**›› Design Concept**

*Using Less,* works within the context of Fly Ranch and its surroundings, creating bold new built forms that mirror existing site elements. The project proposes multi-use hubs that strike a balance between art and energy creation, providing variable public space as well as defining a new visual identity for Fly Ranch. The initial main hub, proposed in the north section of the site, derives its form from the Fly Geyser. Opportunities for expansion propose additional hubs utilizing the same structure, evoking the forms of the Granite Mountains in the center of the site, and Burning Man’s iconic flame at the site of the original Burning Man.

Communities intended for short-duration stays surround the hubs. They are made up of Earth Integrated Shelters, which are partially submerged to meld with their surrounding landscapes to fully immerse visitors within the beauty of the Black Rock Desert. Native vegetation blurs the edges of both the hubs and dwellings, allowing for smooth transitions between built and natural features to integrate them seamlessly into the landscape. Shelters utilize passive design principles to reduce their energy needs, creating new spaces while reducing visual disruption of the existing viewsheds.

Reducing the need for energy is the best way to make the largest impact on reducing waste. *Using Less* looks to reduce waste through energy efficiency. By utilizing passive design and energy sources, like solar and geothermal, sites can be net positive for energy. In addition, energy metering and communication of energy use through block chain will allow each site to relay information on energy needs and give what is needed to reduce waste.

**›› Technology used in your design**

**Active Design Strategies:**

**Prism Solar: BiFacial Photovoltaic Cell**

The main hub is made up of a central 24 meters tall spire. The south facing side of the spire is covered in n-type silicon solar panels by Prism Solar, made to absorb sunlight from both the front and back side of the panels with near equal efficiency. The rest of the spire will be made from a reflective, translucent surface, further maximizing the potential energy capacity. Light will pass through the cells on the south wall, reflect off the inside of the spire on the north wall, and reabsorb the remaining light on the bifacial back wall cells. This type of technology can be up to 35% more efficient than conventional models with the same STC rating. Prism Solar’s tempered glass-on-glass design, combined with hermetic sealing protects the delicate PV cells from external damage. The main hub has 9,180 m² of façade-integrated solar modules and a total output of 1 MWp (MegaWatt-peak).

**Solar Thermal Orb:**

Generation of heat energy for each satellite community will be provided by an orb-shaped solar thermal collector, each collector equaling the efficiency of four evacuated solar thermal collectors. Solar thermal collectors harness the sun’s energy to heat up glycol mediums, which in turn are hooked up to run through a hybrid geothermal system, through a temperature exchanger to provide ample heating to each individual home when passive properties are not enough.

**Geothermal Heating & Cooling:**

A geothermal loop will be used for heating and cooling, combined with the solar thermal collector used for heating. The system will run codependently to create hot air during the cool season, and cool air during the hot season. Heat is removed from the room by pushing inside air across a heat exchange coil, which is running glycol through polyethylene tubing. The glycol absorbs the heat, which runs underneath the ground through a ground source heat loop. The natural, constant temperature of the earth will cool the glycol, acting as a heat sink. This will then run back through the heat exchanger in order to provide cool air to the building.

**Passive Design Strategies:**

**Solar Chimney:**

A type of passive solar heating and cooling system that can be used to regulate the temperature of the building as well as provide ventilation. The main spire draws heat upward out of the structure.

**Green Roof:**

Each of the satellite communities is made up of three different earth-integrated shelters (EIS), using the consistent temperature underneath the ground to regulate temperature. Each EIS is half above ground, half below, covered in natural vegetation. The sun’s rays will be absorbed by the naturally insulating plants covering the shelter, removing heat from the air and lowering the overall temperature of both the roof and inside space.

**Efficiencies**:

**Micro-Grid:** The small network of satellite communities use electricity with a local source of supply that is attached to a centralized national grid but is able to function independently. Since all energy used by satellite communities will be provided directly by the main sources of on-site energy generation, specifically the spire, the lack of grid-tied energy qualifies this project as a micro-grid. All energy being used on site is created on site, and satellite communities interact with each other via blockchain to share energy and increase overall efficiency.

**Metering and Block Chain Communication:**

A Smart Site creates efficiencies on a larger scalethrough the use of energy metering and block chain technology. Each community can monitor and communicate needs and distribute energy with the site at large.

**›› List of activities your design would support**

The Main Hub has a capacity of approximately 100 people**.** Its flexible design supports use as laboratories, and classrooms and conference rooms for educational discussions, lectures, and courses. It would also support artist galleries, located within the courtyard on the surrounding walls and amidst the native plantings at the center. The satellite communities provide overnight accommodations. Each earth integrated shelter can house 1-3 people, for a total of 9 people per satellite community. There are 5 satellite communities per main hub, for a total of 45 people that can receive overnight accommodations for phase one (North site). The satellite communities will function as short term artist residencies and living spaces for those who participate in activities at Fly Ranch. The entire site will have paths for hiking and interpretive elements at major site features such as Fly Geyser to support tours, plant identification walks, and other types of active and passive recreation.

**›› List of system inputs**

Apart from the technical components required during installation, the main requirement for this system is ample sunlight. Northern Nevada has an average solar irradiance of 5.98 kWh/m2 peak sun hours per day, one of the highest in the country. The main spire and the solar orbs will use this solar insolation to create electrical and thermal energy, respectively.

**›› List of system outputs**

**Solar PV**

Output (kWh) = Area \* Efficiency \* Annual Radiation \* Performance Ratio

= 1.3 mWh Annually

**Solar Thermal**

Insolation: 5.98 kWh/m2/day, 4 Evacuated tubes per collector, Electricity cost: $.14/kWh

= 1960 kBTU Annually

There is no waste generated by either solar collector, until the life of the solar thermal, geothermal and PV system is up.

**›› List of the primary materials used in your design and major dimensions**

The main hub has two components – the 3700 square meter outer shell is a climate shell with façade elements consisting of single glazing and photovoltaic modules. The load bearing structure of the outer shell is of timber, as are the structural elements and cladding of the interior. The structure utilizes a drilled pier foundation to reduce impact of moisture fluctuations from clay soils. Satellite communities constructed out of timber and earth.

**›› Order-of-magnitude conceptual cost estimate**

Using the Further Education Center Mont-Cenis as a precedent for cost estimates, it would be approximately **$558,475,096** (<https://miesarch.com/work/2844>). This building is similar in size and material. It uses the same photovoltaic technology at the same magnitude as the main hub. The building is both a public space housing urban development and a milestone on the way to the energy patterns of the future.

**›› A short summary of your strategy for on-site prototype development in the event that you are chosen for an honorarium grant**

The on-site prototype focuses on one earth integrated shelter within a satellite community. The process begins by digging into the ground and installing a foundation. Then it is built up with mass timber and partially buried. Native plants would be installed on the roof. The individual shelter would have a compostable toilet installed.

**Vocabulary**

**Main hub:** The central fixture to which the satellite communities connect. Most solar energy production happens here. Influences the form of the satellite communities. Contains gallery space and a stage for educational presentations.

**Satellite community:** A unit of three earth integrated structures. Satellite communities are offshoots of the main hub each equipped with a solar thermal collector orb. They offer overnight accommodations for artists in residency.

**Earth integrated shelters:** Partially submerged structures fulfil the needs of passive design requirements as well as clearer views of Fly Ranch. This also mimics the form of the main hub design which follows the form concept: “pulled from the earth”.

**»» Environmental impact summary**

The overall goal of construction is to work with the existing landscape and disturb the site only where necessary. The most significant impacts will come from the construction of the main hub and surrounding communities. Their passive design requires excavation of soil to a significant depth in order to build the foundations for each building. As much excavated soil as possible will be reused onsite, acting as growing media for native vegetation to be planted on building roofs. The initial establishment of the vegetation will require some manual watering, but the desert-adapted species will not require human intervention to grow in the long-term.

Both the communities and hubs are Earth-integrated so that they are naturally insulated in order to reduce energy necessary to heat and cool the buildings. The use of geothermal heat pumps further reduces energy needs by heating water through natural processes. The remaining energy needs will be met through power generated on-site by prism solar on the main hubs and solar orbs located within each community.

The forms of the building were designed with the natural landscape in mind. Both the hubs and communities are Earth-integrated in order to blend with the surrounding landscape. The structure of the hubs play off the forms of the surrounding Granite Mountains, fitting into the background rather than standing out and disrupting viewsheds.