

Radiant heating in industrial facilities

The following article evaluates electric radiant heating in terms of energy consumption in production and storage facilities. The aim is to set indicative consumption reference values for similar types of building using an example of a real production plant.

Radiant heating is by its very nature particularly suitable for rooms with higher clear heights, which are typical for industrial and agricultural buildings. At the same time, production plants in particular usually buy electricity at wholesale prices, and so the idea naturally occurs to combine the benefits of radiant heating with the more favourable price of electricity.

FENIX has been producing electric radiant heating systems for more than 30 years, and one of the main product groups is ECOSUN® S+ high-temperature radiant panels, which are designed for the aforementioned type of building. A very common question from potential clients concerns the operating costs that can be expected from such applications. As FENIX uses high-temperature panels in a dominant way for the heating of its own premises at the production plant in Jeseník (mountain climate), the following study was created. Its aim was to assess and determine indicative energy consumption reference values for electric radiant heating.

Data source

The assessment period is the heating season from 1. 9. 2020 to 31. 5. 2021. The energy consumption for heating was taken from the monitoring of an SAS (Peak-shaving storage station), and the selection of facilities was adapted to the measured circuits. The **average outdoor temperature** for this heating season was **4.7 °C** (continuous measuring of temperatures at OC FENIX). The consumption is intentionally given in kWh to make it easier to estimate the operating costs according to different energy prices, or compare them with the energy consumption of other types of heating.

TOTAL CONSUMPTION

Building	Area	Volume	Heating wattage	Machinery wattage	Annual heating consumption	Specific annual energy consumption for heating	
ECOSUN NT	1 522 m ²	6 051 m ³	47 kW	230 kW	11 MWh	7.2 kWh/m ²	1.8 kWh/m ³
ECOSUN VT	682 m ²	2 054 m ³	50 kW	-	12 MWh	17.6 kWh/m ²	5.84 kWh/m ³
METALWORKING	1 471 m ²	10 743 m ³	65 kW	90 kW	17 MWh	11.6 kWh/m ²	1.6 kWh/m ³
ECOFLOOR	4 281 m ²	28 788 m ³	256 kW	63 kW	219 MWh	51.2 kWh/m ²	7.6 kWh/m ³
TOTAL	7 956 m²	47 636 m³	418 kW	383 kW	259 MWh	32.6 kWh/m²	5.5 kWh/m³

The total energy consumption for the heating of the FENIX complex is the result of the sum of several separate buildings (facilities) that have different clear heights. Some of the buildings have been renovated, and some are new, and in some facilities there is machinery that produces significant heat gains (see the details about the facilities). On average, most of the industrial facilities will be of a similar or better standard and the **data obtained can therefore be considered as standard**. A more detailed analysis of the monitored facilities can be found in the following tables.

Sub-operations – ECOSUN NT

Sub-operations	Area	Clear height	Volume	Heating wattage	Machinery wattage	Annual heating consumption	Specific annual energy consumption for heating	
1 st floor coating plant	605 m ²	5.0 m	3 025 m ³	47 kW	230 kW	11 MWh	7.2 kWh/m ²	1.8 kWh/m ³
1 st floor production	513 m ²	3.3 m	1 693 m ³					
2 nd floor	404 m ²	3.3 m	1 333 m ³					
TOTAL	1 522 m²		6 051 m³					

Heating is provided by ECOSUN S+ and TH high-temperature panels (installation height 3.1-3.9 m)

- Maintained day temperature 20 °C (14 hours), night attenuation 16 °C (7 hours), heating completely switched off for part of the night (3 hours)
- On the first floor there is machinery with a wattage of 230 kW (kiln, tunnel for shrinking packaging films)

Sub-operations – ECOSUN VT

Circuit	Area	Volume	Heating wattage	Machinery wattage	Annual heating consumption	Specific annual energy consumption for heating	
ECOSUN VT	682 m ²	2 054 m ³	54 kW	-	12 MWh	17.6 kWh/m ²	5.84 kWh/m ³

- The heating of technical facilities is provided mainly by ECOSUN S+ Short 06 and TH 10 high-temperature panels (installation height 3.1 m)
- Facilities for personnel (changing rooms, sanitary facilities, day rooms) are heated by a combination of low-temperature panels ECOSUN VT, underfloor heating ECOFLOOR and ladder radiators.
- Part of the building (the 2nd floor warehouse, the warehouse and technical facilities on the 3rd floor, and the elevator engine room on the 4th floor) is unheated, and therefore approx. 550 m² weren't included in the assessed area.
- Maintained day temperature 21 °C (11 hour), night attenuation 16 °C (13 hours)

Sub-operations – METALWORKING

Circuit	Area	Clear height	Volume	Heating wattage	Machinery wattage	Annual heating consumption	Specific annual energy consumption for heating	
1.07a	478 m ²	5.0 m	2 390 m ³	65 kW	90 kW	17 MWh	11.6 kWh/m ²	1.6 kWh/m ³
1.07b	223 m ²	5.0 m	1 115 m ³					
1.07b extension	770 m ²	9.4 m	7 238 m ³					
TOTAL	1 471 m²		10 743 m³					

- Heating is provided by ECOSUN S+ 24 and S+ 36 high-temperature panels (installation height 3.9 m and 8 m)
- Maintained day temperature 20 °C (22 hours), night attenuation 16 °C (2 hours)
- Machinery wattage 90 kW (compressors)

Sub-operations – ECOFLOOR

Circuit	Area	Volume	Heating wattage	Machinery wattage	Annual heating consumption	Annual energy consumption for heating	
						kWh/m ²	kWh/m ³
Cable room + warehouse	2 744 m ²	20 027 m ³	90 kW	45 kW	104 MWh	37.9 kWh/m ²	5.19 kWh/m ³
Old NT workshop	319 m ²	1 820 m ³	21,6 kW	-	30 MWh	94 kWh/m ²	16.5 kWh/m ³
Connecting operation	1 218 m ²	6 941 m ³	145 kW	18 kW	85 MWh	69.8 kWh/m ²	12.2 kWh/m ³
TOTAL	4 281 m²	28 788 m³	256 kW	63 kW	219 MWh	51.2 kWh/m²	7.6 kWh/m³

The “cable room + warehouse” circuit

- Heating is mainly provided by ECOSUN S 36 panels (installation height 4.3 m)
- Day temperature 20 °C (13.5 hours), night attenuation 16 °C (10.5 hours)
- Machinery wattage 45 kW

The “old NT workshop” circuit

- Heating is provided by ECOSUN SB 24 panels (installation height 4.3 m)
- Day temperature 21 °C (24 hours), operation without night attenuation

The “connection shop” circuit

- Heating is mainly provided by ECOSUN S 36 panels (installation height 4.3 m)
- Day temperature 19 °C (11 hours), night attenuation 16 °C (13 hours)
- Machinery wattage 18 kW

Conclusion

The obtained data must be seen as **indicative values**. Every industrial facility and production area is different, not only in terms of the thermotechnical properties of buildings, but also with regard to the nature of the operations there, the scope of heat gains from machinery and, last but not least, the climate where the building is situated. However, this report offers at least a basic overview of the operating costs that can be achieved with radiant heating.