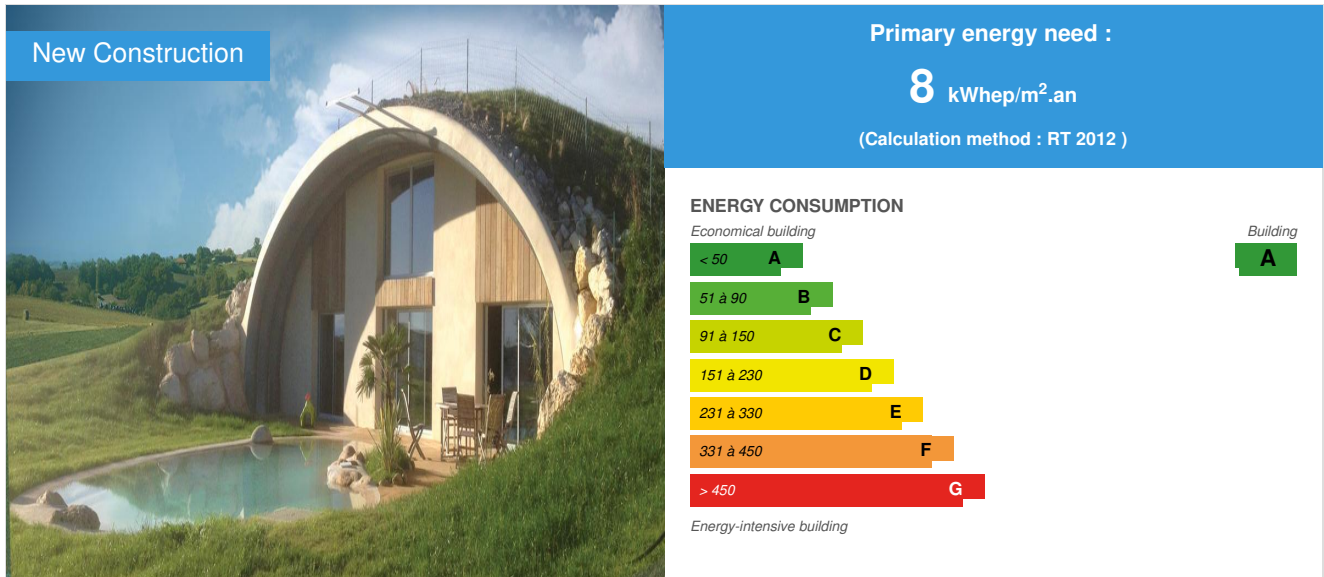


# NATURADOME

by Benoit DARRE / 2016-06-18 19:05:18 / France / 19112 / FR



**Building Type** : Isolated or semi-detached house  
**Construction Year** : 2014  
**Delivery year** : 2015  
**Address 1 - street** : Las hounts 65220 LAPEYRE, France  
**Climate zone** : [Cfb] Marine Mild Winter, warm summer, no dry season.

**Net Floor Area** : 156 m²  
**Construction/refurbishment cost** : 215 280 €  
**Cost/m²** : 1380 €/m²

## Certifications :



## General information

NATURADOME is a green patented bioclimatic ark for the construction of individual or collective housing, public buildings and professional high performance. Its construction process not binding on the constructive regulation, uses circular economy and ensures full integration into the environment. NATURADOME generates outstanding thermal performance (RT2012 least 53%) and the ability to create an interior space 100% customizable from 1380 € tax inclusive / m².

## Sustainable development approach of the project owner

Fed by innovation, we use the principles of circular economy to reduce the environmental footprint of our buildings while guaranteeing optimal comfort, customization of interior spaces, an almost zero consumption in heating and air conditioning. NATURADOME represents the habitat of the future, environmental-friendly, sober in grey energy and in environmental operating costs.

## Architectural description

NATURADOME is an innovative constructive concept that allows for all types of buildings 100% vegetated, with almost no energy requirements. The technical process used is innovative, it can offer individual homes at a lower cost than the market price.

Particularly suitable for the construction of individual houses, the NATURADOME prototype was built in 2014 and has been inhabited by a family since then to study its habitat's evolution and the harmony between the housing and the people, while making sure to respect their environment.

NATURADOME offers the public a detached house with energy performance that exceed the requirements of the RT 2012. Our house offers ideal thermal comfort while minimizing its primary energy needs.

Ultra-customizable, the interior of the house offers a freedom of styles for each family and allows them to project themselves into a cocoon environmentally friendly and in harmony with nature.

Finally, NATURADOME is a perfect integration with the landscape while enjoying the energy and architectural virtues of vegetable and arable coverage.

#### 1.4 Why NATURADOME is innovative?

The construction process NATURADOME was the subject of a patent application No. FR14 01406 filed on 11/14/2014. This patent will then be extended to the European Union and the United States, based on identified international business opportunities.

The project is based on the principles of circular economy:

- use our waste as raw materials,
- upgrade of existing structures
- repackaging materials to give them a new life cycle
- use all the raw materials present on the production site
- converting materials into ultra-short circuit.

Therefore, the innovative nature of NATURADOME comes from the combination of a rehabilitated metal structure (interior finish and formwork bottom basis) with a reinforced concrete vault (bearing function), then a layer of thick wood chips (insulation function), a geo membrane (sealing function), and topsoil in thick glaze (landscape function and surface finish by vegetation).

This device has finally presented the interest to offer a fully cultivable green roof and is capable of producing energy housing in the form of biomass.

Our strategy is to position ourselves through NATURADOME as pioneering the construction of bioclimatic houses of organic architecture. By developing a unique expertise and patented a constructive concept, we make an undeniable advantage over a carrier niche market but whose requirements and performance will tend to be generalized because of the popularity of our societies for sustainable development.

The highly specialized techniques based on innovation in design but also in the manufacture of structures make for contenders their entry difficult. Our goal is therefore part of a logic of specialization of our offering to maintain our margins in a competitive context almost non-existent.

Thanks to our special partnership with the POMES DARRE construction group, we have an industrial base capable of producing immediate passive houses and bioclimatic architecture organic standardized both in terms of structure, highly customizable in terms of development interior design and very aesthetic.

#### PROJECT DETAILS:

The innovation in the constructive concept of NATURADOME relies on 5 ideas:

##### 2.1 Idea # 1 - Simplify the Living envelop through the upgrading of tunnels:

No more vertical walls or horizontal ceilings!

The frame of the building is a geodesic structure of metal and reinforced concrete that provides the lift functions (up to 14.50 m long), high mechanical strength and contemporary interior finish very aesthetic (it is our customers who say that!) in galvanized corrugated metal.

The metal roof comes from the recovery and reclamation of self-supporting aboveground tunnels of the Air Force to house fighter planes and ammunition.

This removable structure is reconditioned and reassembled identical on site. It also serves as shuttering background working for casting a reinforced concrete vault that will ensure the resumption of climate and structural loads is mainly the weight of topsoil 40cm falling on the house. This structure is based on a continuous footing reinforced concrete section that allows current to encircle the book in its periphery and supporting walls Siporex 20cm in south and north facade. These walls intersect the inner roof and the awning to prevent any thermal bridge between the outside and inside inhabited volume. This awning is used to "break" the direct sunlight inside the house especially around the summer solstice.

At the ground will be implemented an industrial flooring with quartz finish to retain the loft appearance while reducing its cost. A finish like polished concrete will be applied. The pavement will be positioned on a 20 cm polyurethane foam isolation based on a hedgehog serious limestone. This paving incorporates rods which can neutralize outbreaks of foot vault.

The external insulation is ensured by 50 cm of wood chips from the valuation of our timber operating waste (crushed pallets from our activities with organic production 400m<sup>3</sup> / year). These chips are being implemented mechanically with a mechanical shovel directly on the frame concrete / steel of the vault. This gives a very porous, very light (300Kg / m<sup>3</sup>), very little compressible, composed of crushed chips.

On the roof, no tile, no bituminous membrane, but only a 15/10 industrial geo membrane that isolates the wood chips pore water. This membrane is covered with 40cm of topsoil to protect it from UV and weather damage.

A turf-type "ray agricultural grass" very rustic and very economical will be implemented. The maintenance of this vegetation will be facilitated by the creation of movements of land around and Housing to ensure the slopes between 2 and 20% or less, accessible for maintenance.

##### 2.2 Idea # 2 - Protecting the environment and reduce costs by using materials from recycling channels shorted (circular economy approach).

###### 2.2.1 The metal structure

The metal structure is a recycled roof of the Air Force used for the storage of weapons and ammunition. It is made of corrugated metal sheets in both directions of inertia which gives it a self-supporting nature. The company acquired from a local community 360ml of steel tunnel with a reach of 14.50 m and a maximum height of 5.50m. These "tunnels" were recovered near our headquarters and will be reassembled in mainly the same radius. Currently we have a potential of 40 houses with the available linear. The company thought already to find other deposits and especially developing a second generation dome house that can do without these tunnels once the depleted stock.

###### 2.2.2 Insulation materials from the recycling of our waste wood

The insulation is made with chips from our internal die revaluation of our wood waste. This waste comes from the grinding non-returnable pallets, reform shuttering wood, wood packaging from our trading business. We produce between 300 and 400t of waste per year which can then be recycled. This constructive process allows sequester more wood 200Kg per sqm built space. This wood is completely isolated from the outside environment by the slab reinforced concrete self-supporting and the other by a geo industrial PVC membrane 15/10. The cost of these chips is mainly limited to the cost of grinding, storage and transport on site is about 25 € / m<sup>3</sup>.

Conventional insulation materials will be limited in this context to the dubbing of South and North facades with 20cm of glass wool and polyurethane foam 20cm under paving.

###### 2.2.3 earthworks

We will only use cuttings from the excavation of the site operations. Inert land from foundations used to create the earth moves. It will not create any ground evacuation, everything is upgraded on site in ultra short chain.

###### 2.2.4 Low-carbon concretes

NATURADOME job only cements from the valuation of blast-furnace slag (CEM III) from the metallurgical industry (rebus ores). All concretes used are made from binder from the circular economy, which may also incorporate a portion of aggregates from the valuation of crushed recycled concrete. This will reduce to 70% the carbon footprint compared to conventional concrete. Finally the formulation and rheological mastery of the concrete developed specifically for NATURADOME

avoids the use of formwork significantly reducing time-and consequently the overall cost of construction and the carbon footprint.

2.3 Idea # 3 - Standardize methods and mechanizing maximum all the constructive tasks to reduce costs and improve working conditions.

All tasks are mechanized earthworks primary platform initially, creating earthworks and revegetation of the roof is done by 25T excavator.

The implementation of concrete is controlled exclusively by pumped concrete with very little manual implementation. No outer formwork is used. Concrete is formulated with a specific know-how acquired through the controlled concrete activity that ensures the production of reinforced concrete surfaces with slopes up to 70 ° (2/1 vertically), without form, without mechanical projection, using only control rheology of concrete through the use of appropriate formulation and chemistry of modern concretes. We obtain a conventional strength concrete (C25 / 30 XF2) with a texture "tile glue" that holds on any medium, without screening and without formwork under the action of vibration.

This example basin (L21m x x 116m H1.60m) architectural concrete, is implemented without form and without projection on slopes close to 100%, in the same way that the constituent of the concrete vault.

Ditto for the paving, while the constructive process is directly inspired by the industrial engineering. The slab is made in one layer over the entire inner surface with a finishing quartz. The partitions in BA13 are positioned directly on the finished slab without screed realization. The works of conventional masonry (75m aerated concrete wall 20cm Siporex in sections of tunnel in south and north facade) and finishing work, very intensive labor will be reduced to their simplest expression.

Although the degree of customization of the facades of inner plates is unlimited, all projects are from the same operative procedure with standardization of reinforcement which is identical in each bay and infinitely reproducible.

2.4 Idea # 4 - Limit the second work and focus on issues finishes of industrial engineering.

The paintings are limited to a few walls between rooms, bathroom and living room. Only the ceiling small rooms (hall and toilet) is made of BA13. Above the hall (home of 155m<sup>2</sup>) is the technical equipment of ventilation (VMC double flow). In other rooms, walls and ceilings are formed by the metal vault itself which considerably limits the areas to "flatten" or painting. It retains the rawness of metal to regain voluntary industrial and contemporary architectural style with a loft. All electric ducts are positioned mainly under paving and partitions. The interior lighting is by recessed spot on the ground with indirect lighting on the ceiling to a valuation by the light of the structure.

2.5 Idea # 5 - The comfort and quality of life of the occupants in the heart of our project

Biometric forms an insured thermal comfort, space and interior volume, mineral inside, priority to plant outdoors with conservation of 100% of the land usable area, here are some simple concepts whose Application is based in the execution of this project and remind the importance of producing a quality of life and environmental excellence for the occupants. NATURADOME is primarily designed as a cocoon, bright, spacious and comfortable.

## Building users opinion

Happy not to pay heating and live in a warm cocoon all year with an inner volume and an incredible brightness.

## See more details about this project

<http://www.naturadream.com>

<http://www.mypositiveimpact.org/projets/solution/item/naturadome-121>

<https://www.wiseed.com/fr/startups/naturadream>

## Stakeholders

### Stakeholders

Function : Construction company

NATURADREAM

benoit.darre@naturadream.com

<http://www.naturadream.com>

NATURADREAM designs living spaces of the future and made of eco-design a dream accessible to all.

### Contracting method

Build and sell construction

## Energy

### Energy consumption

Primary energy need : 8,00 kWhep/m<sup>2</sup>.an

Primary energy need for standard building : 4,00 kWhep/m<sup>2</sup>.an

Calculation method : RT 2012

CEEB : -0

Breakdown for energy consumption : 10% heating, 90% ECS

### Real final energy consumption

Final Energy : 4,00 kWh/m<sup>2</sup>.an

## Envelope performance

Envelope U-Value : 0,90 W.m<sup>-2</sup>.K<sup>-1</sup>

### More information :

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Building Compactness Coefficient : 0,90

Indicator : EN 13829 - q50 » (en m<sup>3</sup>/h.m<sup>3</sup>)

Air Tightness Value : 0,40

Users' control system opinion : no automation system except automated night-time ventilation

## More information

120 Kg per year on average consumed wood pellets to heat an interior of 630m<sup>3</sup> and a corresponding budget less than 50 € per year.

## Renewables & systems

### Systems

#### Heating system :

- No heating system

#### Hot water system :

- Other hot water system

#### Cooling system :

- No cooling system

#### Ventilation system :

- Double flow heat exchanger

#### Renewable systems :

- Wood boiler
- Energy recovery from waste

Renewable energy production : 100,00 %

NATURAWATT is a micro digester coupled with the green roof of NATURADOME. NATURAWATT is mainly powered by turf product in the plant canopy and secondly by sewage housing. This microdigester produces biogas that fuels a boiler for hot water. This boiler producing ECS also heated by waste heat from the interior volume NATURADOME. This habitat is very isolated (U = 0.09) and high performance we do not need energy source to heat the interior volume if we simply indoor atmosphere thermostatically controlled at 20 ° C all year.

#### Solutions enhancing nature free gains :

NATURADOME utilise comme source principale de chauffage les énergies fatales des équipements domestiques ( chauffe eau thermo dynamique, réfrigérateur et ordinateur familial principalement)

## Environment

### Urban environment

Land plot area : 2 500,00 m<sup>2</sup>

Built-up area : 180,00 %

Green space : 2 300,00

NATURADOME can locate in rural conservation area because of its high degree of integration. NATURADOME can also be used to create green networks

## Products

### Product

NATURADOME

NATURADREAM

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Product category : Structural work / Structure - Masonry - Facade

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The social acceptability of the project is complete: Easy achievements in the construction phase, the membership of the occupants living space, social acceptability of the neighborhood that was sensitive to the aesthetic quality of the work.

## Costs

### Construction and exploitation costs

Global cost : 250 000,00 €

Reference global cost : 1 150,00 €

Renewable energy systems cost : 3 800,00 €

Global cost/Dwelling : 250000

Reference global cost/Dwelling : 1150

Cost of studies : 15 000 €

Total cost of the building : 215 000 €

### Energy bill

Forecasted energy bill/year : 150,00 €

Real energy cost/m<sup>2</sup> : 0.96

Real energy cost/Dwelling : 150

## Health and comfort

### Water management

Consumption of grey water : 100,00 m<sup>3</sup>

Consumption of harvested rainwater : 100,00 m<sup>3</sup>

Our process NATURAWATT combines micro digester plant with roof NATURADOME. Biomass grown on the roof, and wastewater housing feeds a digester which produces a biogas for the production of hot water and nitrogenous fertilizer of water used in the biomass (mainly ryegrass and clover) produced on the roof. Vegetative cover serves as a biofilter and ensures the phytoremediation nitrogenous waters after transit of several months in the high land thickness has on NATURADOME is collected by the drainage system and then treated by reverse osmosis to be reused as a domestic water users NATURADOME. This process is the subject of a patent application.

### Indoor Air quality

Very little paint, interior facing food grade steel without solvent fumes. No glues or solvents used in the materials of finishing work.

### Comfort

Acoustic comfort : acoustic classification BR1. The mass of law is ensured by a layer of soil at least 40cm and a massive vault reinforced concrete. The acoustic insulation is total with the external environment. Low frequencies are handled by the mass character of the vault and acute frequency waves of the vaults as well

as insulation in thick wood chips.

## Carbon

## GHG emissions

Building lifetime : 100,00 année(s)

## Contest

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

Les atouts de NATURADOME: Technologie brevetée. Procédé constructif simple, rapide, reproductible et non opposable à la réglementation constructive française. Performance thermique 2 fois supérieure aux exigences de l'actuelle réglementation (RT2012 moins 53%). Grande luminosité intérieure du fait d'une grande hauteur sous plafond (5,15m) et d'une double orientation. Ratio d'éclairage naturel supérieur aux exigences de la RT2012. Toiture 100% végétale et cultivable constituée d'une forte épaisseur de terre végétale ou du terroir d'origine. Très bonne insertion dans le paysage. Pas de climatisation grâce à l'utilisation d'un puits canadien combiné à une sur-ventilation nocturne automatisée. 70% du volume des matériaux constitutif issus de l'économie circulaire.

- Pas d'imperméabilisation du sol sur l'emprise de la construction.
- Possibilité d'un bâtiment à énergie positive sans panneau solaire grâce à la biomasse produite sur la toiture végétale (brevet NATURAWATT en cours de délivrance).
- Séquestration de 300Kg de carbone/m<sup>2</sup> de surface habitable grâce à la valorisation et la mise en oeuvre d'une couche de 60cm de copeaux de bois issus du broyage de palettes non consignées pour assurer l'isolation du volume habitable.
- Coût à partir 1380€ TTC/m<sup>2</sup> en gamme initiale (critères d'habitabilité CCMI).
- 3 mois de délais de construction pour un bâtiment de 100m<sup>2</sup>.
- Déclinaison du concept vers l'habitat collectif, les bâtiments publics ou industriels à hautes performances.
- 15 projets en études pour une réalisation sur 2016/2017.

### Building candidate in the category



Energie & Climats Tempérés



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