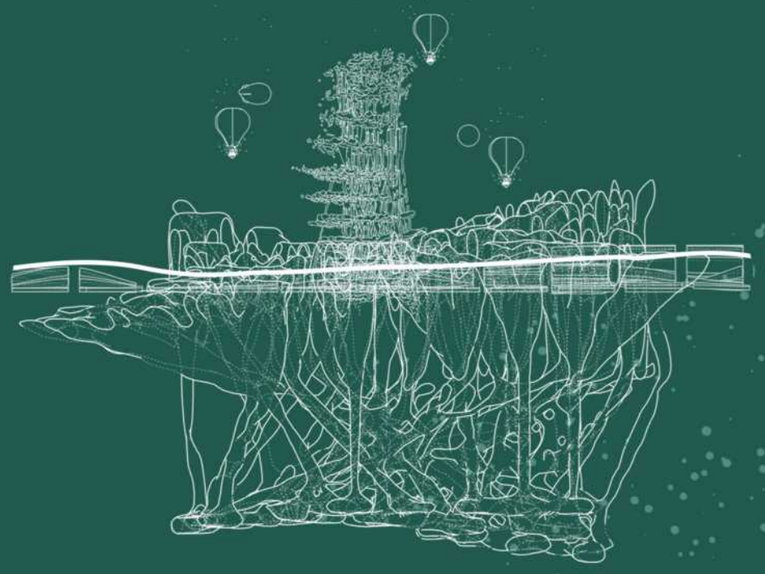
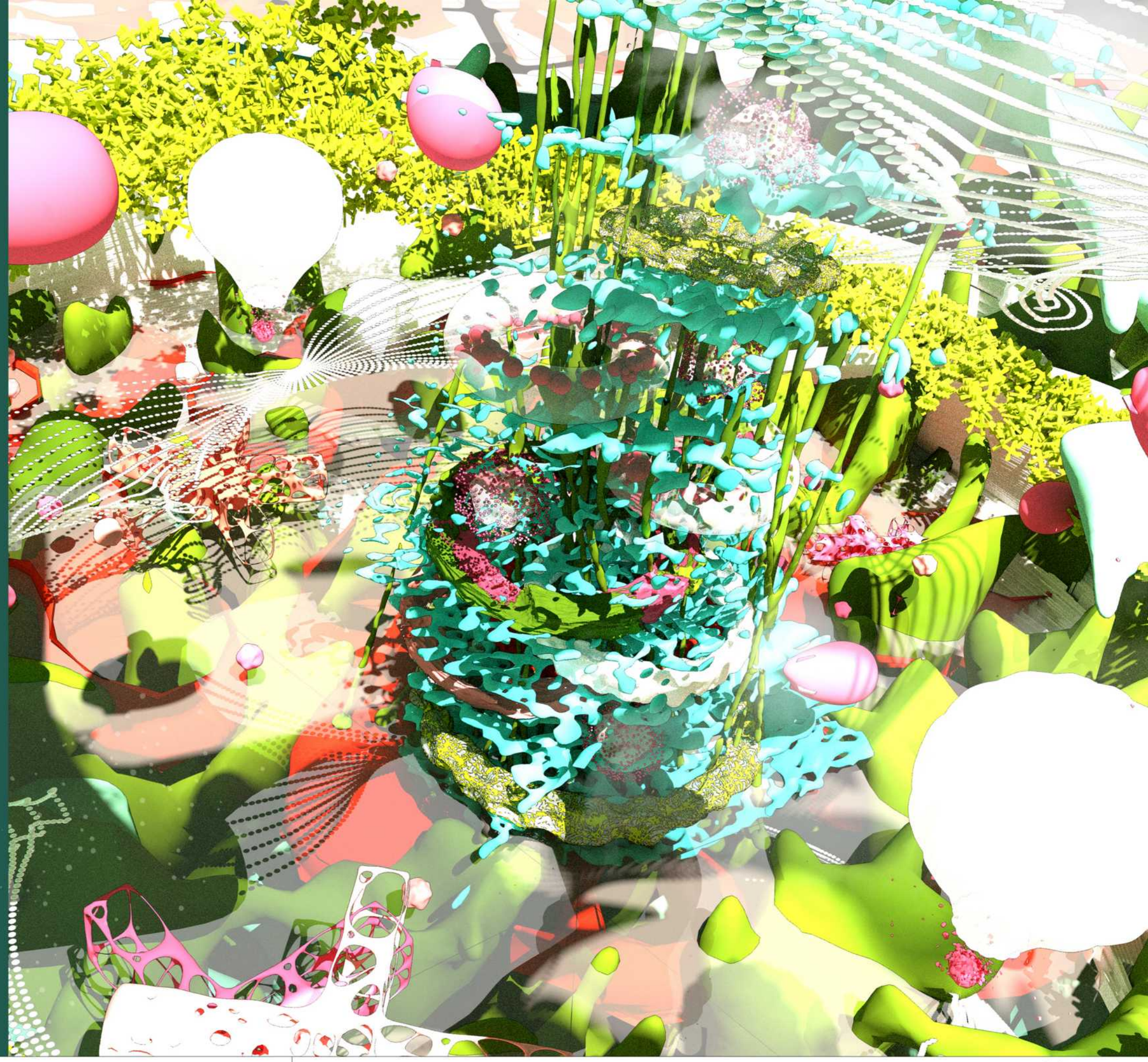
GROWING FUTURE

The action that the world is taking at the moment is proving not to be sufficient to tackle the climate catastrophe that we are already in – therefore, maybe it is time to look at other avenues of thought, some more speculative, science-fiction inspired systems and stories which might require even some counter-intuitive reasoning. 'GROWING FUTURE', therefore, refers to both ethical environmental growth, but also growth in thought, in aspirations and dreams.

Located in the North Sea, the self-growing island-organism proposes an alternative, speculative way of ethically inhibiting water. Making use of synthetic biology applied to architectural scales, intertwined with natural processes, the island aims to exist as a self-sufficient organism which is not jeopardising to marine waters, it is not neutral; it is, in fact, contributing to the eco-system, becoming a part of it.

Processes such as protocell growth, algae production, solar, aeolian and hydrogen energy, synthetic photosynthesis and electrolysis, all define a place which aims to become the catalyst to a more environmentally centred existence – the home of homo ecologicus.





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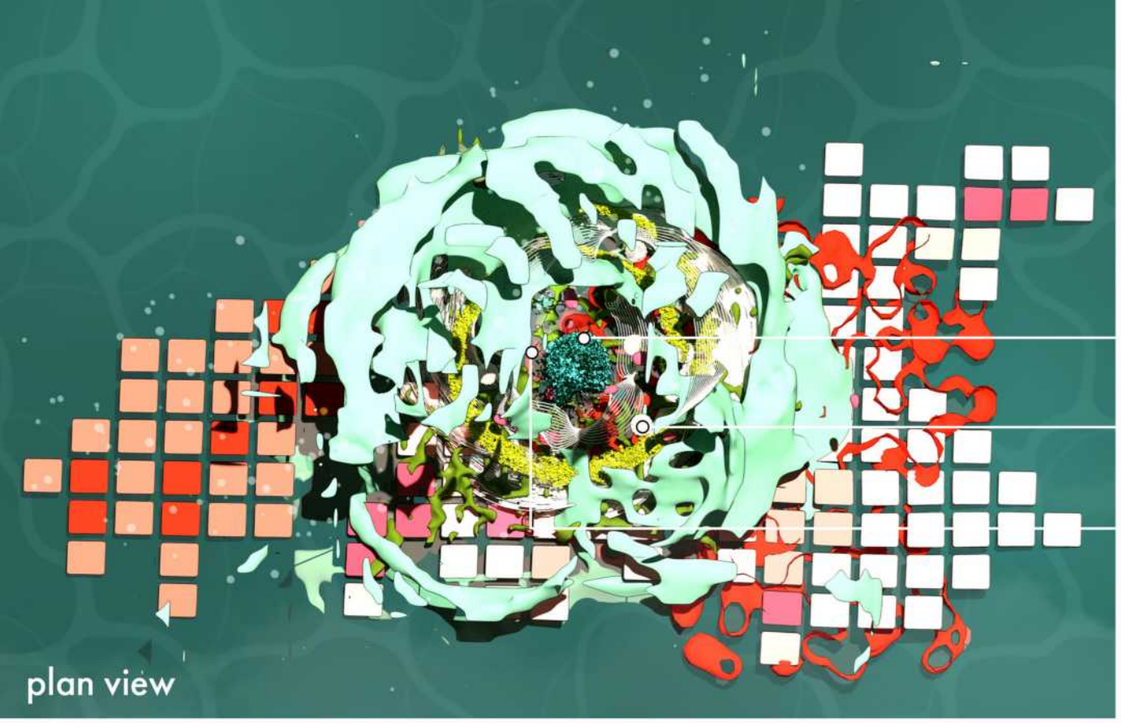
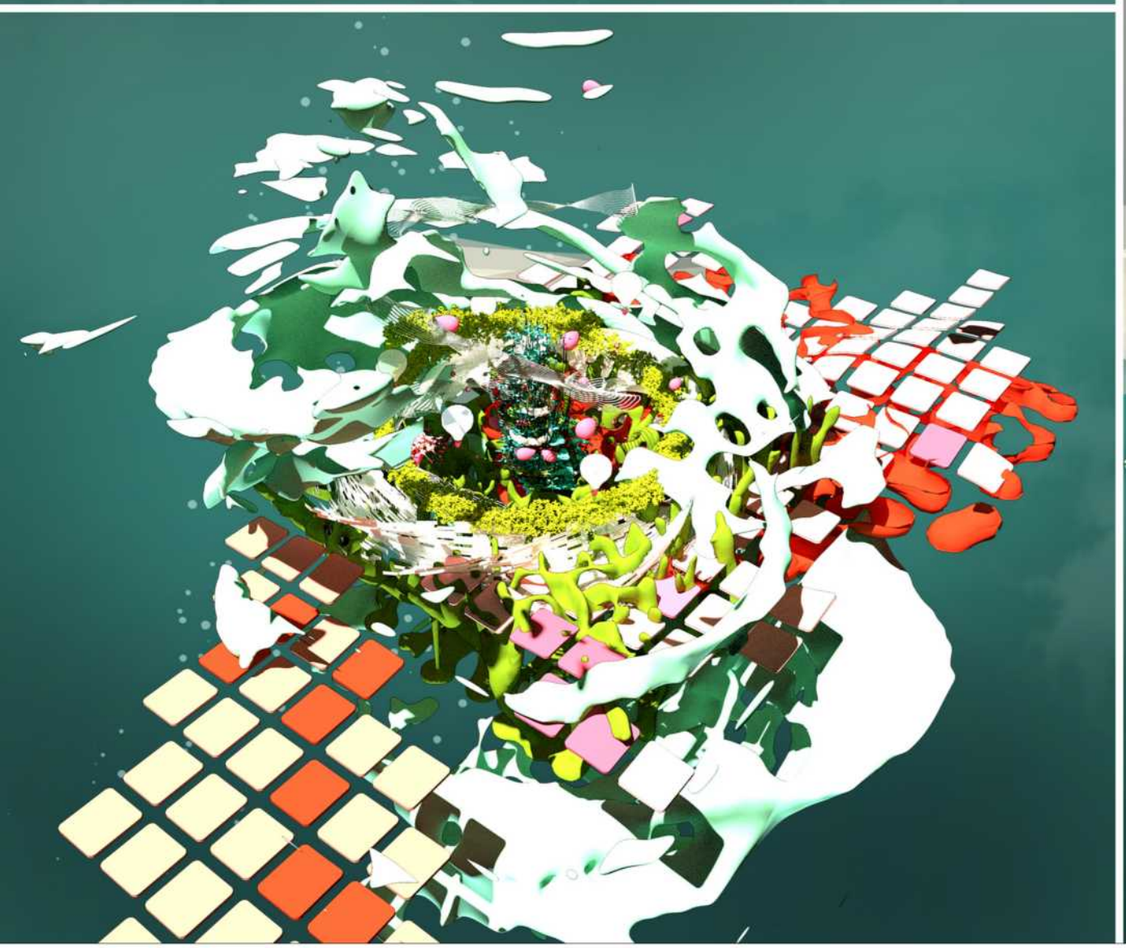




programme

The island is home to a new type of society, a society which lives ethically and is in continuous growth and development, alongside the island organism itself, a true symbiosis between humans and the sea as their home. People live on the island and work in the central research facility, where they study marine life and conduct further research.

central research facility

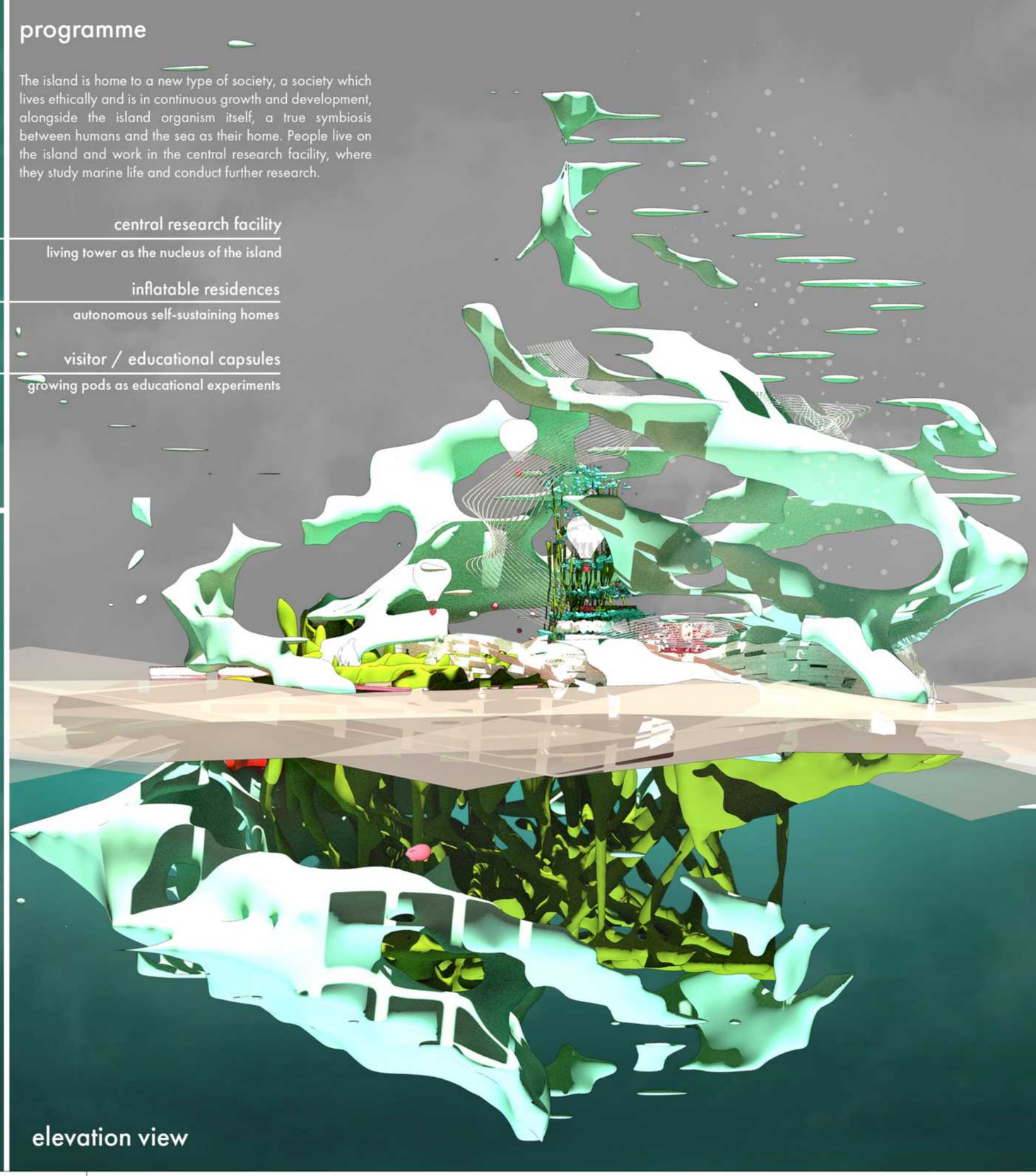
living tower as the nucleus of the island

inflatable residences

autonomous self-sustaining homes

visitor / educational capsules

growing pods as educational experiments



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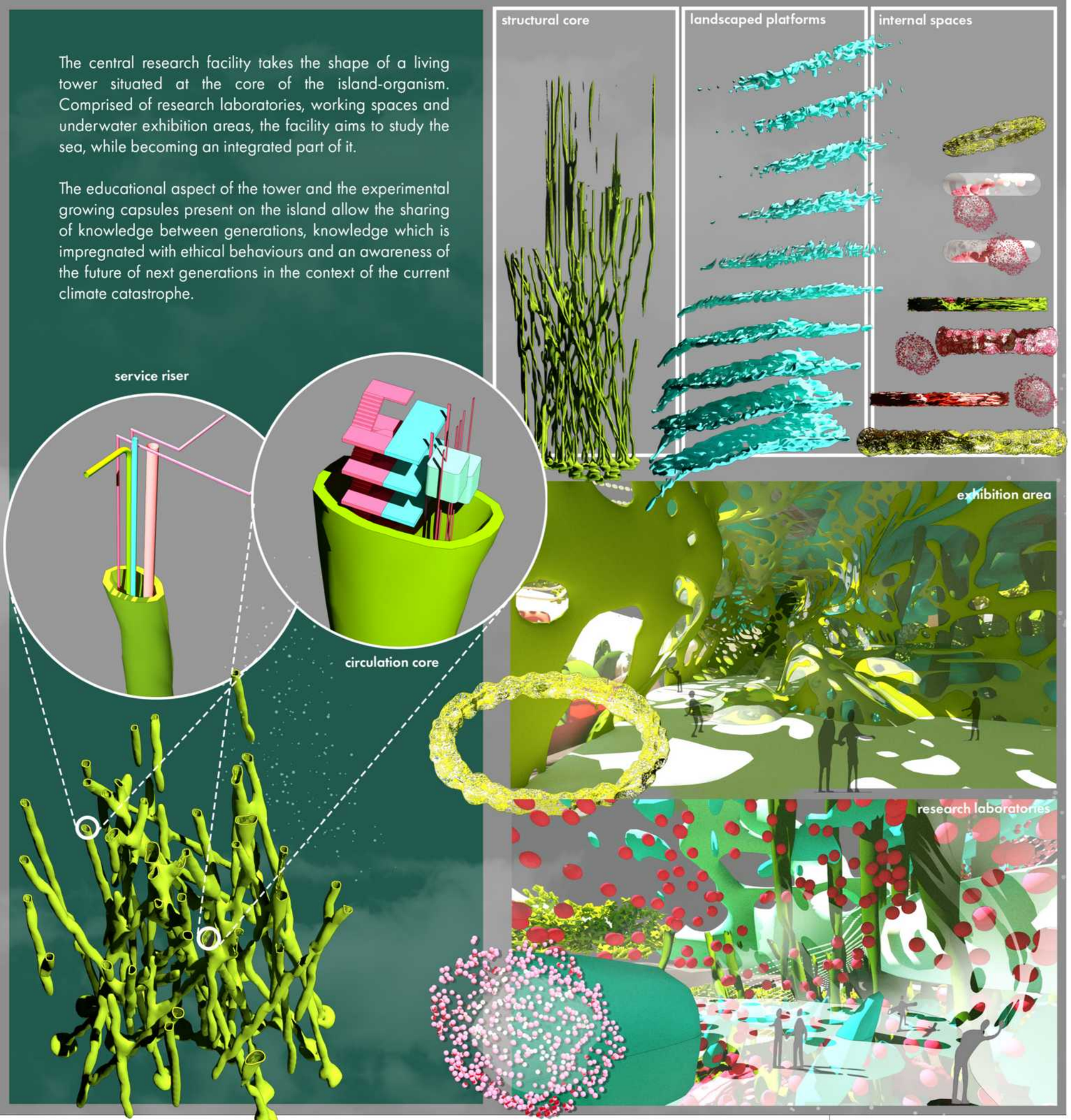
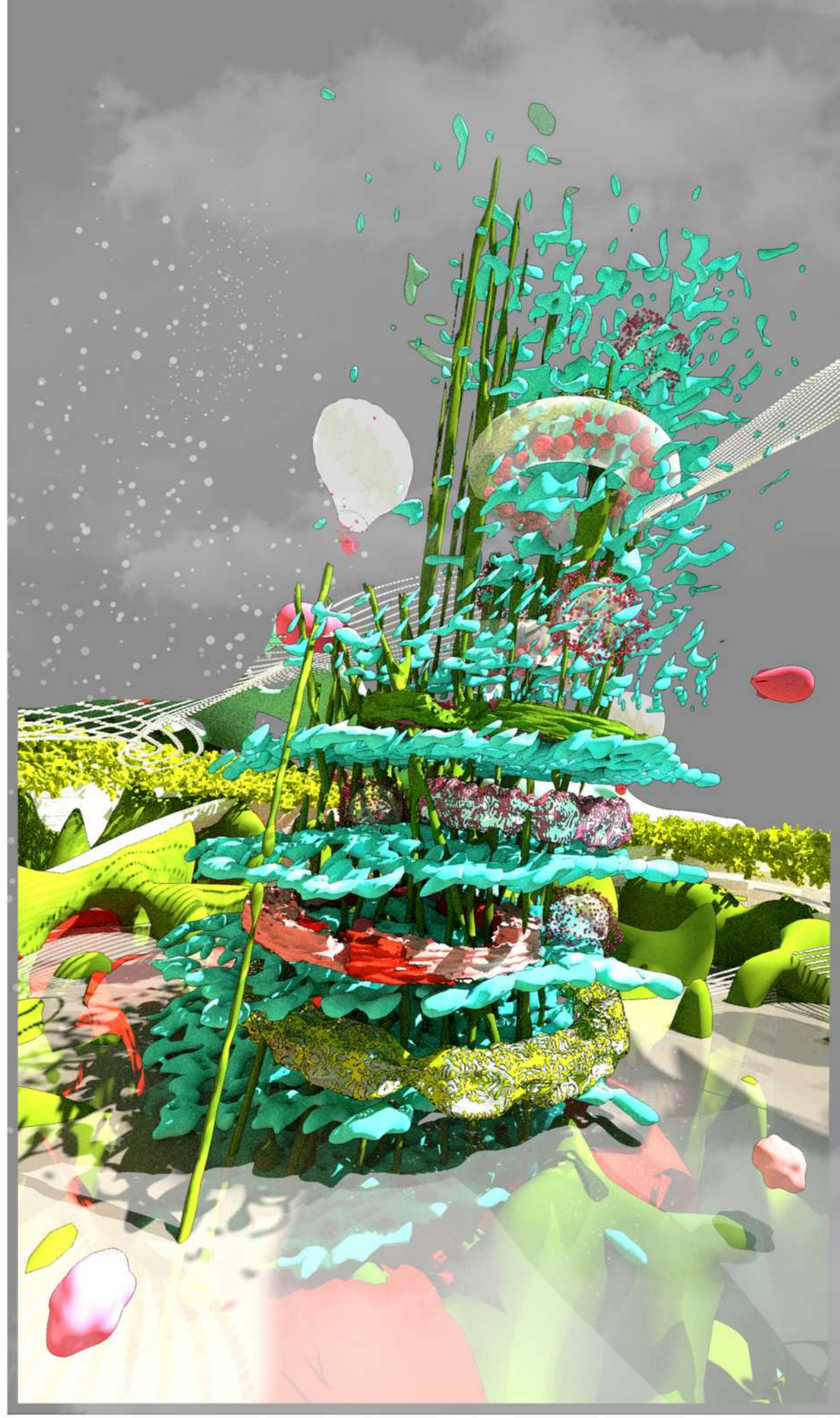
The central research facility takes the shape of a living tower situated at the core of the island-organism. Comprised of research laboratories, working spaces and underwater exhibition areas, the facility aims to study the sea, while becoming an integrated part of it.

The educational aspect of the tower and the experimental growing capsules present on the island allow the sharing of knowledge between generations, knowledge which is impregnated with ethical behaviours and an awareness of the future of next generations in the context of the current climate catastrophe.





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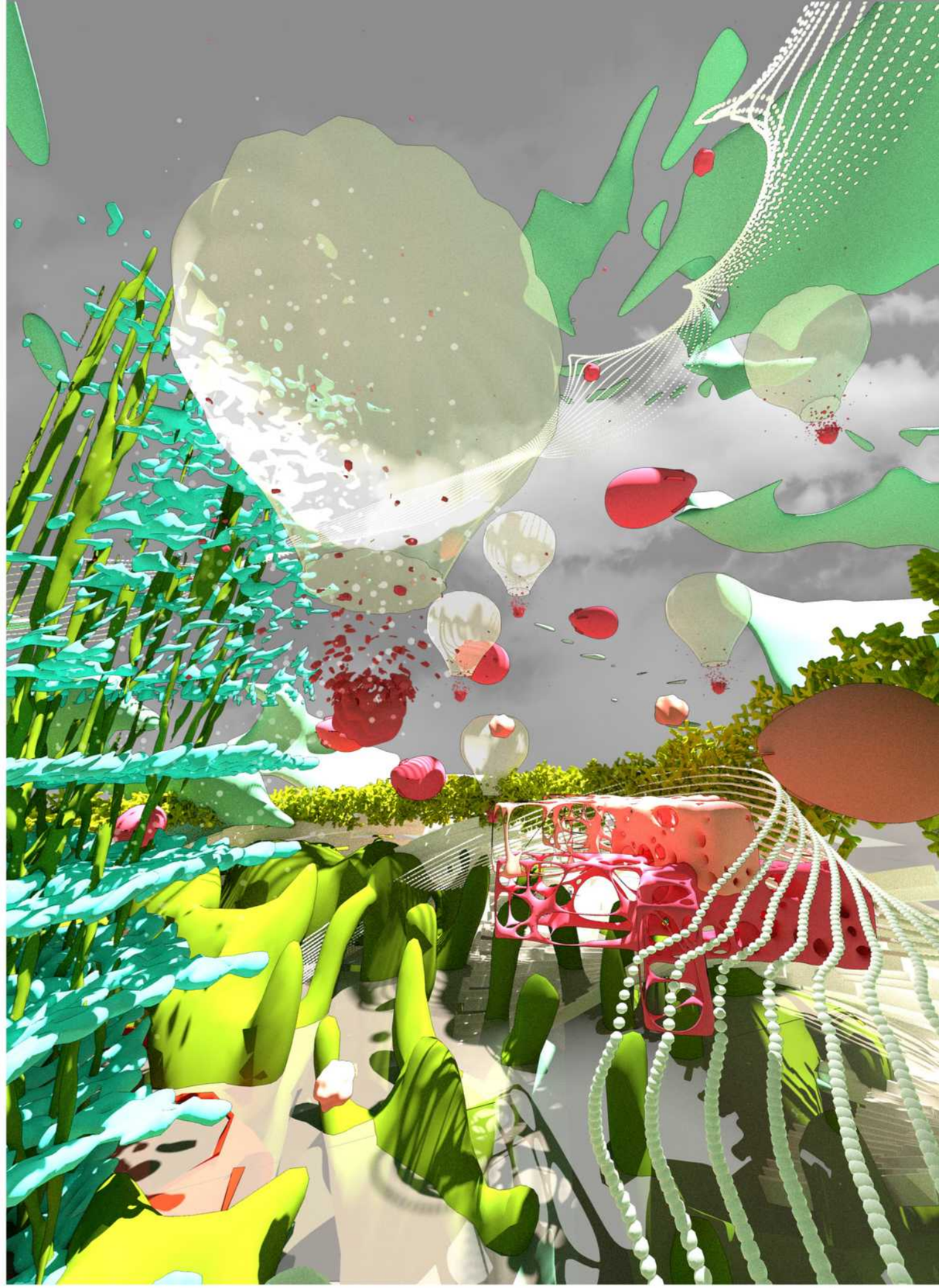
The inflatable residences are autonomous self-sustaining homes which offer a domestic aspect to the island, making it a true home for a growing society. inflated with the help of hydrogen gas which is a product of one of the sustainable energy systems that power the island, the homes present a new typology for domestic spaces: non-permanent, moving and self-sustaining.

The experimental educational capsules represent research projects and experiments. The capsules are formed of protocells, self-organising non-living aggregations. Protocells are capable of mimicking biological behaviours, therefore, they are the backbone of the island-organism. With the help of protocells, the capsules solidify and grow in time, allowing the visitors and students to observe synthetic and live biological processes.



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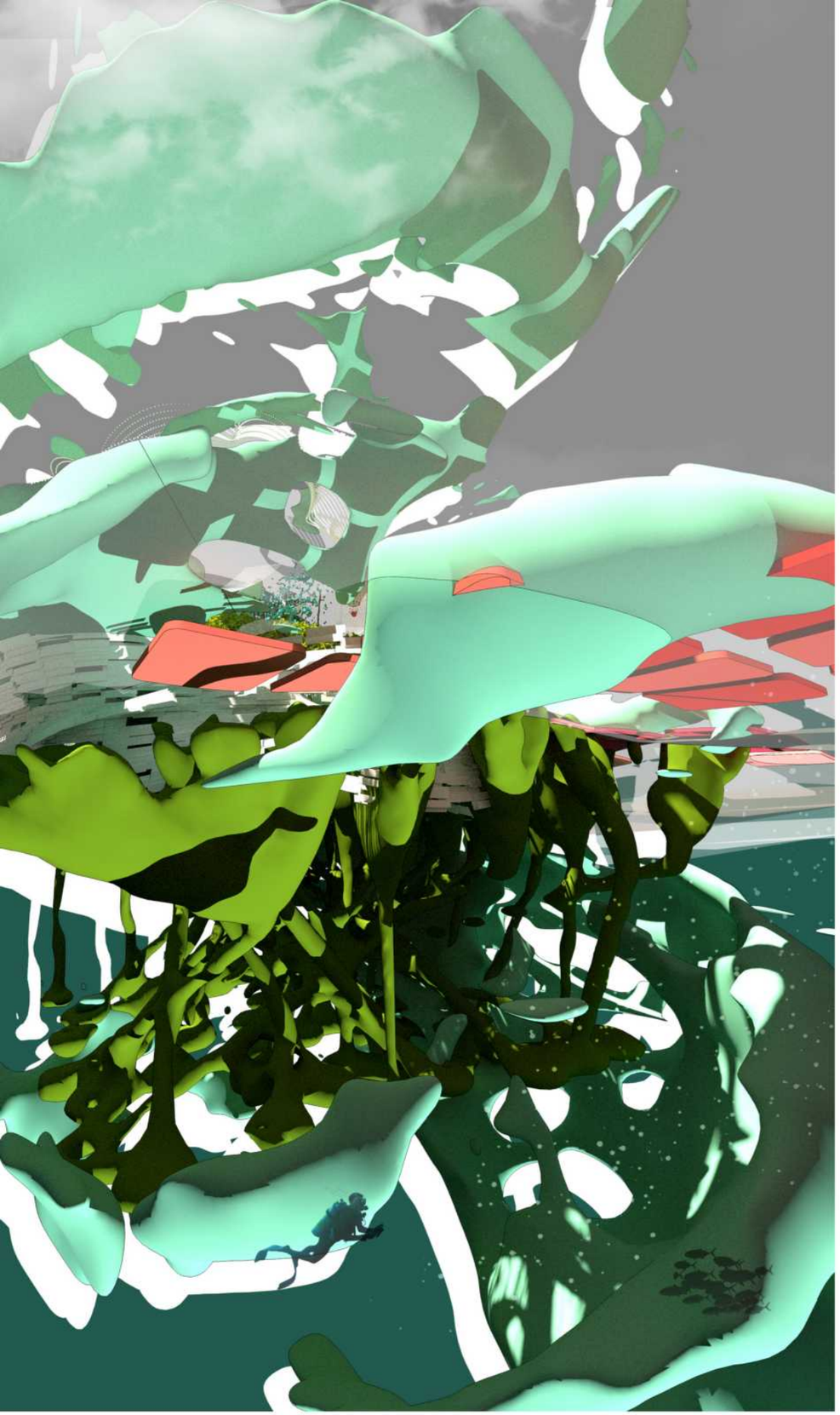

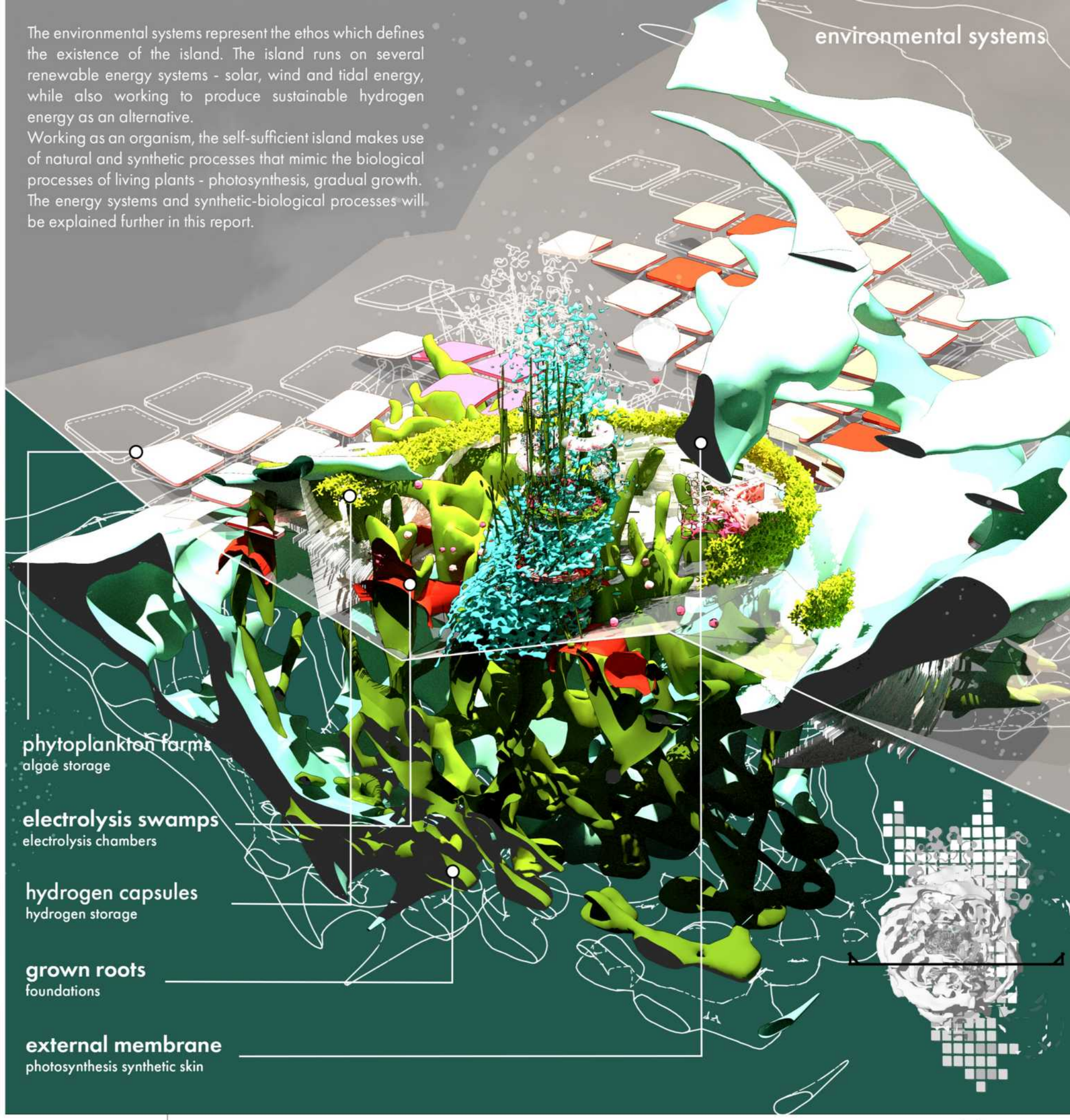

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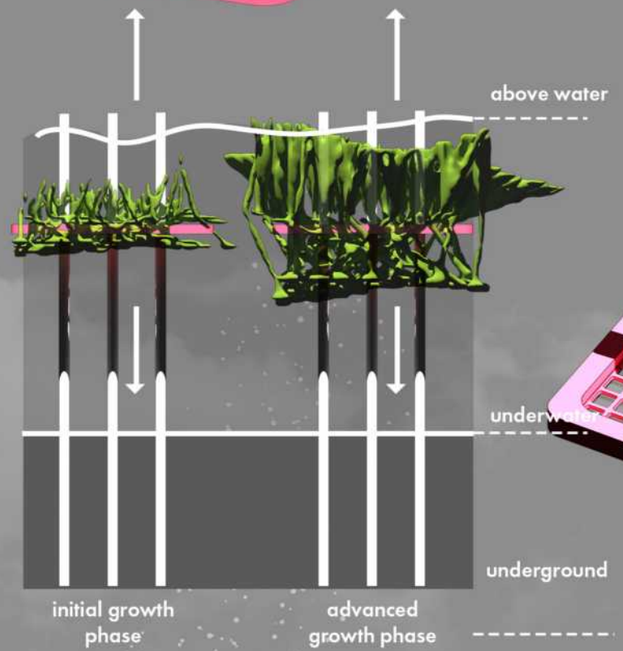
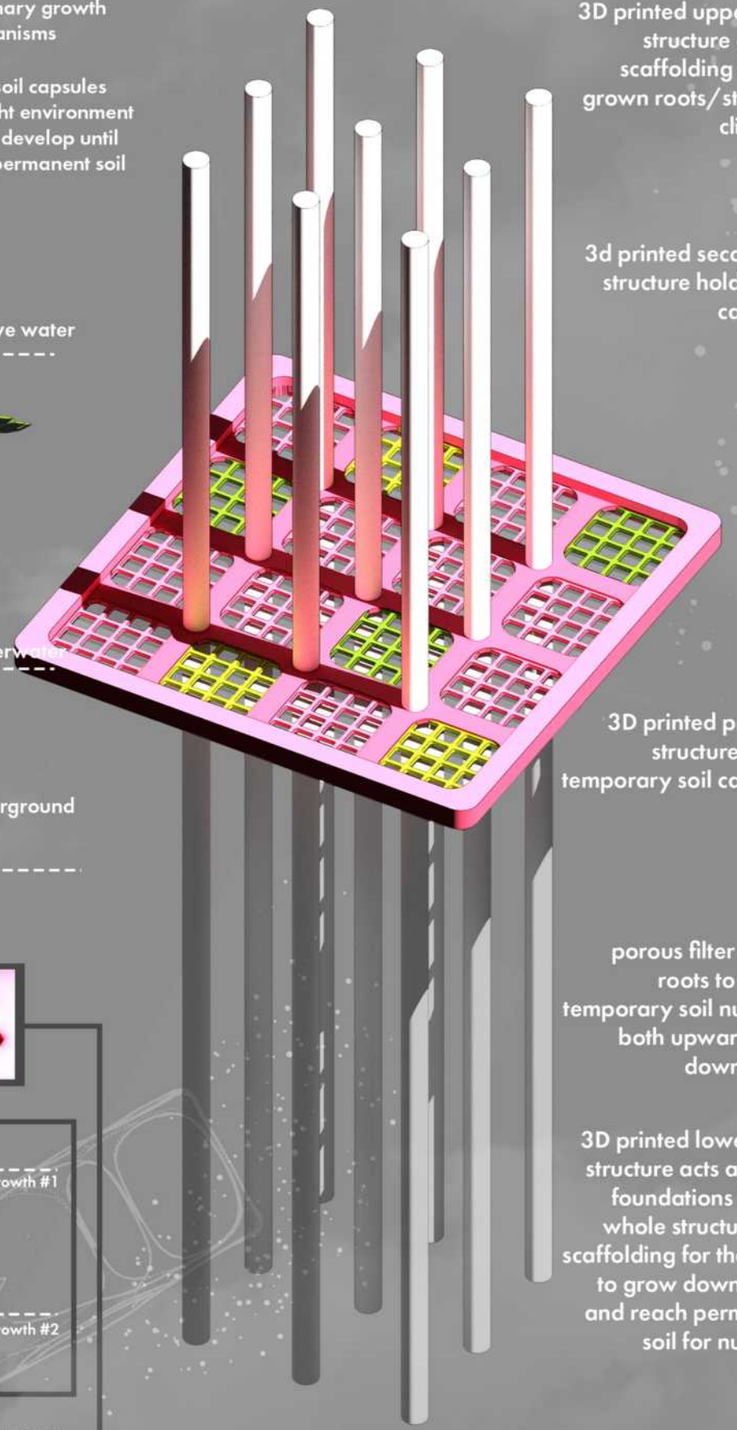
The utopian island is primarily formed of organic syntehtic materials, programmed to grow and act as living organisms. An integrated manufactured structural system represents the core on which the island-organism grows. The structure for the foundation-roots is 3D printed on land as a kit of parts and then constructed on Dogger Bank, in the North Sea. The materials used for 3D printing are light and strong bio-acrylic materials (made from recycled plastic and algae), which are going to withstand underwater pressure.

seed capsules store primary growth organisms

temporary soil capsules offer the right environment for seeds to develop until they reach permanent soil on seabed





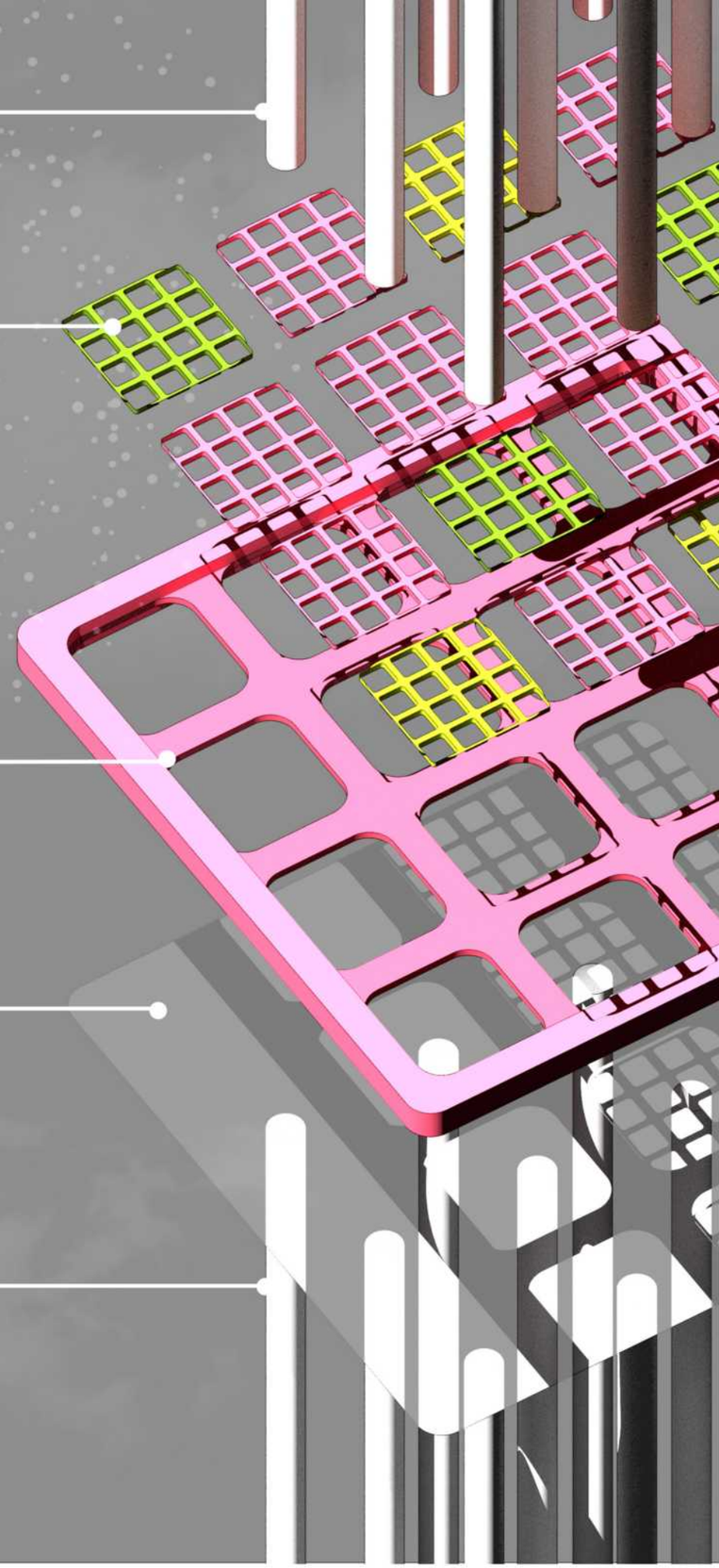
3D printed upper pipe structure acts as scaffolding for the grown roots/stems to climb on

3d printed secondary structure holds seed capsules

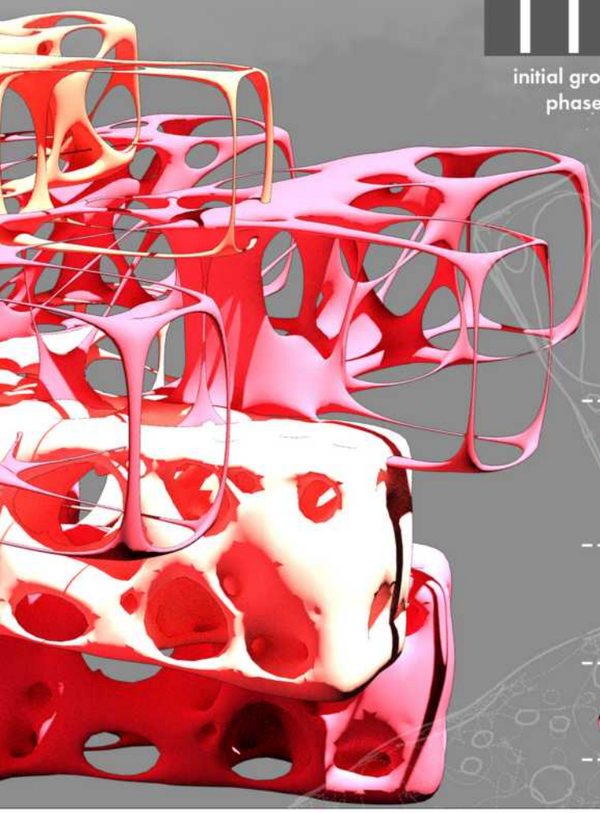
3D printed primary structure stores temporary soil capsules

porous filter allows roots to filtrate temporary soil nutrients both upwards and downwards

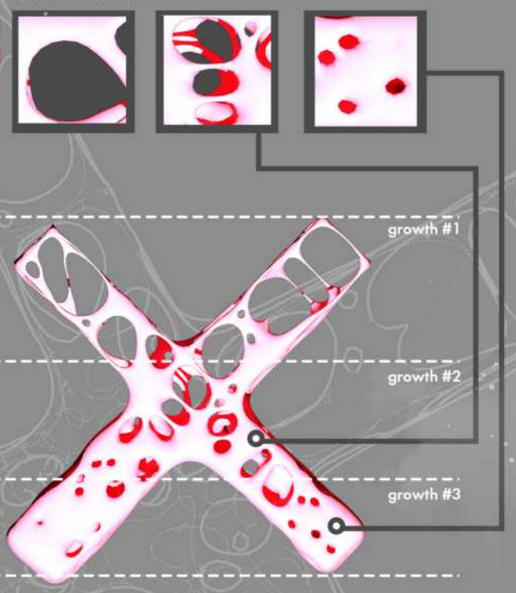
3D printed lower pipe structure acts as piled foundations for the whole structure and scaffolding for the roots to grow downwards and reach permanent soil for nutrients



protocell formation



growth stages (permeable, open spaces):



structural aim

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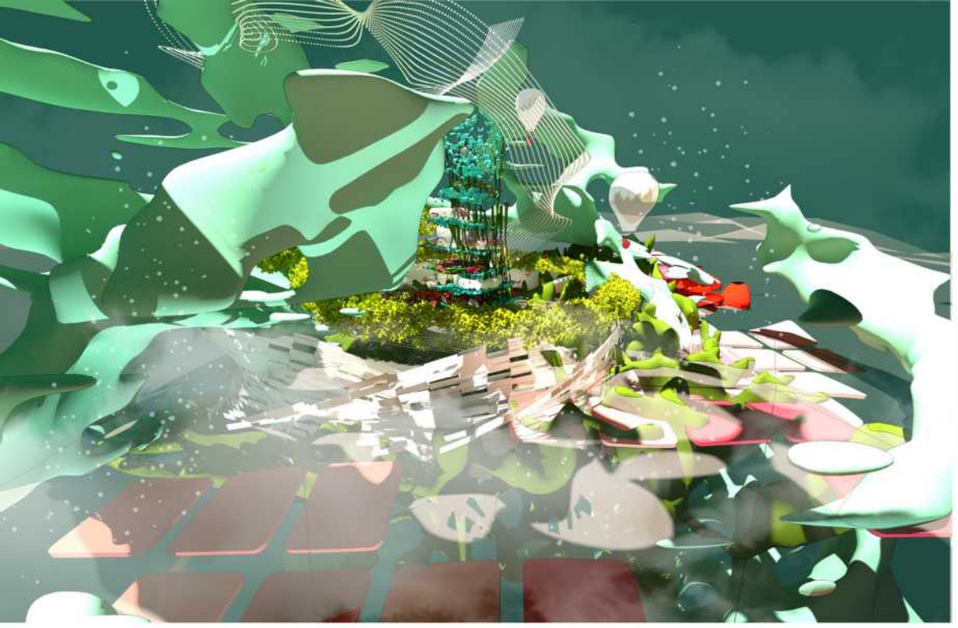
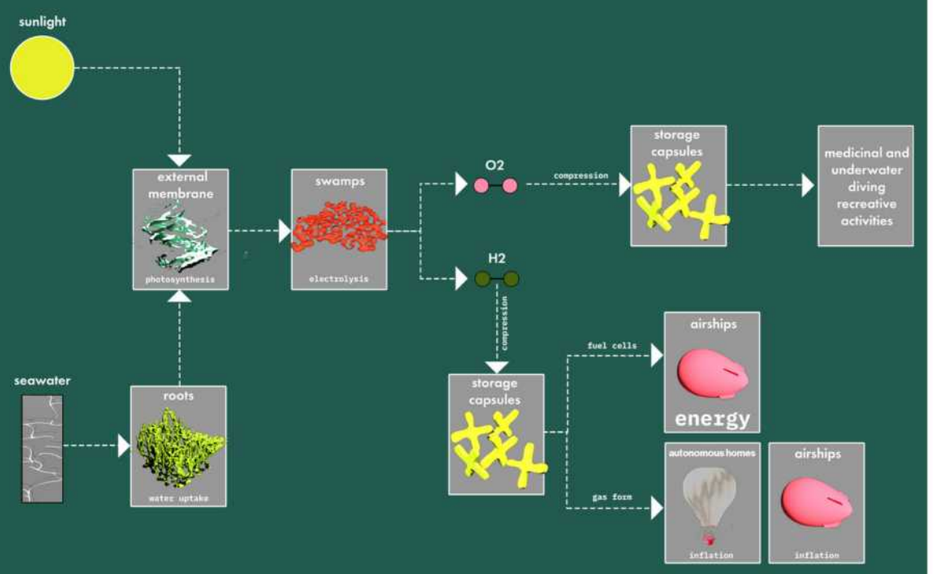


Hydrogen energy is a highly sustainable energy which can be obtained and powered through other renewable energy sources, such as wind or solar power. Hydrogen fuel does not emit carbon dioxide and, therefore, is considered to be a potential avenue for a more environmentally ethical future. Hydrogen is traditionally obtained through the process of splitting water, which results in hydrogen and oxygen molecules. It is, in itself, an old physical process. However, traditionally, this result is achieved by using purified water. Pure water gradually becomes a scarcer resource, while being costly to produce. This raises the following proposal: making use the vast quantity of seawater available to us in order to power the built environment could potentially become a viable solution. The island does not aim to rely on hydrogen production as the only energy source, but aims to propose sustainable alternatives if renewable sources such as solar power, wind power or tidal power, for whatever reasons, fail to deliver.

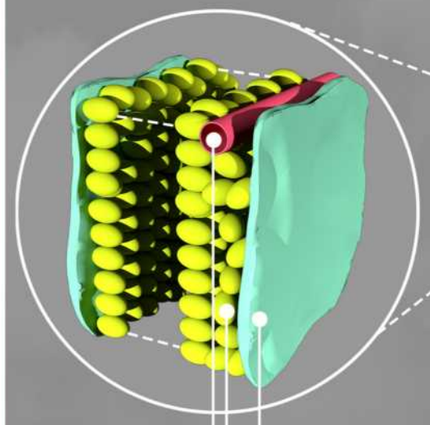


sunlight

Sunlight is captured both through synthetic and natural processes (cellular absorbtion) and also though mechanical processes (use of photovoltaic panels attached to the external membrane).

The external membrane offers multiples functionalities. Firstly, it represents the protective physical skin of the island-organism, creating a protected eco-system within, sheltered from the harsh environment of the North Sea. Secondly, it is the main element which captures sunlight energy. Sunlight is used here with two main aims: on one hand, it is the crucial element which allows photosynthesis and the transformation of CO2 into O2 and on the other hand, it is captured and stored and then used in the environmental hydrogen strategy, where hydrogen fuel is created.

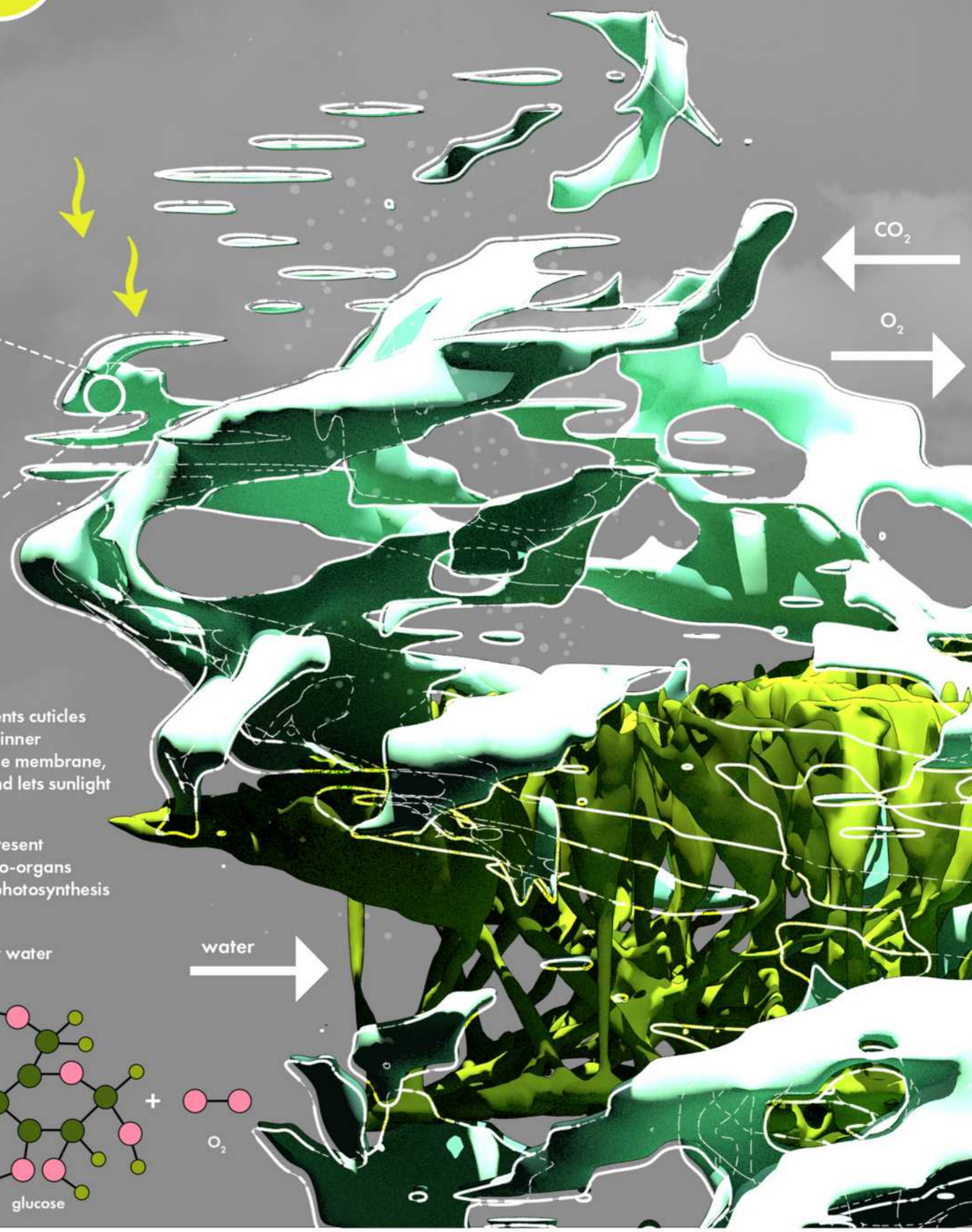
cross-section through external membrane:
width of membrane shown indicatively, not to scale with the rest of shown cells



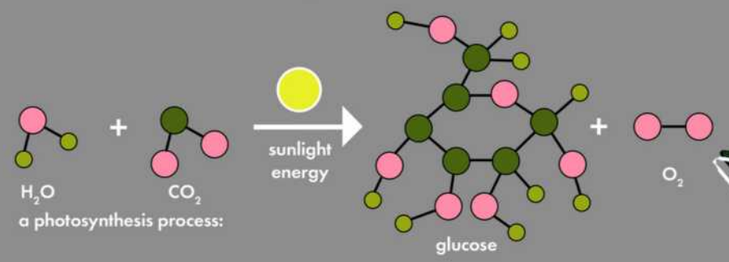
outter layer presents cuticles which protect the inner organisation of the membrane, it is permeable and lets sunlight travel to the cells

mesophyll cells present chloroplasts, micro-organs which house the photosynthesis process

veins which allow water transportation



a photosynthesis process:



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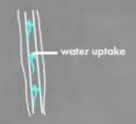
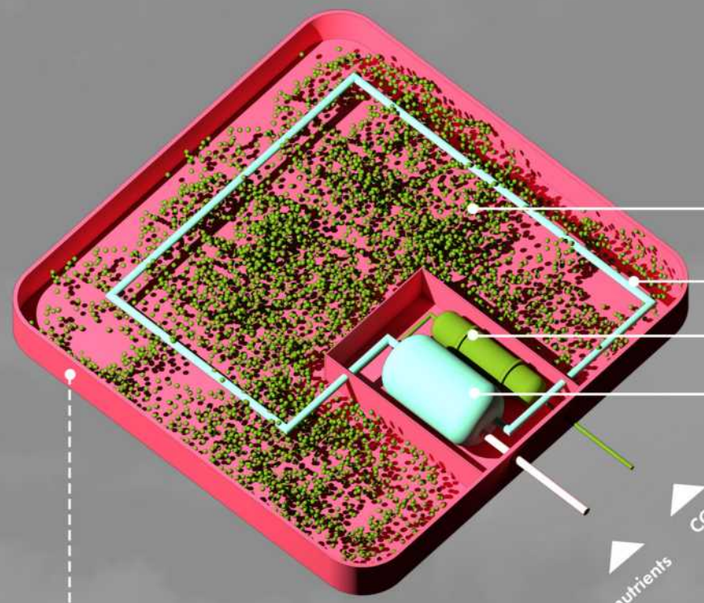
atmospheric carbon capture:
CO2 is captured from the atmosphere and it is then directed to the external membrane where it becomes part of the photosynthesis process

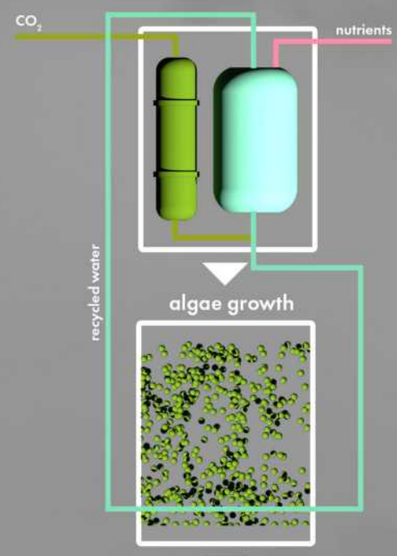
water uptake:
water travels through root canals (water is used for organism survival and excess used in electrolysis system)

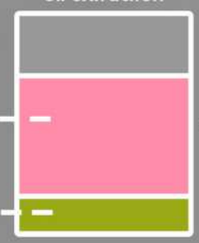


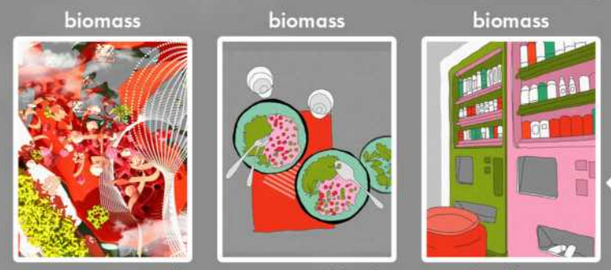
water collection:
water infiltrates cell membranes

carbon sequestration:
CO2 is transmitted into the seabed, where it will aid plant growth, increase soil organic matter and improve water retention capacity

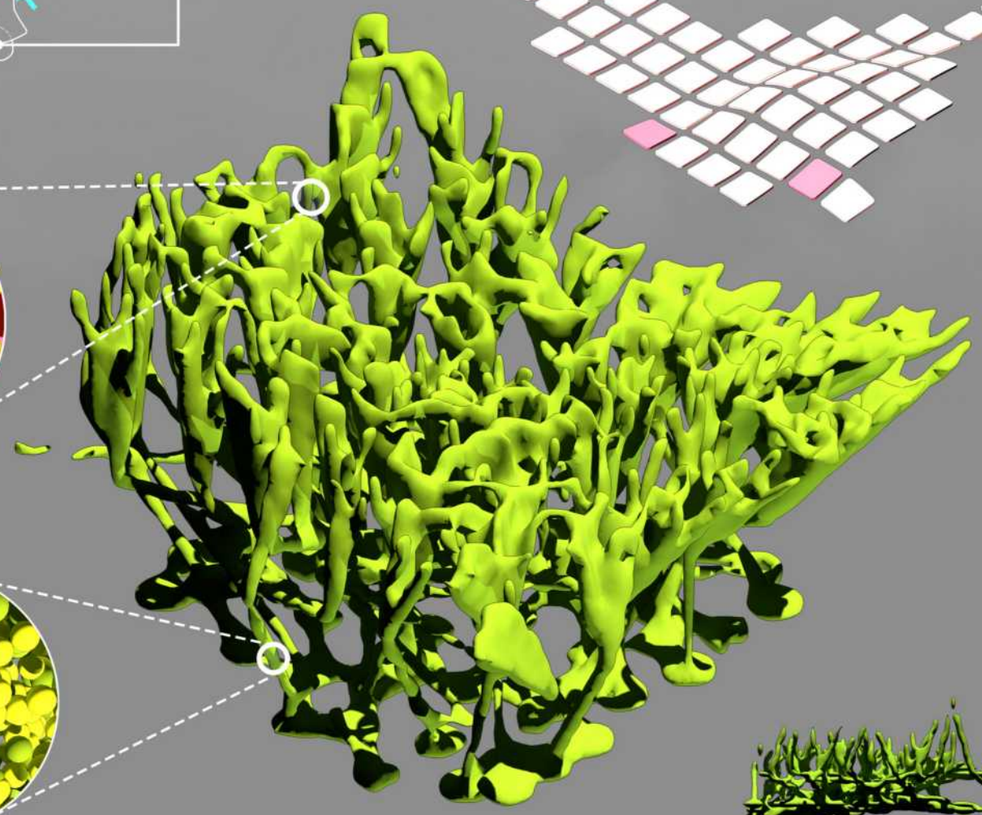




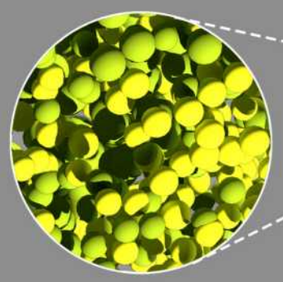




upper roots:
porous cell arrangement features air pockets that aid island buoyancy

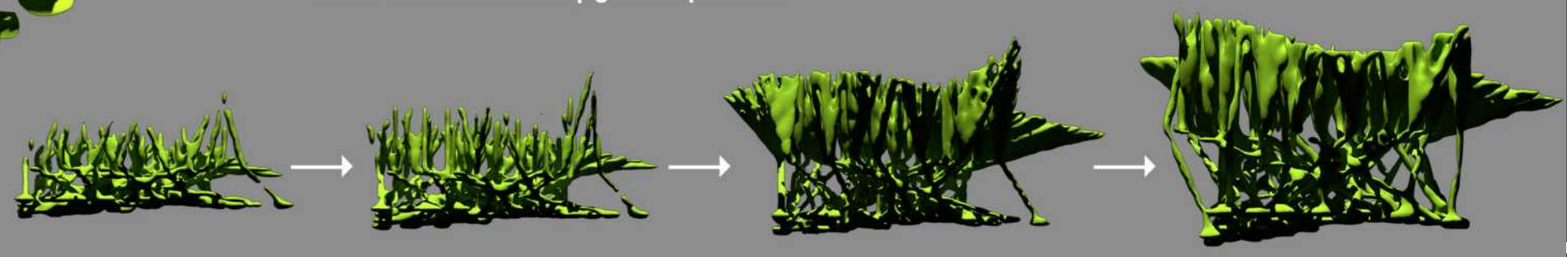


lower roots:
dense cell arrangement offers rigidity and strenght to support entire island



The roots of the island-organism have two roles: structural and environmental. Structurally, the roots grow on the 3D printed manufactured structure and act as foundations for the island, offering rigidity and strenght, but also buoyancy. From an environmental perspective, the roots are the canals which collect sea water used later for electrolysis and the receptors which capture atmospheric CO2, sending it below the seabed where its effects are positive.

roots as foundations | growth process



algae as prime matter

High phytoplankton activity is one of the defining characteristics of Dogger Bank, proving that the existing ecosystem is favourable for algae growth. Algae has been chosen as the prime matter for the development of the island and it sits at the core of all life-sustaining processes: food production, product developments and construction materials. Algae is grown in the algae pods located outside of the external membrane, floating on the water surface. It is then harvested and transformed into either biofuel or biomass, which afterwards can be developed into food, bioplastics or other construction materials.

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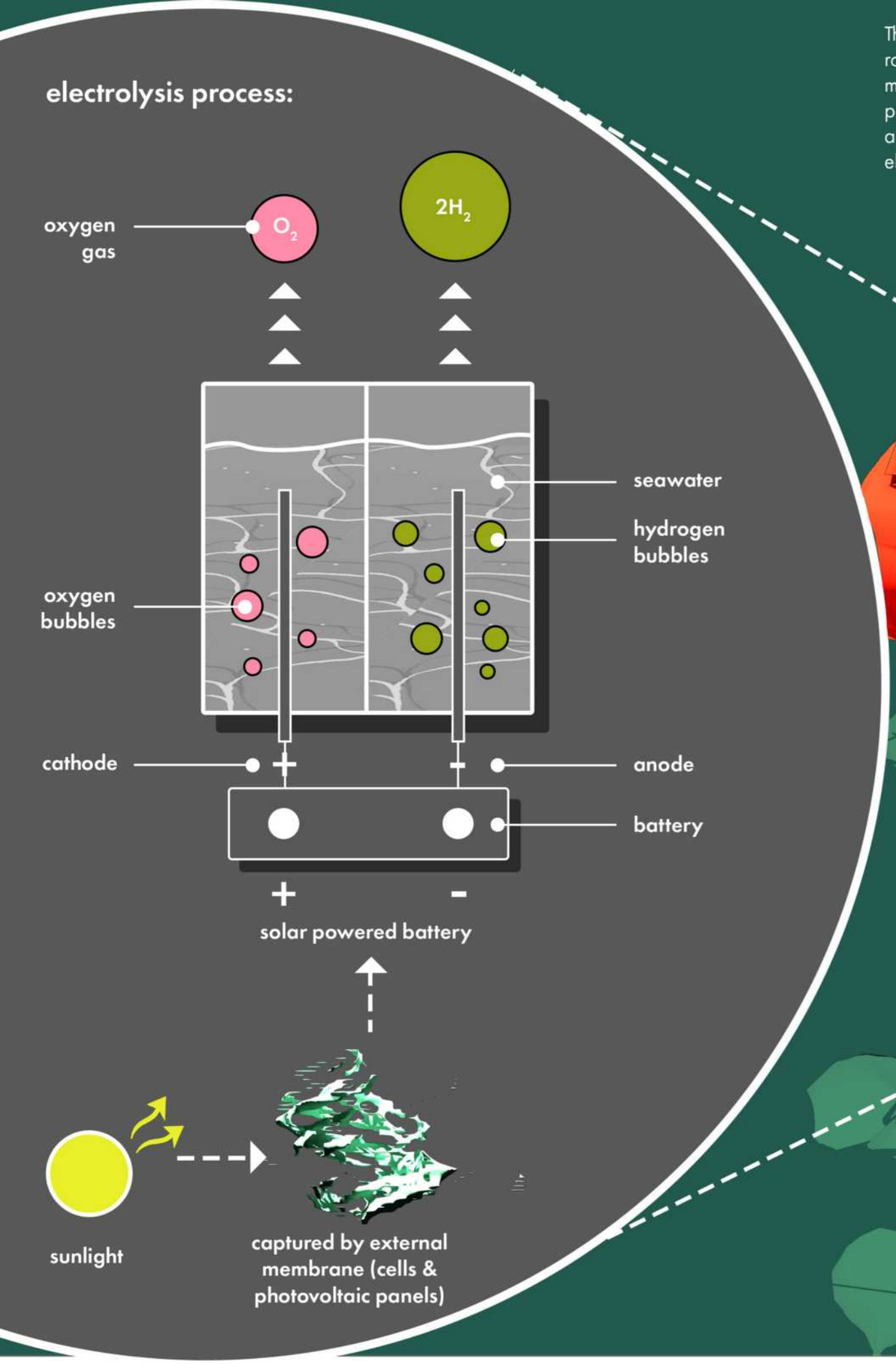
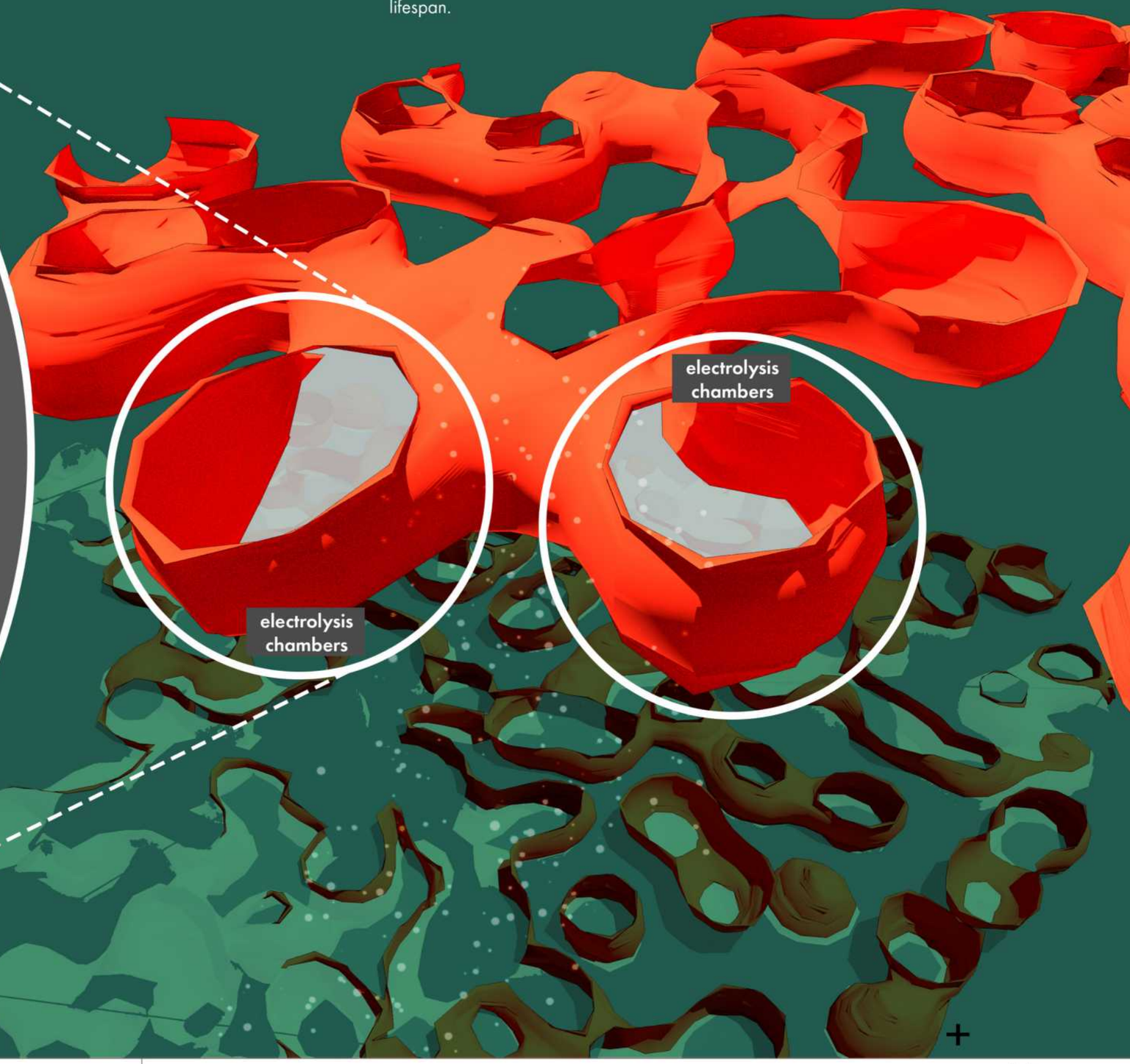
The swamps lie on top of the grown root-foundations and below the external membrane. These swamp-like structures, partly covered by seawater, are formed of a series of protected chambers in which the electrolysis of seawater takes place.

Electrolysis of water is the process of splitting water into oxygen and hydrogen gas due to an electric current being passed through water. Traditionally, this process is achieved by using purified water. Seawater has not been, so far, a viable solution because of its corrosive nature, leading to a very short lifespan for the positive cathode of the required battery. Scientists have recently proposed a solution: by coating the cathode with a nickel layer, the negative charge of the nickel will repel the positive charge in the chloride water, substantially prolonging the battery lifespan.





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