**	E bKPI L2 N2 specific electrical consumption per carcass ton of rabbit
	The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.			
Best or Average KPI	Best	**KPI Value**	60 kWh/t carcass	
	J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry. Renewable and Sustainable Energy Reviews 57: 393–411			

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6.11. Electrical average KPI-97. Specific Electrical Consumption (SEC) per ton of cured ham.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per ton of cured ham</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.1</td><td>Subsector</td><td colspan="2">Cured ham production</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (cured ham)</td></tr>
<tr><td colspan="4">The indicator includes all the electrical energy necessary to produce a ton of cured ham, including auxiliary processes of the industry, such as meat defrosting before starting curing process.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / CH (kWh/t)
where E represents the annual electrical energy consumption (kWh), and CH designates the annual tons of cured ham produced (t).
The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of cured ham, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of cured ham.
Annual production (tons) is obtained from industry recordings.
The methodology is based in audits referred in the paper of Nunes et al. (2016).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t cured ham</td><td>Name</td><td>E aKPI L2 N2 specific electrical consumption per ton of cured ham</td></tr>
<tr><td colspan="4">The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.</td></tr>
<tr><td>Best or Average KPI</td><td>Average</td><td>KPI Value</td><td colspan="2">500 kWh/t cured ham</td></tr>
<tr><td>Source</td><td colspan="4">J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese ham industry. Renewable and Sustainable Energy Reviews 57: 393–411</td></tr>
</table>

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6.12. Electrical best KPI-98. Specific Electrical Consumption (SEC) per ton of cured ham.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per ton of cured ham</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.1</td><td>Subsector</td><td colspan="2">Cured ham production</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (cured ham)</td></tr>
<tr><td colspan="4">The indicator includes all the electrical energy necessary to produce a ton of cured ham, including auxiliary processes of the industry, such as meat defrosting before starting curing process.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / CH (kWh/t)
where E represents the annual electrical energy consumption (kWh), and CH designates the annual tons of cured ham produced (t).
The annual electrical energy consumption is obtained from the electrical bill of the industry. If the industry includes other processes different from the production of cured ham, it is necessary to disaggregate the consumption by sector, and to assign a value of consumption to the production of cured ham.
Annual production (tons) is obtained from industry recordings.
The methodology is based in audits referred in the paper of Nunes et al. (2016).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t cured ham</td><td>Name</td><td>E bKPI L2 N2 specific electrical consumption per ton of cured ham</td></tr>
<tr><td colspan="4">The size of the industry influences the ratio. This indicator is usually higher in small industries than in big industries.</td></tr>
<tr><td>Best or Average KPI</td><td>Best</td><td>KPI Value</td><td colspan="2">300 kWh/t cured ham</td></tr>
<tr><td>Source</td><td colspan="4">J. Nunes, P.D. Silva, L.P. Andrade and P.D. Gaspar. 2016. Key points on the energy sustainable development of the food industry – Case study of the Portuguese ham industry. Renewable and Sustainable Energy Reviews 57: 393–411</td></tr>
</table>

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6.13. Electrical average KPI-99. Specific Electrical Consumption (SEC) per ton of frozen meat.

INDICATOR	Specific Electrical Consumption (SEC) per ton of frozen meat			
Sector (NACE code)	NACE 10.1	**Subsector**	Frozen meat production	
Level of indicator	Product level (frozen meat)			
	The indicator includes the electrical energy necessary to produce a ton of frozen meat, from carcass. So the basic processes considered in this indicator are cutting, deboning and freezing, and the auxiliary processes involved.			
Thermal or Electrical process	Electrical			
Energy source	Any source			
Description of the INDICATOR	The SEC value is determined by the equation: SEC = E / FM (kWh/t) where E represents the annual electrical energy consumption (kWh) of cutting, deboning, freezing and the auxiliary processes involved, and FM designates the annual tons of frozen meat produced (t). The annual electrical energy consumption is obtained from the electrical bill of the industry. Annual production (tons) is obtained from industry recordings. The methodology is based in the work referred in the paper of Ramírez et al. (2006).			
Upper Lever	Industry level			
Lower level	Process level			
Associated Variables	**Unit**	kWh/t of finished product (boneless cut frozen meat)	**Name**	E aKPI L2 N2 specific electrical consumption per ton of frozen meat
	As KPI is given in tons of finished product, we use the following carcass cutting yields to convert kilograms of boneless cut meat to dress carcass weight: 1.53 for cattle, 1.37 for pork and 1.8 for poultry. Note that frozen poultry products demand more energy not only because of higher refrigeration requirements but also because the meat is submitted to higher temperatures during scalding.			

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Best or Average KPI	Average	**KPI Value**	Electrical consumption (cutting and deboning): 60 kWh/t finished product (cattle, pig and poultry) Electrical consumption (freezing process): 300 kWh/t finished product (frozen cattle meat) 400 kWh/t finished product (frozen pig meat) 900 kWh/t finished product (frozen poultry meat)
Source	C.A. Ramirez, M. Patel, K. Blok. 2006. How much energy to process one pound of meat? A comparison of energy use and specific energy consumption in the meat industry of four European countries. Energy 31: 2047–2063 M. Swain. 2008. Energy use in food refrigeration. Calculations, assumptions and data sources. FRPERC JOB NO. 2006013, University of Bristol, UK		

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6.14. Electrical best KPI-100. Specific Electrical Consumption (SEC) per ton of frozen meat.

<table>
<tr><td>INDICATOR</td><td colspan="4">Specific Electrical Consumption (SEC) per ton of frozen meat</td></tr>
<tr><td>Sector (NACE code)</td><td>NACE 10.1</td><td>Subsector</td><td colspan="2">Frozen meat production</td></tr>
<tr><td rowspan="2">Level of indicator</td><td colspan="4">Product level (frozen meat)</td></tr>
<tr><td colspan="4">The indicator includes the electrical energy necessary to produce a ton of frozen meat, from carcass. So the basic processes considered in this indicator are cutting, deboning and freezing, and the auxiliary processes involved.</td></tr>
<tr><td>Thermal or Electrical process</td><td colspan="4">Electrical</td></tr>
<tr><td>Energy source</td><td colspan="4">Any source</td></tr>
<tr><td>Description of the INDICATOR</td><td colspan="4">The SEC value is determined by the equation:
SEC = E / FM (kWh/t)
where E represents the annual electrical energy consumption (kWh) of cutting, deboning, freezing and the auxiliary processes involved, and FM designates the annual tons of frozen meat produced (t).

The annual electrical energy consumption is obtained from the electrical bill of the industry. Annual production (tons) is obtained from industry recordings.
The methodology is based in the work referred in the paper of Ramírez et al. (2006).</td></tr>
<tr><td>Upper Lever</td><td colspan="4">Industry level</td></tr>
<tr><td>Lower level</td><td colspan="4">Process level</td></tr>
<tr><td rowspan="2">Associated Variables</td><td>Unit</td><td>kWh/t of finished product (boneless cut frozen meat)</td><td>Name</td><td>E aKPI L2 N2 specific electrical consumption per ton of frozen meat</td></tr>
<tr><td colspan="4">As data is given in tons of finished product, we use the following carcass cutting yields to convert kilograms of boneless cut meat to dress carcass weight: 1.53 for cattle, 1.37 for pork and 1.8 for poultry.

Note that frozen poultry products demand more energy not only because of higher refrigeration requirements but also because the meat is submitted to higher temperatures during scalding.</td></tr>
</table>

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Best or Average KPI	Best	**KPI Value**	Electrical consumption (cutting and deboning): 50 kWh/t finished product (cattle, pig and poultry) Electrical consumption (frozing process): 250 kWh/t finished product (frozen cattle meat) 350 kWh/t finished product (frozen pig meat) 800 kWh/t finished product (frozen poultry meat)
Source	C.A. Ramirez, M. Patel, K. Blok. 2006. How much energy to process one pound of meat? A comparison of energy use and specific energy consumption in the meat industry of four European countries. Energy 31: 2047–2063 M. Swain. 2008. Energy use in food refrigeration. Calculations, assumptions and data sources. FRPERC JOB NO. 2006013, University of Bristol, UK		

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