2020 JACQUES ROUGERIE FOUNDATION AWARDS - Jules Verne Year

Award's category : "The African Coastline"

Project's Name Nimbus

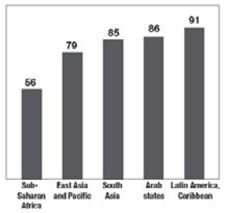
Description A circle of light; A halo. A gray rain cloud.

JACQUES ROUGERIE FOUNDATION
SPACE AND SEA GENERATION
INSTITUT DE FRANCE

water is life

water scarcity is an abstract concept to many to the modern world but a glaring reality for many in sub-saharan africa. throughout history, the lack of this natural resource has triggered an innumerable amount of environmental, political, economic and social dispute in the region.

the world health organization reported in 2015 that more than 40 percent of the global water-stressed population lives in sub-saharan africa and nearly one billion people do not have access to clean safe water.
whilst the world is made up of 70% of water, only 2.5 percent of the water is drinkable.
therefore, within this project, i am on a quest to test the thesis on how to refine the abundant resource into viable drinking water; to resolve the social, cultural and economic issues of coastal areas of sub saharan africa.



current solutions

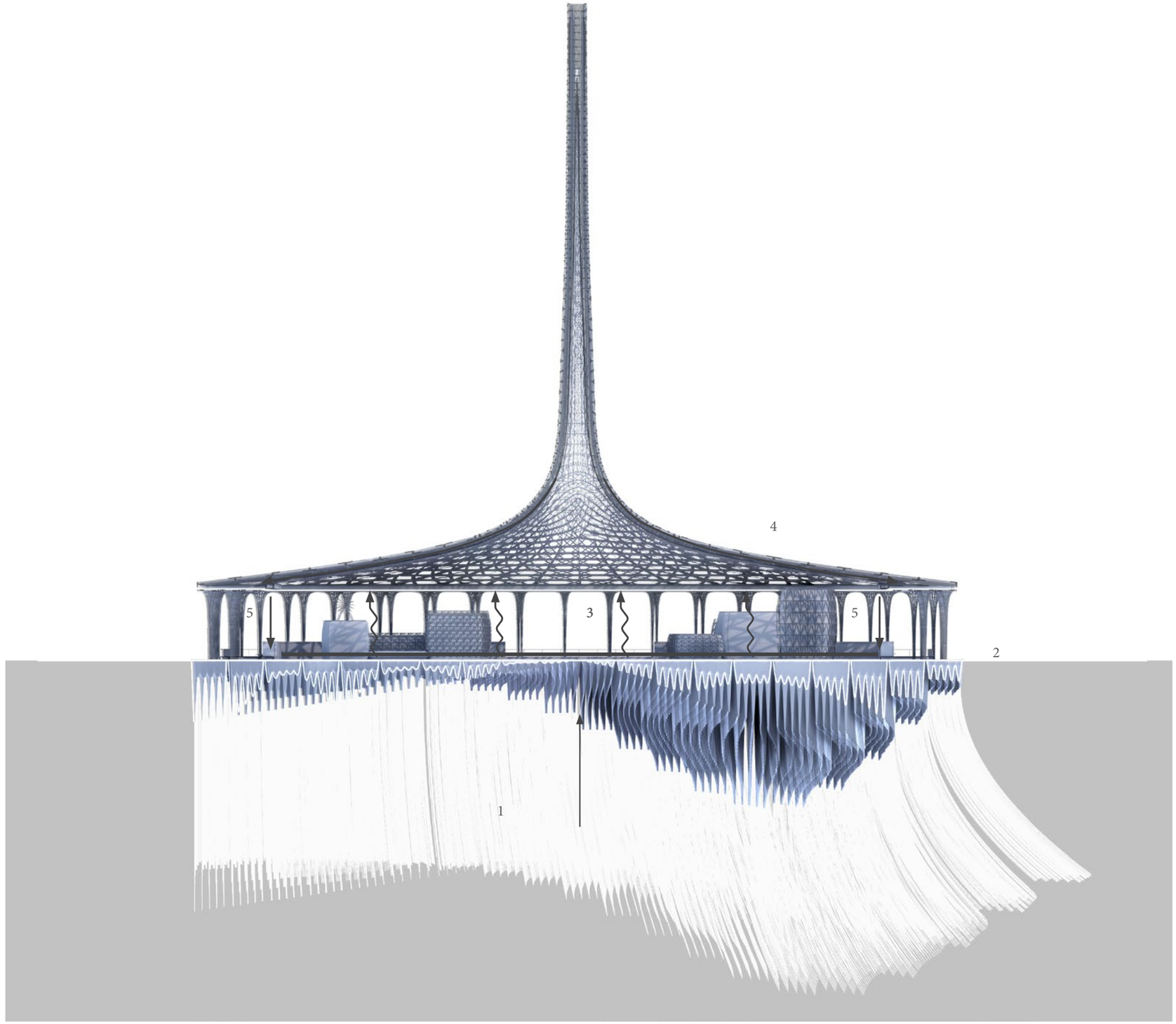
Water desalination plants
water desalination plants turns seawater into drinking water. it has proven to be an extremely effective process in countries like singapore. however, the only way for desalination to solve the water crisis is for the process to be energy efficient and environmental protections are in place to save marine life.

Life Straw
the lifestraw is a straw the filters and purifies water. it removes all the bacterial, parasites and micro plastics in the water allowing the water to be drinkable. since its deployment, it has saved millions of lives by providing safe water for children.
one of the problems to solve the water crisis in sub-saharan africa is the technology is not scalable to meet the demands of the water crisis.

system breakdown

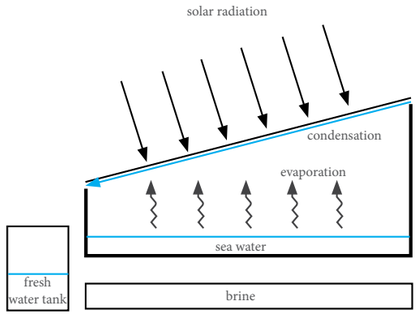
1 Water absorption and filtration
2 Water pool + Salt pan
3 Seawater Evaporation
4 Seawater condensation
5 Drip Edge
6 Water Collection

design components



nimbus

a circle of light; a halo.
a gray rain cloud.

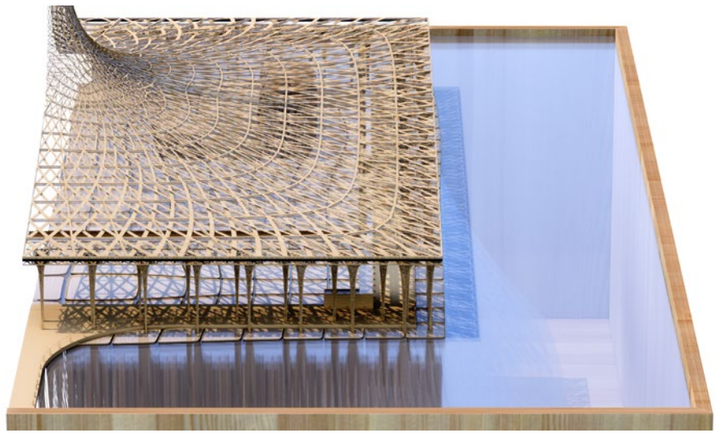


the nimbus intends to recreate the principle of large-scale membrane distillation, in an attempt to resolve the water crisis present in the coastal cities of sub-saharan africa.

to try to solve the inevitable shortage of water, it is interesting to observe nature and understand its functioning in order to find a solution to the problem. so we turn to the clouds.

when water from the earth's surface evaporates, it drops into the atmosphere as droplets and then cools. as a result, and as a result of condensation, a cloud forms. as the water droplets grow larger and become too heavy to stay in suspension, they fall as rain.

membrane distillation reproduces this process in a similar way to the principle of cloud formation. as the solar energy heats the water to the boiling point, it evaporates and rises, then it cools and condenses again. this allows distilled drinking water to be obtained. this process filters the original water, separating it from its impurities, such as salts and heavy metals, and also eliminates biological microorganisms. these residues are then treated and transformed into table salt used for food preservation.



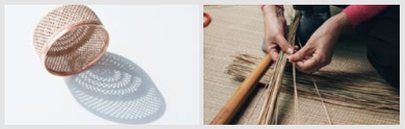
design components

yushania alpina exoskeleton

african basketry is an extensive and dynamic art form. it has been shaped by both environmental and economic factors.

historically, baskets have been made with natural products to carry crops and produce to and from markets. households use them for food and beverage storage. the traditional fibers used in basketry heavily depend on the habitat.

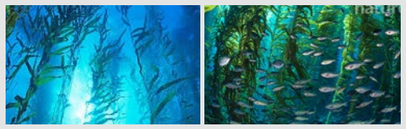
nimbus carries on the tradition by weaving together local bamboo to a larger structure to hold the clouds. the loads and the geometry of this complex structure is parametrically calculated and crafted by local builders.

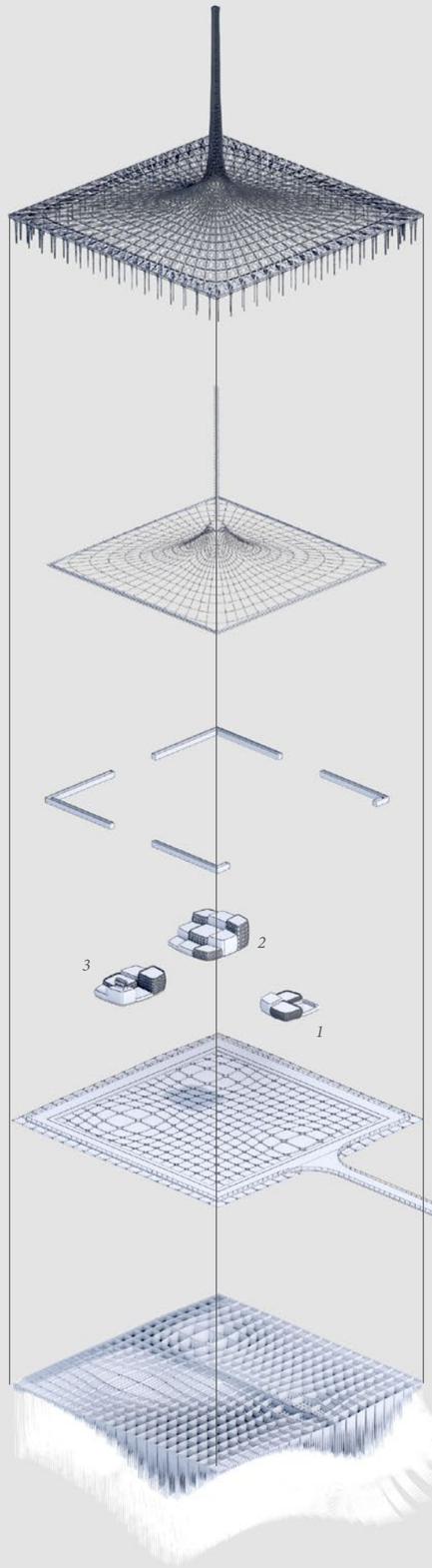


kelp forest

kelp forests are high density of kelp seaweed, these covers over 25% of the world's coastlines. they are documented as one of the most prolific ecosystems we have.

to add to the sub saharan coastline, we have been inspired to install these man-made kelp forest to help filter the large impurities and absorb the water into the dynamic filtration system.





Yushania Alpina Exoskeleton

the exoskeleton is inspired by the hand craft of tribal weaving of african tribes.

weaving has formed an integral part of african culture for thousands of years. from baskets and bags to fishing nets to furniture and now architecture.

this exoskeleton would house the condenser and wind turbine.

The Cloud

the membrane is the condenser and cloud of the project.

water vapor evaporates and condenses on the membrane, where the clean water runs off to the rain trough towards the edge.

Rain Collector

the rain collector is built from a clay wall that catches the raindrops running off the membrane.

taps run across the wall, where fresh water could be collected.

Pods

three cluster of pods are located on top of the floatation salt pans; 1) visitor center, 2) fresh water storage and the 3) curing room.

Footpath

the footpath surrounds the perimeter of the floating saltpans and connects towards to promenade.

Flotation Salt Ponds

three cluster of pods are located on top of the floatation salt pans; 1) visitor center, 2) fresh water storage and the 3) curing room.

Dynamic Filtration

this dynamic filtration system imitates kelp forests for water purification.

The lower kelp structure serves as the primiary filtration to filter out large ocean wastes and absorbs the filtered water into the secondary filtration before absorbing into the saltpans.

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rain collector

the water wall

the rain collector collects and stores the daily consumption of the distilled water for distribution.

sea water is filtered (1) and absorbed from the kelp forest (2) onto the salt pan (3).

as the solar ray heats up the salt pans, the water evaporates and is collected by the cloud (5). as the molecules drips down the cloud due to gravity, the distilled water is collected at the drip edge (6) where clean water rains down into the rain collector (7) and is filtered (8) from microbes before distribution through the 60 taps (9) over the facility.

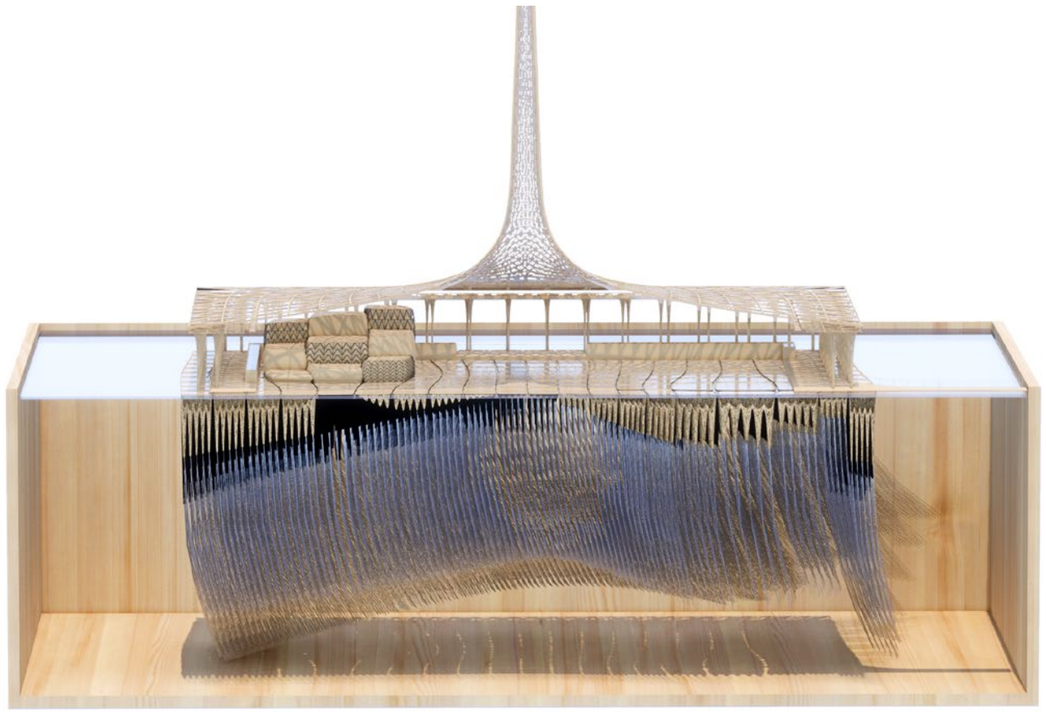
constructed by layers of dried clay, the water wall collects up to a volume of 400,000 liters of distilled water daily from the trough on the cloud.

this method of water filtration would serve as a large scale water distribution plant, allowing the public to freely collect their daily consumption of clean water for crops and drinking.

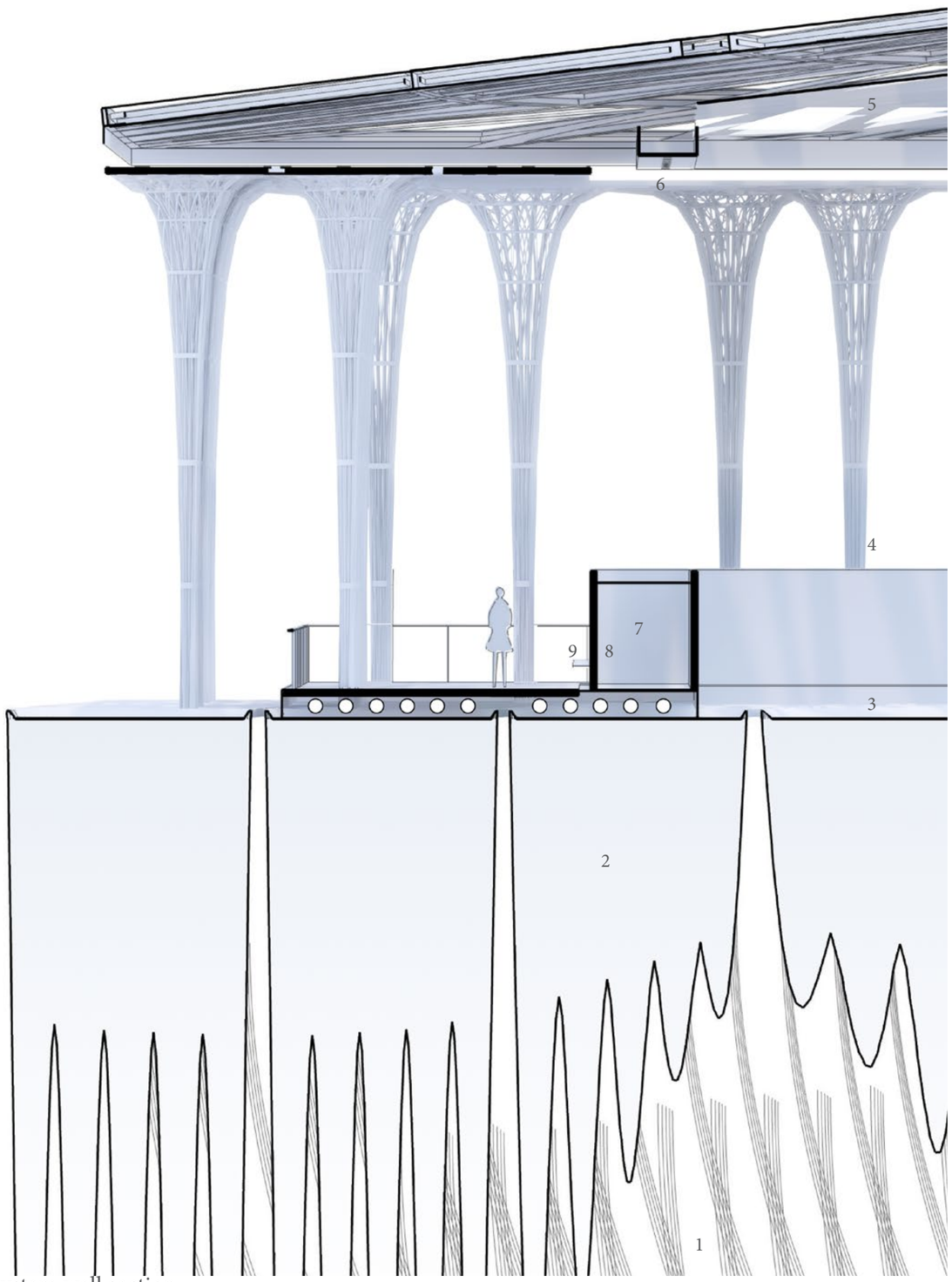
with this solution put in place, sustainable agriculture is possible. children could get back to school and reducing the chances of waterborne illnesses. parents find more time to care for their families, expand minimal farming to sustainable levels instead of finding a source of clean water daily.

keymap

1 kelp forest
2 filtration
3 Water pool + Salt pan
4 Seawater Evaporation
5 the cloud
6 drip edge
7 rain collector
8 microbe filter
9 taps



sectional model design - kelp forest



system wall section

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the floatation salt pans

salt harvesting

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the floatation salt pans

salt evaporation ponds

one of the byproducts of nimbus; the sea water evaporation are the brines and salts.

salt is a valued asset in our world for its utility, predominantly as the primary preservative for meat and vegetables. it also made it possible to preserve dairy products to form cheese and butter safely stored for far longer than milk could in the absence of refrigeration.

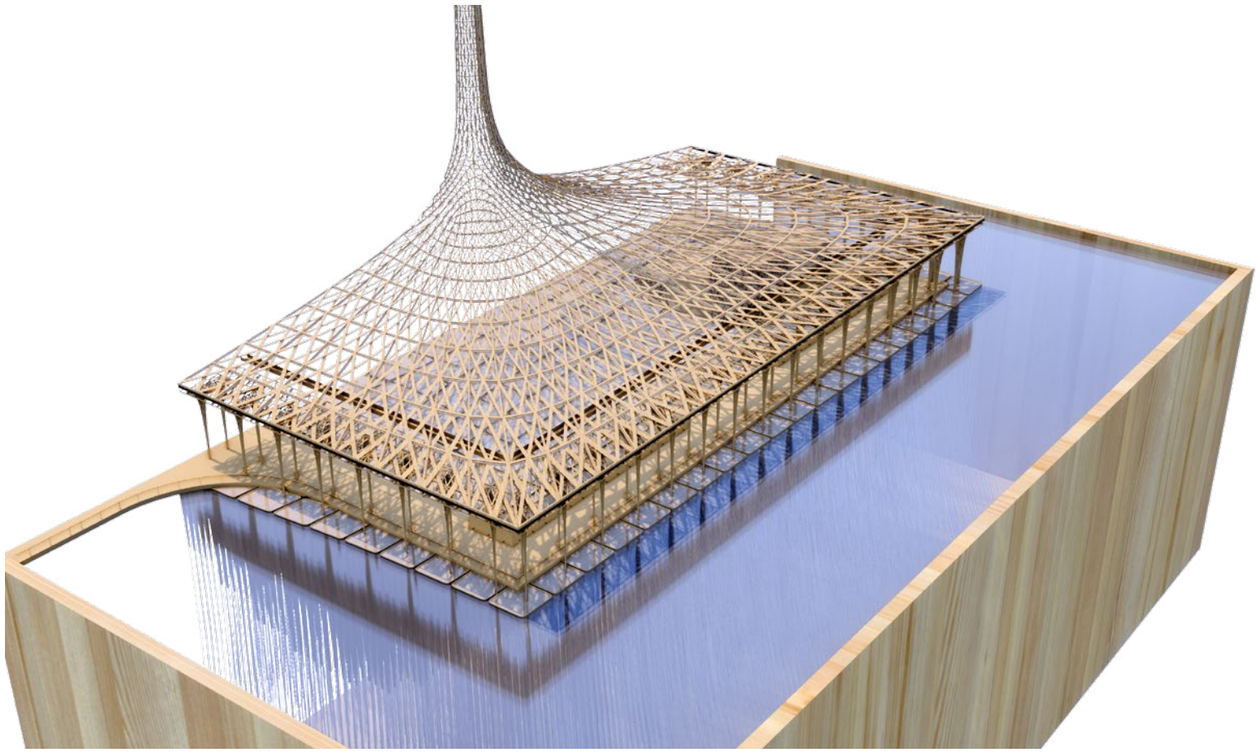
as previously described, the seawater is filtered and absorbed by the kelp forest and fed onto the large evaporation ponds. the fresh water is drawn out through natural evaporation which allows the salt to be subsequently harvested.

as an alternate form of tourism, visitors and locals are encouraged to harvest the excess salt. brooms and rakes are provided on site as salt are raked to a pyramid to allow the excess water to drain off.

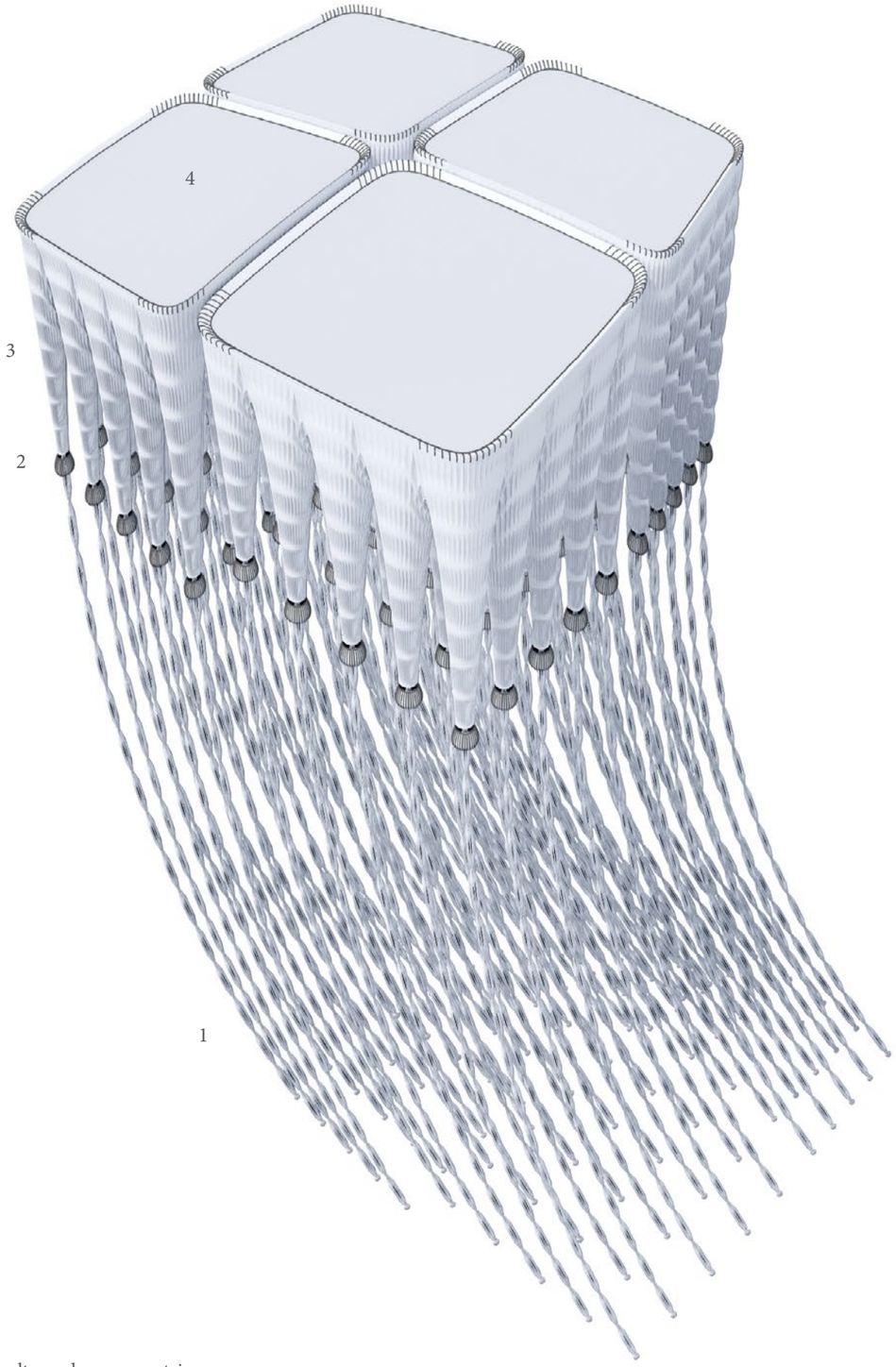
salts would then be transferred into the baskets to be given away to the villages or the curing house, where meats, vegetables and dairy products would be cured for storage.

keymap

1 kelp forest
2 kelp forest cap
3 dynamic/microbe filtration
4 evaporation pond



sectional model design - roof weave



the flotation salt ponds axonometric

the curing house
salt foods curing

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food preservation

the curing house is one of the three amenity pods on nimbus. with preservation of food being a key issue on food scarcity in sub saharan africa, the curing house aims to preserve food and flavor the foods by the byproducts of water production.

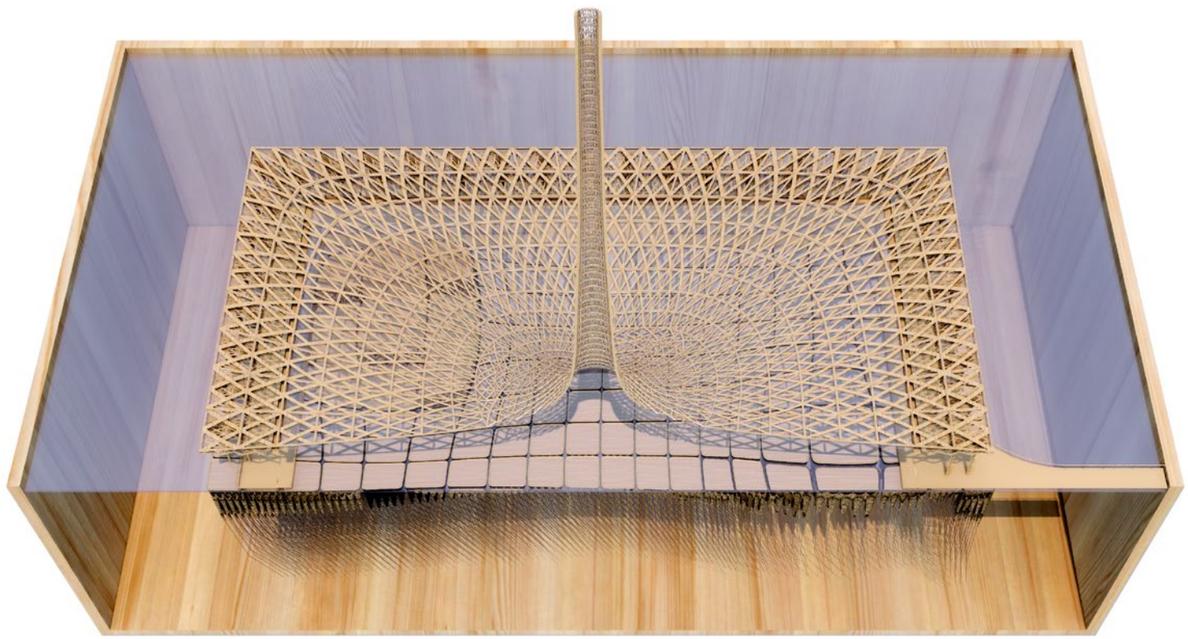
by the addition of salt, moisture would be drawn out of the food by the process of osmosis. as curing increases the solute concentration in the food, decreases the foods water content, rendering it inhospitable for microbe growth which causes food decompositions.

fish and vegetables from the coasts are brought to nimbus to allow the staff to cure the foods. the coarse salt and spices are rubbed over the meat and hung for hours drawing the moisture from the interior to the surfaces of the foods. the salt surface is then removed after 30 days allowing the foods to be stored and transported back to the villages.

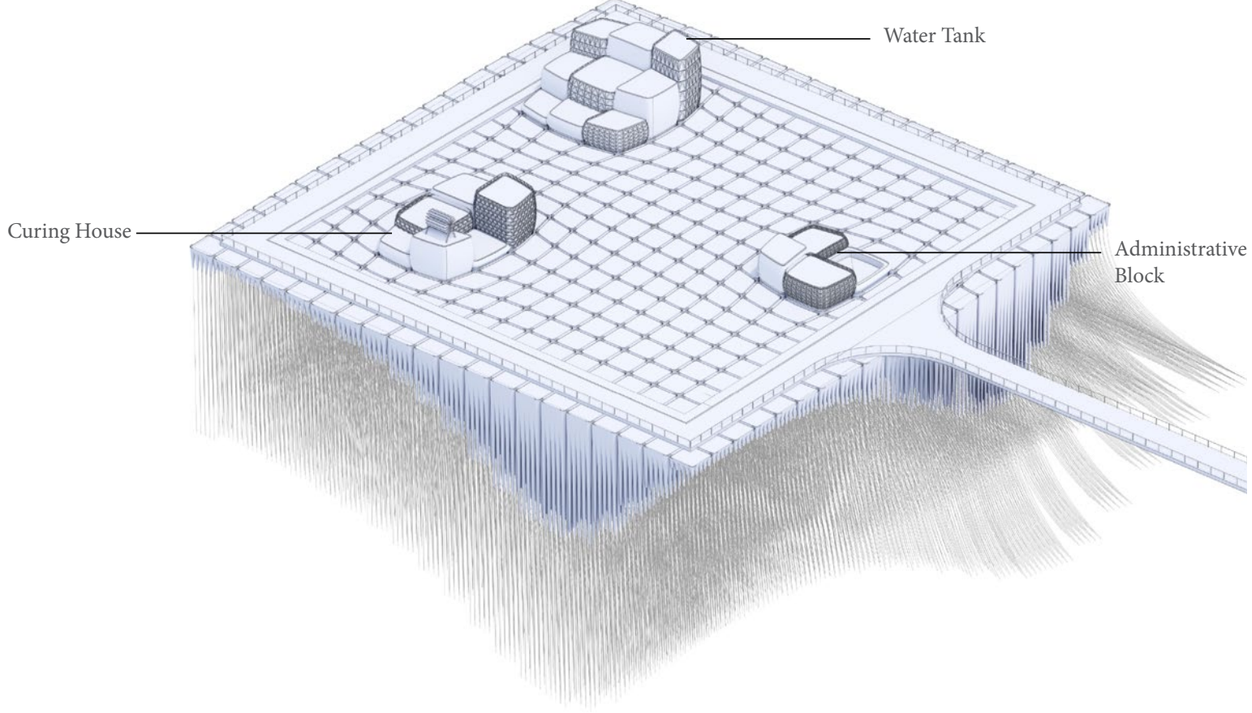
keymap

1 hanging rack
2 salt jars
3 workers bench
4 spice pots
5 pod structure
6 ladder

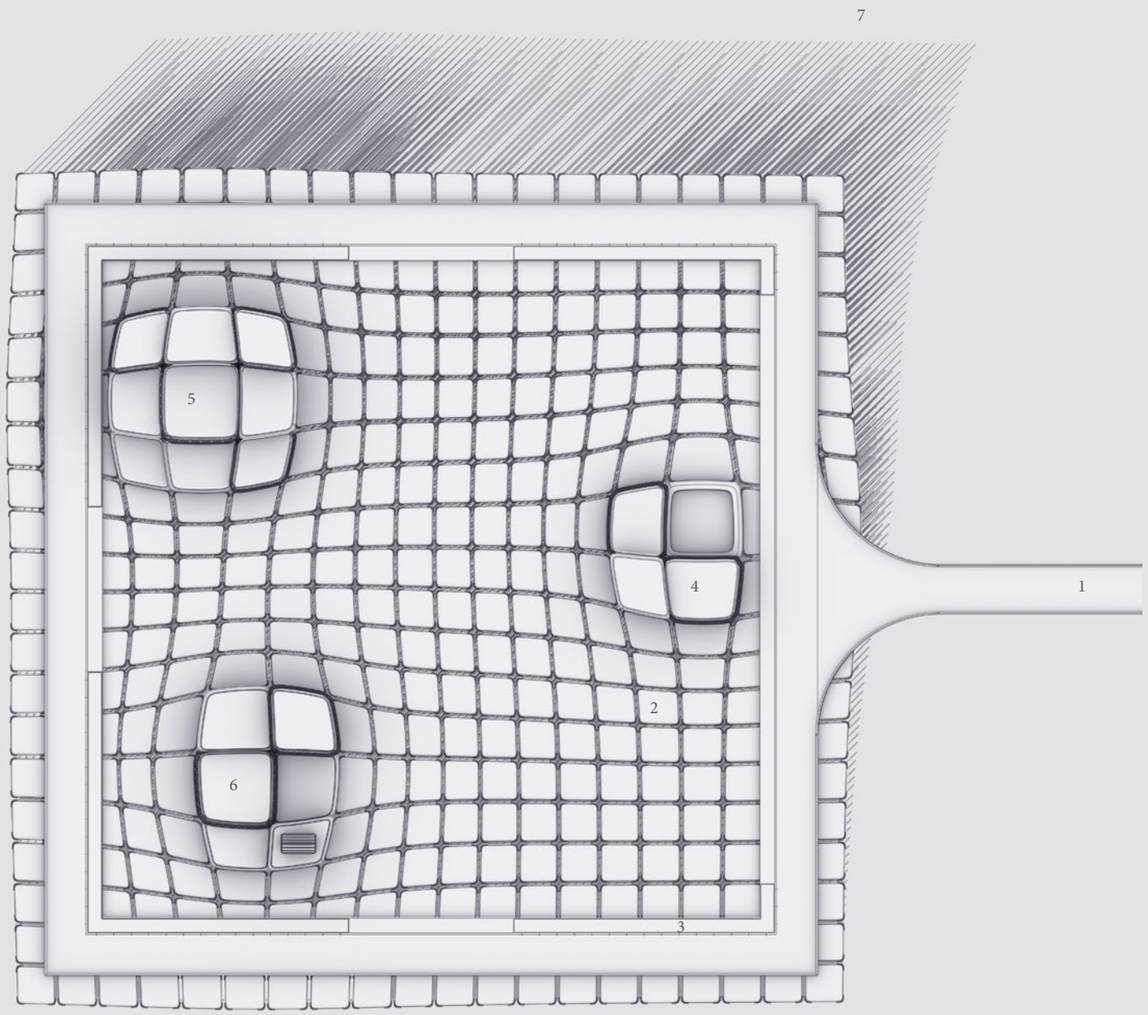
the curing house



sectional model design - roof weave

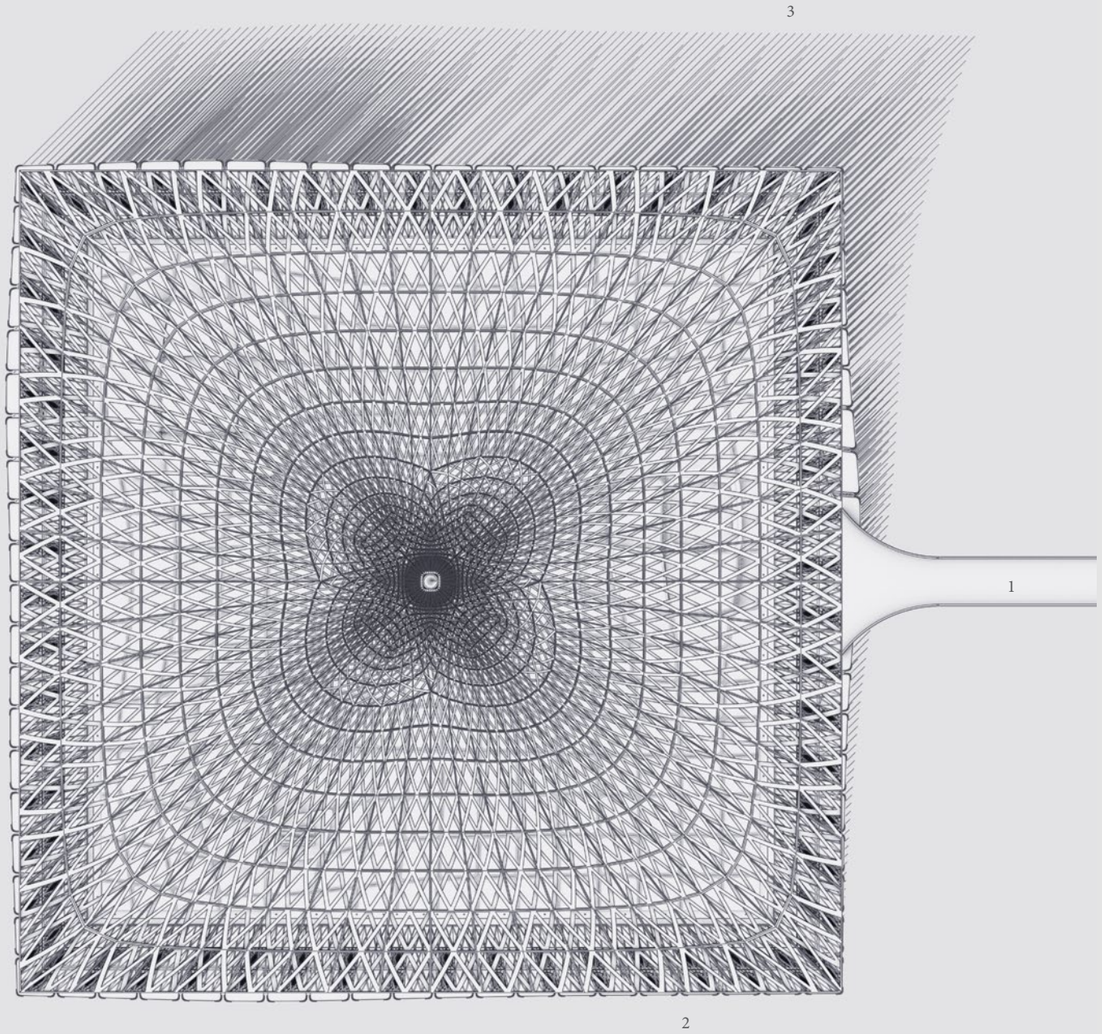


nimbus amenities



ground floor plan

1 board walk to promenade
2 floatation salt pans
3 rain collector
4 visitor center
5 distilled water storage
6 curing room
7 kelp forest



roof plan

1 board walk to promenade
2 yushania alpina exoskeleton
3 kelp