Project Statement

The nudibranch is a shell-less marine gastropod, otherwise known as a sea slug. With over 2,000 species, nudibranchs are ubiquitous throughout the world’s oceans, including dozens of species in Port Phillip Bay, and most prevalent in shallow, tropical waters. Given their wide distribution, nudibranchs have developed an immense diversity of adaptations which has resulted in their stunning colors and forms. Several nudibranch species can excrete toxic substances they have absorbed through their carnivorous diet as a self defense and the Phyllodesmium species can even extract energy from the sun. These tiny mollusks, which don’t live longer than a year, are an exciting proxy for to adaption to the dramatically different global contexts from which renewable energy must be approached.

Using these vibrantly-colored miniscule native marine creatures as fun symbols of regional and cultural adaptability, we have essentialized the “nudi” as a simple arched slug shape. The arched “nudi” form maximizes solar gain, makes an eye-catching canvas for renewable energy production and is easily scaled up and down, as our proposal suggests. The arched nudi’s form was equally inspired by Australia’s maritime history, and the nautical yet organic forms are repeated throughout the site, guiding visitors from St. Kilda’s vibrant shopping and dining district to its popular beach.

Nudibranchs are tiny creatures. They can be as small as a two centimeters and never bigger than 30. Just as the climate crisis and the immense task of shifting our energy regime is too often ignored by individuals and governments alike, the tiny nudi will be scaled up to larger-than-life proportions and will be impossible to ignore. These new landmarks will be noticed not only for their size and playful lighting elements but for their blatant exhibition of solar energy production.

Australia and solar energy are a promising pair. The country has vast solar resources and open space needed for commercial-scale production. While large-scale facilities are a piece of the energy solution, they are not appealing in space-restricted urban spaces thus smaller-scale applications must be incorporated into our everyday urban lives. Thin-film solar photovoltaics are a developing technology with ever-increasing levels of investment, interest, and improving efficiency. The thin and lightweight cells , can be utilized in a number of shapes and sizes and can be manufactured in various colors and transparencies. With flexibility like this, solar panels are now being applied to existing building structures and in lightweight applications becoming a more prevalent and commonplace element in our urban landscapes.

The colorful nudi arches lure visitors to the site during the day with their character and interactive elements. While many solar applications are on roofs and operate unbeknownst to the visitor, the nudi structures showcase their batteries on their undersides, viewable through translucent recycled plastic skin. The battery-groups are known as the Nudi’s heart and notify viewers about solar energy production and storage. Lead-acid batteries have been selected over lithium ion batteries due to their near 100% recyclability rates, and bulkiness. With batteries that are hard to ignore, it prompts viewers to consider the full process of capturing renewable energy and to question what goes into producing such means of storage and how can we improve them. Producing energy during the day that feeds into the Melbourne energy grid, the Nudi hearts power colorful LED lights after dark that turn the Nudi arches into whimsical glowing beacons whose programmed brightness corresponds to the amount of energy captured that day.

Play is a critical element in bringing “Nudi Beach” to life. Three different scales of structures provide different interactive elements. The smallest Nudi functions as an arched double-swing, operable during the day and at night when LED lights cast magenta and blue glows over the visitors. Allowing children to play safely in immediate proximity to solar energy production normalizes renewable energy for the next generation. A mid-sized Nudi serves a pedestrian pass-through where visitors walk through colored light as the sunlight penetrates translucent colored plastic Nudi skin, creating shifting patterns on the concrete below. Benches could be easily attached in the interior to create semi-shaded reflection points for observing the Nudi Hearts above. The third Nudi typology is the largest and passes over Jacka Blvd, visually bridging the park site to St. Kilda beach. The jumbo Nudi arch hosts a sign welcoming visitors to Nudi Beach, and will certainly become a new St. Kilda landmark, as you’ll now hear people say “Meet me at the giant pink Nudi”.

Materials selection in regards to the structures has been guided by a commitment to keeping them free of non-recyclable metals as much as possible, and to allow the materials to contribute to a conversation about resource conservation and environmental degradation. Given the emerging global concern over plastics in the ocean, we are using high-density polyethylene plastic, which is the most structurally rigid and recyclable plastic we can make from ocean plastics such as milk jugs, soda bottles, and plastic bags, to construct the colorful yet semi-translucent skin of our Nudis. Custom-made Nudi recycle bins placed at the larger Nudi arches serve as collection points for ocean plastic rescued by beachgoers, connecting the materials story to St. Kilda’s beaches.

Nudi Beach at St. Kilda has powerful branding potential, marrying the outlandish Nudi form with traditional tourist items such as t-shirts, hats and towels. This presents an important opportunity to address the financial sustainability of our open spaces. Revenue generated from the sale of such apparel could fund park maintenance, Nudi arch improvements and be partially donated to research or larger-scale clean-up efforts of ocean plastics. We are waiting to see our first Nudi hat on Instagram!

Repeating the three Nudi scales, we are proposing 10 nudi arches on-site, all of which capture solar energy throughout the day. Additional PV panels may be installed on the roof of the new hotel behind the Palais Theatre. A small Nudi head peeking over the roof would remind visitors to the site that the story and solar processes continue to populate the city’s underutilized rooftop surfaces. It is our hope that the Nudi’s proliferate in their new urban environments and continue to adapt to new sites, bringing interactive solar energy and renewable energy education to new audiences throughout Melbourne and Australia.

**Environmental Impact Statement**

Our proposal consists of a series of arches constructed at three scales. All three types are fabricated with the same materials. Cross-laminated lumber (CLT) is used to create the arches and support the panels. Wood has been shown to outlast steel and concrete in life-cycle assessment studies. We also chose wood because it can be sustainably harvested from certified lumber companies in Australia, reducing the need to ship globally. Furthermore, wood absorbs carbon while growing and requires less energy to produce than other materials.

Thin-film solar panels have an energy payback of about a year, meaning that it takes one year or less to produce the energy it took to manufacture them. We have chosen lead-acid batteries as our energy storage unit because they have recyclability rates upwards of 90%, as opposed to lithium ion batteries for which recyclability is still developing.

The rest of our structure is composed of plastic specially manufactured from recycled ocean plastics, in the form of high-density polyethylene. While emissions are produced during the recycling process, plastics are removed from the marine environment and the recycled plastics manufacturing displaces the manufacturing of virgin plastics with comparable emissions.

**Dimensions**

Total footprint of arches: 250m2

Annual energy production

We intend the Nudis to power their own batteries during the day and to have the surrounding building roofs provide excess energy to the grid.

|  |  |
| --- | --- |
| Building | ~Area m2 |
| A | 200 |
| B | 225 |
| C | 110 |
| D | 182 |
| E | 143 |
| F | 1848 |
| G | 825 |
|  |  |
| Total | 3533 |
|  |  |
| <https://pvwatts.nrel.gov/pvwatts.php> |  |
| DC System Size (kW): (total area / default 25m2 system) | 141.32 |
| Module | Thin Film |
| Mount | Roof Mount |
| system loss (stuck with default | 14.00% |
| Tilt (default = site latitude) | 38 |
|  |  |
| kWh/Year | 166,018 |
| Average / day | 454.8438356 |
|  | 227.4219178 |