

# SOLAR - POWERED FOOD FREEZING

## 1 - OBJECTIVE

- To study energetic, economic and environmental viability of using photovoltaic solar panels in a small ice cream company, in which refrigeration systems account for the biggest waste of energy in the production line.

## 2 - PHOTOVOLTAIC TECHNOLOGY

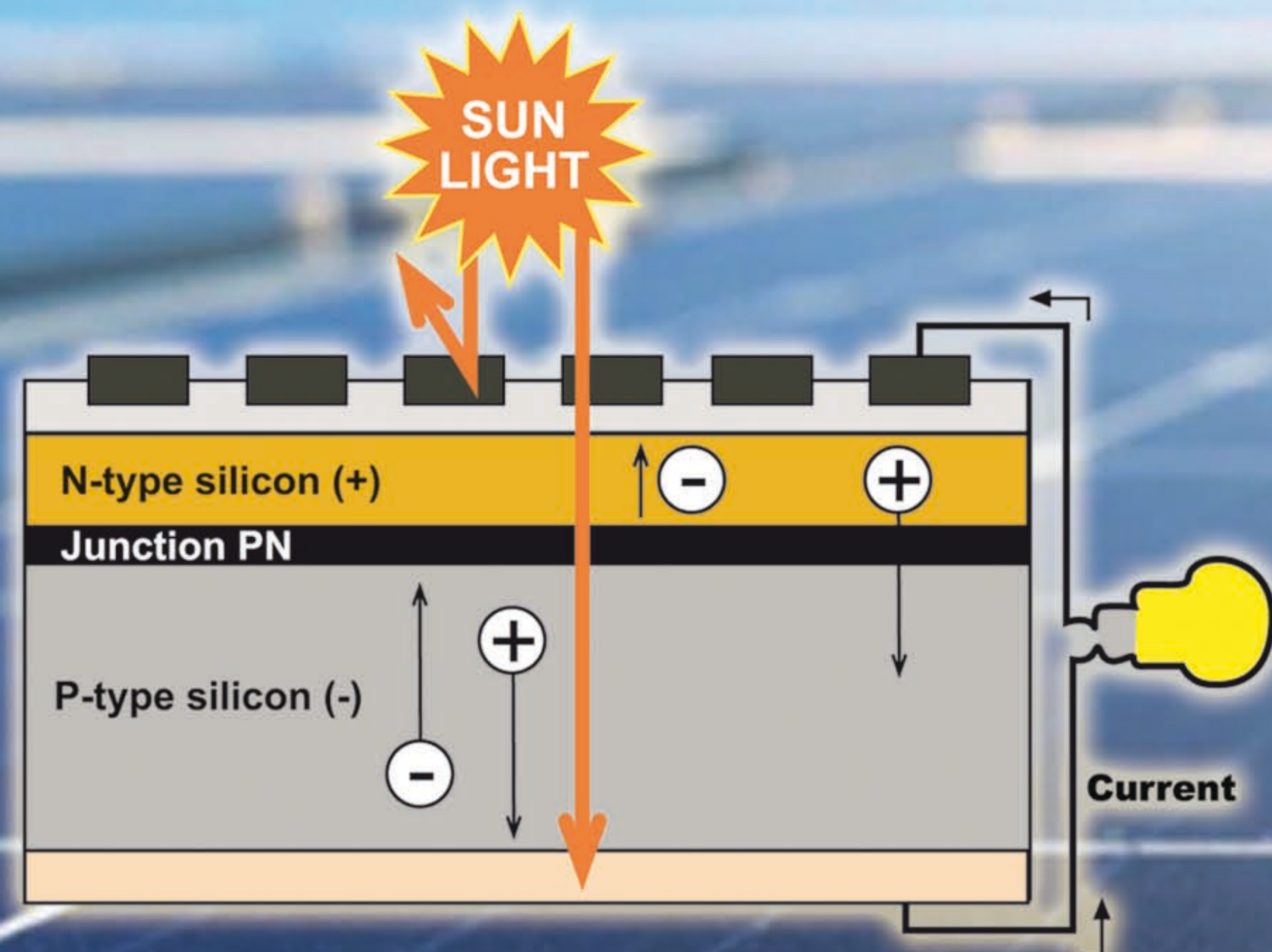


Figure 1. Graphic representation of a typical solar cell's functioning.

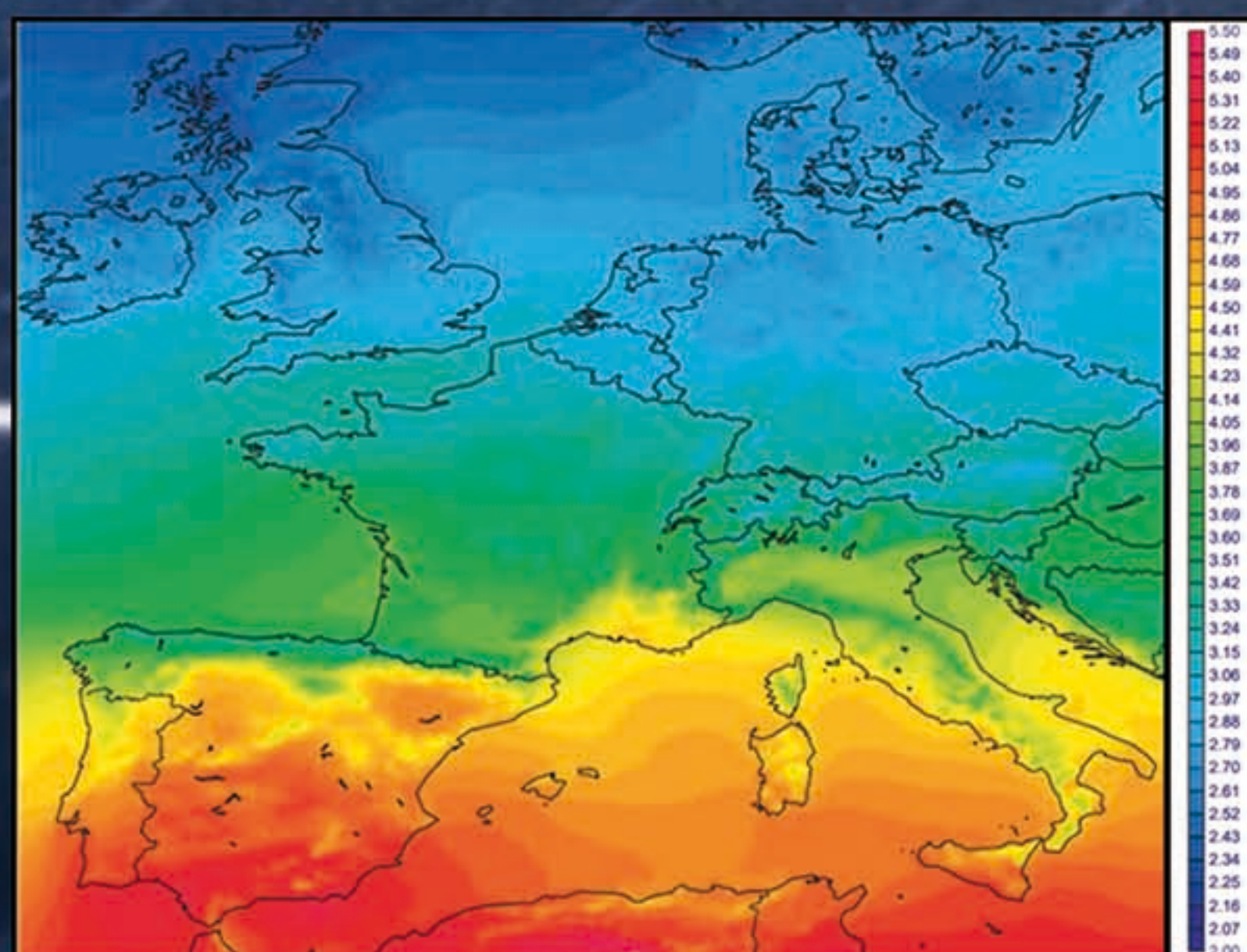


Figure 2. Average global irradiance in Europe (1983-2005) in (kWh m<sup>-2</sup> day<sup>-1</sup>). Source: (Sancho et al., 2012)

## 3 - ENERGY BALANCE OF THE PLANT

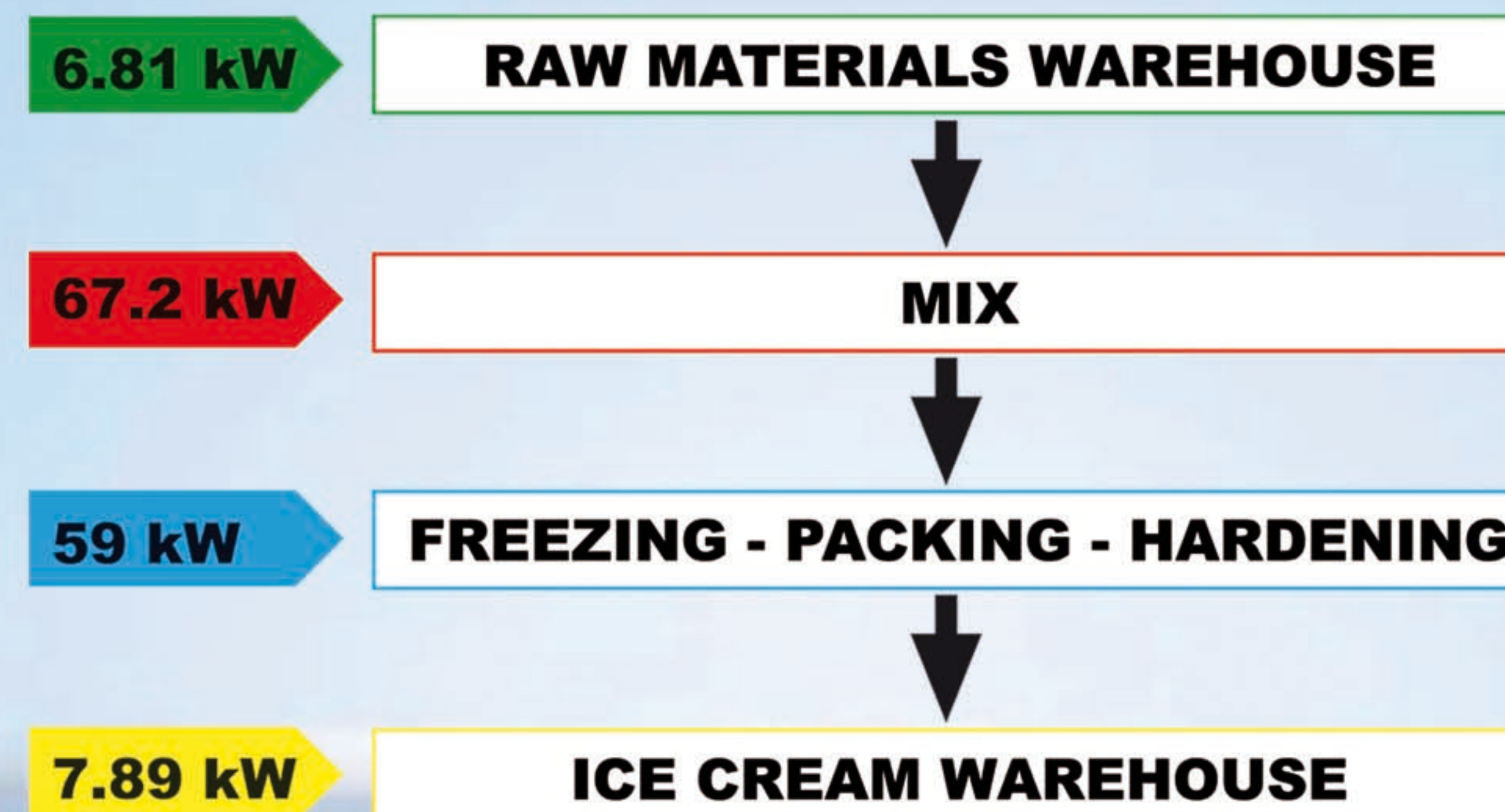


Figure 3. Energy balance of a 600 L/h ice cream production plant.

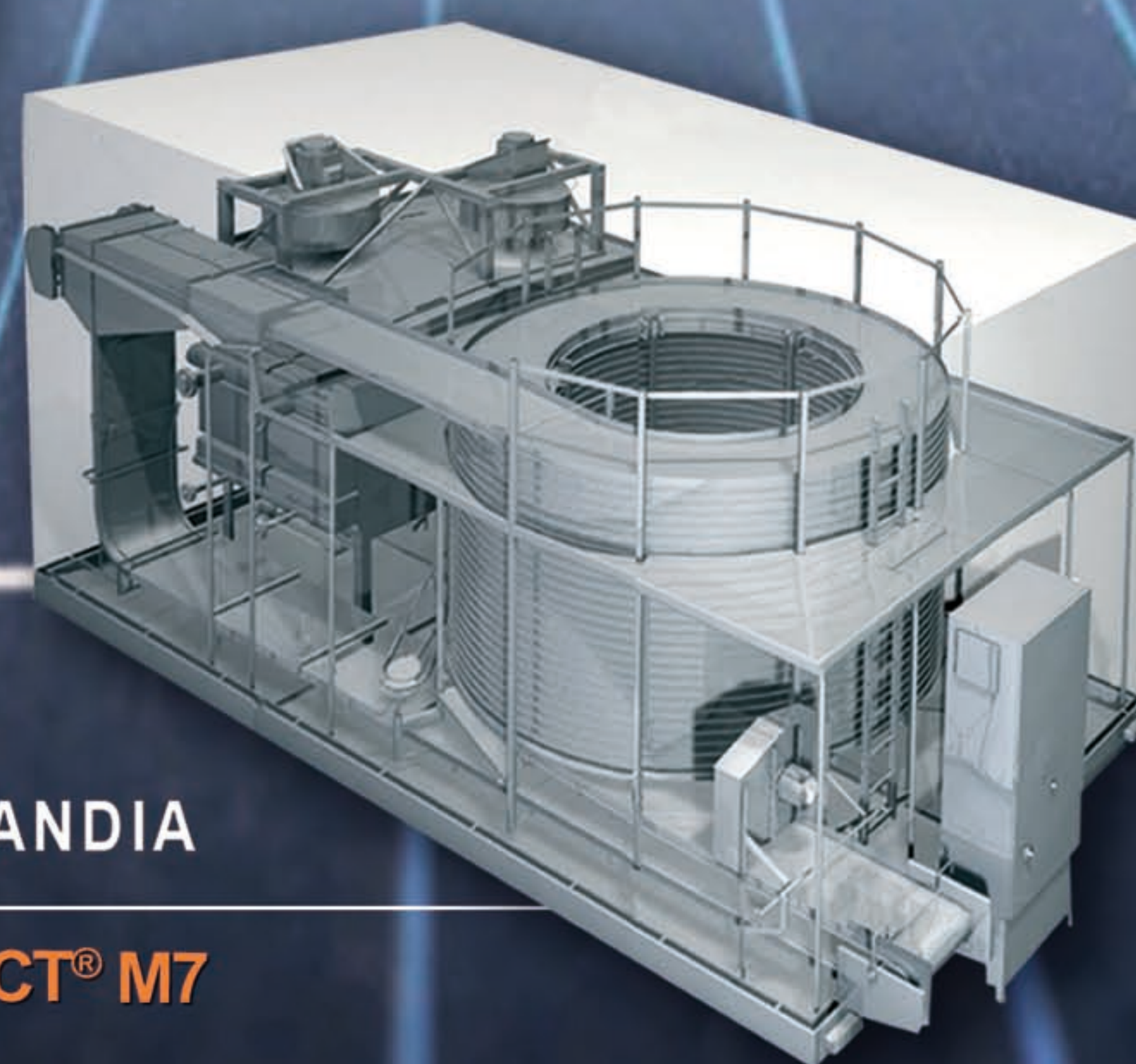


Gram  
Equipment

Mod. GIF 600

FRIGOSCANDIA

GYRoCOMPACT® M7



## 4 - ENERGY MANAGEMENT

Chart 1. Relevant features in solar panel installation pre-budget by Naturgy.

BRAND AND MODEL OF SOLAR PANEL USED	SOLAR PANEL EFFICIENCY	DIMENSIONS OF THE PHOTOVOLTAIC INSTALLATION	COST OF PHOTOVOLTAIC INSTALLATION	EXCESS POWER COMPENSATION
JA Solar 455W JAM72S20 455/MR Mono PERC	20.4 %	436.5 m <sup>2</sup>	67,342.07 €	0.08 €/kWh

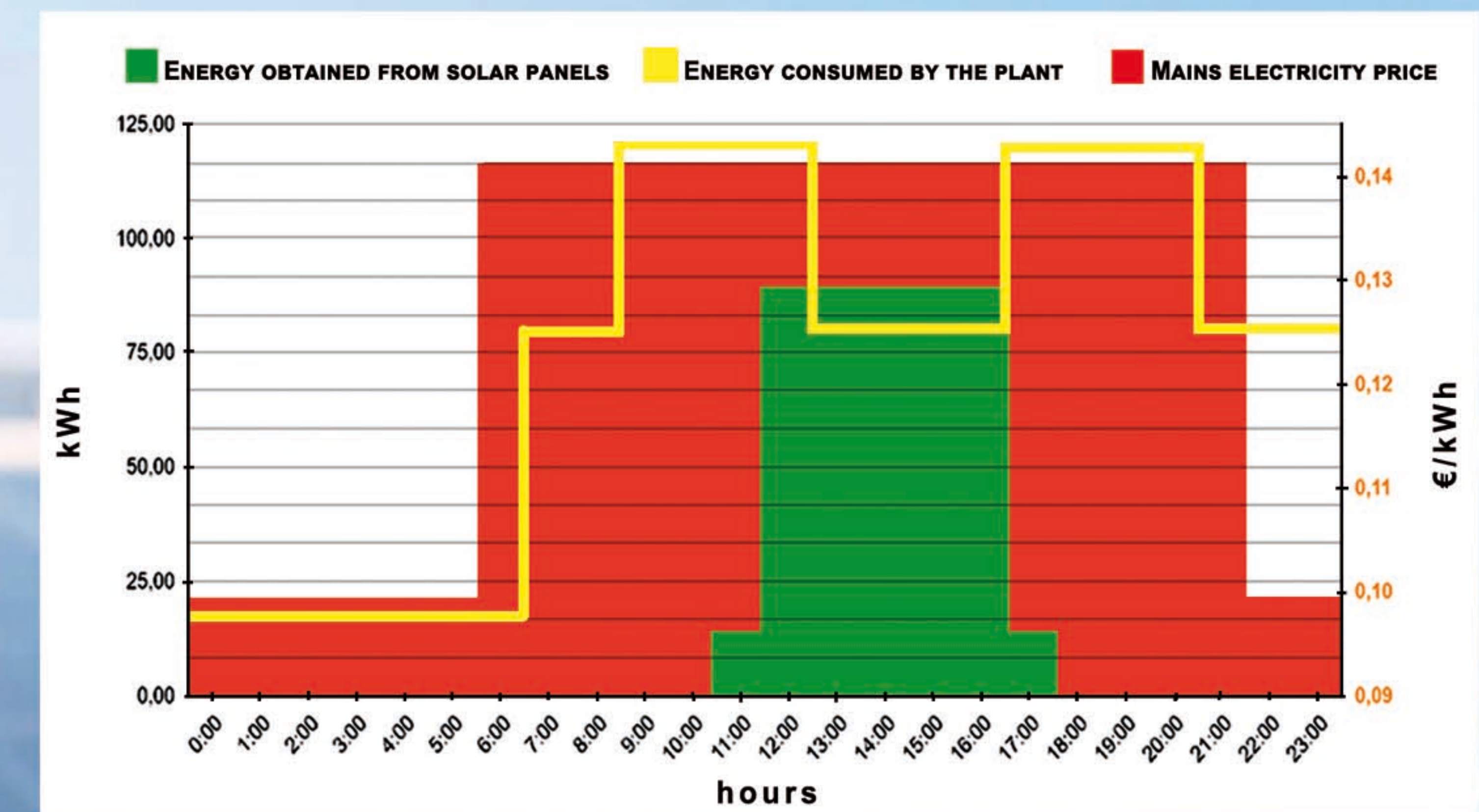


Figure 4. Graphic of an average working day of the plant.

## 5 - CONCLUSIONS

- The studied company becomes more energetically efficient, as well as economically (20,123.86 € less spent per year) and environmentally (a 23.44 % reduction of CO<sub>2</sub> emissions per year).
- Only a few companies use this technology, due to its big initial investment requirement (67,342.07 €) and its long return on investment (3.35 years).
- To make this a more profitable process, the next step would be to increase the solar panels area, in order to generate the necessary amount of energy. Installing storage batteries (like hydrogen ones) would also be part of this step, to have access to this generated energy during hours with no sunlight. With all these mechanisms, the company would be able to completely disconnect from electrical mains.

