



# Energy efficiency in the agri-food industry: the results of EU-MERCI project and the technical validation of the good practices selected

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# Agenda



### *Energy Efficiency opportunities in the Agri-Food Sector: a success case in using efficient refrigeration systems*

- Plant Energy Analysis
  - Context
  - Results
- Technical-economic feasibility study
- Energy saving intervention implementation
- Incentives obtained

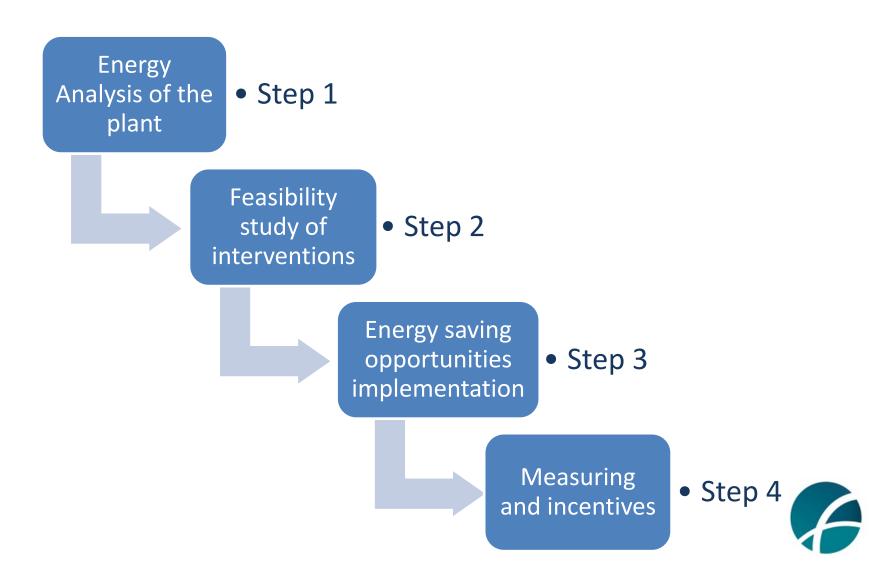




Project road map



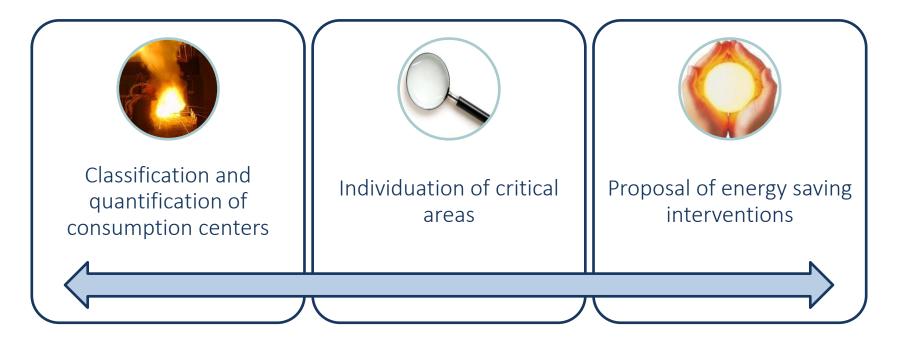
### Integrated approach towards Energy Efficiency







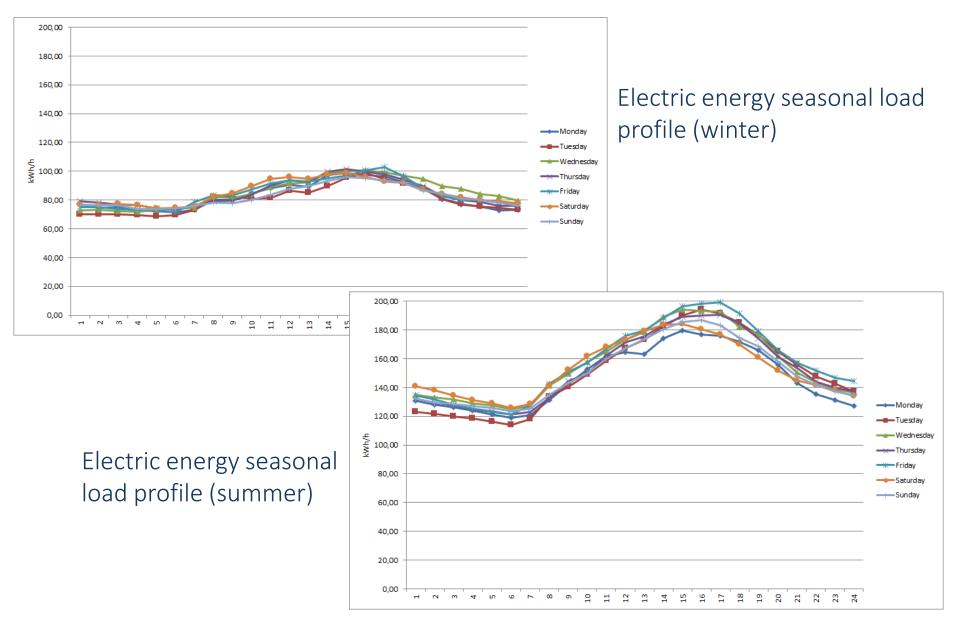
Structured analysis of the energy consumption of the plant aimed at:







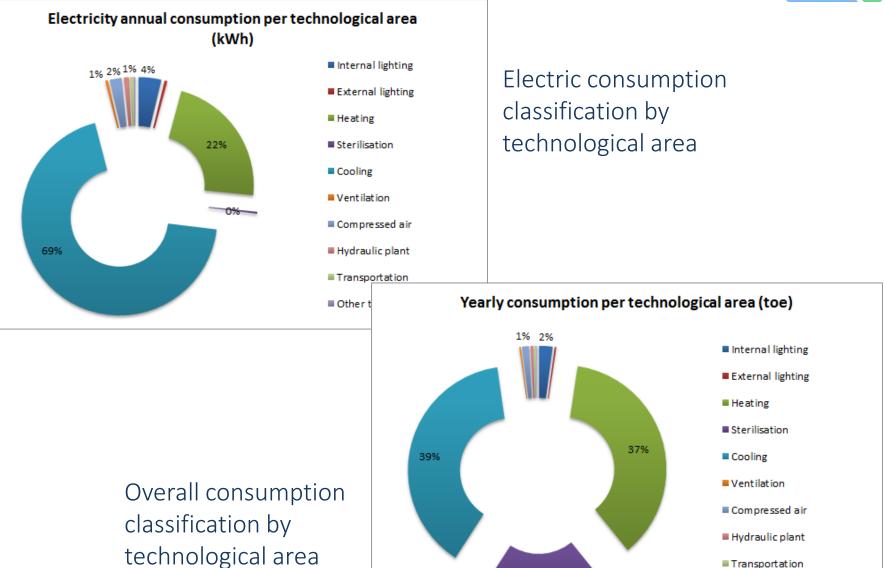








Other technological plants



20%





#### Intervention proposals

Intervention	Priority	Intervention classification	Incentives
Replacement of the current chiller with a high-efficiency unit	High	Technological	Yes
Installation of speed-regulation systems according to effective load on pumps for chilled water	High	Technological	Yes
Enlarge the tolerance of temperature and humidity set-points to avoid continuous heating/cooling and humidifying/drying in cells	High	Managerial	No
Specific maintenance activities on air treatment centres	High	Procedural	No
Introduction of maintenance and equipment/machinery purchase policies, focusing on energy consumption drivers and costs on plant lifecycle	High	Procedural	No
Intervention on batteries of condensers of the current re-phasing system (the value of the power factor is below 0,9 in all months)	Medium	Technological	No
Installation of a plant for pre-cooling in summer and pre-heating in winter for external air of all air treatment centers	Medium	Technological	Yes
Replacement of current fluorescent T8 tube bulbs having a ferromagnetic power unit with LED lamps	Medium	Technological	No
Replacement of heaters burners (now using agricultural diesel) with new natural-gas burners	Medium	Technological	No
Installation of a natural gas CHP plant	Medium	Technological	Yes
Installation of a high-pressure humidification plant	Low	Technological	No
Installation of a photovoltaic plant on the roof of the building	Low	Technological	No





# Feasibility study



#### Intervention:

• Replacement of the existing chiller with a new high-efficiency machine

#### Quantification of the correct cooling needs

Evaluation of different technological alternatives Choice of the new machine through economic indicators



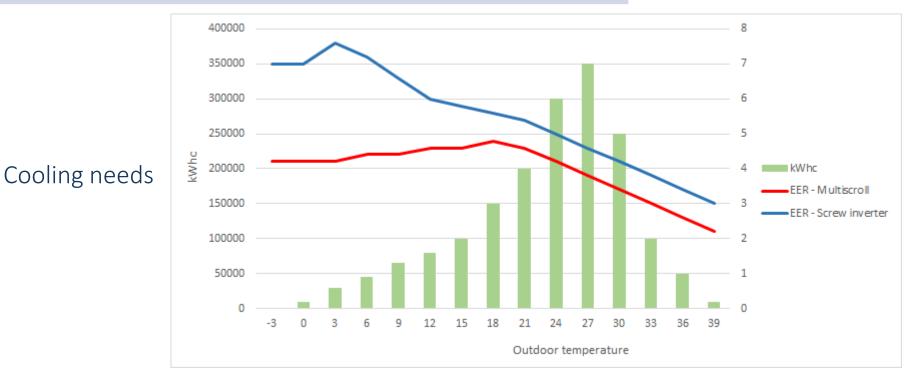


# Feasibility study



CHILLER	Circuits	kWc	kWe *	EER		
30 GX 247 (EXISTNG)	2	809	297,0	2,72		
30 RB 0802 - MULTISCROLL	3	768,8	300,7	2,56	Technological	
30 XAV 0800 - SCREW INVERTER	2	813,1	242,5	3,35	alternatives	

\* Standard Eurovent Conditions: Evaporator entering/leaving water temperature 12°C and 7°C. Outdoor air temperature 35°C

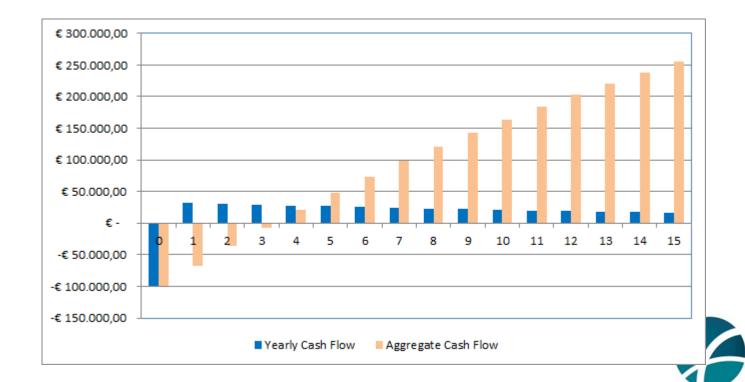




## Feasibility study



Economic Indicator	Value 3,2 255.000 €		
Pay-Back Time (PBT)	3,2		
Net Present Value (NPV)	255.000€		
Internal Rate of Return (IRR)	33,8%		

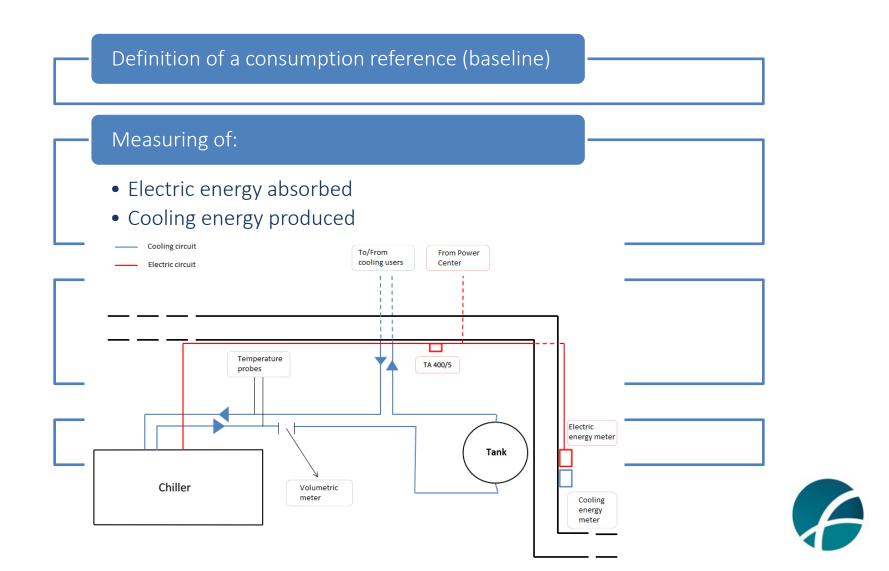








#### White Certificates scheme of incentives









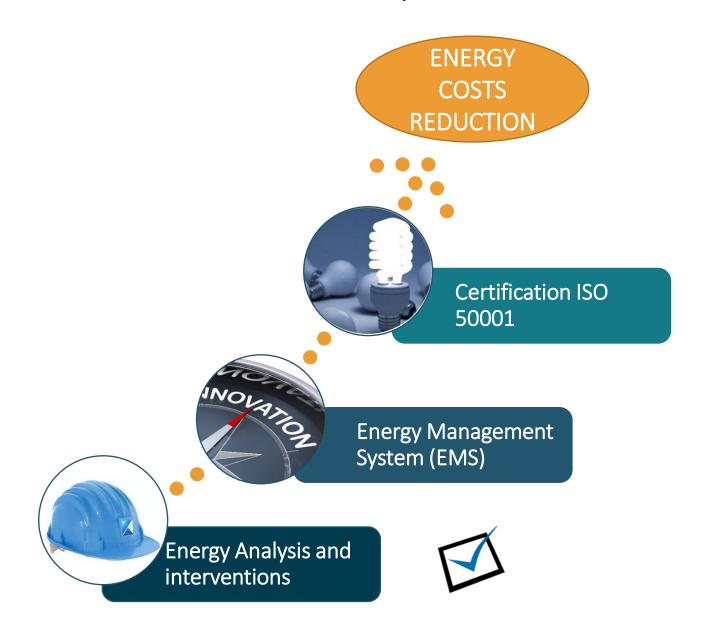
#### After 2 years of operation

Meter n. 1	Meter n. 2							
Electric energy	Cooling energy	Energy Efficiency	Energy Efficiency					
absorbed by the	produced by the	Ratio of the new	Ratio of reference	Savings obtained	Conversion factor	Savings obtained		
new chiller	new chiller	chiller	(baseline)					
kWh <sub>e</sub>	kWh <sub>cool</sub>	EER <sub>i</sub>	EER <sub>ref</sub>	kWh <sub>e</sub>	toe/kWh <sub>e</sub>	toe		
24.502	131.600	5,37	3,0	19.365	0,000187	3,62		
9.034	49.800	5,51	3,0	7.566	0,000187	1,41		
7.122	41.000	5,76	3,0	6.545	0,000187	1,22		
5.122	25.500	4,98	3,0	3.378	0,000187	0,63		
6.588	34.600	5,25	3,0	4.945	0,000187	0,92		
9.454	50.900	5,38	3,0	7.513	0,000187	1,40		
22.407	119.500	5,33	3,0	17.426	0,000187	3,26		
40.993	202.700	4,94	3,0	26.574	0,000187	4,97		
48.842	218.700	4,48	3,0	24.058	0,000187	4,50		
78.247	312.700	4,00	3,0	25.986	0,000187	4,86		
68.083	291.700	4,28	3,0	29.150	0,000187	5,45		
52.402	229.900	4,39	3,0	24.232	0,000187	4,53		
372.796	1.708.600	4,58		196.737		36,79		
							Conversion factor	Savings obtained
				EETs year 1		97	conversion factor	Savings obtained
		kWh <sub>e</sub>	kWh <sub>cool</sub>	EER	EER <sub>ref</sub>	kWh <sub>e</sub>	toe/kWh <sub>e</sub>	toe
	01/10/2016	19.15	3 105.90	0 5,5	3 3,0	16.147	0,000187	3,02
	01/11/2016	11.71	6 67.10	0 5,7	3 3,0	10.651	0,000187	1,99
	01/12/2016	4.72	8 27.00	0 5,7	1 3,0	4.272	0,000187	0,80
	01/01/2017	6.23	9 33.70	0 5,4	0 3,0	4.994	0,000187	0,93
	01/02/2017	6.80	9 38.60	0 5,6	7 3,0	6.058	0,000187	1,13
	01/03/2017	12.49	8 67.40	0 5,3	9 3,0	9.969	0,000187	1,86
	01/04/2017	15.71	0 85.30	0 5,4	3 3,0	12.723	0,000187	2,38
	01/05/2017	38.41	3 177.80	0 4,6	3 3,0	20.854	0,000187	3,90
	01/06/2017	64.61	5 261.00	0 4,0	4 3,0	22.384	0,000187	4,19
	01/07/2017	64.96	0 255.90	0 3,9	4 3,0	20.340	0,000187	3,80
	01/08/2017	80.94	9 330.20	0 4,0	B 3,0	29.118	0,000187	5,45
	01/09/2017	35.90	7 182.40	0 5,0	B 3,0	24.893	0,000187	4,65
	TOTALE	361.69	8 1.632.30	0 4,5	1	182.402		34,11
						EETs year 2		90
	Electric energy absorbed by the new chiller kWh <sub>e</sub> 24.502 9.034 7.122 5.122 6.588 9.454 22.407 40.993 48.842 78.247 68.083 52.402	Electric energy absorbed by the new chiller     Cooling energy produced by the new chiller       kWh <sub>e</sub> kWh <sub>cool</sub> 24.502     131.600       9.034     49.800       7.122     41.000       5.122     25.500       6.588     34.600       9.454     50.900       22.407     119.500       40.993     202.700       48.842     218.700       78.247     312.700       68.083     291.700       52.402     229.900       372.796     1.708.600       01/10/2016     01/11/2016       01/11/2016     01/01/2017       01/02/2017     01/03/2017       01/03/2017     01/04/2017       01/05/2017     01/06/2017       01/07/2017     01/08/2017	Electric energy absorbed by the new chiller     Cooling energy produced by the new chiller     Energy Efficiency Ratio of the new chiller       kWh <sub>e</sub> kWh <sub>cool</sub> EER;       24.502     131.600     5,37       9.034     49.800     5,51       7.122     41.000     5,76       5.122     25.500     4,98       6.588     34.600     5,25       9.454     50.900     5,33       22.407     119.500     5,33       40.993     202.700     4,94       48.842     218.700     4,48       78.247     312.700     4,00       68.083     291.700     4,28       52.402     229.900     4,39       372.796     1.708.600     4,58       01/10/2016     19.15:     01/11/2016     11.714       01/22017     6.803     01/02/2017     6.803       01/02/2017     10.804     01/02/2017     10.804       01/01/2016     19.15:     01/11/2016     11.714       01/02/2017     6.803     01/02/2017     6	Electric energy absorbed by the new chiller     Cooling energy produced by the new chiller     Energy Efficiency Ratio of the new chiller     Energy Efficiency Ratio of reference (baseline)       kWh <sub>e</sub> kWh <sub>cool</sub> EER;     EER <sub>ref</sub> 24.502     131.600     5,37     3,0       9.034     49.800     5,51     3,0       7.122     41.000     5,76     3,0       5.122     25.500     4,98     3,0       6.588     34.600     5,25     3,0       9.454     50.900     5,38     3,0       22.407     119.500     5,33     3,0       40.993     202.700     4,44     3,0       48.842     218.700     4,48     3,0       52.402     229.900     4,33     3,0       52.402     229.900     4,33     3,0       01/10/2016     19.153     105.90       01/10/2016     19.153     105.90       01/10/2017     6.239     33.70       01/02/2017     6.809     38.60       01/02/2017     15.710     8	Electric energy absorbed by the new chiller     Cooling energy produced by the new chiller     Energy Efficiency Ratio of the new chiller     Energy Efficiency Ratio of reference (baseline)     Savings obtained       kWhe     kWhcool     EER, 9.034     EER, 9.034     EER, 9.034     EER, 9.034     EER, 9.034     KWhe 9.035     KWhe 9.035     KWhe 9.034     No     7.566       7.122     41.000     5,76     3,0     6.545       5.122     25.500     4,98     3,0     3.378       6.588     34.600     5,25     3,0     17.426       9.454     50.900     5,38     3,0     17.431       22.407     119.500     5,33     3,0     17.426       48.842     218.700     4,48     3,0     24.535       78.247     312.700     4,00     3,0     25.986       66.083     291.700     4,28     3,0     24.232       372.796     1.708.600     4,58     196.77       01/02/2017     6.239     33.70     5,4       01/02/2017     6.239     33.70     5,4 <th>Electric energy absorbed by the new chiller     Cooling energy produced by the new chiller     Energy Efficiency Ratio of the new (baseline)     Energy Efficiency Ratio of reference (baseline)     Savings obtained     Conversion factor       24.502     131.600     5,37     3,0     19.365     0,000187       3.034     49.800     5,51     3,0     7.566     0,000187       7.122     41.000     5,76     3,0     6.545     0,000187       5.122     25.500     4,98     3,0     3.378     0,000187       9.454     50.900     5,38     3,0     7.513     0,000187       9.454     50.900     5,38     3,0     7.513     0,000187       19.454     22.407     119.500     5,33     3,0     17.426     0,000187       140.993     202.700     4,94     3,0     26.574     0,000187       78.247     312.700     4,28     3,0     25.986     0,00187       52.402     229.900     4,39     3,0     24.232     0,00187       52.402     229.900     4,35     &lt;</th> <th>Electric energy absorbed by the new chiller     Energy Efficiency Ratio of the new chiller     Energy Efficiency Ratio of the new chiller     Savings obtained (baseline)     Conversion factor     Savings obtained       24.502     131.600     5,37     3,0     19.365     0.000187     3.62       9.034     49.800     5,51     3,0     7.566     0,000187     1,41       7.122     41.000     5,76     3,0     6.545     0,000187     0,92       9.034     49.800     5,21     3,0     3.78     0,000187     1,22       5.122     25.500     4,98     3,0     3.737     0,000187     0,92       9.454     50.900     5,38     3,0     7.513     0,000187     1,40       22.407     119.500     5,33     3,0     1.7426     0,000187     4,97       48.842     218.700     4,48     3,0     24.058     0,000187     4,95       78.247     312.700     4,28     3,0     29.150     0,000187     4,56       78.242     22.900     4,35     3,0</th> <th>Electric energy absorbed by the new chiller     Cooling energy Ratio of the new chiller     Energy Efficiency Ratio of treference (baseline)     Savings obtained     Conversion factor     Savings obtained       24.502     131.600     5.37     3.0     19.365     0.000187     3.62       9.034     49.800     5.51     3.0     7.566     0.000187     1.41       7.122     41.000     5.76     3.0     6.545     0.000187     0.63       6.588     34.660     5.25     3.0     4.445     0.000187     0.63       9.9.454     50.900     5.38     3.0     7.7123     0.000187     3.26       40.939     202.700     4.94     3.0     26.574     0.000187     4.50       78.347     7312.700     4.48     3.0     22.590     4.39     3.0     24.532     0.000187     4.50       52.402     223.900     4.38     3.0     22.598     0.000187     4.53       372.796     1.706.600     4.58     196.737     3.0     16.147     0.000187       01/10</th>	Electric energy absorbed by the new chiller     Cooling energy produced by the new chiller     Energy Efficiency Ratio of the new (baseline)     Energy Efficiency Ratio of reference (baseline)     Savings obtained     Conversion factor       24.502     131.600     5,37     3,0     19.365     0,000187       3.034     49.800     5,51     3,0     7.566     0,000187       7.122     41.000     5,76     3,0     6.545     0,000187       5.122     25.500     4,98     3,0     3.378     0,000187       9.454     50.900     5,38     3,0     7.513     0,000187       9.454     50.900     5,38     3,0     7.513     0,000187       19.454     22.407     119.500     5,33     3,0     17.426     0,000187       140.993     202.700     4,94     3,0     26.574     0,000187       78.247     312.700     4,28     3,0     25.986     0,00187       52.402     229.900     4,39     3,0     24.232     0,00187       52.402     229.900     4,35     <	Electric energy absorbed by the new chiller     Energy Efficiency Ratio of the new chiller     Energy Efficiency Ratio of the new chiller     Savings obtained (baseline)     Conversion factor     Savings obtained       24.502     131.600     5,37     3,0     19.365     0.000187     3.62       9.034     49.800     5,51     3,0     7.566     0,000187     1,41       7.122     41.000     5,76     3,0     6.545     0,000187     0,92       9.034     49.800     5,21     3,0     3.78     0,000187     1,22       5.122     25.500     4,98     3,0     3.737     0,000187     0,92       9.454     50.900     5,38     3,0     7.513     0,000187     1,40       22.407     119.500     5,33     3,0     1.7426     0,000187     4,97       48.842     218.700     4,48     3,0     24.058     0,000187     4,95       78.247     312.700     4,28     3,0     29.150     0,000187     4,56       78.242     22.900     4,35     3,0	Electric energy absorbed by the new chiller     Cooling energy Ratio of the new chiller     Energy Efficiency Ratio of treference (baseline)     Savings obtained     Conversion factor     Savings obtained       24.502     131.600     5.37     3.0     19.365     0.000187     3.62       9.034     49.800     5.51     3.0     7.566     0.000187     1.41       7.122     41.000     5.76     3.0     6.545     0.000187     0.63       6.588     34.660     5.25     3.0     4.445     0.000187     0.63       9.9.454     50.900     5.38     3.0     7.7123     0.000187     3.26       40.939     202.700     4.94     3.0     26.574     0.000187     4.50       78.347     7312.700     4.48     3.0     22.590     4.39     3.0     24.532     0.000187     4.50       52.402     223.900     4.38     3.0     22.598     0.000187     4.53       372.796     1.706.600     4.58     196.737     3.0     16.147     0.000187       01/10



### Next steps











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