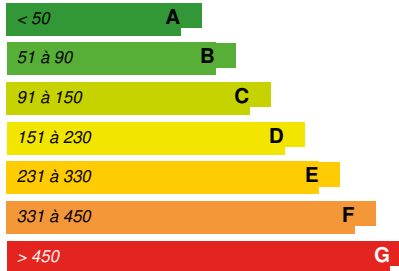


# "Aerem " factory

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**Building Type :** Factories  
**Construction Year :** 2018  
**Delivery year :** 2018  
**Address 1 - street :** ZAC du Roulage 32600 PUJAUDRAN, France  
**Climate zone :** [Cbc] Mild, dry winter, warm and wet summer.

**Net Floor Area :** 3 700 m<sup>2</sup>  
**Construction/refurbishment cost :** 5 000 000 €  
**Number of Installed Kw :** 80 Installed Kw  
**Cost/m2 :** 1351.35 €/m<sup>2</sup>

## General information

**Aerem factory won the Low Carbon Award of the 2019 Green Solutions Awards at the France level + the international Low Carbon Award.**

Aerem's head office in Pujaudran (32) is a positive energy plant, delivered by the end of 2018. This company, organized in SCOP, offers solutions with a mechanical focus for the aerospace, space and pharmaceutical industries. In order to define the layout and the building envelope based on real needs, our architecture agency co-designed this plant with and for SCOP Aerem. This building, of 3,800 m<sup>2</sup> designed to accommodate up to 80 people, is the result of 4 years of work for a total cost of € 5,000,000 excluding tax. The project was conceived to be able to extend, the project owner and the master of work anticipated the future evolution of the premises and thus leave the free field on the parcel.

This project is based on 5 fundamental values: space, everyone's contribution, customer relations, sustainable and ecological development and well-being at work.

## Sustainable development approach of the project owner

### The Challenges of the Project

Just like our atypical SCOP status in our aeronautics and space activity sectors, AEREM wanted to build a building that resembles it. It must be both modern, adapted to a demanding industrial activity, respectful of its environment and the safety of its activities, durable, comfortable and welcoming.

These values led our real estate project to a "different" building for which we had to face many challenges:

**Technical :** cohabitation of heavy industrial process constraints (ventilation, noise, vibrations, thermal stability of technical areas, collection of waste from the means of production) with those of a positive energy building

**Ecological** : willingness to move towards 0 our energy footprint in construction and for exploitation through the choice of sustainable building materials and biobased locally, and a selection of regional players for construction

**Social** : make it a social catalyst by favoring equity, exchange and work together, raise group values and print the orientation of the SCOP towards its customers and towards its ecosystem, boost recruitment and promote eco behaviors -responsables (journeys, management of water and energy, ...)

**Sustainable development** : to be inscribed in the future to allow to welcome several generations of cooperators and tolerate a growth of its activities in the long term, to stimulate the virtue on the management of the waste (sorting and recycling),

**Activity** : boost our development and productivity, strengthen ties with our historical customers and convince our prospects, strengthen our image and our influence

**Financial** : build a cost-effective traditional book and eventually build a "mattress" heritage for the scop, sell the old premises to finance the new, reduce operating costs in the medium and long term.

If the technologies for the implementation of a construction meeting these constraints are known, they are today still little retained and less aggregated in one and the same real estate project, which is more industrial. This is how this project is said to be "remarkable".

## Architectural description

An eco-designed factory by its occupants:

Several months of exchanges have made it possible to match the needs, the process and an architectural optimization for the Aerem \* factory project. From this collaborative work has emerged the project of the factory of the future, eco-designed by its occupants.

The strong idea is to promote exchanges between blue-collar and white-collar workers. To allow this porosity, the offices were placed in the heart of the factory, between the workshops. They are naturally lit and ventilated by three large patios. Workshops on the outskirts can expand (future developments) and respond to various material transfer needs. The central floor will be used for the customer journey and the overall views of the plant.

Differently, the roots of the project are in ground garden, small open level on a shared garden dedicated to the relaxation and to the recreational exchanges. These common areas are connected to the other levels by vertical distributions (stairs, elevator).

A powerful and removable envelope in wood box and straw filling:

This scalable plant will be BEPOS (positive energy building) and eco-designed with a powerful and removable envelope in wooden box and straw infill. Part of the roof will receive photovoltaic panels, heating and cooling is done by geothermal (active slab). The summer overheating will be limited thanks to a night super-ventilation facilitated by skylights and various devices of solar protection (siding in front of the bays, blinds, awnings).

This reflection is not limited to the building, integrating an environmental dimension to the process with the furnace, through paint booths, suction torches for welding fumes and oil mist, chip management via the garden level by garbage under bells or the integration of constraining spaces to built volume (waste, machinery, engine, fluids, stocks ...).

This scalable and eco-designed plant is the result of a participatory design in which the user is a player in his work tool.

### Owner's point of view: Innovative & original solutions

**First innovation** , the method of participatory design of the project throughout the process with a steering committee and participatory workshops with all employees cooperators (SCOP).

The commitment of the Scop went to the full support of the Locksmithing lot in order to print in his building his own know-how.

## Building users opinion

The obtained results

The relocation of all our activities took place between S51-2018 and S01-2019 and is therefore still relatively recent, but we can already see the following results:

Gain new markets in aircraft and satellite flight parts and new customers

Reduction of the number of work accidents

Image of clients and candidates for recruitment (more choice and better recruitment)

Rapid assimilation of the boiler team in the SCOP

No business interruption after the move

Improved health and safety conditions

Total satisfaction of the cooperators regarding the new industrial tool and the well-being it provides

Industrial tool more efficient and more compatible with a load increase

Improved dialogue between offices and workshops

Given the youth of the site we have not yet been able to measure the savings on the building's operation. A display of the current and 12-month consumption will be installed in order to be able to measure and communicate real-time savings.

## If you had to do it again?

The encountered difficulties Let's not hide that such a project was complex because of: -Technical difficulties on which sometimes innovative answers must be found -The coordination of a large number of actors selected for construction -The construction deadline imposed by the purchaser of the former premises In more details, here are some of the brakes encountered: Poor mechanical quality of the ground requiring special foundations / while the needs for ground operating costs are important Coexistence of constructive constraints ICPE of non-flammability / insulation in straw Coexistence of the management of welding fumes & oil mists imposing important air renewals / vocation of the building to be very energy efficient and very stable in temperature Ground operating load of 5 tonnes per m<sup>2</sup> / active slab: floors and concrete floors heating & cooling Capturing the heat dissipated by the production machines Integrate from the design of any extensions of the workshops Large permeability of exchanges between offices and workshops / acoustic problems up to more than 100 Db in workshops Maximize natural lighting and bring in the sun / temperature stability of the workshops (MMT + machining + large machining) at 0.5 ° C 1st day lighting (direct natural light) of all offices / integration of offices in the center of the building Photovoltaic in self-consumption and injection of the surplus in the network / general power supply in High Voltage All of these points (non-exhaustive list) required many adjustments and know-how. It was necessary to pool the skills, knowledge and experience of companies, design offices, Threshold architecture and Aerem to find concrete solutions, sometimes original, and adapt them to the constraints of construction and planning.

See more details about this project

<http://www.seuil-architecture.com/2016/11/18/usine-du-futur-eco-responsable/>

<https://www.construction21.org/france/articles/fr/green-solutions-usine-aerem-a-energie-positive.html>

Photo credit

Stéphane Brugidou

## Stakeholders

### Contractor

Name : Aerem

Contact : Joel Bry

<http://www.aerem.fr/aerem/la-societe.php>

### Construction Manager

Name : Seuil architecture

Contact : Leslie Gonçalves

<http://www.seuil-architecture.com/>

### Stakeholders

Function : Thermal consultancy agency

Soconer

Yann Lebigot

<http://www.soconer.fr/>

Thermal engineering office

### Contracting method

Separate batches

### Type of market

Table 'c21\_luxembourg.rex\_market\_type' doesn't exist

## Energy

### Energy consumption

Primary energy need : 26,00 kWh<sub>ep</sub>/m<sup>2</sup>.an

Primary energy need for standard building : 125,00 kWh<sub>ep</sub>/m<sup>2</sup>.an

Calculation method :

Breakdown for energy consumption : Distribution RT2012: heating 28%, DHW 16%, cooling 6%, ventilation 28%, auxiliary distribution 1%, lighting 21%

### Real final energy consumption

Final Energy : 10,00 kWh<sub>ef</sub>/m<sup>2</sup>.an

### Envelope performance

More information :

All floors are heavy type. The outer walls are wood box type with straw bale filling made in Pompiac (32) 22km from the Pujaudran site. The choice to make a large part of the wooden box walls ensures a better airtightness for the entire building.

## Renewables & systems

### Systems

Heating system :

- Geothermal heat pump

- Low temperature floor heating
- Fan coil

Hot water system :

- Individual electric boiler

Cooling system :

- Geothermal heat pump
- Floor cooling

Ventilation system :

- Nocturnal ventilation
- Double flow heat exchanger

Renewable systems :

- Solar photovoltaic
- Heat Pump on geothermal probes
- Energy recovery from waste

The installed photovoltaic generator has a power of 99.9 kWp.

Solutions enhancing nature free gains :

Chauffage/rafraîchissement par PAC géothermique ; freecooling nocturne ; récupération de l'eau pluviale

## Environment

### Urban environment

Land plot area : 9 369,00 m<sup>2</sup>

Built-up area : 34,40 %

Green space : 2 600,00

ZA du roulage: The project is based on the landscape and environmental context of the site. Topography, landscape features, environmental sensitivities are project support elements. They are constituents of the identity of the area of activity.

The principles that guided the project are:

- A maintenance and enhancement of biological continuity by preserving natural areas along the creek of Artus
- The organization of the tracks, the parcel division and the implantations/batiments are part of the site's topography. The tracks follow the pentenural terrain and maintain open perspectives on the Lartus ripisylved and the hillside landscape.

## Products

### Product

Marc Abrahamowski

Batimap

village 32130 Pompjac - marc.abrahamowski[at]orange.fr

Product category : Second œuvre / Cloisons, isolation

3000 boots were used for the insulation of the factory.

Dimensions: 47 X 37 X 120 cm with a R = 6.5

Upstream of the delivery of the boots, the owner Aerem, Seuil Architecture and the company Pyrenees Charpente controlled the quality of the boots:

- Deformation of the boot less than 10%.
- Moisture of the boot between 10 and 20%.
- The boot must have a density of at least 80kg / m<sup>3</sup>.

A traceability of the material was done by the company on delivery, the owner of Aerem and Seuil Architecture also assisted in the implementation of some boots in the wooden boxes to ensure good practices.

The control office relied on the professional rules of straw construction to ensure that the work was compliant.

This material proposed by the architects to the project owner, as insulated bio-sourced low cost and local (<30km from the factory) was well received by Aerem who saw a new challenge in the construction of its frugal building and sustainable.

Threshold Architecture was formed to the professional rules of straw construction, qualifying training conducted by the RFCP ... and so could ensure the building.

## Costs

### Construction and exploitation costs

Reference global cost : 5 000 000,00 €

Renewable energy systems cost : 407 000,00 €

Reference global cost/Installed Kw : 5000000

Subsidies : 557 000 €

Additional information on costs :

During the studies, the projected consumption of the building was carried out and evaluated 1,253,052 kWh / year, including office automation and process.

## Health and comfort

### Water management

Recovery of rainwater for watering plants and supply of toilets. A recovered rainwater distribution network is installed in the building (separated from the mains water network so that both networks can be switched if necessary).

### Indoor Air quality

Air quality (extraction of welding fumes, night ventilation, close VOC 0 for paints, no plastics, ...)

The air handling units have powerful filters.

### Comfort

Health & comfort :

We studied worked visual comfort by calculating the daylight factor (FLJ), through the entries of wall lights and zenithals, valuing natural lighting to the maximum. As well as acoustic comfort through acoustic mapping and help with prescription via the acoustician of the operation: Emacoustic.

Comfort has been integrated in all its dimensions through eco-design and co-design with users (steering committee). But also through two participatory workshops bringing together the group of cooperators of SCOP Aerem. These groups of reflections mixed employees of different positions, ages and sexes in order to mix the most possible exchanges on the various themes proposed and in particular the comfort in the workshops, in the offices and the shared spaces.

Calculated indoor CO2 concentration :

Certaines pièces à occupation spécifiques sont munies de sondes de CO2 pour un asservissement de la ventilation (salle de réunion / usinage / grand usinage)

Measured indoor CO2 concentration :

ertaines pièces à occupation spécifiques sont munies de sondes de CO2 pour un asservissement de la ventilation (salle de réunion / usinage / grand usinage)

Calculated thermal comfort : STD réalisée pour appréhender le niveau de confort, notamment estival des usagers.

Measured thermal comfort : GTC enregistre les niveaux de température et d'hygrométrie dans toutes les zones du bâtiment.

Acoustic comfort :

Noise management: accompagnement of an acoustician, mass law with heavy walls in the central part, acoustic suspension bridges, perforation 15% of the ceilings and walls of the workshops, acoustic baffles in the offices

Daylight factor : Eclairage naturel renforcé pour limiter l'éclairage artificiel, 2 bornes VL électriques, éclairages leds

## Contest

### Reasons for participating in the competition(s)

Attached to the load-bearing metal framework, the building envelope consists of wooden boxes (from France - Epicéa and douglas) filled with 3000 straw bales (from a local farmer).

The Photovoltaic panels, the active slabs, geothermal energy source and waste management (factory process / building life cycle) complete the sustainable approach of this exemplary building.

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