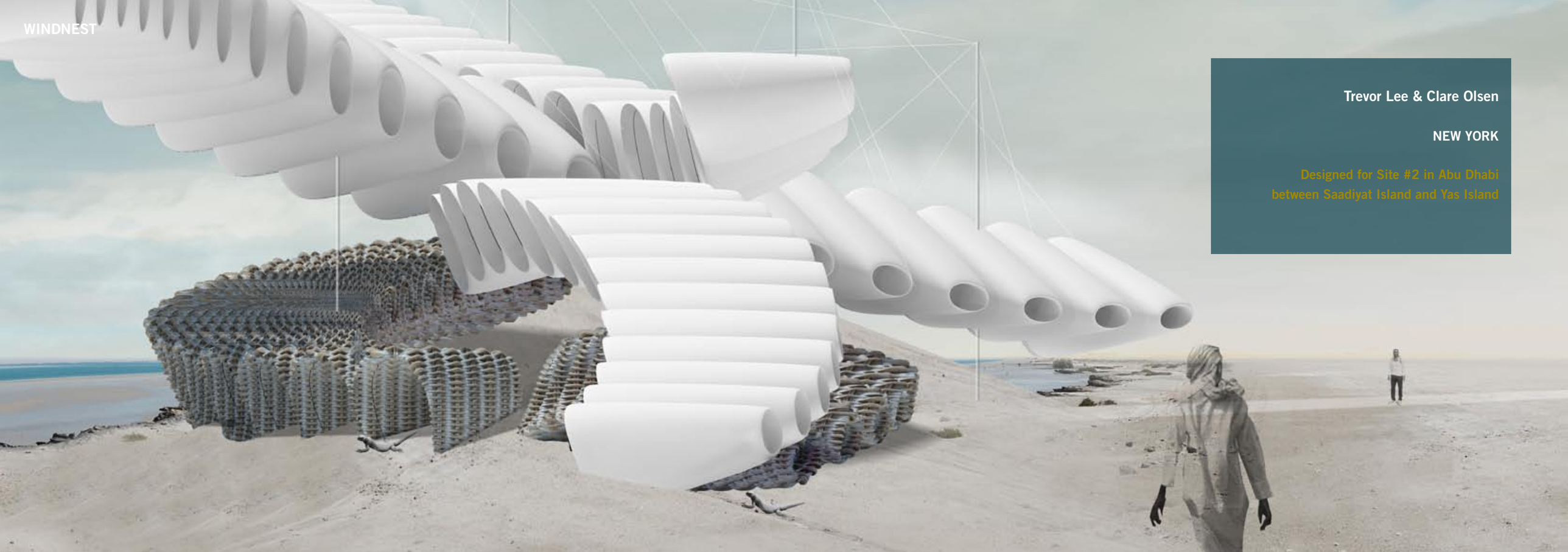
land art generator initiative

RENEWABLE ENERGY CAN BE BEAUTIFUL

2010 UAE DESIGN COMPETITION

www.landartgenerator.org



Trevor Lee & Clare Olsen

NEW YORK

Designed for Site #2 in Abu Dhabi
between Saadiyat Island and Yas Island

WHAT IS THE LAND ART GENERATOR INITIATIVE?

The Land Art Generator Initiative (LAGI) is a worldwide public arts initiative that offers the opportunity for collaborative teams of artists, architects, landscape architects and designers, working with engineers and scientists, to create new ways of thinking about what renewable energy generation looks like. It begins with the statement that renewable energy generation can be beautiful at the same time that it is functional. It seeks to broaden public awareness of renewable energy's promise by inspiring and educating through public art about the potential for a sustainable future. The LAGI project is a way for interdisciplinary teams to arrive at pragmatic and thought-provoking solutions to the problems that face us (global warming, resource management, environmental pollution).

The LAGI project calls on design teams to conceive of large-scale public artworks for specific sites that, in addition to their conceptual beauty, also have the ability to harness clean renewable energy from nature, convert the energy to electrical power, and distribute the power to the utility grid of the city. The built designs have the potential to provide clean power to thousands of homes.

The inaugural year of the LAGI competition took place on three sites in the United Arab Emirates in 2010 with over 200 entries from 40 countries. The project has been featured in articles in numerous local and international press outlets, including *The New York Times* and *Dwell Magazine*.

The prize for the winning design of LAGI's first international design competition was sponsored by Masdar, Abu Dhabi's multi-faceted initiative advancing the development, commercialisation and deployment of renewable and alternative energy technologies and solutions. Masdar serves as a link between today's fossil fuel economy and the energy economy of the future—developing the "greenprint" for how we will live and work tomorrow. Backed by the stability and reputation of the Mubadala Development Company, an investment vehicle of the government of Abu Dhabi, Masdar is dedicated to the emirate's long-term vision for the future of energy.

LAGI continues to pursue the construction of the best designs while in the planning stage for the 2012 New York City competition. The plan is to maintain a biennial schedule for competitions in cities around the world.

Once completed, the finished artworks will brand cities and participating partners as world leaders in sustainability and in cutting-edge modern art patronage as the initiative is inevitably duplicated around the world.

There has been much popular debate recently pertaining to the potential downside aspects of renewable energy installations that are in close proximity to development (noise pollution, utilitarian "engineer" aesthetics). At the same time, cities around the world have been stating in policy positions a greater interest towards an integration of renewable energy into urban planning.

Because LAGI is focused on the betterment of public spaces, there are ample opportunities to invigorate cities with artwork that has added relevance for the 21st century—art that provides a legacy for future generations to reflect on and that speaks to the gravity of the issues that confront contemporary culture. Through its production of real kilowatt-hours of renewable energy that are directed into the city power grid, the LAGI competition forges a new path of collaborative efforts toward innovative urban planning solutions.

2010 LAGI COMPETITION DESIGN BRIEF

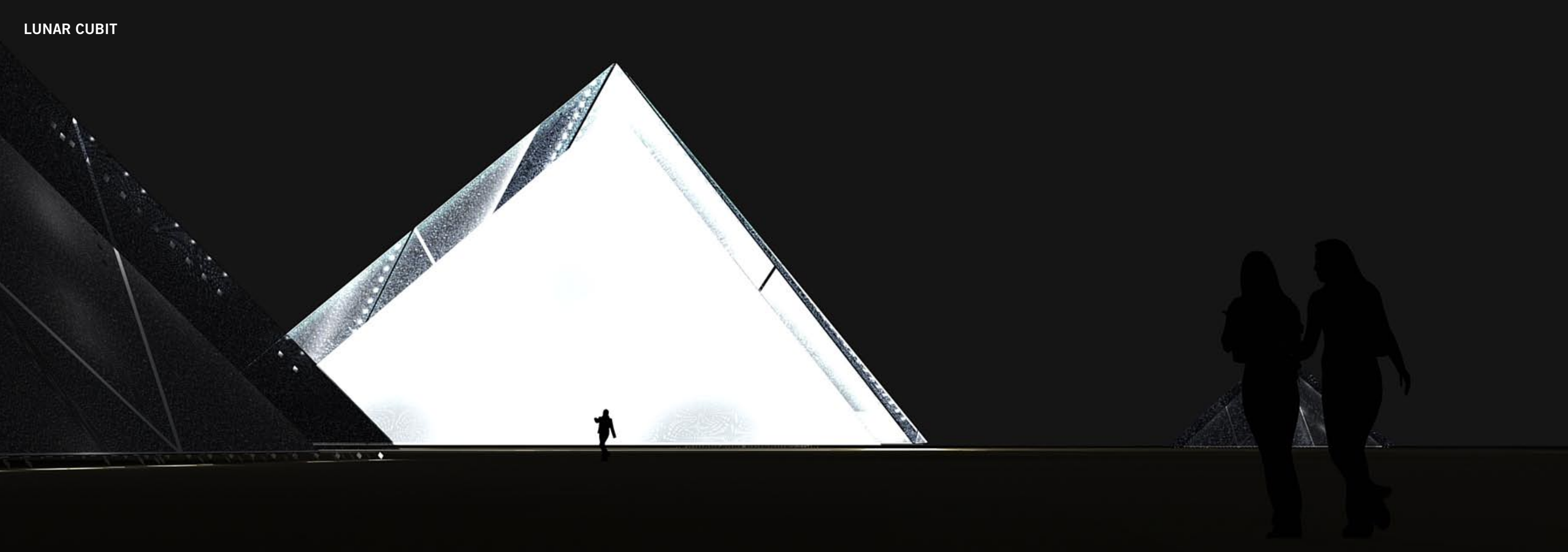
The call for the 2010 competition was to design an art installation for one of three pre-selected sites in the United Arab Emirates that fulfilled the following criteria:

- Is a three dimensional form that has the ability to stimulate and challenge the mind of the viewer on a contemplative level.
- Embodies a sense of beauty and concept in its built form that is derived from the artistic sensitivities of the design team and from an acute attention to details.
- Captures energy from nature, converts it into electricity, and has the ability to store, and/or transform and transmit electrical power to a power grid connection point to be supplied by others.
- Does not create secondary emissions other than electricity and does not pollute its surroundings.
- Is safe to people who would view it. Consideration must be made for viewing platforms and boundaries between public and restricted areas.
- Is pragmatic and constructible within reason and employs technology that can be scalable and tested. There is no limit on the type of technology or the proprietary nature of the technology. The Land Art Generator Initiative will endeavor to reach contractual agreements with any company and/or patent holder that is specified as a part of a successful design entry.
- Does not negatively impact the natural surroundings. Each entry should provide an environmental impact assessment in order to determine the effects of the project on the ecosystem into which the installation is to be constructed. Mention should be given to a mitigation strategy that will address any foreseeable issues.
- Uses all or any portion of the site. There is no requirement or restriction on size other than those of the plot limits themselves and the environmental footprint of the design.

The following pages contain selected entries from the Land Art Generator Initiative 2010 design competition. As you will see from just these few examples, the potential for interdisciplinary collaboration on sustainable solutions is without limit.

And over time, these works of public art will pay back both their carbon construction footprint and their installation cost, making them the perfect investment in our future.

LUNAR CUBIT



LUNAR CUBIT

ENERGY TECHNOLOGY: amorphous silicon
ANNUAL CAPACITY: 3,500 MWh

Combining artistic vision with sustainable design and engineering, *Lunar Cubit* examines the nature of time through nightly contemplation of lunar phases and daily transformation of sunlight into electricity. The work is open to the public, inviting a personal experience where one can literally reach out and touch a 1.74MW utility-scale power plant that takes the form of nine monolithic pyramids rising from the sands of Abu Dhabi.

Lunar Cubit is a timekeeper—a monthly calendar—allowing viewers to measure time through the eight lunar phases represented by a ring of eight pyramids encircling one central pyramid. All nine are proportional to the Great Pyramid of Cheops in Giza and scaled using the royal cubit but they're not made from stone; they're made of glass and amorphous silicon, giving them the appearance of onyx polished to a mirror finish. Supported from within, the façade of the pyramids is neatly seamless, like the face of a skyscraper, crisp against the heavens, reaching from base to tip. Using frameless solar panels dramatically reduces embodied energy, cutting the time to be energy positive from seven years to five years.

Lunar Cubit illuminates in an inversely proportional relationship to the lunar cycle so that the work becomes most fully lit during the night of a new moon. Accompanying the center pyramid is a corresponding outer pyramid, clearly marking the lunar phase like the hand of a clock. On the night of a full moon, only moonlight will trace a crown of silvery shadows across the desert floor until the following evening when the pyramids begin to glow and the moon begins to fade; light forever rising and falling as the moon spins around earth.

Data monitoring will be accessible on site and remotely via an online application.

Robert Flottemesch, Jen DeNike, Johanna Ballhaus, & Adrian P. De Luca

NEW YORK

Designed for Site #3 in Abu Dhabi on Airport Road near Masdar City

WINDSTALK

ENERGY TECHNOLOGIES: piezoelectric generator, torque generator
ANNUAL CAPACITY: 20,000 MWh

Windstalk starts out as a desire, a whisper, like grasping at straws, clenching water. It takes clues from the way the wind caresses a field of wheat, or reeds in a marsh.

Windstalk consists of 1203 stalks, 55 meters high, anchored on the ground with concrete bases that range between 10 to 20 meters in diameter. The stalks are made of carbon fiber reinforced resin poles, 30 cm in diameter at the base and 5 cm at the top. The top 50 cm of the stalks are lit up by an LED array that glows with the strength of the wind. When the stalks are still, the lights go dark.

The bases that support the stalks are arrayed along the site following a logarithmic spiral, the kind we see in the center of a sunflower. They are shaped like vortices. When it rains, the rain water slides down the slopes of the bases to collect in the spaces between, concentrating scarce water. Here, native plants can take hold.

Visitors can walk on the bases of the stalks, lean on the slopes, lie down, stay awhile and listen to the sound the wind makes as it rushes overhead.

Within each hollow pole is a stack of piezoelectric ceramic discs. Between the ceramic disks are electrodes. Every other electrode is connected to each other by a cable that reaches from top to bottom of each pole. When the wind sways the stalks, the stack of piezoelectric disks is forced into compression, generating a current through the electrodes.

Within each concrete base is a hollow chamber that houses a torque generator. The generator converts the kinetic energy of the swaying poles into electrical energy by way of an array of current generating shock absorbers, which convert energy produced by the forced movement of fluid through the shock absorber cylinders.

CONCEPT AND DESIGN:
Darío Núñez-Ameni & Thomas Siegl, with Atelier dna
NARRATIVE AND POETICS:
Gabrielle Jesiolowski
STRUCTURE AND ENGINEERING:
Radhi Majmudar PE, with ISSE Innovative Structural & Specialty Engineering
ECOLOGY AND RENEWABLE ENERGY STRATEGY:
Ian Lipsky, with eDesign Dynamics

NEW YORK CITY

Designed for Site #3 in Abu Dhabi on Airport Road near Masdar City

LIGHT SANCTUARY: AN EMPOWERED LANDSCAPE FOR THE UAE

ENERGY TECHNOLOGY: organic photovoltaic (similar to Konarka™, G24 Innovation™, or Solarmer™)
ANNUAL CAPACITY: 4,500 MWh

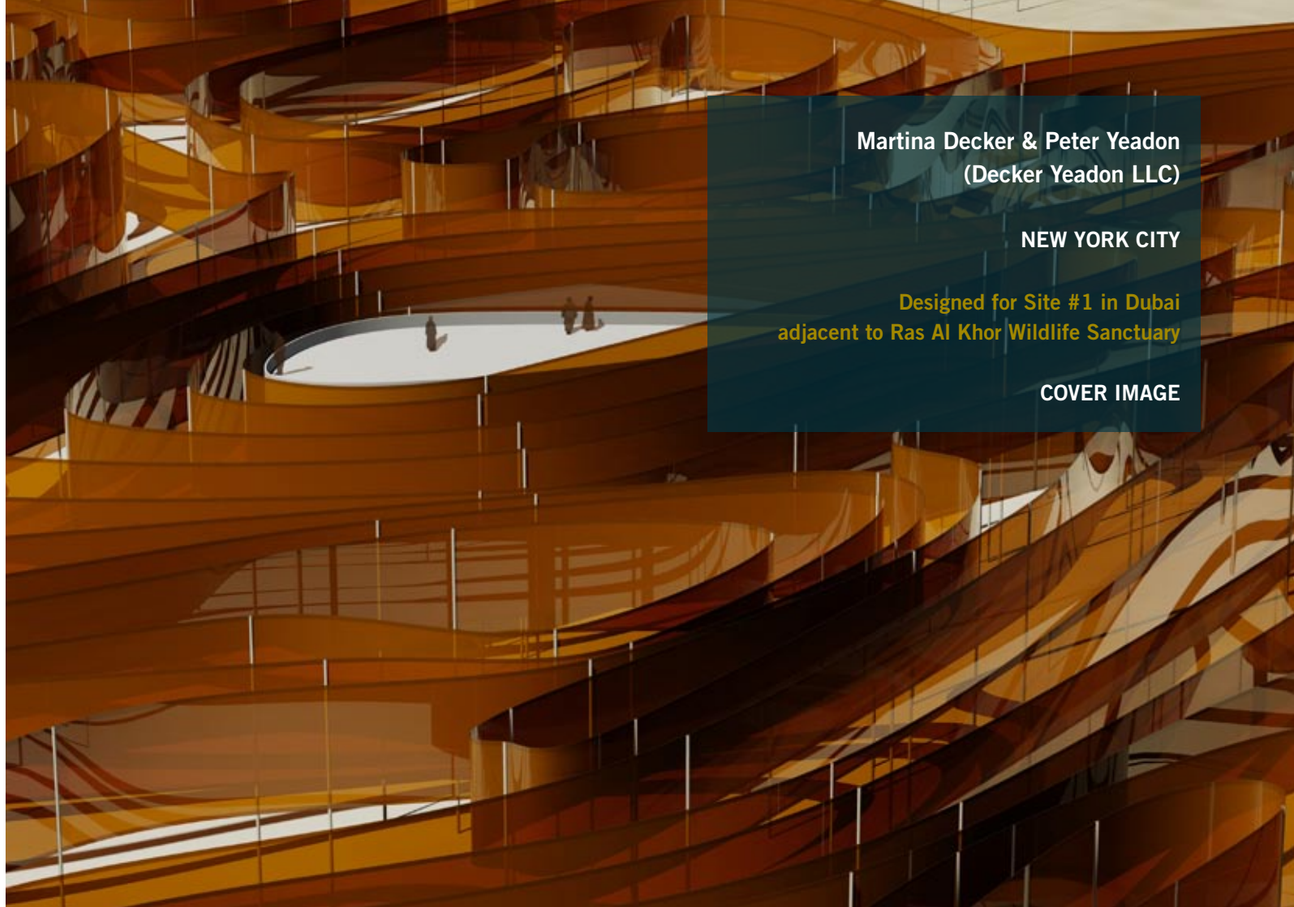
What if a mirage were real? The precise optical effects of reflection, diffusion, and inversion that are an essential feature of the desert landscape have acquired a reputation of mystery and even of deception. This artwork, instead, brings clarity, utility, lightness, and authentic meaning to the idea of the mirage as a scintillating fluid structure seeming to float above the dry landscape, balancing and enhancing its calligraphic geography and fierce beauty.

It is a sea of ribbons, incorporating photovoltaic technology, touching lightly on the land, reaching out toward the water's edge. Forty kilometers of ribbons, some 80,000 square meters in total surface area, are raised like a continuous flag a minimum of six meters above grade. These ribbons, each 10m in height, are poised on a distributed network of strong but slender masts, structurally recalling nomadic fabric architecture.

The ribbons are folded and swooped and nestled and caressed into complex waveforms that evoke natural landscape formations of desert and coastline, sand and water—but which are actually technologically optimized for the oriented exposure of their surface to light, heat, and shade. Their surfaces are continuous laminations of third-generation photovoltaics which have an inherent beauty: the surprising amber and pomegranate tones of its translucent surface evoke the resins, silica, and clays that are part of the desert's natural botanical and geological resources.

Unlike older silicon-based panels, these translucent membranes can absorb light across 140° relative to their surface. This extraordinarily wide angle of available light absorption enables them to work well when installed vertically, which minimizes the accumulation of dust and sand; further, their flexible properties enhance their ability to vibrate small particles off the photovoltaic surface—to essentially be self-cleaning.

An elliptical viewing platform is approached by a ramped and curving path that guides the viewer up through a shaded forest of supports, up through a sea of amber, and to a promenade just above the ribbons.



Martina Decker & Peter Yeadon
(Decker Yeadon LLC)

NEW YORK CITY

Designed for Site #1 in Dubai
adjacent to Ras Al Khor Wildlife Sanctuary

COVER IMAGE

s: FLOW

ENERGY TECHNOLOGY: Sphelar™ photovoltaics by Kyosemi Corporation
ANNUAL CAPACITY: 6,400 MWh

The *s: flow* project is an active land art installation which creates a flow of visible interactions between environment, technology and the phenomena of sunlight reflections. At the same time the installation questions the visual dimension of distance and length perception. The use of "s:" references sun, sunlight, solar, sunshade, sea, sky, and sand. While moving along the installation, the sun reflections on the glass continuously change and create the flow of sunlight motion.

The installation takes a whole new appearance based on the time of day in a permanent dialogue between light and shadow, nature and technology, and man and his environment. This dialogue is completed by the viewers, in this way, the viewer becomes an integral part of the installation. The volume of the project is made more or less visible according to the movement of the sun and is accentuated by the contrast between the blueness of the sky and the reflectivity of the sand.

The shape of the installation is a simple deformation of a straight line into a spline. The spline follows the natural shape of the area's edge: the borderline between sea and land. The form of *s: flow* is composed of a reflective glass which provides a vast surface for solar energy. Energy captured from sunlight and its reflections from the sand is transformed into electrical power by Spherical Micro Solar Cells: Sphelar™. There is no hidden side—both sides generate electricity wherever the light source is located.

According to the laws of reflection i = r and the incident ray AO, reflected ray OB and normal ON to the mirror all lie in the same plane. It is the phenomenon of change in the path of light without any change in medium.

Joanna Wlaszyn, Qian Xu, & David Verrier

FRANCE

Designed for Site #2 in Abu Dhabi between Saadiyat Island and Yas Island

PV DUST

ENERGY TECHNOLOGIES: Sphelar® by Kyosemi Corporation
ANNUAL CAPACITY: 50,000 MWh

PV Dust is a site-specific land art installation producing clean energy with astonishing efficiency.

PV Dust covers 175,000m^2 of desert ground with a new breed of photovoltaic technology, aggregating into a cloud of energy-producing dust. The *PV Dust* cloud has an eerie presence, recalling the great desert sand storms of the Gulf. Below the cloud, a network of sand-colored gravel paths striates the territory. Seen from the flight path of incoming, airport-bound jets, the forking pathways assume the appearance of traditional Islamic lattices. Made of sand-colored gravel, Pebbles and crushed roof tiles, this landscape relies on a distinct desert palette and does not need to be watered.

PV Dust is made of 279 cubic modules of 25m*25m*25m featuring innovative, omni-directional PV technology. Depending on the amount of energy required, the modular *PV Dust* cloud could be resized to meet those needs, and then grow incrementally over an unspecified period of time, like an orchard or vine. *PV Dust* fits on just 174,375m^2 of land. This is about 57% of the catchment of flat PVs. The proposal has a substantially smaller footprint and it spares valuable earthbound resources. With a diameter of a mere 1 to 1.5mm, Sphelar® Cells can be connected in parallel or in series. This enables diverse spherical products to be created, such as dome-shaped solar cells and “flexible” solar cells aligned on soft film substrates. Our proposal assumes Sphelar® Cells are grafted on a light plastic sphere of 500mm diameter, called a Host. Collectively, the Hosts make *PV Dust*.

Visitors will perceive the cloud of *PV Dust* from every corner of a lower ground complex that is tied to the proposed light rail transportation line. Should they wish to visit the installation itself, they can use the public stairs on either side of the LRT platforms to reach the ground floor and walk though the gravel pathways for a quick tour of *PV Dust*.

George Legendre, Emanuele Mattutini, Jean-Aime Shu, & Alfonso Senatore

UNITED KINGDOM

Designed for Site #3 in Abu Dhabi on Airport Road near Masdar City

DECEMBER 2ND, 1971/SOLAR (ECO) SYSTEM

DECEMBER 2ND, 1971/SOLAR (ECO) SYSTEM

ENERGY TECHNOLOGIES: various types of photovoltaic panels of differing reflective hues
ANNUAL CAPACITY: 500MWh

The project is an artistic interpretation of the Solar System and marks the position of the planets corresponding to the configuration of the Solar System on December 2nd 1971, the day in which the United Arab Emirates was founded.

The environmental installation is a metaphor of the seven Emirates, represented in the form of a Sun with six planets. The artwork is also meant to create a new iconic sun for the City of Abu Dhabi: the astronomic Sun radiating energy to the new photovoltaic sun, which will generate light and electricity for the city. The PV sun works as the attracting element and symbolizes the unity and infinity of the cosmos. The endless geometrical pattern of the golden surface, with its timeless perfection and purity, represents the starry sky and creates a spherical motif of both light and shade. The PV sun is to be completed by means of LEDS that will light up its skin throughout the night. The spheres are all different, varying in structure, dimension, color, transparency degree and photovoltaic technology. The Earth is the only place in the universe where life is known to exist: life on earth is therefore symbolized by an already existing tree, around which will be constructed a photovoltaic greenhouse with the serigraphy of the continents. The Moon, its satellite, is endowed on the surface with an opening in shape of a Crescent.

The founding concepts for the other planets are suggested by astronomic phenomena, such as: the presence of atmosphere in a planet for the double concentric spheres, the impact craters on the surface for the sphere composed by circles, the ring system for the split globe, the cloud bands of a gas giant for the photovoltaic solar shading sphere and the eclipse for the black planet. The planets, like pavilions, can host entertaining and educational facilities, such as temporary exhibitions or public activities, in order to create a new place of collective identification and a fascinating cultural site. Each sculpture has an extremely limited contact zone on the ground, thus preserving the nature of the site and integrating itself with the local ecosystem.

Antonio Maccà & Flavio Masi

ITALY

Designed for Site #3 in Abu Dhabi on Airport Road near Masdar City

SOLARIS

ENERGY TECHNOLOGIES: photovoltaic panels
ANNUAL CAPACITY: 75,000 MWh

Solaris is a sculptural art installation comprised of hundreds of photovoltaic panels arranged in the pattern of a familiar cultural ornamental. This approach combines the benefits of modern technology for producing solar energy as electricity with a visual representation of traditional images having cultural significance. Due to its size and proximity to the airport, the site offers an opportunity to showcase a design from an aerial vantage point that is quite distinctive and provides an attractive alternative to a strictly utilitarian configuration of panels in flat straight rows.

Panels may be manufactured in a handful of different geometric shapes, such as triangular and rhomboid, and then arranged in a virtually unlimited number of configurations to create customized patterns of design. This versatility allows the concept to be replicated in various locations with minimal cost for customization, straightforward and scalable manufacturing and installation, and site-specific design specifications for pattern development.

As shown, *Solaris* will contain 1,418 photovoltaic (PV) panels and will be able to produce 45 MW of electricity at peak capacity. On the side nearest the coast, the PV panels will be arranged along the coastline itself. They will integrate the design seamlessly into its environment and also mark the contour of the coastline at a particular point in time so that any future changes in it will be easily visible.

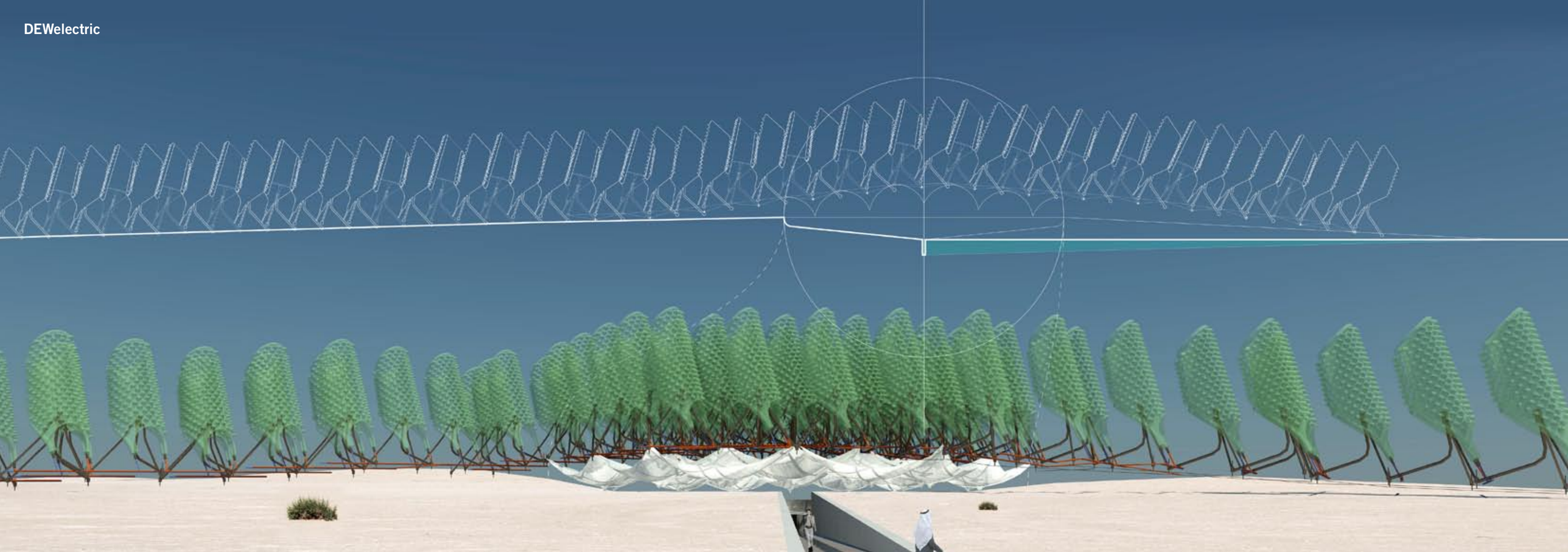
Integrated into the design is a dome structure that can serve multiple functions as a visitor's center and renewable energy education venue. Multi-media exhibits could connect viewers in real time to events occurring in particular places on the planet, such as rainforests, glaciers, oceans, etc. and act as a historical record of changes over time.

The name "Solaris" is taken from the novel of the same name published in1961 by Stanislaw Lem. The novel depicts the relationship between people of the future and "the rational ocean", which the artist sees as a metaphor for nature itself. The issue at hand is the coexistence of human beings and the natural environment.

Oleg Lobykin
WITH RENDERINGS BY:
Transparent House

PALO ALTO

Designed for Site #2 in Abu Dhabi
between Saadiyat Island and Yas Island



DEWelectric

ENERGY TECHNOLOGIES: pneumatic condenser, wind turbine
ANNUAL CAPACITY: 23,750 MWh (475 water stalks at 50 MWh each) and 84 million litres of potable water

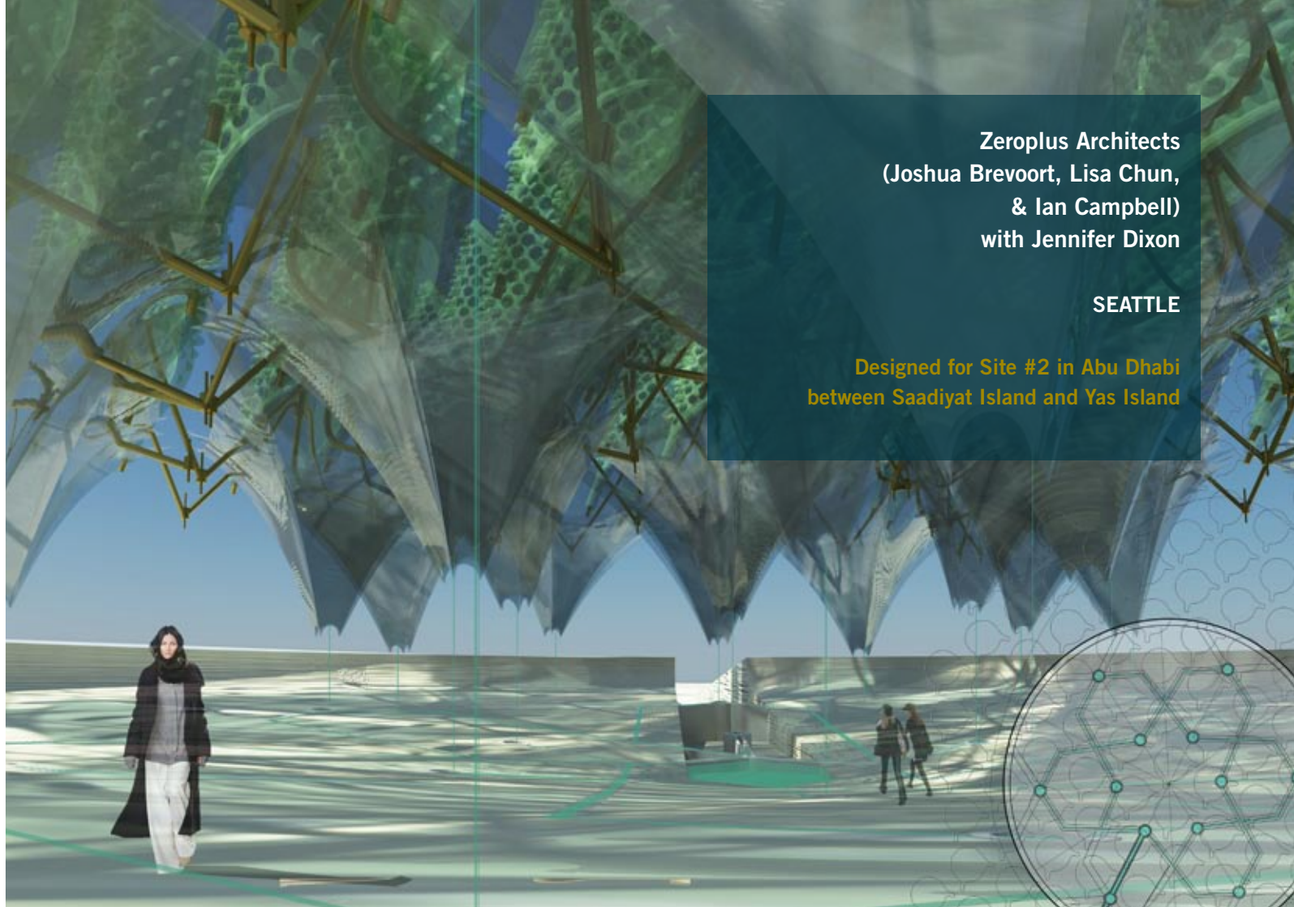
Fresh water is a scarce and precious resource in the UAE. It sustains all life, is nourishing, cleansing, regenerative, purifying, and rich in symbolic meaning.

The Namib Desert beetle survives in the harsh environment of the Namib Desert where only a half-inch of rain falls annually. In response to the arid environment, the beetle has developed a unique water collection mechanism that allows it to collect water from humidity in the air.

Mimicking the Namib Beetle, each water stalk condenser in *DEWelectric* is designed to create water while simultaneously generating electricity. Each condenser is constructed around a water-source heat sink loop. Water vapor condenses from warm air when it hits the skin of the tower which is cooled by pneumatic tubes and textured like the beetle's hydrophilic shell. The delta in temperature around the chilled towers creates a negative pressure that draws air down the column spinning a 7.5 kilowatt wind turbine that generates electricity to feed the municipal grid and also powers the pumps that draw the water from the sea to the condensers.

The artwork consists of three components: an array of water stalks, a channeled walkway, and a shaded community gathering space that celebrates the vitality of water and provides a means for people to learn about the rich possibilities of passive water and energy harvesting and gather around the celebration of water and clean power.

The towers are distributed throughout the site in a pattern that resembles the natural flow of water to or from a single source. Each tower will generate 180 kilowatt hours per day of electricity and 485 liters of water per day. This passive method of water collection also reduces consumption from the grid by a total of 3,217,600 kilowatts of power per year.



Zeroplus Architects
(Joshua Brevoort, Lisa Chun,
& Ian Campbell)
with Jennifer Dixon

SEATTLE

Designed for Site #2 in Abu Dhabi
between Saadiyat Island and Yas Island

FERN (FUTURE / ENERGY / RENEWABLE / NATURE)

FERN (Future / Energy / Renewable / Nature)

ENERGY TECHNOLOGY: flexible semitransparent photovoltaics
(reference: John Rogers @ University of Illinois, or Solarion™)
ANNUAL CAPACITY: 2,400 MWh per each 1,000 FERN units (10,256 units would fit on site 1)

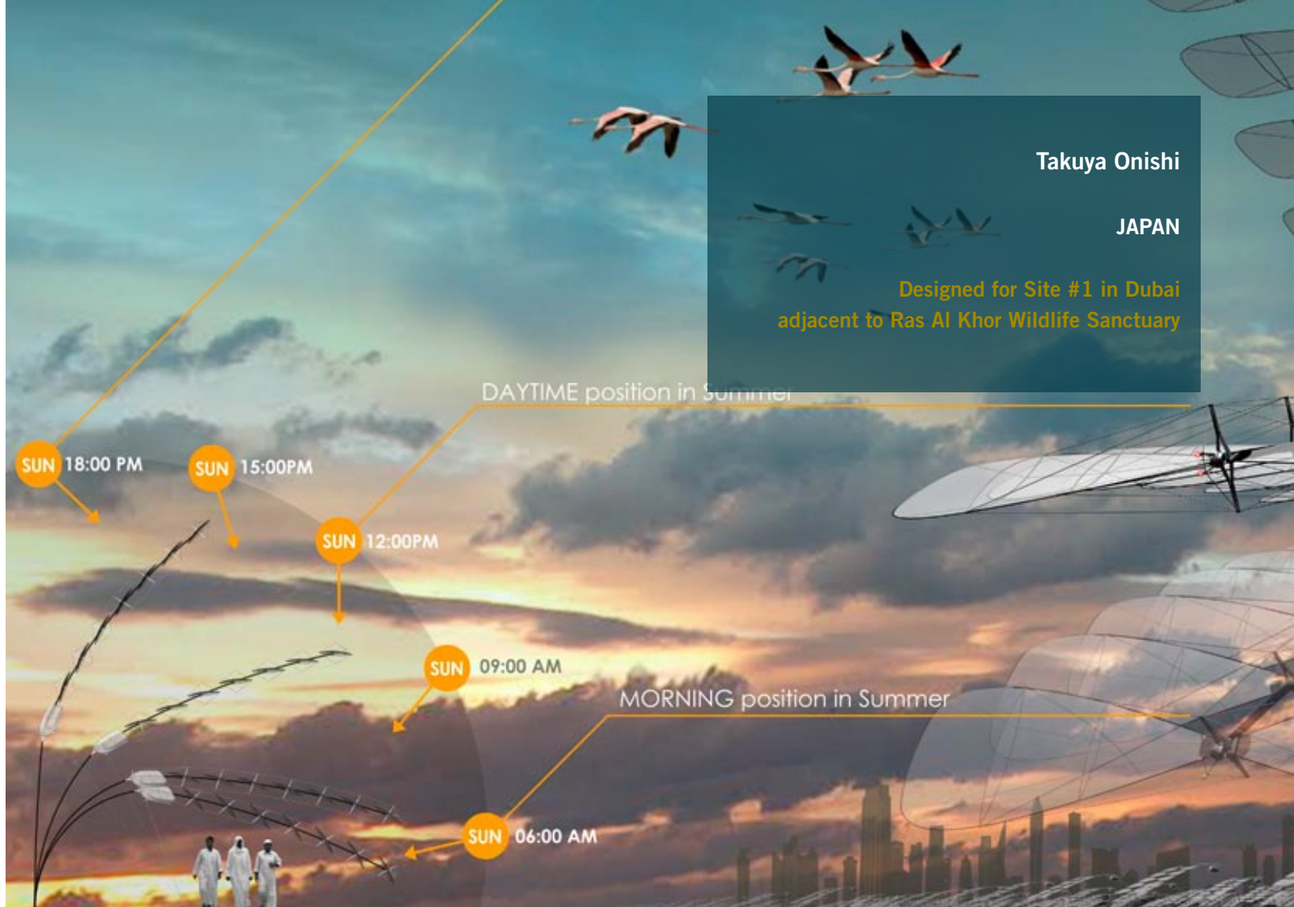
An ordinary solar plant places solar panels and frame structures directly on the ground. The narrow space in between each row combined with the lack of shade and reflections create an unfriendly environment for human, animal and vegetation.

On a site where there is such beautiful scenery and indigenous vegetation, *FERN* solar plants are designed to gently sway four meters above the ground to provide cover from the sun and add to the visual beauty of the landscape. The *FERN* leaf/solar panel is a semi-transparent and flexible solar cell that gives a gentle light and provides a friendly space for all kind of animal and greenery below.

FERN is designed to artfully follow the movement of the sun at all times. A flexible carbon fiber structure with a tension wire adjuster system achieves constant slow movement for following the sun at any position in the sky. A rotation motor for the PV leaf panels provides even greater accuracy.

The stalk of *FERN* is made of material similar to that used for pole vaulting, providing a strong but flexible effect.

While *FERN* casts wide shadows during the daytime, it gradually stands vertical in the evening and then lights up to the sky for the night as it slowly turns from the western to the eastern horizon to await tomorrow's dawn.



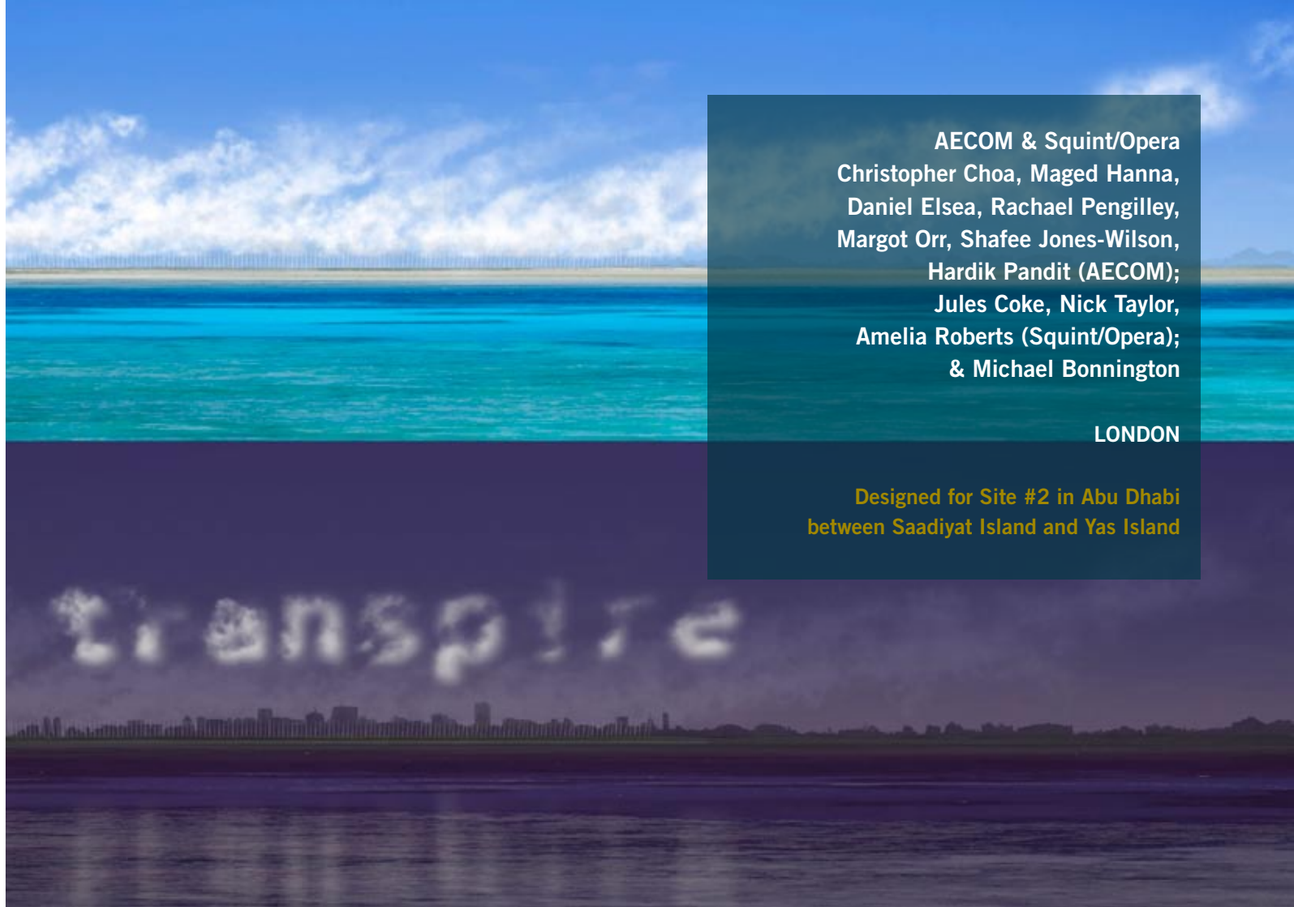
TRANSPIRE

ENERGY TECHNOLOGIES: concentrated solar power (parabolic trough)
ANNUAL CAPACITY: 30,000 MWh

On a long narrow site bounded by a canal and a highway, one hundred iconic stainless-steel spires sway like reeds and produce a soft shape-shifting cloud that clearly marks the site from a great distance. Elegant in its simplicity, the installation celebrates the alchemy of natural elements essential for human survival; sunlight and seawater transform into abundant electrical power, freshwater, and salt. *TRANSPIRE* is a net producer of energy, a net zero-carbon solution, and emits zero pollutants. *TRANSPIRE* creates a unique public intervention in an unexpected place. It is also a dynamic art venue: imagery, films and text created by invited artists or the public can be projected onto the cloud bank at night. During the day, under certain atmospheric conditions, a rainbow will form, visible all the way from Abu Dhabi.

TRANSPIRE consists of five inter-related parts:
The extended area under the 300,000sm of 9-meter wide raised parabolic troughs is shaded from the sun—a landscape that can be used as a public park. Heat exchange infrastructure, including underground molten salt reservoirs, turbine generators, and the desalination system, is contained within a 1 Ha secure perimeter. Stored thermal energy powers steam turbines to generate up to 12MW electrical power during the day, or 6Mw at night. Seawater heated in an independent loop as a by-product of the power generation cycle produces low-pressure steam and potable water. Guided tours will allow the public to observe the technical processes at close range. One hundred spires line the expressway and vent condensing fresh-water steam to seed the cloud bank. Each spire is 30 meters in overall height. An internal pivot point within the central flange of the base allows the top of the spire to react freely to external wind movements. Low-pressure steam is fed into the spires and vented through nozzles along the spire's edges.

A grove of one thousand acacias in sealed planter beds is irrigated by 300,000 liters/day of potable water produced entirely on-site by the desalinization cycle. A by-product of the desalinization cycle, concentrated brine cascades down terraces and creates and creates a surreal multi-hued crystalline field around sealed acacia planters. No waste brine is discharged into the canal.



AECOM & Squint/Opera
Christopher Choa, Maged Hanna, Daniel Elsea, Rachael Pengilley, Margot Orr, Shafee Jones-Wilson, Hardik Pandit (AECOM); Jules Coke, Nick Taylor, Amelia Roberts (Squint/Opera); & Michael Bonnington

LONDON

Designed for Site #2 in Abu Dhabi between Saadiyat Island and Yas Island

Masdar is the prize award sponsor for the first international Land Art Generator Initiative design competition held in 2010 for the United Arab Emirates.

land art generator initiative

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