Acque Alte: Transforming the Venetian Lagoon

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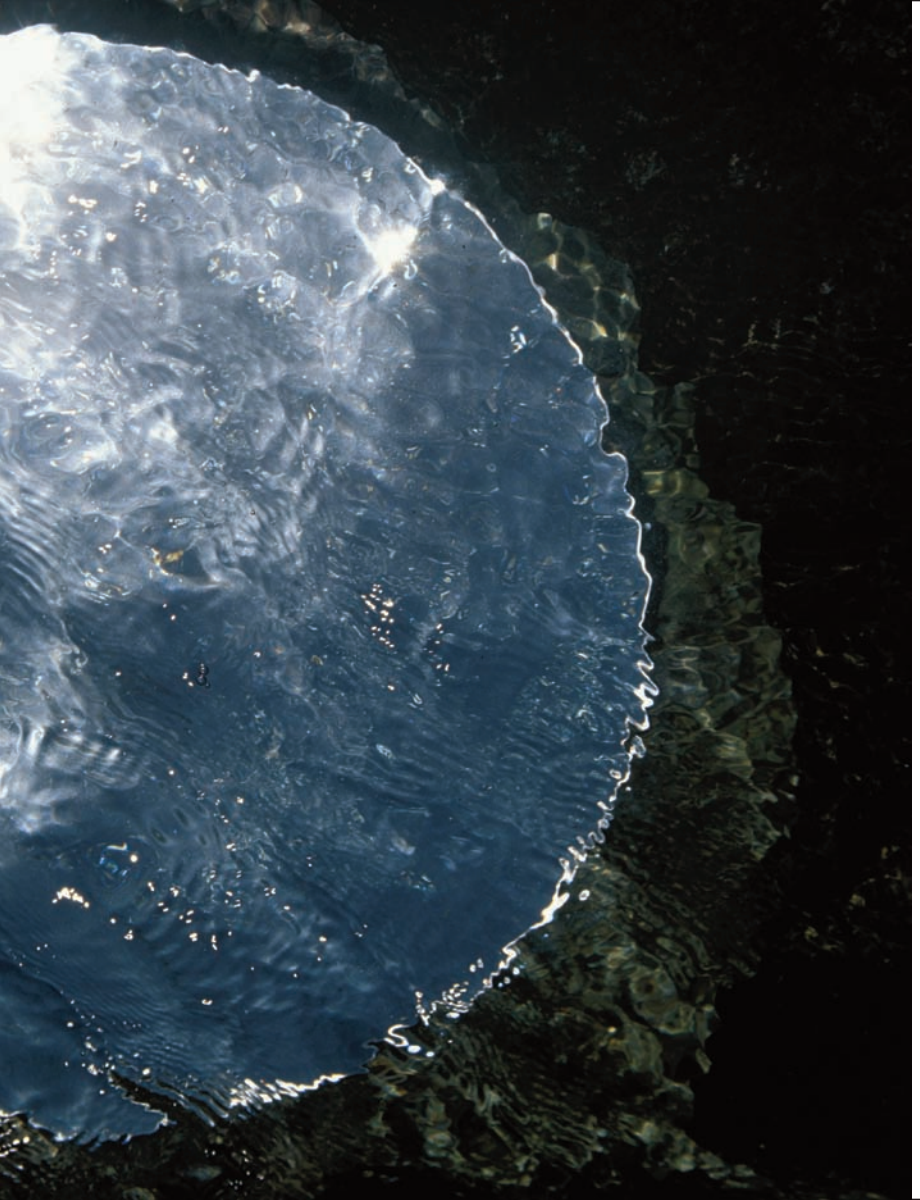


Water's relation to architecture has a long history. The city of Venice marks the quintessential marriage of architecture and water; however, this relationship turns out to be a precarious one—sustained only through an immense technological and political tour de force.

Beginning in the 1400s, in order to preserve shipping access to the Adriatic Sea, the rulers of the Venetian Republic decreed military and defensive operations to halt the natural evolution of the Venetian lagoon into coastal marshland. By 1480 the River Brenta had been diverted and no longer emptied its fresh water and silt into the lagoon; by 1683 the River Sile had also been turned aside. As a result, the lagoon's water grew increasingly saline and the makeup of marine life changed. During the same period, the original eight sea inlets along the lagoon's shore were reduced to three and deepened, making the lagoon increasingly subject to sea wave action and erosion. The lagoon has enlarged since 1400; several islands have sunk and the woodlands at their edges have become intertidal flats. In the twentieth century, this erosion was counteracted by intensive land reclamation. Indeed, only through constant hydraulic intervention has the lagoon been prevented from either silting over entirely and joining the Venetian plain, or having its sandbanks and coastline claimed by the Adriatic Sea.

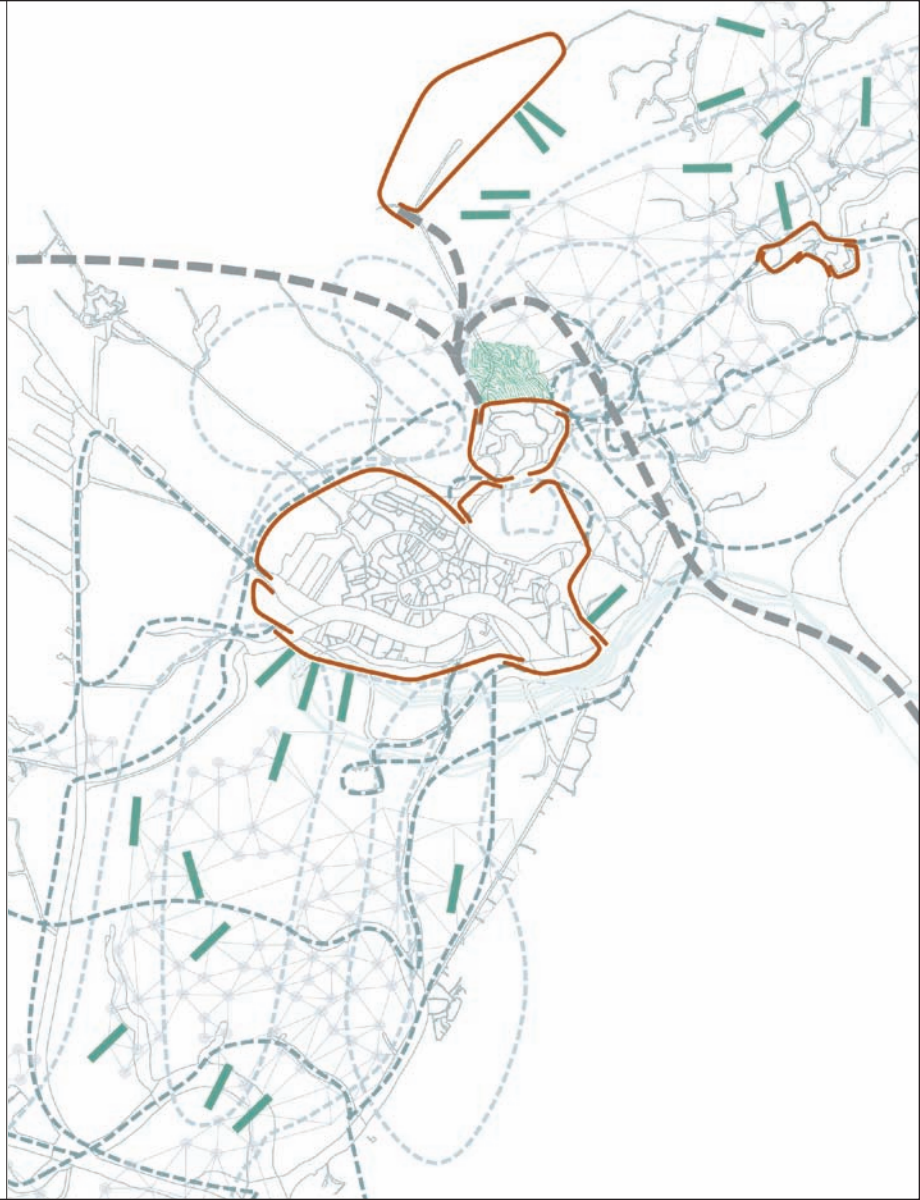
The famous Venice Lagoon is therefore far from a natural phenomenon. Rather, it is a major piece of human-engineered infrastructure, carefully constructed and maintained for the benefit of the city's military and mercantile needs. Unfortunately, this infrastructure is now in a precarious state.

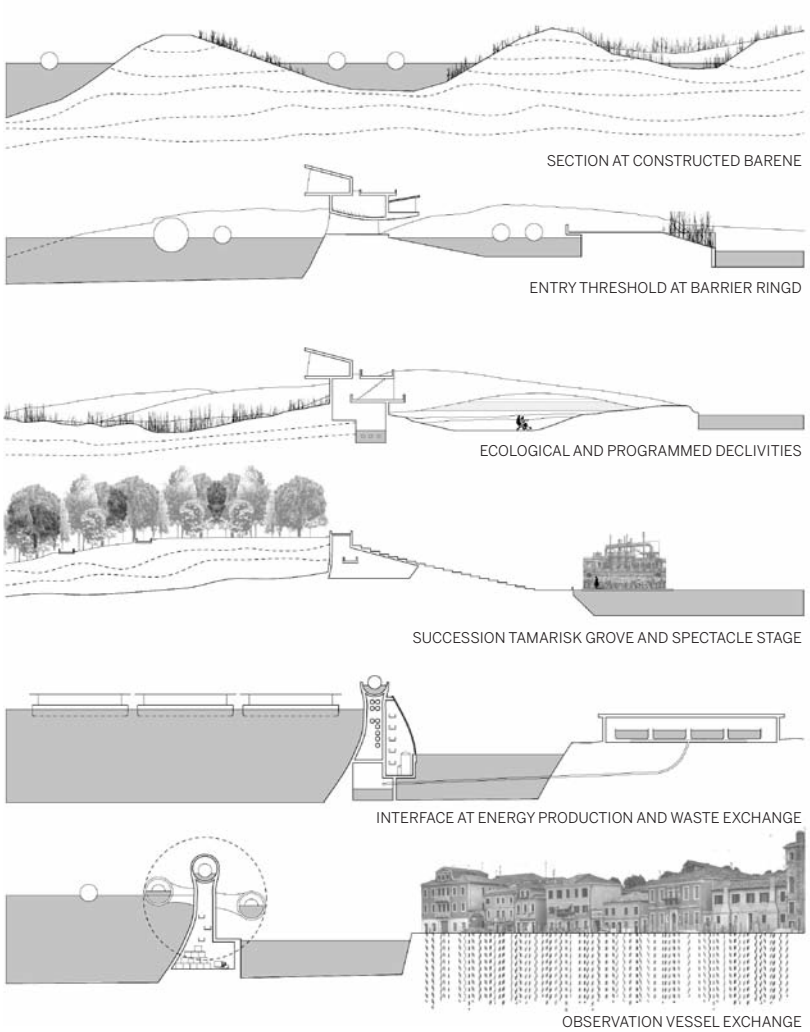
Depleted underground aquifers, compacted silts, and the gradual rise in sea levels have caused the waters of the lagoon to rise almost

22 centimeters relative to the islands between 1908 and 1980, placing the city under ongoing threat of tidal flooding. St Mark's Piazza sits only a few centimeters above the current spring high-tide sea level. The centuries-long struggle to maintain the lagoon continues, with massive infrastructure projects such as MOSE (Modulo Sperimentale Elettromeccanico or Electromechanical Experimental Module), a three-and-a-half-billion-euro floodgate designed to protect the lagoon from a rise in water levels of up to one meter.

But worst-case global climate change predictions foresee a rise in sea level of as much as 14 meters in the next century, a result that would submerge the entire Venetian plateau in the Adriatic like a latter-day Atlantis, easily swamping even MOSE. While the image of a Venice sunk beneath the waves is painful to contemplate, it may be an inevitable result; the ongoing war against the sea may be one that the Venetians cannot win. We think it is time to take a different approach, to start considering what ecological and economic possibilities might emerge from a flooded lagoon. The lagoon has the potential to serve as a future space for aquacology, with the surface of the water supporting industrial-scale food and energy production. What's more, both the water's surface and the cultural treasures buried beneath it present wonderful opportunities for an expanded tourist industry: the Venice Lagoon Park.

We imagine a future in which Venice proper, its nearby islands of Murano, San Michele, and Giudecca, and a few other culturally significant lagoon islands (as well as Marco Polo airport) will be enclosed by protective ring walls, inside which current water levels will be maintained. Except for these few preserved islands, the Venice Lagoon Park will be primarily an aqueous experience. Constructed using dam-building methods, with locks for boat access, the ring walls will act as a prophylactic barrier. Far from being merely protective devices for the city of Venice, the rings will also form a critical link between the water-based food and energy production and land-based end users, containing facilities for receiving, processing, warehousing,





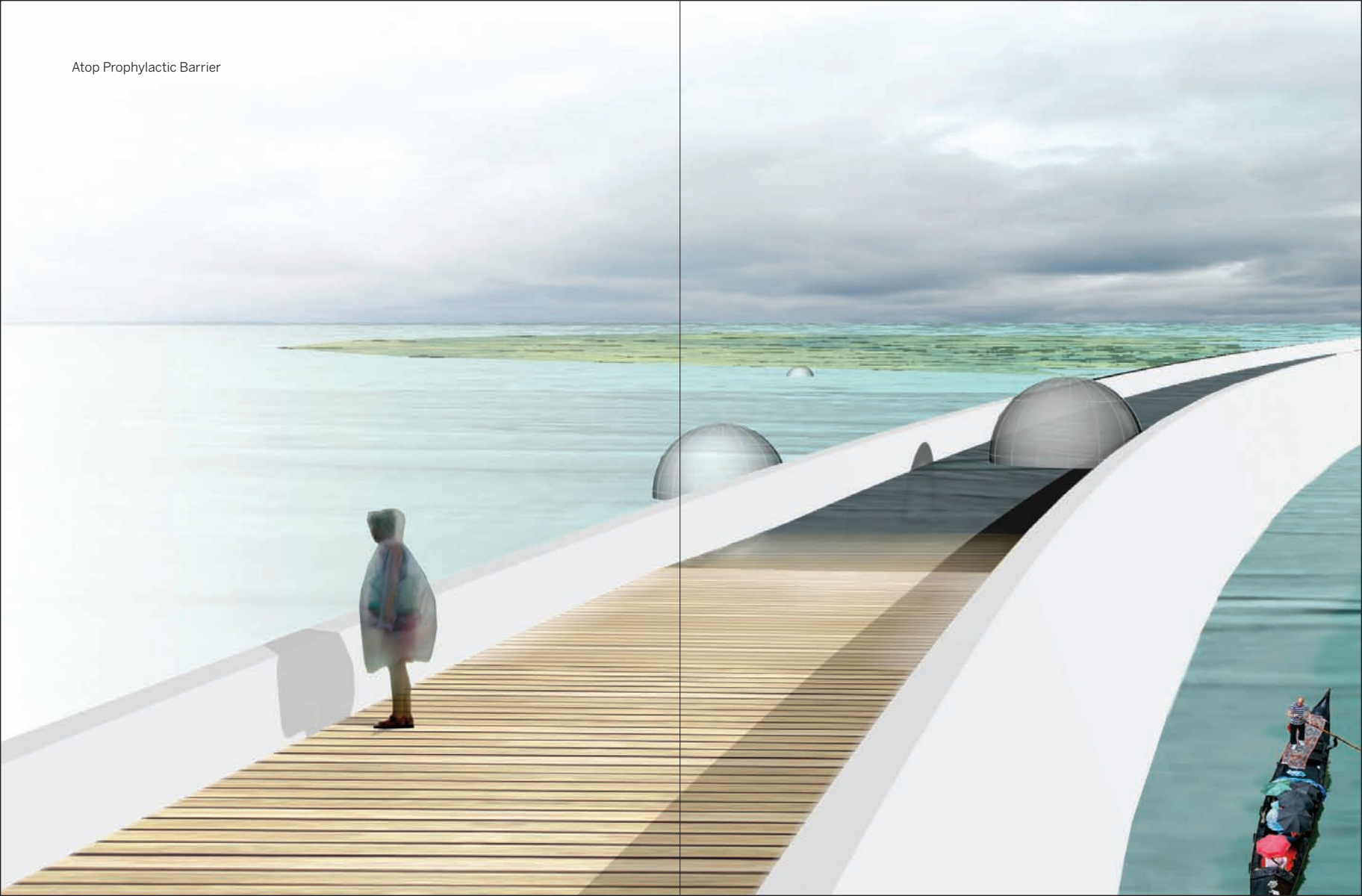
and shipping the products of the new lagoon agricology. They will become the landing stages for all vessels plying the new cultural and ecological lagoon park, and the gateway to the remaining islands; travelers disembarking on these outer rings will find information centers and sites for renting tourist vessels.

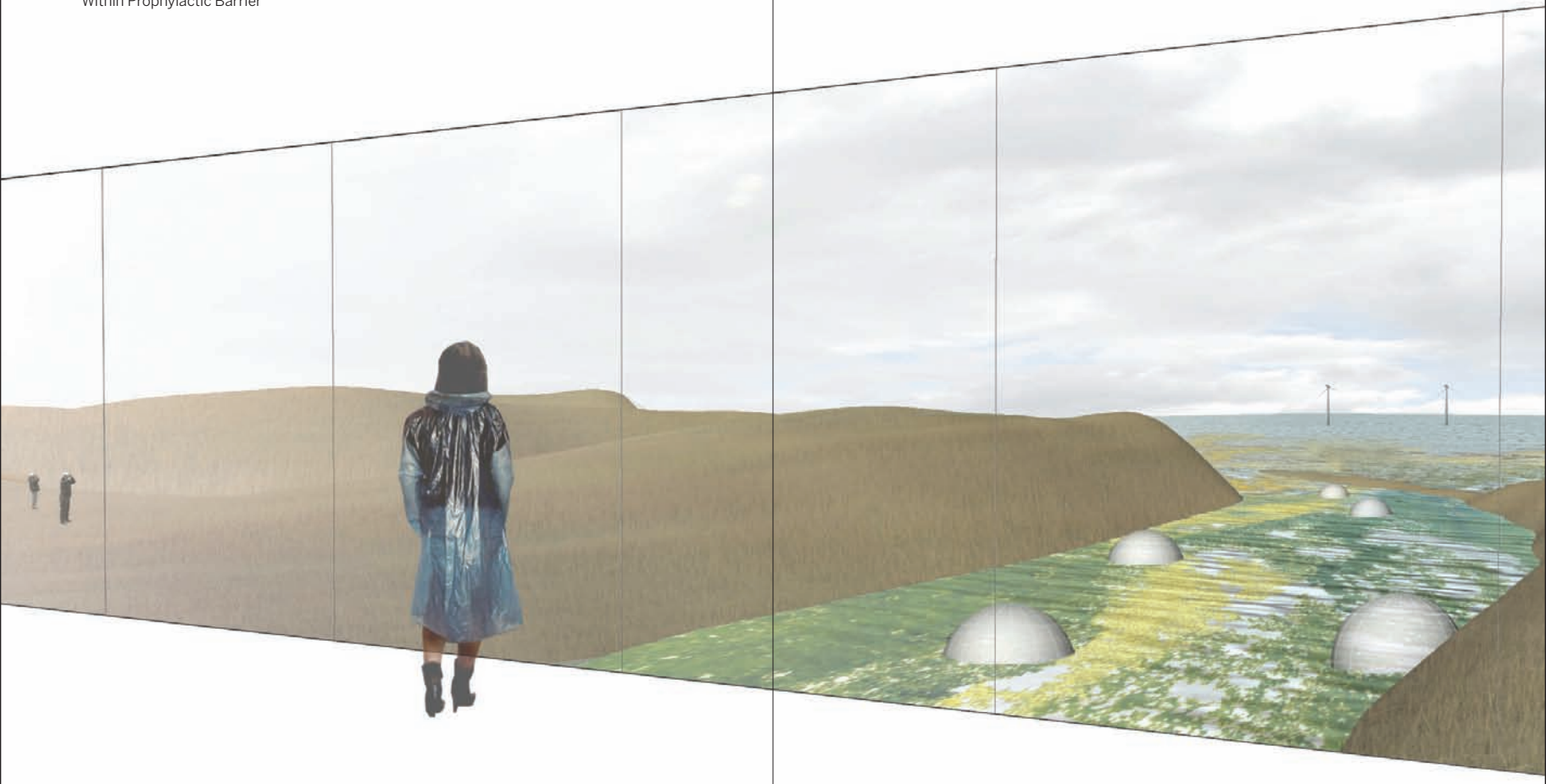
Although the end of daily tidal flushing of the lagoon sandbanks, or *barenes*, will precipitate the death of a number of currently existing ecologies within the lagoon, new ecologies will be constructed. Micro-algae, naturally occurring in most expanses of water, will be intensively farmed on a matrix of barges, and used as a source of food and minerals, and as a basis for hydrogen production. Pink micro-algae such as *Haematococcus pluvialis*, which is found naturally in the Adriatic Sea, use the energy of the sun through photosynthesis to fix CO_2, the most significant greenhouse gas, into carbohydrates, which can then be used as a food source. A byproduct of *H. pluvialis* is astaxanthin, a very expensive pigmentation source used in the food and cosmetic industries. The production of astaxanthin will add another niche industry to the Venice Lagoon. Other strains of algae can be used for biofuel production, with yields a hundred times those of corn ethanol production. Still other strains may be used to make hydrogen through photosynthetic water splitting. The result will be a system that can simultaneously grow food, produce clean energy, and reduce atmospheric greenhouse gases.

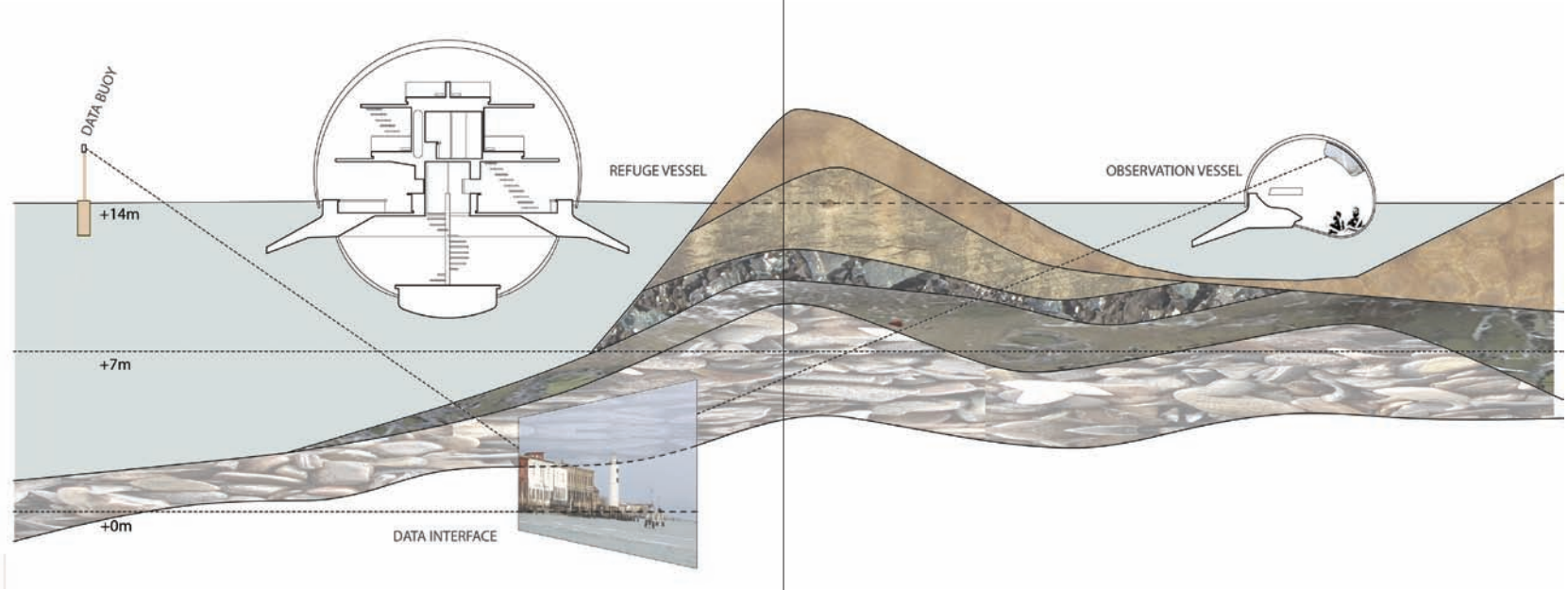
In addition to this algal-energy industry, other barges will support more traditional hydroponic agriculture and fish hatcheries, as well as floating wind turbines and solar collection cells. Even MOSE will be retooled to collect tidal energy.

A new landscape in the form of ridges, valleys, and inlets will be created with the material gained from the excavations required to construct the barrier rings. This ecological preserve and study area will be connected to the existing island of Sacca San Mattia (itself an entirely constructed terrain, built up in the middle of the twentieth century, partially with debris from the Venetian glass industry), just

Atop Prophylactic Barrier



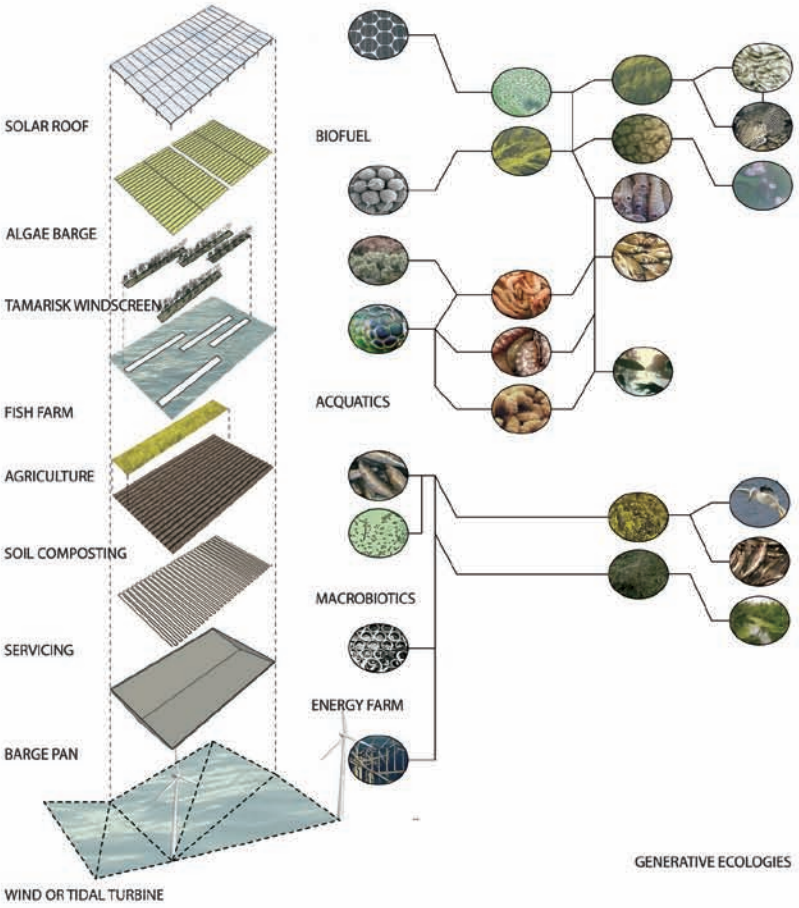




outside its protective ring. The preserve will evolve over time, altered daily by the tides. The southern portion of the new San Mattia, inside the barrier ring, will contain sports fields, recreational circuits, and open-air theatres. Tidal flats and marshlands will be manufactured as a dynamic ecological zone in the northern portion of the island for the preservation and study of marine species.

Taken together, these new infrastructure elements (a submerged city, protected cultural zones, aquacological food and energy industries, ecological preserves) will keep tourists coming to Venice. New facilities will be created to allow visitors to observe and study the historical elements of the Venice Lagoon Park and its floating industrial present. Tourists will board transparent floating bubbles for one or two people in order to view the ecological zone and the submerged portions of the park. In addition to allowing unrestricted views both above and below the water line, these vessels' highly performative skin will provide information, wayfinding, and air filtration. The skin will also act as a hydrogen-producing membrane, using artificial photosynthesis to split water molecules, thereby making the vessels energy self-sufficient.

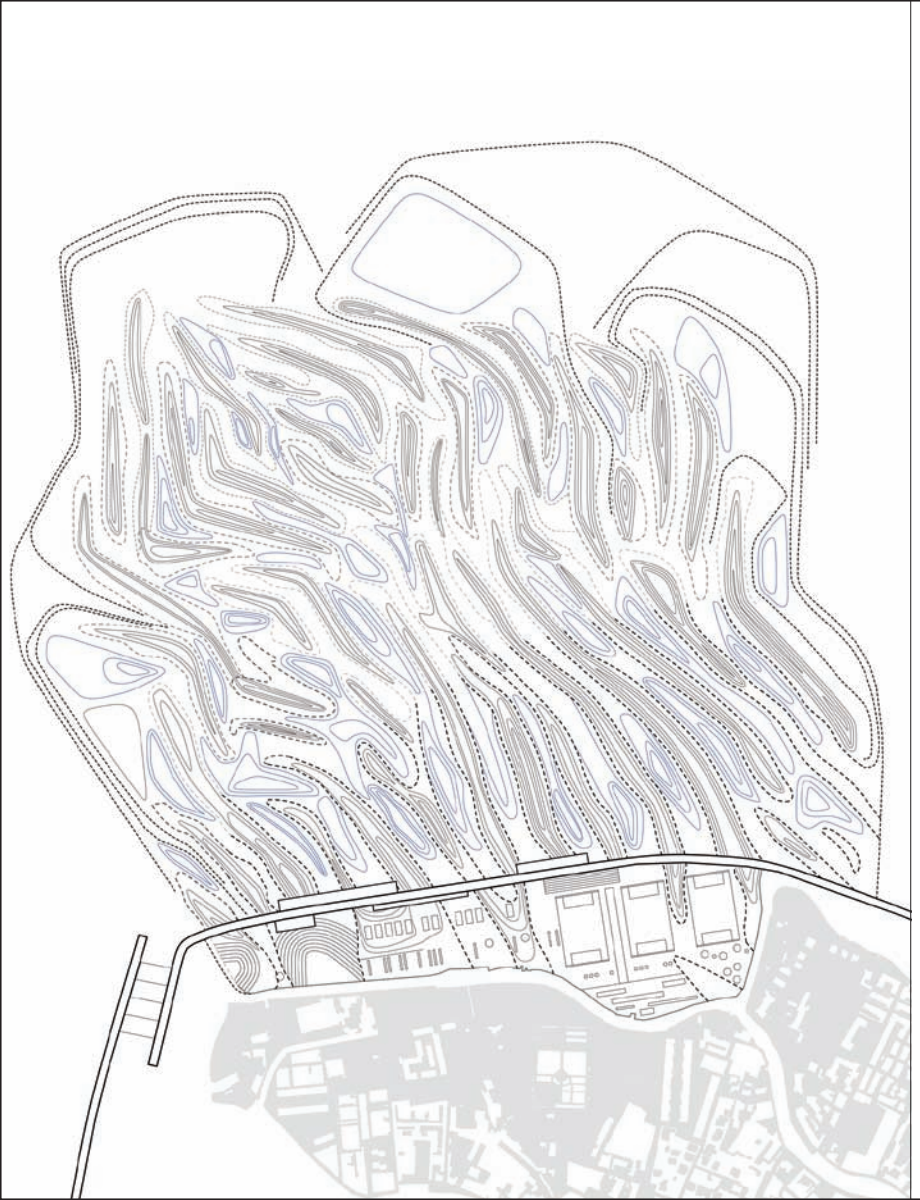
Larger hotel-like vessels for up to eight people, tethered at nodal points of the geomatic and informatic grid laid over the lagoon, will accommodate longer stays in the Lagoon Park. Artificial photosynthesis will be deployed in the skin of the refuges to provide not only hydrogen but also food, in the form of carbohydrates derived from



ENERGY WAYSTATION PROTOTYPES

GEOMATIC AND INFOMATIC GRID

CULTURAL / CIVIC ASSETS



the CO_2 in the carbon-rich atmosphere, thereby making the vessels net reducers of atmospheric greenhouse gases and largely self-sufficient in terms of food production.

As the new Venetian gondolas, the vessels will present an experience without parallel today. Travelers will be floating observers of powerful new technologies at peace with the terrifying power of the natural world. The Venice Lagoon Park will offer an optimistic vision of a world at once utopic and dystopic, a world in ruins and a world moving relentlessly into an unknown future.

CREDITS
Design drawings for this article are by RVTR (www.rvtr.com)
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