B I F R Ö S T

**A BURNING RAINBOW**

L A G I 2 0 2 0 | F L Y R A N C H

*In Norse mythology, Bifröst is a burning rainbow bridge that reaches between Midgard (Earth) and Asgard, the realm of the gods, it may mean “shimmering path.” The first element of Bilröst—bil (“a moment”)—”the fleeting nature of the rainbow,” which connects to the first element of Bifröst—the Old Norse verb bifa “to shimmer” noting that the element evokes notions of the “lustrous sheen” of the bridge.*

Inspired by the beautiful colours the Geyser has and how powerful a source of value to the land, it was needed to create another powerful source of meaning as the inspiration of Bifröst means to culture and nature. The possibilities for a poetic project linked to nature and sustainability created this design, this dream of a sustainable rainbow in the desert.

SITE

The concern about the fire risk, plus the warning of the climate change, was primordial to situate the project connected to water, to use it as a source of renewable energy and as an AQUEDUCT, a chain of different modules that are linked to support the program.

This AQUEDUCT is a forest of modules, which each one is eolic and solar energy generators, leaning on the ground,, which means 2.82 m2 in total over the land barely touching the terrain to protect it. The courtyards generated by the 10 modules placement, create a site for reunions, visitors, exterior art exhibitions.

The foundation of the Bifröst project is water, which will be retained from rain, reused after filtrations, and energy produced by falling through the different heights of the pools to generate farms and living walls. The vegetation that grows as living walls around the columns, will help to cool the building and its surrounding during the day. The interior gardens for organic farms are paired with a net-screen on top to mitigate sunlight.

The idea of re-creating the foundation of the FLY GEYSER, could self protect from within, having a continuous current of **water 24/7 and all year long.** With the capacity to explode its water to control a fire and its surroundings. It can also spray to create the best micro climate for farming.

MODULE DESIGN

Influences such as *Instant City* 1971 in Ibiza, an experimental community living, inspired the ***Bifröst*** project to grow as a *community of connected modules*; constructively independent, for an easy, fast and cheap construction as well as giving the opportunity of growing, and adaptability to land with a minimum footprint.

The circular economy of the project was essential, understanding how to recycle the waste land, to create a project which allows atotal regeneration of it, thanks to the water tanks to filter water and waste for a clean use of energy.

It will generate its own production of energy.

**Bifröst** becomes a sum of two separated and modulated worlds: two natural resources (water and land) that woking perpendicular and parallel between them, each other separates the unified modulated program naturally in categories and spaces without closed surroundings, respecting each other limits and interacting between them as a whole.

Bifröst is a forest of three types of modules that explore variations adapting to land naturally, and generate energy from Sun, Wind and Water.

The NW main direction of the Wind stroke and the optimal orientation N-W, E-W direction for sun capture were taken within the creation of the module and the growing on the land.

**BIFROST** has 10 modules. They share the same height to access to the main floor, but they differ between them in the domes.

The Domes

This roof shape is more easily cooled and are linked to EOLIC energy production, which in total sums: 13252 watts

*\* The formula for the electric power is P = π/2 \* r² \* v³ \* ρ \* η, one watt is calculated as 1 W = 1 kg \* m² / s³.*

On top of each Dome there is an Oculus for Natural light and SUN captation with solar panels of 90.54 m2 in total the 10 modules. There are 3 heights of domes with the same wood structure shape and configuration.

T1 X 2 UNITS

H= 5 M, ∅= 20 M, TURBINE ∅ 0.15

EOLIC ENERGY PRODUCTION: 165,65 WATTS

X 8 (1 MODULE) = 1325.2 WATTS

X2 UNITS= 2650.4 WATTS

T2 X 4 UNITS

H= 2.6M , ∅= 20 M, TURBINE ∅ 0.15

EOLIC ENERGY PRODUCTION: 165,65 WATTS

X 8 (1 MODULE) = 1325.2 WATTS

X4 UNITS= 5300.8 WATTS

TYPE 3 X 4 UNITS

H= 1.5 M , ∅= 20 M, TURBINE ∅ 0.15

EOLIC ENERGY PRODUCTION: 165,65 WATTS

X 8 (1 MODULE) = 1325.2 WATTS

X4 UNITS= 5300.8 WATTS

The Continuous Facade

The curved facade links all of the 10 modules, and has aluminium as reflective material to create in the landscape reflections and mirrors, protecting the inside from heat. It has a total of 526 windows with solar panels to capture SUN energy 365 days. The flexibility, the glossy and appealing surface, and the reduced weight of this material helps to contain overall structure costs of the building.

The Structural Columns

A group of 4 tree columns in a module, supporting a circular floor above. Surrounding them are situated the living walls that closes the perimeter but doesn't damage the land, meanwhile it generates a support for Farming Walls and Living Walls that grows into the interior of the building for air cleaning. The surface of living walls is 621.4 m2, an integrated water tank that is used to filter the rain water and retain it for hydroelectricity in a small scale in between the pools, as they are separated with different heights to create a natural fall. **Dams** are huge barriers that block the flow of water, creating a large reservoir. Water falls from the dam, and its [potential energy](https://www.omnicalculator.com/physics/potential-energy) is converted into mechanical energy during the fall. The **power output of a dam** is P = η \* ρ \* g \* h \* Q

Program:

ACCESS FLOOR

We arrive at Bifrost after a walk of 1.2 km from The Fly Geyser to the south.

* The main entrance and two private access ( library and dorms).
* Desert Art Exhibition AREA: 10681 M²
* Organic Farms AREA: 363.2 M²
* Filtration Pools : AREA: 1193.8 M²
* Fountains

MAIN FLOOR

* Hall: event areas, coffee shop, exhibitions
* Teaching and Learning: classes, studios.
* Laboratory: classes, farm, investigation, development.
* Communal living: director and tutors departments, dorms, restrooms, dining room, kitchen, studio, rest area.

SECOND FLOOR

* Library
* Studio

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Modules*** | ***Name*** | ***Quantity*** | ***Dome Diameter***  ***(m)*** | ***Dome***  ***High***  ***(m)*** | ***Floor***  ***Number*** | ***Floor***  ***High***  ***(m)*** | ***Total High***  ***(m)*** |
|  | A | 2 | 20 | 5 | 2 | 3 | 13.7 |
| B | 4 | 20 | 2.5 | 1 | 3 | 11.3 |
| C | 4 | 20 | 1.56 | 1 | 3 | 10.3 |
| *TOTAL* | 3 | 10 |  |  |  |  |  |

**ENVIRONMENTAL IMPACT STATEMENT**

Bifröst energy renewal program is focused on the use of the WIND, SUN and WATER as all natural sources of energy that are planned, designed and adapted to be developed as a circular energy economy within the project.

Construction activities have considerable impacts on the environment including the water resources. To achieve sustainable construction, construction activity must change the processes of constructing built environments to a cyclical process. An intake is a structure placed in a surface water body to withdraw water. The intake towers of the modules and submerged foundations for water storage for the use of a program of domestic activities, investigation, events and fire‐fighting purposes. The common water storage structures are hydropneumatic tanks, buried reservoirs, generate a sustainable approach as water treatment plants and the distribution network but also manage water sources and the consumption pattern with intelligent software and databases.

Wastewater collection and disposal by canals and conduits that surround and compose the overall project of Bifröst for the circular economy to keep products and materials in use and to maintain their value, to regenerate natural systems in and around Bifröst, to have economical, social and environmental benefits with the farms and energy power.

Bifröst will become a resilient micro-city:

-Will keep material in use and reduce virgin material pressures: min. Footprint

-Working with local and distributed production capacity

-Harnessing digital technology

WIND:

*10 modules generate 13252 Watts.*

SUN:

*ROOF SOLAR PANELS: AREA: 90.54 M²*

*WINDOW W/ SOLAR PANELS: AREA: 973.1 M²*

*SI\_EF\_MIN\_TILTED\_SURFACE\_HORIZONTAL SRB/FLASHFlux 1/2x1/2 Minimum Solar Irradiance for Equator Facing Horizontal Surface (kW-hr/m^2/day)*

*SI\_EF\_MIN\_TRACKER SRB/FLASHFlux 1/2x1/2 Minimum Solar Irradiance Irradiance Tracking the Sun (N/S Orientation)*

*SI\_EF\_MIN\_TILTED\_SURFACE\_LAT\_PLUS15 SRB/FLASHFlux 1/2x1/2 Minimum Solar Irradiance for Equator Facing Latitude Plus 15 Tilt (kW-hr/m^2/day)*

*SI\_EF\_MIN\_OPTIMAL\_ANG\_ORT SRB/FLASHFlux 1/2x1/2 Minimum Solar Irradiance Tilted Surface Orientation (N/S Orientation)*

*SI\_EF\_MIN\_OPTIMAL SRB/FLASHFlux 1/2x1/2 Minimum Solar Irradiance Optimal (kW-hr/m^2/day)*

*SI\_EF\_MIN\_TILTED\_SURFACE\_LATITUDE SRB/FLASHFlux 1/2x1/2 Minimum Solar Irradiance for Equator Facing Latitude Tilt (kW-hr/m^2/day)*

*SI\_EF\_MIN\_TILTED\_SURFACE\_LAT\_MINUS15 SRB/FLASHFlux 1/2x1/2 Minimum Solar Irradiance for Equator Facing Latitude Minus 15 Tilt (kW-hr/m^2/day)*

*SI\_EF\_MIN\_OPTIMAL\_ANG SRB/FLASHFlux 1/2x1/2 Minimum Solar Irradiance Optimal Angle (Degrees)*

*SI\_EF\_MIN\_TILTED\_SURFACE\_VERTICAL SRB/FLASHFlux 1/2x1/2 Minimum Solar Irradiance for Equator Facing Vertical Surface (kW-hr/m^2/day)*

**E = A \* r \* H \* PR**

WATER:

*10x 2.95 m2 water cross section area of chanel = 29.5 m2*

Discharge: Q = A \* v = 29.5 \* 2 = 59 m³/s. (If water runs 2m/s)

*P = η \* ρ \* g \* h \* Q = 0.8 \* 998 \* 9.81 \* 5 \* 59 = 2,310\*10³ W =2310 kW*

MICROBIAL AND VERTICAL FARMS:

To follow the Microbial Biogeochemistry from Fly Ranch Geysers study, which raises awareness of the uniqueness of the geothermal features of Fly Ranch and the microorganisms that live within. Focus on the hydrothermal ecology found on Fly Ranch, a rare and delicate resource: the microorganisms living in the geothermal water conduct life supporting chemistry, one of the reasound of creating farms that reinforces the modules structure around them, to grow and protect the building and it self, giving each one of the two words the space and the time of growing with time with the optimal conditions.

supporting chemistry. and creating renewable energy within the structure through friction with the bacteria heat.

COST ESTIMATE:

Bifrost Area: 3355.2 m2 GENERAL FLOOR = 36115.0 sq. ft.

Nº Columns: 40, material: steel, heigh: 4.5 m

Substructure: 4 trusses / module\_ TOTAL 40 TRUSSES. MATERIAL: STEEL

Nº FILTRATION POOLS: 10, DIAMETER 12M: AREA:119.8 M2, DEPTH: 2.5 M

Floors: 1 x 3355.2 m2

Second Floor 2 X 117.15 m2= 234.3 m2

TOTAL FLOORS: 3589.5 M2, MATERIAL WOOD

10 DOMES OF WOOD: PREFABRICATED W/ WIND GENERATORS

Nº WINDOWS: 526, MATERIAL: PLASTIC W/ SOLAR PANELS: AREA 1 WINDOW=1.85 M2 TOTAL: 973.1 M2

ALUMINIUM FACADE: PERIMETER 417.92 M, HEIGHT: 3M : TOTAL SURFACE 1253.76 M2 - WINDOW SURFACE: 280.66 M2

**Approx Cost of Construction of Medium Specification = 1000 \* 900 = Rs. 9,00,000** Where, 1000 is built up area and 900 is As per thumb rule assumed value.

#### **Total Cost** = Built Up area × Approx cost per sq. ft.=Builtup area×Approx cost per sq. ft. =36115.0×1000=36115.0×1000=36115000.00 Rs.