

## FLY RANCH - TREASURE HUNT:

Growing up, we play with Legos and formulate shapes and spaces without recognizing what we are doing. We are inspired by the geometry of the shapes and the colors. Here on this project, anyone who is interested in being part of this collective art, could be taking their triangles and start creating their own tessellations. These tessellations are forming different angles, bending and folding and undulating as they create spatial experiences around us that constantly shift our perspective and our perceptions about the world and the natural landscape around us. The framework that results would become the frame from which the canvas is wrapped around. These canvases would use the latest technologies in renewable energies where each of those energies also play a role in part of the larger canvas. On this canvas, panels of renewable energy are covering the structure with a diverse striation of art and colors. Each triangulated solar panel is an art in itself and could be part of a larger art piece. At times, these triangulated shapes are embedded in the ground close to the earth while others rise at steeper angles, reaching higher points that define different zones of the treasure hunt experience.

For centuries, the Numu and Newe were the stewards of Nevada and Fly Ranch, they respected the land they walked upon. In the 1850s, while the gold seekers were looking for a treasure, provoking conflicts with the Paiute people, the Paiutes were well aware that the true treasure is immaterial. This is why we chose "Treasure Hunt" as a concept to work with. We hope to gain their wisdom by learning that the earth is the true treasure while we raise awareness and acknowledge their struggles, past and present. We seek to honor the lessons they can teach us by considering them as a key reference of our design and the inspiration of our way of looking at the land.

- A Story of Hunting and the Patience of the Hunter
- Why the North Star stands still
- Ghost Dance

The first two stories are legends and the "Ghost Dance" is a dance ceremony that was customarily performed by the Numu people. We looked at the traditional stories and folktales they told to see what type of messages and wisdom they were communicating. Through the process of "Treasure Hunt", these stories will be told so that, at the end, the one who goes on the journey will be able to understand the wisdom of the Numu people. This is the true treasure of the "Treasure Hunt" journey.

Influenced by the Paiute's shelter 'the wickiup' (a frame structure of willow branches covered with a layer of rocks and mud with a smoke hole in the middle), we envisioned a shelter made from a frame structure constructed from 3D triangular tessellations. The triangles are filled with different renewable energy panels forming the overall undulating triangulated shell with strategic openings in the roof to allow the sun to warm the space and to allow natural light and natural ventilation.

We are also inspired by the Paiute's nomadic lifestyle in the way each community traveled together when the seasons changed. And so, we envisioned the three large parcels of land on the Fly Ranch site to be three distinct places that attract people with different interests. The experiences in these three distinct areas of the site are connected through different paths and gatherings of different scale with different program elements. In these places of gathering, some activities will be planned while some will come together organically.

The design is based on the principles of “Burning Man” where the participants design their space as an art canvas. Whether it is through the use of solar panels that become an expression of art or wind turbines that generate power or other concepts that could be an integrated part of the main creation. We are embracing current and future renewable energy technologies to release the self and leave no trace

The treasure hunt experience is within each of the three areas. The peak you reach part of the treasure hunt experience is after traveling along a path reaching a destination. The journey is designed to help one come into a dialogue with aspects of oneself and to form a bond with the self and with others as it encourages chance encounters. The whole of the journey is to learn that the most hidden sides, open the self to the world. It is a place for people to retreat in order to reconsider views, to face fears and prejudices, and to make choices.

We divided our general program to address three main interrelated aspects of the Human’s Soul and Body. The three areas are called Nutrition, Action and Wholeness. Each area houses different program elements related to either Nutrition, Action or Wholeness. Each part supports the other and is an extension of the other for a healthy, independent, self reliant, self sufficient, self empowered individuals and communities -- creating a whole union for better awareness and for a more joyful existence. This synergetic whole, addresses different aspects of the self from the mental to the physical. Thus, the site allows the empowerment of one by using the latest technologies in ways to serve the individual and the collective.

**On Nutrition-** This aspect includes Food Systems and the act of being involved in learning about, growing and harvesting your own food. Agricultura Centres, Hybrid plantations, including in Mud Therapy, etc. will be a part of the site programs.

**On Body-** Physical activities. The people can engage themselves in geographical learnings of the spaces including space studies. They can partake in multifarious sports activities as well.

**On Wholeness** – Art, Music and Expressions, wellness, wholeness are the key characteristics of the experiences offered by the spaces. It aims at rejuvenating the mind, body and soul. The site allows the empowerment of one by latest technologies and to use it in ways to serve the individual and the collective.

**The South** part (green code) of the site is dedicated to Food and its complementary functions. We intend on farming and growing specific plant species in various systems of Permaculture and Polyculture. Hydroponic plantation beds would be used to grow plants to a suitable nascent stage and then they can be planted in the soils around the site in strip cropping or cover cropping patterns. Food growing, harvesting and eating collectively will result in becoming an art form.

**The Middle** part of the Site (orange code) is dedicated for the activities related to the body, the active engaging part of the human. Orange, generally reflecting the zeal and enthusiasm related to the active functions of the individual or the group. The idea of interactive learning and creating together as a community are promoted by our programs. We also aim at instilling a strong sense of the surrounding site and its context for the people based on our activities which pertain to historic, geographical and physical activities. The landscape around the middle site plays an ode to the organic, native grasses and shrubs that are currently present on site and deeply acknowledges them.

**The Upper Part** of the site is for the rejuvenation of the mind and the soul using art and music as a form of expression. Calming hues of blue color depict the nature of the spaces and the experiences offered. It focuses on evocating expressions and performances. The water bodies around on the landscape areas of different

experiential characters which will allow the people to engage themselves into various body healing hydrotherapies. Water bodies with varying temperatures and depths and with additional characteristics will serve as a refreshing experience, while also an extension of the Fly Geyser and the many other springs and water bodies adjacent to this part of the land.

Our project seeks to connect an individual person's awareness of the history of the land and the Paiutes, but also plans to adapt the challenges of today and tomorrow.

Program for Low Impact Boundaries:

**1- Renewable Energy Generation and Transmission-** We intend on making the structure a net-zero sustainable structure. It produces more energy than it consumes. The energy would largely be generated by the latest and most efficient sources of renewable energy be it, solar panels, solar films, wind chimes, wind movement, Algae Bioreactors, solar fabrics, wind harvesting. We are providing the framework within which different artists and creators can design their canvas for renewable energy.

Currently, we are considering technologies in solar panels where it allows the panels to be a part of the art itself creating and empowering the triangulation of the surfaces creating spaces as shelters to house functions where the participants become active in creating threshold between interior and exterior and between shaded exteriors and open to sky exteriors.

In the current scheme, the solar panels would be installed on the panels of our structure in the direction which is most optimum for it. We consulted Kameleon Solar for the details of the energy outputs, while there are also other companies, including Sistine Solar, Inc. We calculated that the Panels on the Northern part of the site, the blue building will generate approximately 950000 kWh per year, or 950 MWh (1MWh is capable of powering two refrigerators for an entire year, so this is quite a lot of power).

**The Algae Bioreactors:**

- There are two kinds of algae: microalgae and macroalgae.
- Algae are microscopic plants in its most primitive form and lacks the defined parts of plants like shoots, roots, leaves, seeds and fruits
- Microalgae cannot be seen with the naked eye, but if it grows in water with enough nutrition, the color of the water will change to green, brown, blue or orange due to the massive amounts of microalgae. Hence these colors can also correspond to our building colours.
- To create a functioning microalga building, it will need input from the outside for nutrients. The wastewater from the sewage can be used in an anaerobic digester and produce CO<sub>2</sub>, methane, coal, phosphate and nitrate. The microalgae will consume the phosphate, nitrate and CO<sub>2</sub> and with photosynthesis, it will produce biomass. The biomass will be used for biomolecules for the production of high value products and hydrogen. The hydrogen is used in a fuel cell combined with the produced O<sub>2</sub> from microalgae cultivation to generate electricity. Heat produced with the fuel cell can be used for the building. Excessive heat energy can be used for district heating or stored under the building.
- Photobioreactor can be custom made in the shape that fits into the triangles of the space frame. Bioreactor tubes can be integrated in the existing roof of the frame's construction.
- There are many advantages over land crops by using microalgae. The high growth rate of microalgae makes them a perfect candidate to satisfy the energy need in the future with limited usage of land resources.

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**2- Agriculture-** The system of Polyculture has been adopted for all the parts of the site, and it has been customised according to every part. Hydroponics, Strip cropping, Cover plantations and permaculture techniques will be implemented in different land patches. Polyculture is a form of agriculture in which more than one species is grown at the same time and place in imitation of the diversity of natural ecosystems.

We propose to adopt Carbon Farming methods to contribute to the net-zero sustainability aspect of our design. It is a name for a variety of agricultural methods aimed at sequestering atmospheric carbon into the soil and in crop roots, wood and leaves. Increasing soil's carbon content can aid plant growth, increase soil organic matter (improving agricultural yield), improve soil water retention capacity and reduce fertilizer use and the accompanying emissions of greenhouse gas nitrous oxide. Biosequestration will be implemented to a certain extent owing to the functions and programs proposed for the design. Biochar and Organic Mulch will be used as the products for nourishing and enriching the soil qualities.

**3- Designing Experience-** allowing certain experiences to occur through design. Recreational activities related to agriculture- The sense of community actions and togetherness is instilled at most of the activity spaces. The people can come together and carry out the farming and harvesting practices. While doing this, they will also learn of the various agricultural systems implemented and will also learn about the site and its native plants.

The people could cultivate together in groups on the different patches of land and contribute in the making of the larger art piece of the landscape while also retaining a sense of belonging to the plantations. Collective harvesting of the grown fruits and vegetables and other plantations can be done. This produce can be used in the community kitchens itself and contribute to the self-sufficiency of the building.

**4- Water Harvesting-** With dozens of hot and cold springs, hundreds of pools, and half a dozen artesian wells, water is the lifeblood of Fly Ranch. We intend to deploy spring water filtration units near the northern part of the site and propose greywater recycling. Water can be made available through saving, reuse, rainwater harvesting, desalination, or direct use of seawater for salt-loving plants. Reuse of treated water and the closing of cycles is the most efficient because closed cycles stand for unlimited and sustainable supply - rainwater management is a decentralized solution and applicable for inland areas. The water can be distributed using natural earthenware canals which are semi open in nature or through troughs. Depending on the method of distribution of the water according to the site conditions, it can then be provided in different methods to the plants.

## **GREY WATER TREATMENT**

A membrane bioreactor (MBR) system is used to treat, store and reuse the waste water for toilet flushing, irrigation, and cooling systems. This reduces the fresh water requirement on site by over 75% and decreases energy costs associated with pumping. Living machines are another system used to treat combined wastewater for reuse.

## **ON-SITE PROTOTYPE STRATEGY:**

The strategy is to have a little kiosk for information that provide shading area of about 5.75 m x 6.25 m.

- Materials used are Steel members connected in the proposed triangulated geometry with Solar Panels, Algea Panels as Exterior finish and Recycled Fabric Panel as Interior Finish when needed.

- Two fabricators were consulted to determine rough cost estimate. The prototype assumes a structure of recycled steel tubes connected. The honorarium grant would cover the fabrication of the steel elements and the connections between members and the ground plate connection. The solar panels and the Algea panels and the recycled fabric and all the infill materials would be offered at no cost. The prototype submitted could be simplified if needed. Bruno Works was consulted for the cost and fabrication details.

## **ENVIRONMENTAL IMPACT SUMMARY:**

The Environmental and energy aspects of the technology proposed:

An effort was made to engage the owner of the proprietary technology. The specific owner of this technology is Kameleon Solar as its mission and product was pushing the edge of design for more freedom and visual effects. Kameleon Solar's mission is to grant complete freedom of design and aesthetics to architects, building owners, and façade builders.

A company by the name Sistine Solar was also engaged in early discussions to determine the right technology for the output being considered.

## **TECHNOLOGY**

The structure is made up of colored, custom-made photovoltaics. Each triangular sub-surface can be divided into a series of PV-modules, custom-made to maximize the yield within that specific shape and area. There are different methods to achieve color on these surfaces; by incorporating colored foils within the solar modules, by digitally printing ceramic inks on the outer glass, or by integrating the solar cells within colored, semi-translucent bio-composite materials. Ceramic printing on the outside of custom glass PV modules has been used for the purposes of this calculation.

## **GLASS PV MODULES – LIFESPAN AND RECYCLING**

Glass solar panels have a longer lifespan than those with a polymer backing and this grants a longer period of CO<sub>2</sub>-neutrality (and reduction in comparison to other energy sources) after the PV modules have achieved their energy payback time. The manufacturer of the modules is a member of PV Cycle, an EU-funded recycling body, which has achieved a recyclability of 94.7% for solar modules with a polymer backing. Modules with a glass backing would have an even higher recyclability. The manufacturer is required to pre-fund the recycling of its modules so that they can be properly processed at the end of their expected lifespan of 40-50 years.

## **CERAMIC PRINTING**

The solar panels are printed with ceramics inks in a metric pattern so as to evenly distribute light across the underlying cells whilst also granting the appearance of a homogeneous color from a distance of 2-7 meters, depending on the pattern. Ceramic inks are tempered with the glass and remain colorfast for a period of more than 100 years; if a PV module ceases to produce electricity, it will maintain its aesthetic and structural function for a much longer period of time. This color technique for PV modules results in a power loss of 10 – 40%, depending on the vibrancy of the chosen color. On average, the power is 25% lower than an uncolored module of the same size and cell type.

Ceramic inks are extremely durable, after tempering they are as hard and resistant as the glass itself.

## **SPECIFIC MODULE AND MANUFACTURER**

For this proposal, modules from Kameleon Solar in the Netherlands are being used. Modules have been calculated as having a power of 200 Wp in a 60-cells size.

Monocrystalline 6-inch cells are being used, in combination with 4mm tempered front glass and 5mm tempered, black rear glass. EVA encapsulants are used. The color technique is called ColorBlast. Kameleon Solar has also developed a new color technique for more vibrant colors that can also be used in this project. In this case, artwork and photography can be depicted on the modules an additional to ColorBlast's single colors and basic vector designs.

The modules can be fitted with holes for mounting brackets so that the modules can be attached to one another or to an underlying structure.

## **SYSTEM OUTPUTS**

Power:

We calculated the power based on the surface area for the blue site only. We got about 1000 megawatt hours on the blue site.

Maintenance

PV systems have low maintenance, overall.

The front glass should typically be washed 2-3 times per year, in a location such as Nevada, the frequency should be increased to at least 3-4 times per year. We do not have data on the amount of water that is required for this. This is the most resource intensive maintenance required.

Inverters should be checked once per year and have a standard product warranty of approximately 10 years; hence one inverter should be calculated per 10 years of service.

The PV modules themselves should also be checked periodically.

If monitoring devices are used, PV module maintenance can be sporadic, less than once per year and likely performed in conjunction with inverter maintenance. A monitoring system will likely indicate any system faults and maintenance can be planned based on this.

Batteries, if used, should be checked more regularly. An employee at the local site can easily be trained to perform simple checks on the batteries and alert an installer to perform maintenance. Otherwise, batteries can be checked together with the inverters.

## **NET-ZERO SUSTAINABILITY**

The energy payback time of crystalline modules is estimated to be between 0.4 and 1 year in South-Europe with the ideal orientation and tilt. Translated to Nevada, in non-ideal circumstances and with colored modules, this can safely be translated to 3-4 years. After this period, the PV installation will have generated more clean energy than the amount of energy used in the production process. To be on the safe side, we can add an additional two years to account for the energy used in mounting, installation, transportation and the manufacturing process of other components used throughout the entire installation. After a safe 6-7 years, we would estimate that the PV installation will become energy positive. The modules have a guaranteed lifespan of 20 years, granting an additional 13-14 years to payback any additional energy inputs and generate years of fully clean energy. The expected module lifespan is 40-50 years, suggesting a total clean output that is at least 7 times greater than the energy used in production.