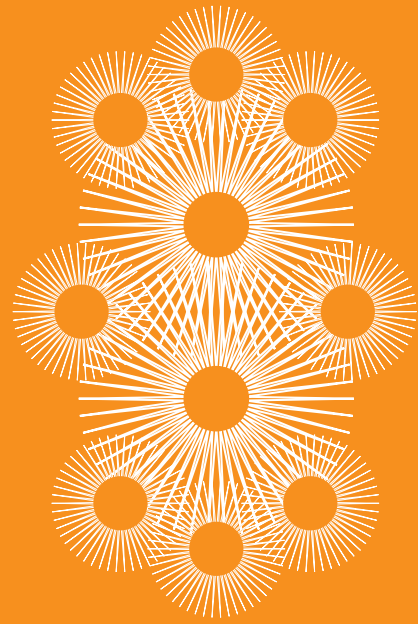
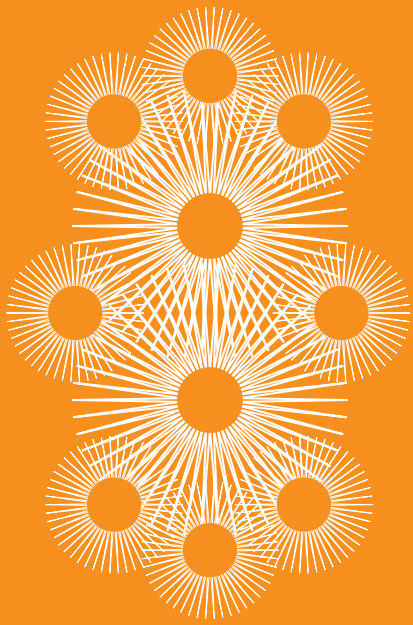


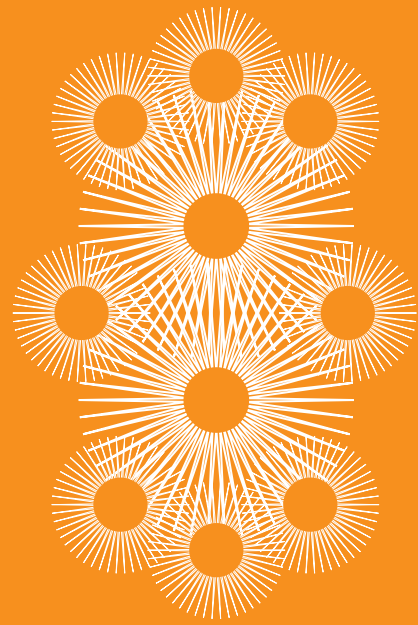
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## BEYOND THE WAVE

ART



All of the pink ribbon is the energy technology.

ENERGY TECHNOLOGY  
organic photovoltaic  
(OPV)

**846 HOUSES**  
can be powered by this  
artwork (4,230 MWh per year)

### DESIGN TEAM

Jaesik Lim, Ahyoung Lee, Sunpil Choi,  
Dohyoung Kim, Hoeyoung Jung, Jaeyeol  
Kim, Hansaem Kim



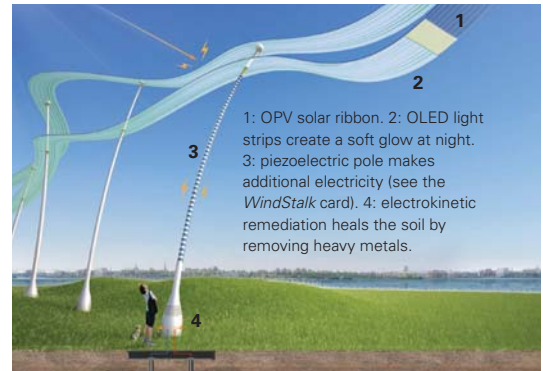
## BEYOND THE WAVE

INFO

ENERGY TECHNOLOGY  
organic photovoltaic  
(OPV)

The waving ribbons in this artwork are all made from a flexible and colorful type of solar technology. The artists invite you to explore underneath, have a picnic, walk around, or take a nap. It's designed to be a calming space where you can think about the relationship between people and nature, and about all of the electricity that the beautiful pink ribbons are making from the power of the sun!

LAGI 2014 COPENHAGEN

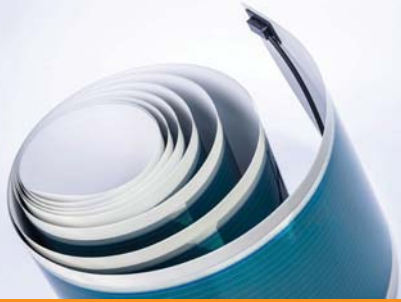


1: OPV solar ribbon. 2: OLED light strips create a soft glow at night.  
3: piezoelectric pole makes additional electricity (see the *WindStalk* card). 4: electrokinetic remediation heals the soil by removing heavy metals.



## ORGANIC PHOTOVOLTAIC (OPV)

TECH



OPV uses organic polymers to absorb sunlight and transmit electrical charges. Organic PV can be manufactured in solutions that can be painted or rolled onto proper substrate materials. Current OPV technology has peak power output of about half that of mono-crystalline silicon PV per unit area, but its production cost, flexibility, and performance in ambient light mean that it can—in some cases—outperform conventional PV over time. It can be sewn into backpacks, laptop cases, tents, jackets, and integrated into creative building façades (or art!).

### CHARACTERISTICS

flexible, colorful,  
translucent

### IMAGE ABOVE

© Heliatek GmbH,  
André Wirsig.

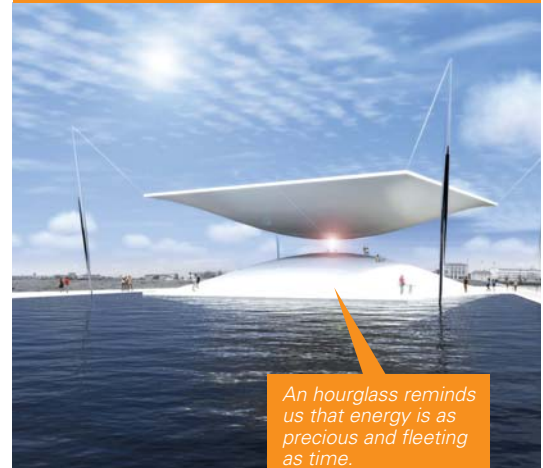
### THIS CARD WORKS WITH

Beyond the Wave, 99 Red Balloons, WindNest



## THE SOLAR HOURGLASS

ART



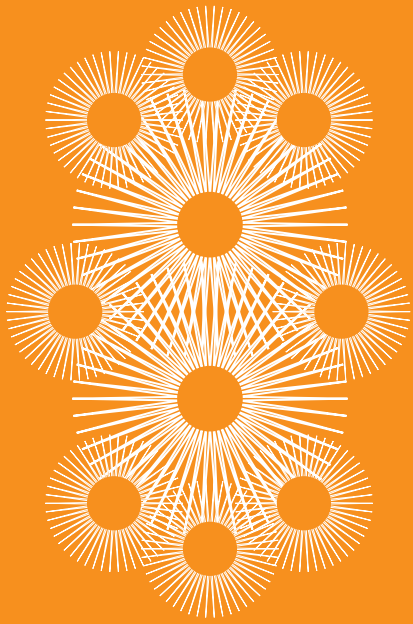
An hourglass reminds us that energy is as precious and fleeting as time.

ENERGY TECHNOLOGY  
solar thermal CSP  
(solar power tower)

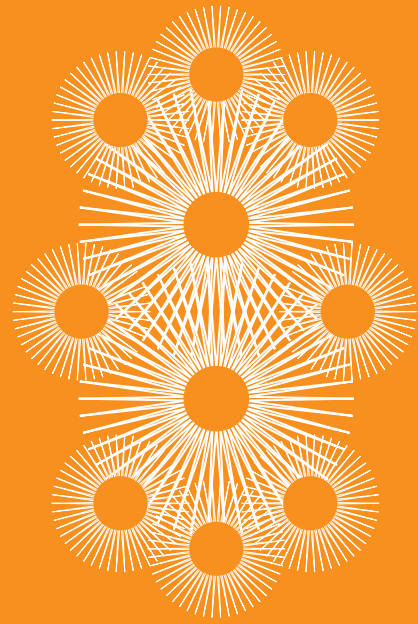
**1,500 HOUSES**  
can be powered by this  
artwork (8,250 MWh per year)

### DESIGN TEAM

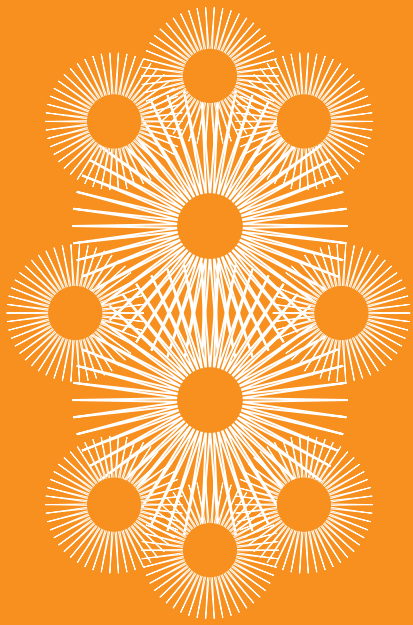
Santiago Muros Cortés



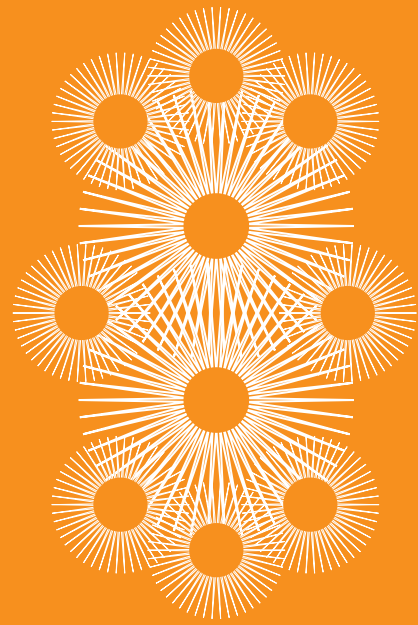
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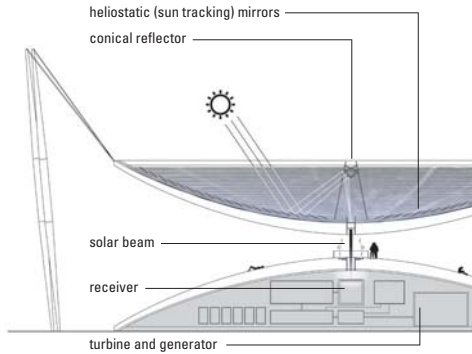


# THE SOLAR HOURGLASS

ENERGY TECHNOLOGY  
solar thermal CSP  
(solar power tower)

Rather than using sand to measure time, *The Solar Hourglass* uses the power of the sun. Sun-tracking mirrors focus thermal energy onto a central parabolic-shaped mirror to create a vertical beam of intense light and heat—a beacon across the harbor that powers a large generator below. Visitors can get close to an insulated glass cylinder and safely feel the heat on their hand. This new kind of public park is a breathtaking setting for inspiration, education, and relaxation.

LAGI 2014 COPENHAGEN



# SOLAR THERMAL CSP SOLAR POWER TOWER



This type of concentrated solar thermal power consists of an array of mirrors at the ground level that track the sun's location in the sky and focus its heat onto a single collector positioned high atop a central tower pylon structure (or beam it to a ground-mounted collector with another set of mirrors). By using a high heat capacity material such as molten salt in the collector (which transfers heat to water to run a steam turbine) energy can be stored to produce electricity even after the sun has set.

**CHARACTERISTICS**  
reflective, beam of light, intense heat, energy storage

**IMAGE ABOVE**  
The 110 MW SolarReserve Crescent Dunes plant in Nevada has 1,100 MWh of energy storage. Image courtesy of SolarReserve.

**THIS CARD WORKS WITH**  
The Solar Hourglass



# TRANSPIRE



A rainbow over the city celebrates the power of the sun.

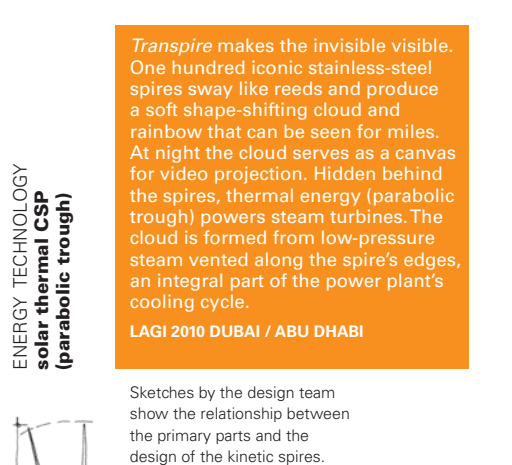
ENERGY TECHNOLOGY  
solar thermal CSP  
(parabolic trough)

**6,000 HOUSES** can be powered by this artwork (33,000 MWh per year)

**DESIGNTEAM**  
Christopher Choa, Rachael Pengilly, Shafee Jones-Wilson, Maged Hanna



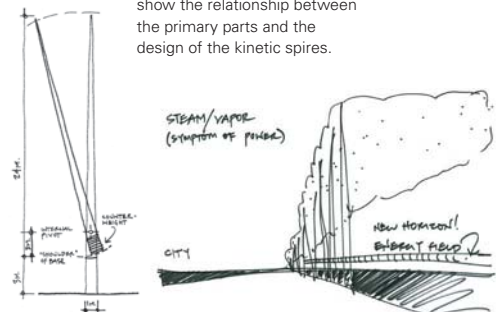
# TRANSPIRE

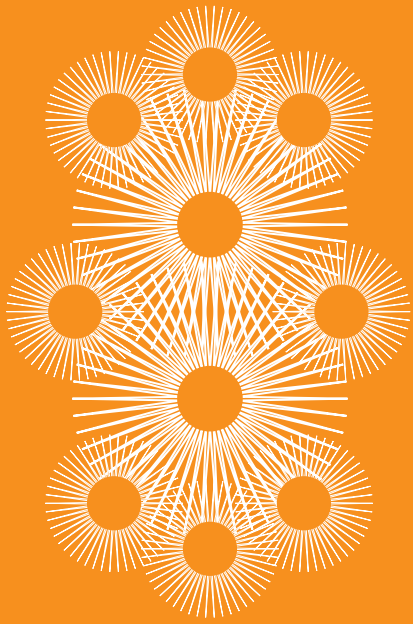


*Transpire* makes the invisible visible. One hundred iconic stainless-steel spires sway like reeds and produce a soft shape-shifting cloud and rainbow that can be seen for miles. At night the cloud serves as a canvas for video projection. Hidden behind the spires, thermal energy (parabolic trough) powers steam turbines. The cloud is formed from low-pressure steam vented along the spire's edges, an integral part of the power plant's cooling cycle.

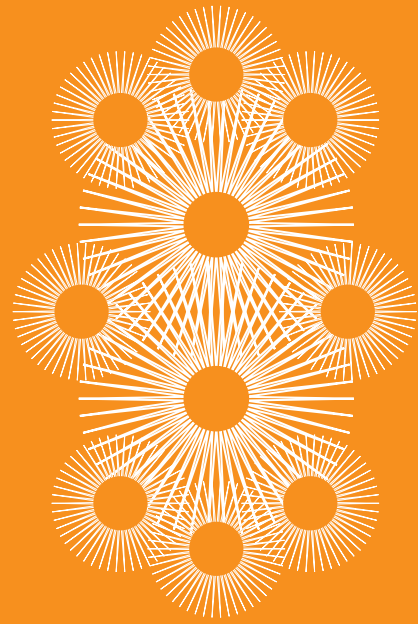
LAGI 2010 DUBAI / ABU DHABI

Sketches by the design team show the relationship between the primary parts and the design of the kinetic spires.

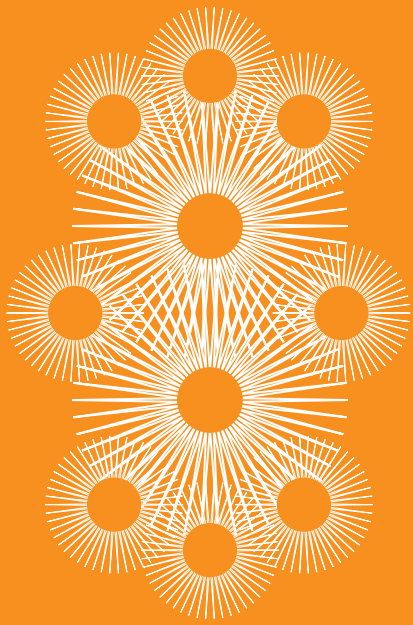




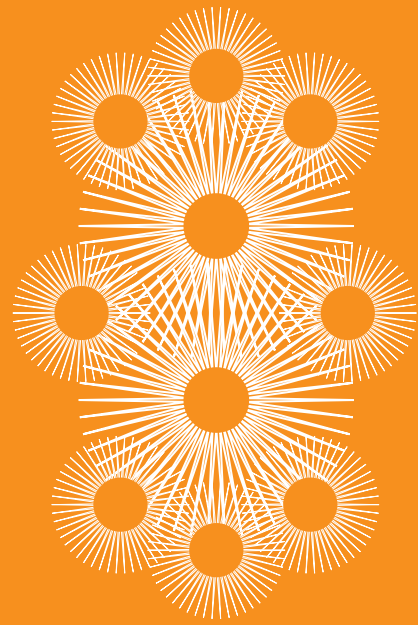
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## SOLAR THERMAL CSP PARABOLIC TROUGH



The parabolic trough design consists of a series of long, highly polished parabolic reflecting surfaces that focus sunlight onto an absorber tube running along the focal point of the parabola. Heat transfer fluid running through the tube is heated to approximately 400°C. The parabolic shape of the reflector allows the troughs to be oriented on a north-south axis and track the sun in only one rotational axis from east to west each day.

**CHARACTERISTICS**  
reflective, linear,  
beam of light

**IMAGE ABOVE**  
SEGS power plant at  
Kramer Junction in  
the Mojave desert is  
owned and operated  
by FPL Energy.

**THIS CARD WORKS WITH**  
Transpire



## SOLAR ECO SYSTEM



*The Earth is represented  
by a palm tree within a  
photovoltaic sphere.*

ENERGY TECHNOLOGY  
**solar photovoltaic (PV)  
panels/modules**

**180 HOUSES**  
can be powered by this  
**artwork** (990 MWh per year)

**DESIGNTEAM**  
Antonio Maccà, Flavio Masi



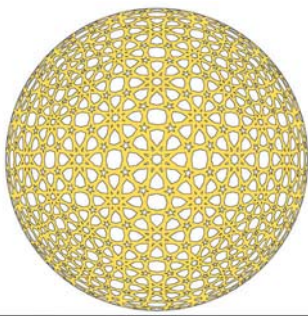
## SOLAR ECO SYSTEM

*Solar Eco System* celebrates the relative position of the planets around the sun on December 2, 1971, the day the United Arab Emirates was founded. The new photovoltaic sun for Abu Dhabi generates light and electricity for the city from the astronomical sun. The surrounding planets are clad in various types of specialty photovoltaics (PV) (CIGS) and represent the most salient features of each. The Earth becomes a spherical PV greenhouse surrounding one existing palm tree.

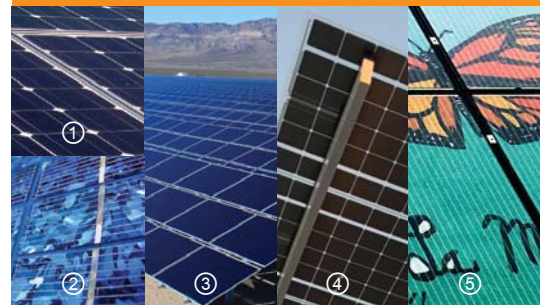
LAGI 2010 DUBAI / ABU DHABI

ENERGY TECHNOLOGY  
**solar photovoltaic (PV)  
panels/modules**

The photovoltaic sun is made of custom fabricated gold-tinted polycrystalline solar modules that create a beautiful arabesque sphere.



## SOLAR PHOTOVOLTAIC (PV) PANELS/MODULES

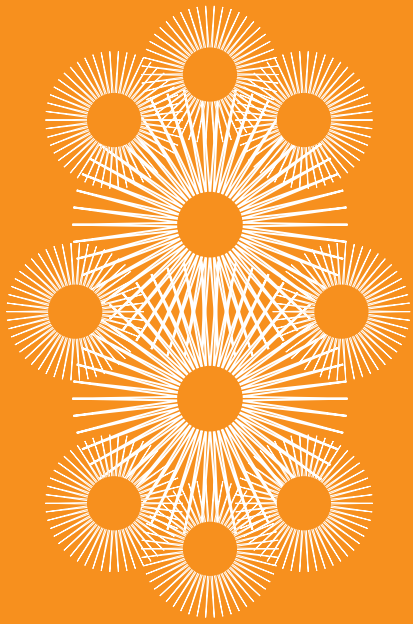


Solar panels come in a variety of types. The most common is made from Silicon (Si)—either monocrystalline ① or polycrystalline ②. Others use different semiconductors such as Copper-Indium Gallium Selenide (CIGS) and Cadmium Telluride (CdTe) ③. Solar panels can be integrated into buildings within frame-less glass ④, tinted, or laminated with special films that make the panel appear as a solid color or even a printed image ⑤ while still generating electricity.

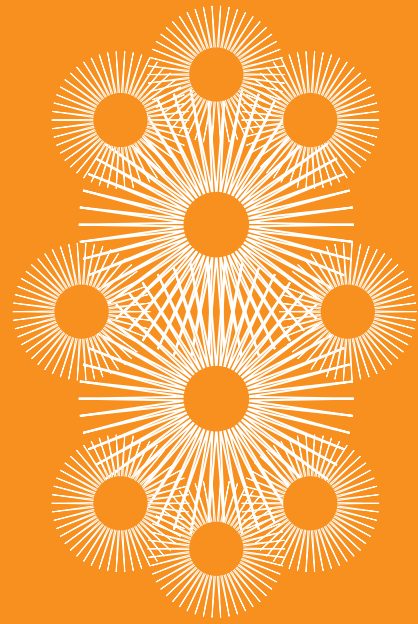
**CHARACTERISTICS**  
flat, thin, rigid, usually  
dark color, can be  
tinted or laminated,  
glass face

**IMAGES (1-5)**  
Siemens AG; Scott  
Robinson; Semptra LLC;  
Lumos Solar; and LAGI  
Solar Mural® "La Monarca"  
San Antonio, TX (photo by  
Penelope Boyer).

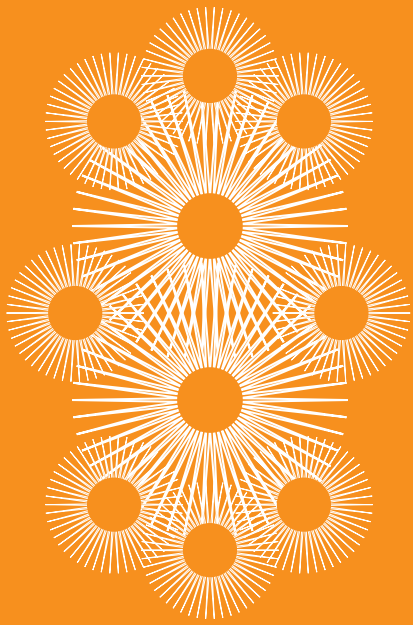
**THIS CARD WORKS WITH**  
Energy Duck, Night & Day,  
Solar Eco System, Solar Sound Field



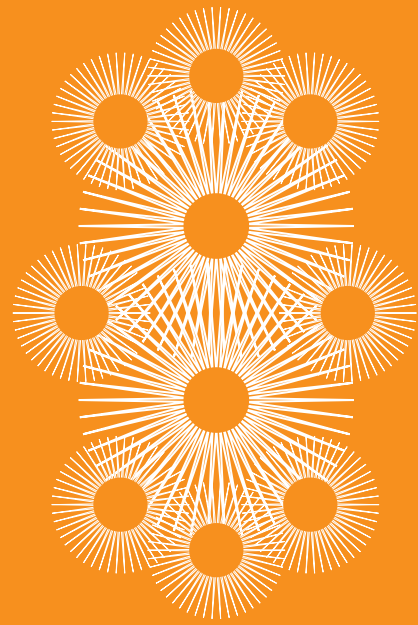
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## ENERGY DUCK

ART



Everyone loves a duck—and this one powers an entire neighborhood!

ENERGY TECHNOLOGY  
solar photovoltaic (PV)  
panels/modules

**80 HOUSES**  
can be powered by this  
artwork (400 MWh per year)

**DESIGN TEAM**  
Hareth Pochee, Adam Khan,  
Louis Leger, Patrick Fryer



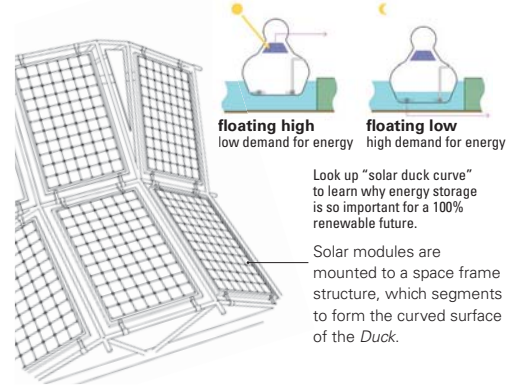
## ENERGY DUCK

INFO

*Energy Duck* is an entertaining and iconic sculpture, a renewable energy generator, a tourist destination, and a buoyant energy storage device. As lights switch on at the end of the day, the price of electricity is at its peak. Just then the *Duck* begins to sink slowly under the weight of the artwork as micro-hydro turbines in its belly send power to the grid. In the morning when energy demand is low, the solar panels pump water out of its belly and again it is floating high!

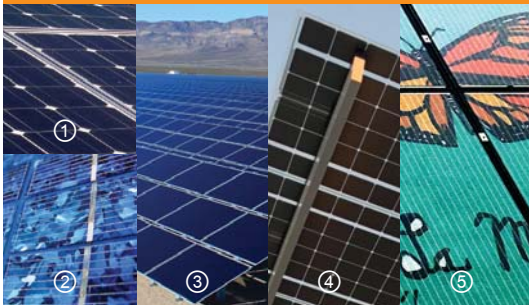
LAGI 2014 COPENHAGEN

ENERGY TECHNOLOGY  
solar photovoltaic (PV)  
panels/modules



## SOLAR PHOTOVOLTAIC (PV) PANELS/MODULES

TECH



Solar panels come in a variety of types. The most common is made from Silicon (Si)—either monocrystalline ① or polycrystalline ②. Others use different semiconductors such as Copper-Indium Gallium Selenide (CIGS) and Cadmium Telluride (CdTe) ③. Solar panels can be integrated into buildings within frame-less glass ④, tinted, or laminated with special films that make the panel appear as a solid color or even a printed image ⑤ while still generating electricity.

**CHARACTERISTICS**  
flat, thin, rigid, usually dark color, can be tinted or laminated, glass face

**IMAGES (1-5)**  
Siemens AG; Scott Robinson; Sempra LLC; Lumos Solar; and LAGI Solar Mural® "La Monarca" San Antonio, TX (photo by Penelope Boyer).

**THIS CARD WORKS WITH**  
Energy Duck, Night & Day, Solar Eco System, Solar Sound Field



## 99 RED BALLOONS

ART



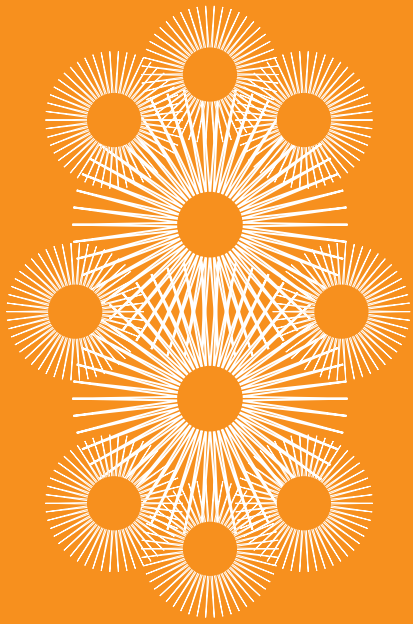
Balloons—symbols of joy and wonder—can help to power our post-carbon city.

ENERGY TECHNOLOGY  
organic photovoltaic (OPV)

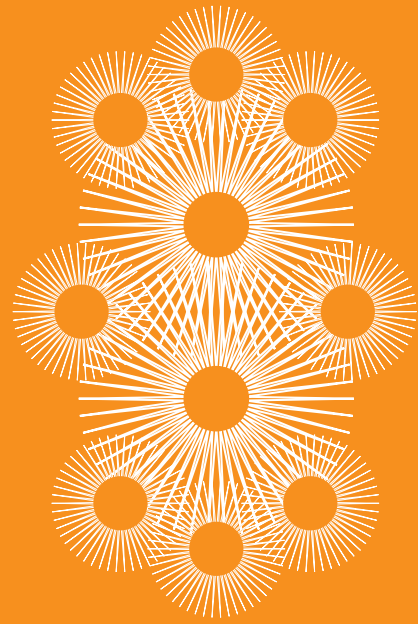
**2,500 HOUSES**  
can be powered by this  
artwork (12,500 MWh per year)

**DESIGN TEAM**  
Scott Rosin, Meaghan Hunter, Danielle Loeb, Emeka Nnadi, Kara McDowell, Jocelyn Chorney, Indrajit Mitra, Narges Ayat, Denis Fleury

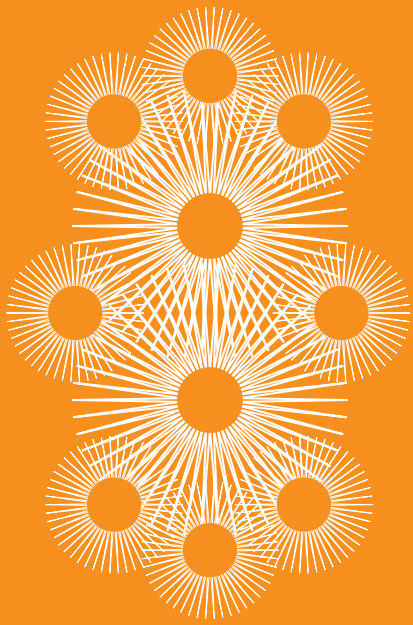




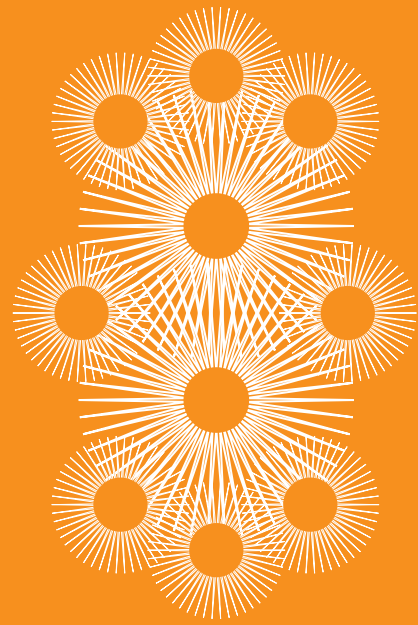
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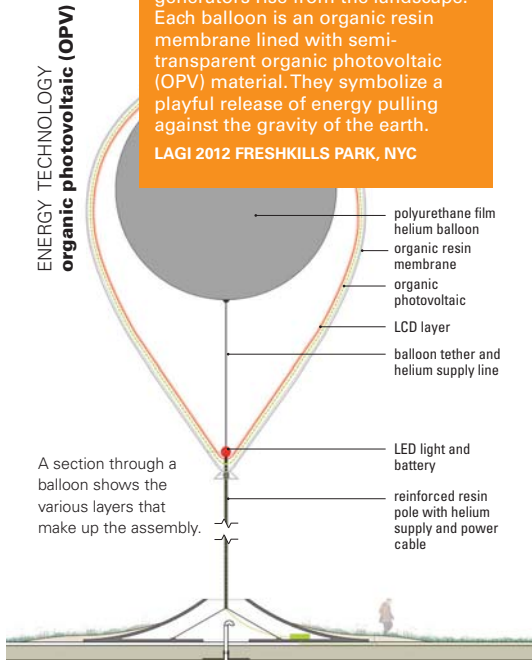


## 99 RED BALLOONS

INFO

Inspired by an excerpt from the 1984 song by Nena, 99 identical balloon-shaped photovoltaic solar generators rise from the landscape. Each balloon is an organic resin membrane lined with semi-transparent organic photovoltaic (OPV) material. They symbolize a playful release of energy pulling against the gravity of the earth.

LAGI 2012 FRESHKILLS PARK, NYC



## ORGANIC PHOTOVOLTAIC (OPV)

TECH



OPV uses organic polymers to absorb sunlight and transmit electrical charges. Organic PV can be manufactured in solutions that can be painted or rolled onto proper substrate materials. Current OPV technology has peak power output of about half that of mono-crystalline silicon PV per unit area, but its production cost, flexibility, and performance in ambient light mean that it can—in some cases—outperform conventional PV over time. It can be sewn into backpacks, laptop cases, tents, jackets, and integrated into creative building façades (or art!).

**CHARACTERISTICS**  
flexible, colorful, translucent

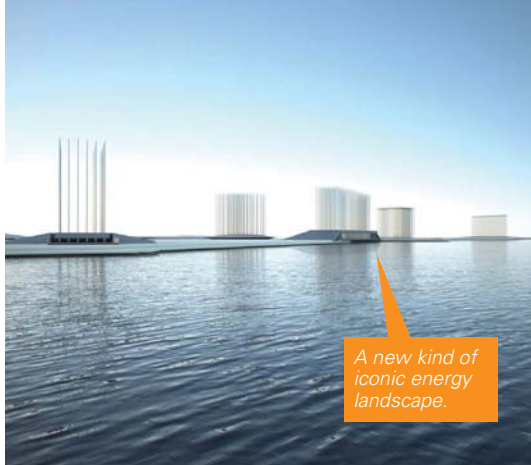
**IMAGE ABOVE**  
© Heliatek GmbH, André Wirsig.

**THIS CARD WORKS WITH**  
Beyond the Wave, 99 Red Balloons, WindNest



## SOLAR SOUND FIELD

ART



*A new kind of iconic energy landscape.*

ENERGY TECHNOLOGY  
**solar updraft tower; solar photovoltaic panels**

**1,820** HOUSES can be powered by this artwork (9,100 MWh per year)

### DESIGN TEAM

Sage and Coombe Architects: T. Kelly Wilson, Timothy Dunne, John Parker, Richard Kress, Peter Hansen, Christoph Timm, Peter Coombe, Allen Slamic, John Reed



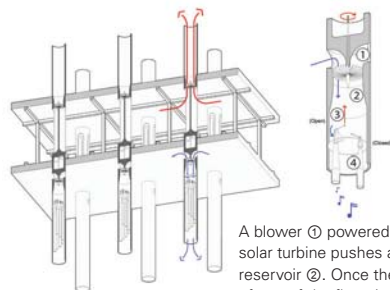
## SOLAR SOUND FIELD

INFO

ENERGY TECHNOLOGY  
**solar updraft tower; solar photovoltaic panels**

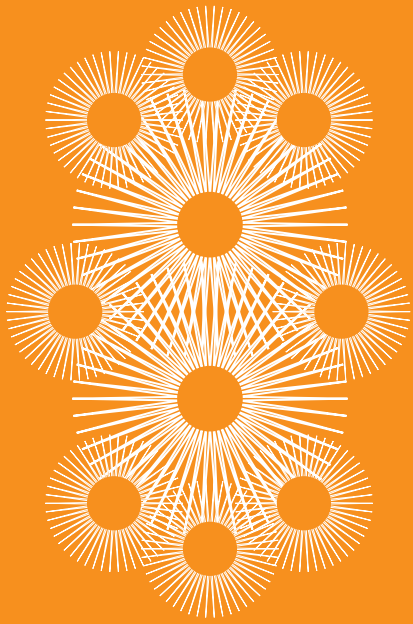
Five musical machines each contain an acoustic chamber, a glass greenhouse, and an array of 60-meter tall chromium steel pipes. A stream of hot and buoyant air heated by the sun within the greenhouse rises up the chimneys. This airflow creates a sustained musical note through the resonance chambers and drives a turbine to generate electricity. Electricity is also generated by 24,000m<sup>2</sup> of photovoltaic cells below the greenhouse glass.

LAGI 2010 DUBAI / ABU DHABI

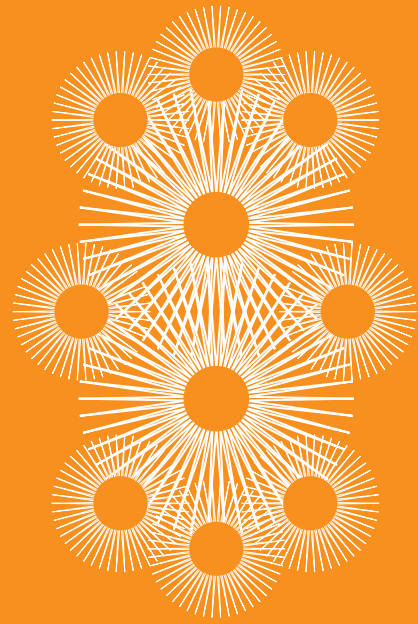


Detail of the sound pipe chamber.

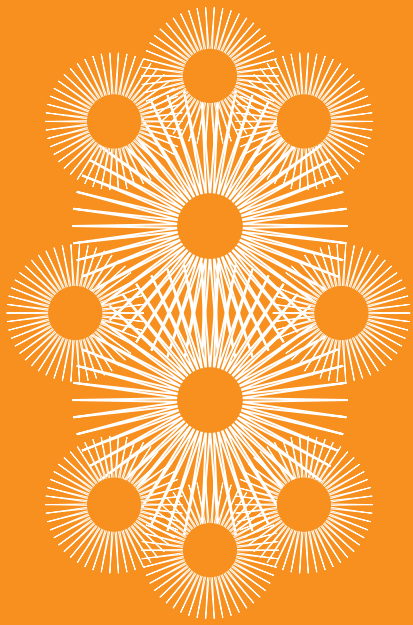
A blower ① powered by the solar turbine pushes air into the reservoir ②. Once the valve ③ of one of the flue pipes ④ is put into position, the air enters the pipe to play a note.



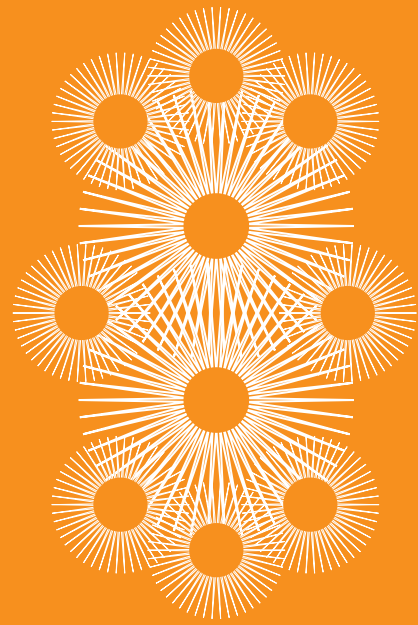
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## SOLAR UPDRAFT TOWER

TECH



The stack effect is the natural property of air within a closed space to rise vertically with buoyancy when heated in relation to ambient air temperature. The greater the heat differential the faster the resulting air movement. This differential is made as great as possible in the updraft tower by 1) heating the air at ground level via a greenhouse with thermal storage, and 2) building the tower tall enough so that the ambient temperature of the air is naturally lower by a few degrees at the mouth. Solar updraft technology uses the stack effect to power turbines located at the base of a very tall tower.

### CHARACTERISTICS

tall, wide base, inhabitable, warm air flowing

### THIS CARD WORKS WITH

Solar Sound Field



## SUN RAY

ART



ENERGY TECHNOLOGY  
solar thermal CSP  
linear Fresnel reflector

**220 HOUSES**  
can be powered by this  
artwork (1,100 MWh per year)

DESIGNTEAM  
Antonio Maccà



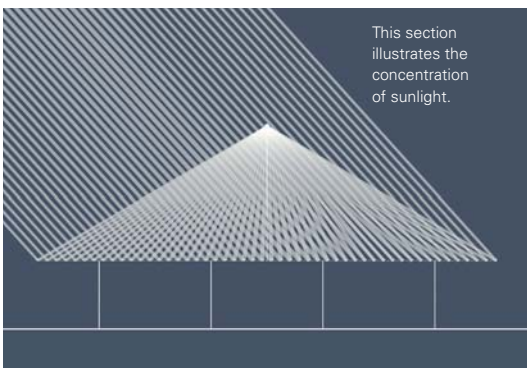
## SUN RAY

INFO

*Sun Ray's* solar field is a dynamic canopy composed of rows of flat linear mirrors equipped with a single-axis sun tracking system. The "specular sun," which measures 85 meters in diameter, reflects sunlight and converges it throughout the day onto the fixed cardinal linear receiver situated in the common focal point of the reflectors. Energy storage and conversion equipment are housed underground.

LAGI 2018 MELBOURNE

ENERGY TECHNOLOGY  
solar thermal CSP  
linear Fresnel reflector



## SOLAR THERMAL CSP LINEAR FRESNEL REFLECTOR

TECH

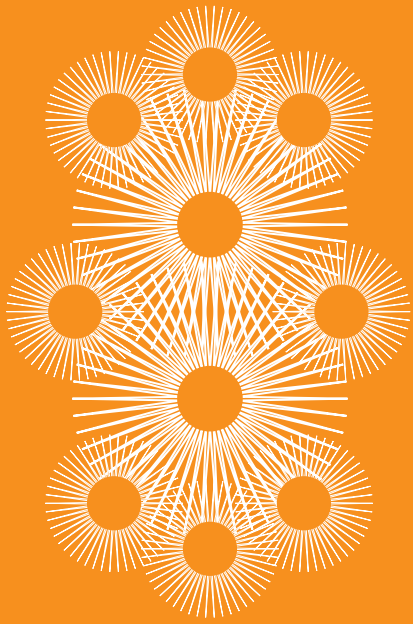


Linear Fresnel reflectors (LFR) use long, thin segments of flat mirrors to focus sunlight onto a fixed absorber located at a common focal point of the reflectors. Similar to the more common parabolic trough, this single-axis tracking concentrated reflector system heats up a transfer fluid which in turn heats water to run a steam turbine. Fresnel geometry allows flat surfaces to act in a way that mimics a parabolic mirror.

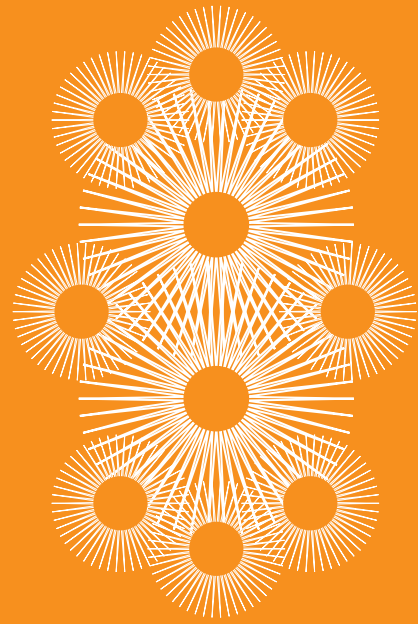
CHARACTERISTICS  
reflective, flat,  
linear, directional  
line of light, shadow

IMAGE ABOVE  
Kimberlina Power  
Plant in Bakersfield,  
CA. Image courtesy  
of AREVA Solar.

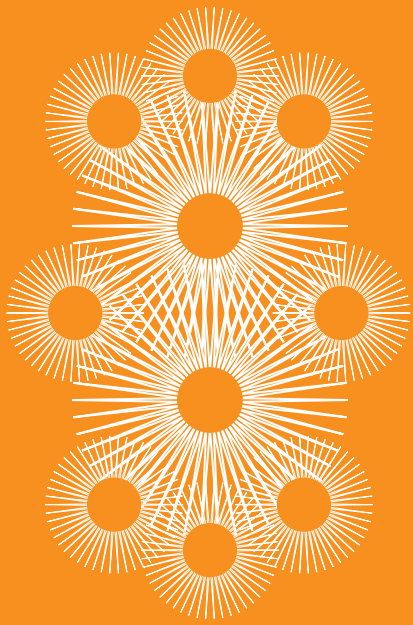
THIS CARD WORKS WITH  
Sun Ray



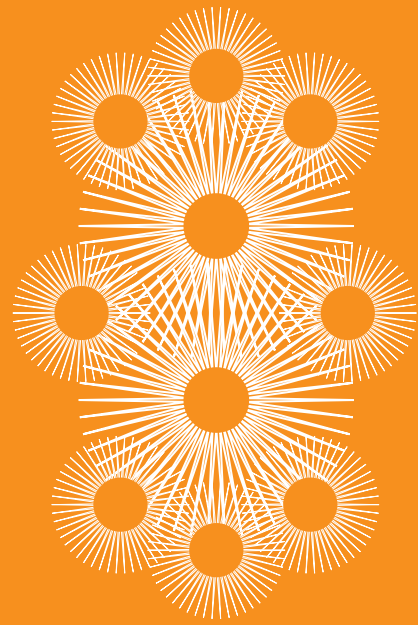
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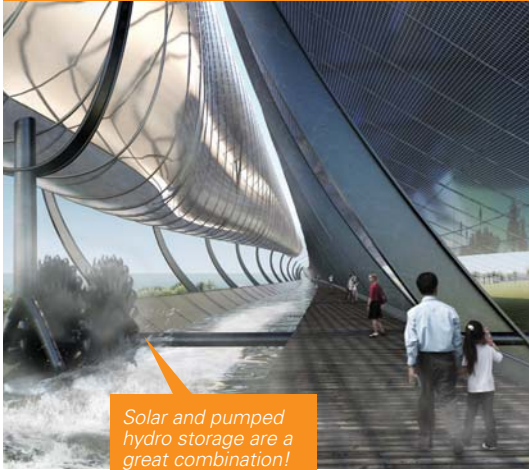


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## NIGHT & DAY HYDRO-SOLAR GENERATOR

ART



Solar and pumped hydro storage are a great combination!

ENERGY TECHNOLOGY  
solar photovoltaic panels  
(with pumped hydro  
energy storage)

**200 HOUSES**  
can be powered by this  
artwork (1,000 MWh per year)

### DESIGN TEAM

Kevin Kudo-King, Annie Aldrich, James Juricevich, Evan Harlan, Vikram Sami, Erin Hamilton, Gabriela Frank, MacKenzie Cotters, Lauren Gallow, Jonathan Nelson (Olson Kundig)



## NIGHT & DAY HYDRO-SOLAR GENERATOR

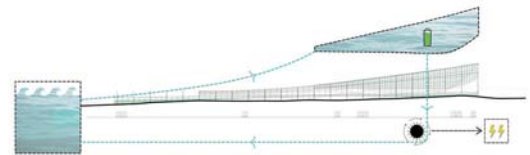
INFO

ENERGY TECHNOLOGY  
solar photovoltaic panels  
(with pumped hydro  
energy storage)

The *Hydro-Solar Generator* is a power generator that works night and day to leverage the full potential of the site's natural resources of water and sunshine. The machine takes the form of a pedestrian bridge linking public spaces that have become fragmented over time. The 5,400m<sup>2</sup> solar sail's curvature is optimized for annual solar energy harvest. During the day 82% of the solar power is pushed to the grid while 18% is utilized for pumping water into the hydro battery.

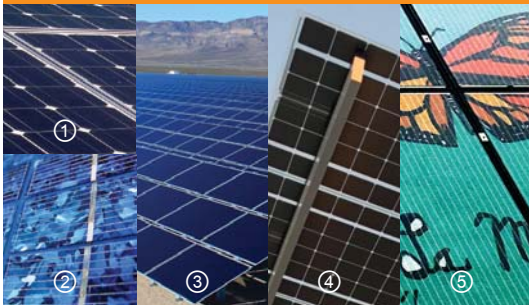
LAGI 2018 MELBOURNE

The pumped hydro storage machine can provide 350 kWh of electricity after the sun has set.



## SOLAR PHOTOVOLTAIC (PV) PANELS/MODULES

TECH



Solar panels come in a variety of types. The most common is made from Silicon (Si)—either monocrystalline ① or polycrystalline ②. Others use different semiconductors such as Copper-Indium Gallium Selenide (CIGS) and Cadmium Telluride (CdTe) ③. Solar panels can be integrated into buildings within frame-less glass ④, tinted, or laminated with special films that make the panel appear as a solid color or even a printed image ⑤ while still generating electricity.

### CHARACTERISTICS

flat, thin, rigid, usually dark color, can be tinted or laminated, glass face

### THIS CARD WORKS WITH

Energy Duck, Night & Day, Solar Eco System, Solar Sound Field

### IMAGES (1-5)

Siemens AG; Scott Robinson; Sempra LLC; Lumos Solar; and LAGI Solar Mural® "La Monarca" San Antonio, TX (photo by Penelope Boyer).



## SOLAR ORBS

ART



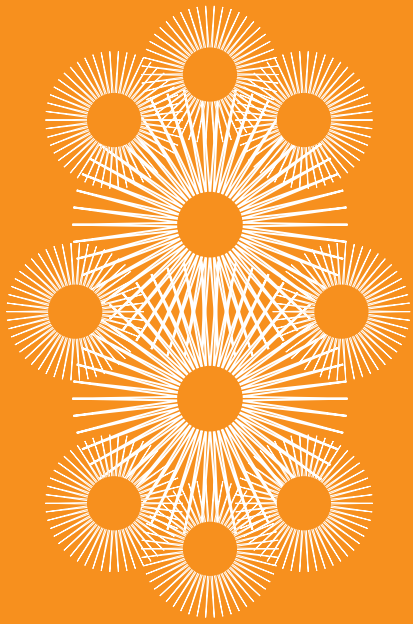
The orbs magnify the sun and flip the horizon upside down.

ENERGY TECHNOLOGY  
concentrated photovoltaic

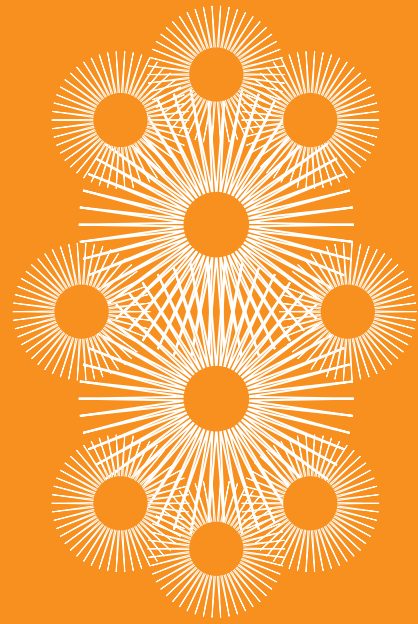
**110 HOUSES**  
can be powered by this  
artwork (550 MWh per year)

### DESIGN TEAM

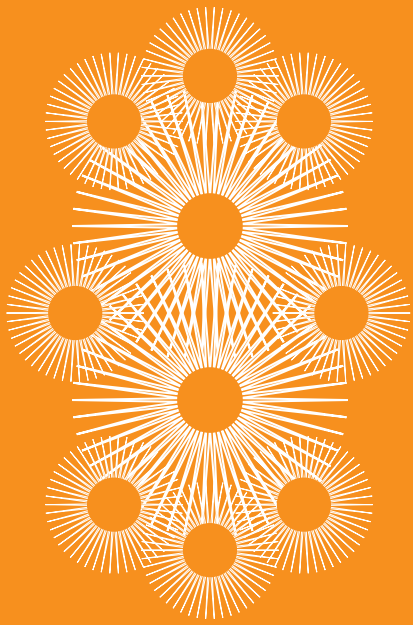
Kaitlin Campbell, Chad Grevelding, Bridget Snover, Kyle Stillwell



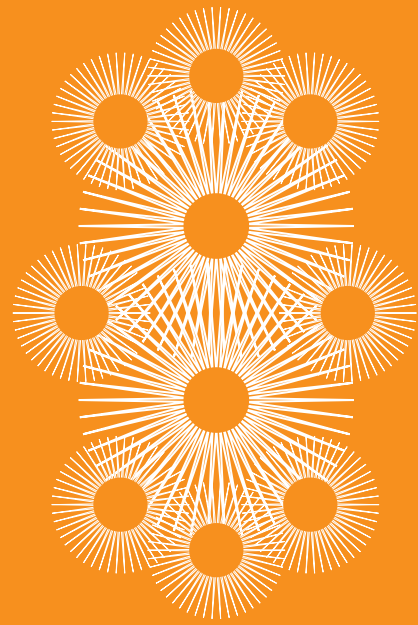
**SOLAR**  
**POWER**  
landartgenerator.org



**SOLAR**  
**POWER**  
landartgenerator.org



**SOLAR**  
**POWER**  
landartgenerator.org



**SOLAR**  
**POWER**  
landartgenerator.org



## SOLAR ORBS

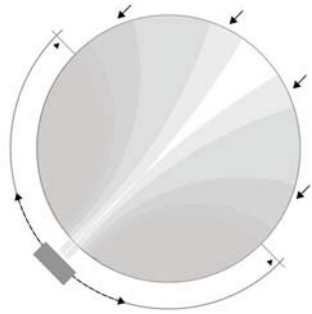
INFO

ENERGY TECHNOLOGY  
**concentrated photovoltaic**

The design of *Solar Orbs* utilizes spherical solar concentrators to focus sunlight onto a photovoltaic + thermal solar cell. The high-performance cell tracks the concentrated light throughout the day, gliding in the shadow of the sphere along a dual axis system. The concept of spherical solar concentrators was first introduced by Andre Broessel, the founder of Rawlemon.

LAGI 2018 MELBOURNE

The solar cell is set on a tracking system that moves behind the water-filled acrylic sphere.



## CONCENTRATED PHOTOVOLTAIC (CPV)

TECH



CPV uses photovoltaic cells, but rather than rely on the standard intensity of naturally occurring solar radiation energy, the CPV system concentrates the sunlight and directs a magnified beam onto a smaller area solar cell specifically designed to handle the greater energy and heat. Because the solar cell can be much smaller, the amount of semiconductor material required is far less for the same watt capacity output when compared to standard PV.

**CHARACTERISTICS**  
reflective, lens, magnification, optics, kinetic, heliostatic, dual-axis tracking

**IMAGE ABOVE**  
CPV installation. Image courtesy of SolFocus, Inc.

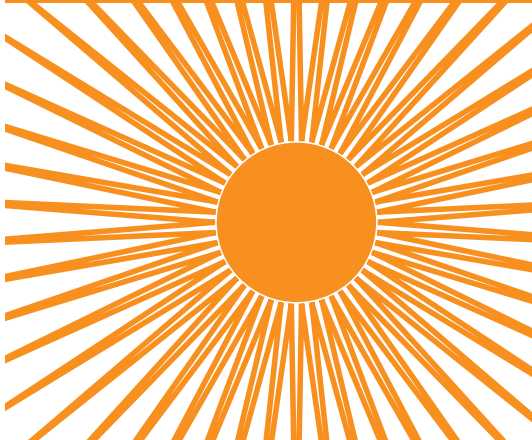
**THIS CARD WORKS WITH**  
Solar Orbs



## WILD CARD

TECH

Play this card with any solar **ART** or **INFO** card.



**DESIGN INNOVATION**

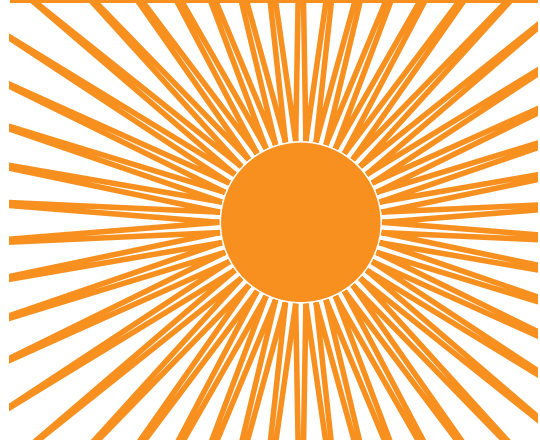
Innovation happens when you dare to think creatively about challenges. The next decade promises to be an exciting time for new energy products and solutions, both in clean generation and in energy storage. Many of the new technologies, like solar paints, modular solar tiles, and clear solar window glass can be incorporated into the design of our cities, landscapes, and public art.



## WILD CARD

TECH

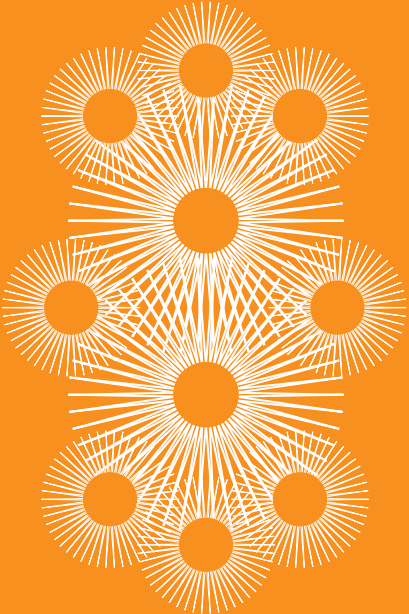
Play this card with any solar **ART** or **INFO** card.



**DESIGN INNOVATION**

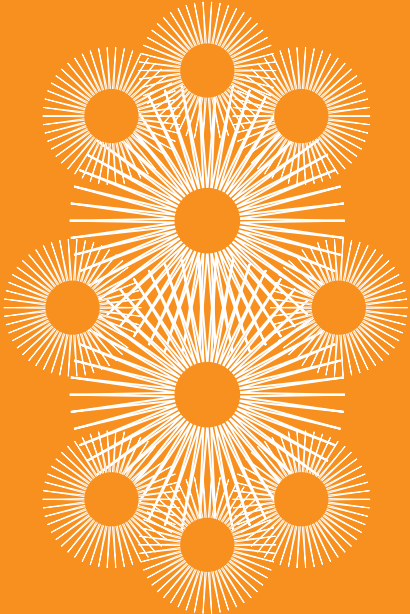
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**SOLAR  
POWER**  
landartgenerator.org

This graphic features a central orange circle surrounded by six smaller orange circles, each with radiating white lines, all set against an orange background with a white dotted border.



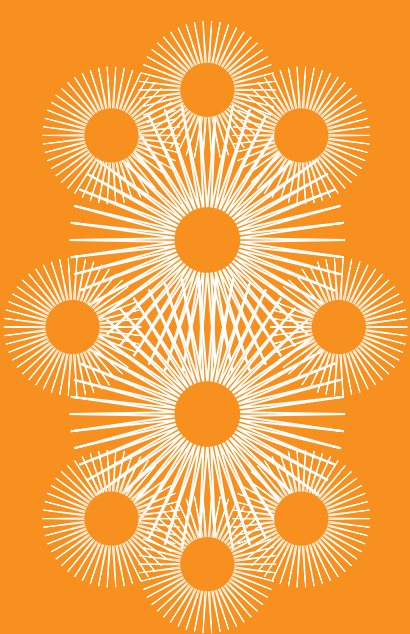
**SOLAR  
POWER**  
landartgenerator.org

This graphic features a central orange circle surrounded by six smaller orange circles, each with radiating white lines, all set against an orange background with a white dotted border.



**WIND  
POWER**  
landartgenerator.org

This graphic features a central white circle surrounded by six smaller white circles, each with radiating white lines, all set against a red background with a white dotted border.



**SOLAR  
POWER**  
landartgenerator.org

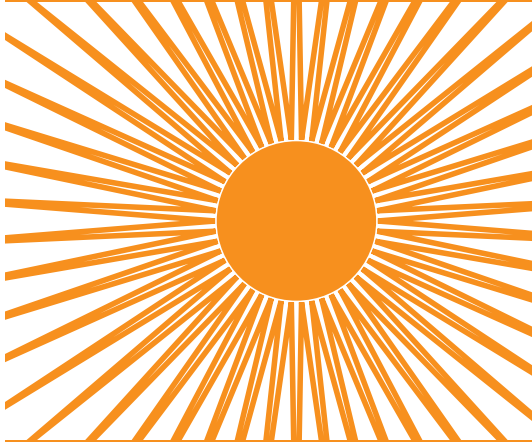
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## WILD CARD

TECH

Play this card with any solar ART or INFO card.



DESIGN  
INNOVATION

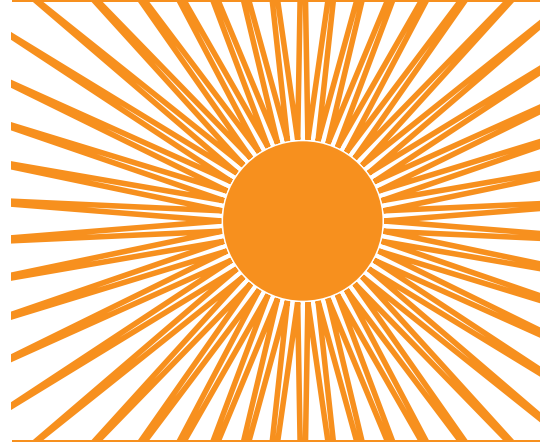
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## WILD CARD

TECH

Play this card with any solar ART or INFO card.



DESIGN  
INNOVATION

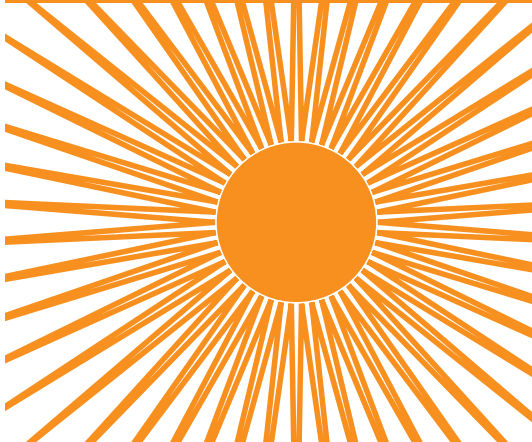
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## WILD CARD

TECH

Play this card with any solar ART or INFO card.



DESIGN  
INNOVATION

Innovation happens when you dare to think creatively about challenges. The next decade promises to be an exciting time for new energy products and solutions, both in clean generation and in energy storage. Many of the new technologies, like solar paints, modular solar tiles, and clear solar window glass can be incorporated into the design of our cities, landscapes, and public art.



ART

## FRESH HILLS



*These large wind turbines blend into the landscape.*

ENERGY TECHNOLOGY  
horizontal axis wind  
turbine

**50 HOUSES**  
can be powered by this  
artwork (250 MWh per year)

**DESIGNTEAM**  
Matthew Rosenberg, Matt Melnyk,  
Emmy Maruta, Robbie Eleazer



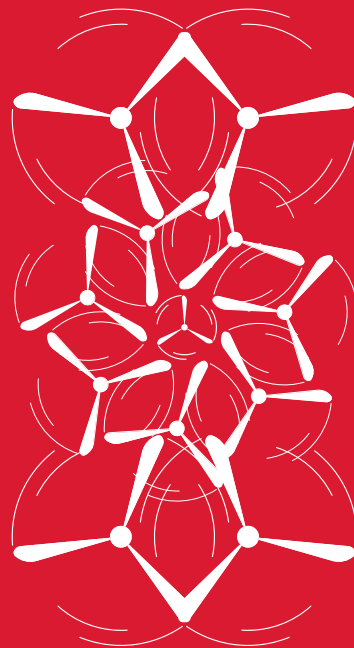
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**POWER**  
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## FRESH HILLS

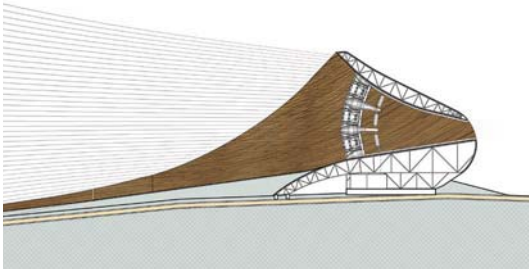
INFO

ENERGY TECHNOLOGY  
horizontal axis wind turbine

As the wind rushes up each side of the hill, it is concentrated into landforms that increase the velocity of flow and channel the energy to turbines located around a calm and pastoral central plaza. The landforms are generated by grafting the site's wind rose diagram onto the landscape to create a seamless exchange between site-specific data and a work of land art that harvests the energy of its environment.

LAGI 2012 FRESHKILLS PARK, NYC

Wind rushes into the bamboo land forms, and accelerates as it approaches the turbine.



## HORIZONTAL AXIS WIND TURBINE (HAWT)

TECH



Horizontal axis wind turbines have been around for centuries. In the past 50 years their design has become increasingly efficient and streamlined to the 3-blade that we see dotting many of our landscapes. As the diameter (wind-swept area) increases, the power capacity goes up quickly and turbines are getting larger every year (approaching 200 meters diameter). A ducted (compact acceleration) wind turbine (right image) uses a cone or lens to concentrate the wind, increasing its velocity as it passes through the turbine (Venturi effect) and generating more electricity than a "free-running" turbine of the same diameter.

**CHARACTERISTICS**  
dynamic, large, rotate, circle

**IMAGES ABOVE**  
Onshore turbine; Offshore turbine (U.S. DOE); Ducted turbine in Fukuoka Prefecture Japan (Wikimedia Commons).

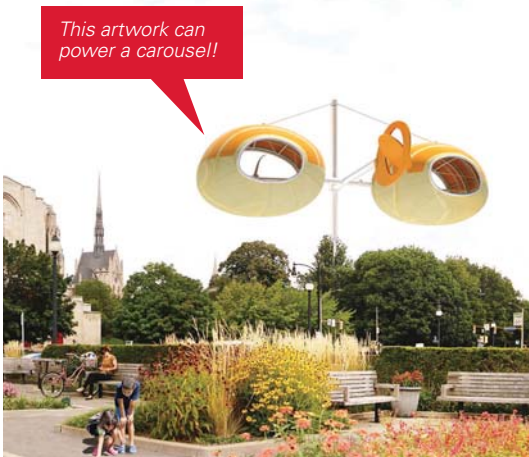
**THIS CARD WORKS WITH**  
Fresh Hills, WindNest



## WINDNEST

ART

*This artwork can power a carousel!*



## WINDNEST

INFO

ENERGY TECHNOLOGY  
horizontal axis wind turbine;  
organic photovoltaic

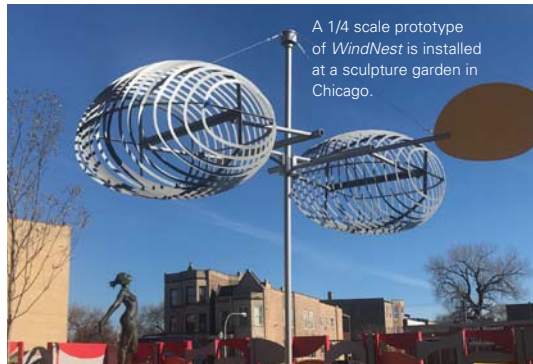
*WindNest* demonstrates the potential for our sustainable infrastructures to be joyful contributions to creative placemaking. Visitors experience a set of moving cloud formations overhead. As they linger on their way through this beautiful place, they will discover that the pods above them are generating clean electricity with a mix of wind and solar technologies—a power plant as full of wonder as the carousel it powers.

LAGI 2010 DUBAI / ABU DHABI

ENERGY TECHNOLOGY  
horizontal axis wind turbine; organic photovoltaic

**20 HOUSES**  
can be powered by this artwork (100 MWh per year)

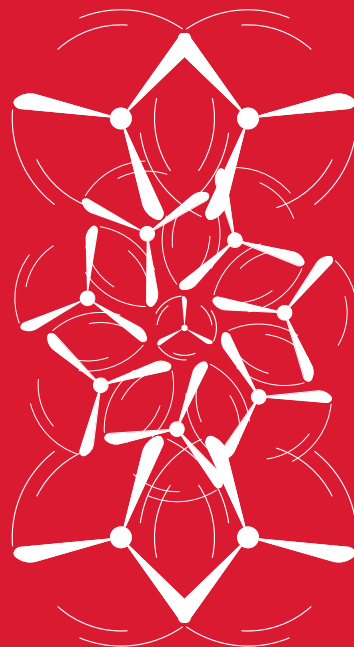
**DESIGNTEAM**  
Trevor Lee (Suprafutures)



A 1/4 scale prototype of *WindNest* is installed at a sculpture garden in Chicago.



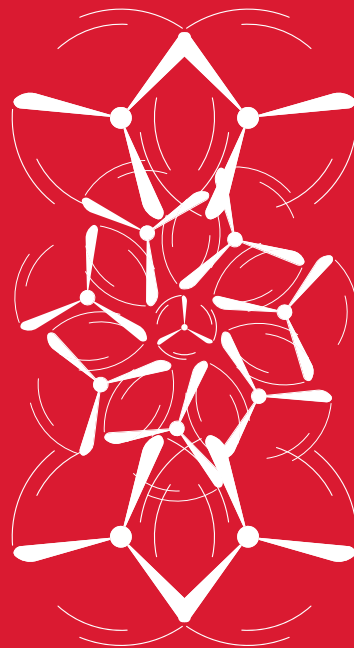
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## HORIZONTAL AXIS WIND TURBINE (HAWT)



Horizontal axis wind turbines have been around for centuries. In the past 50 years their design has become increasingly efficient and streamlined to the 3-blade that we see dotting many of our landscapes. As the diameter (wind-swept area) increases, the power capacity goes up quickly and turbines are getting larger every year (approaching 200 meters diameter). A ducted (compact acceleration) wind turbine (right image) uses a cone or lens to concentrate the wind, increasing its velocity as it passes through the turbine (Venturi effect) and generating more electricity than a "free-running" turbine of the same diameter.

**CHARACTERISTICS**  
dynamic, large, rotate, circle

**IMAGES ABOVE**  
Onshore turbine; Offshore turbine (U.S. DOE); Ducted turbine in Fukuoka Prefecture Japan (Wikimedia Commons).

**THIS CARD WORKS WITH**  
Fresh Hills, WindNest



## WIND GRAZERS



As goats harvest energy from the grass, Wind Grazers harvest energy from the air.

ENERGY TECHNOLOGY  
high altitude wind power

**105 HOUSES**  
can be powered by this artwork (525 MWh per year)

**DESIGNTEAM**  
Jennifer Sage, Peter Coombe, Andrew Kao, Allen Slamic, Taewook Cha, Trevor Sell, John Reed

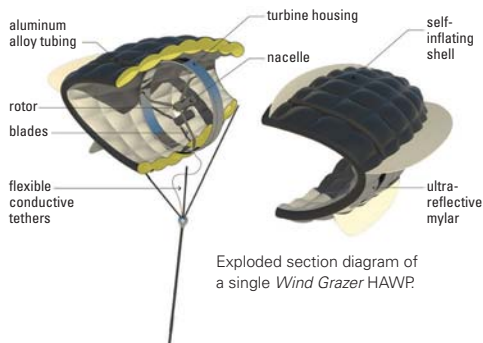


## WIND GRAZERS

ENERGY TECHNOLOGY  
high altitude wind power

A field of 200 turbines hovers in the sky, gridded like rows of crops recalling the site's agricultural past. Retractable tethers of equal lengths anchor an aerial array of turbines and project the topography into the sky, making it visible to the surrounding city. Each turbine is held aloft by helium-filled aerostats with horizontal axis wind turbines. At high altitudes these turbines can take advantage of very high speed winds, unimpeded by land surface friction and turbulence.

LAGI 2012 FRESHKILLS PARK, NYC



Exploded section diagram of a single Wind Grazer HAWP.



## HIGH ALTITUDE WIND POWER



The power of the wind at high altitudes is stronger and more consistent than winds nearer to the ground. However, getting access to this source of energy presents an awesome design challenge. Experimentation has led to a variety of HAWP types including kites, sails, aerostats, airfoils, drogues, rotating blimps, and gliders like the one pictured above, designed to soar through crosswinds in a constant circle while multiple turbines on the wings send power to the grid below through a tether.

**CHARACTERISTICS**  
dynamic, movement, tied to the ground, soaring in the clouds

**IMAGE ABOVE**  
Image courtesy of Joby Energy.

**THIS CARD WORKS WITH**  
Wind Grazers, UNWIND



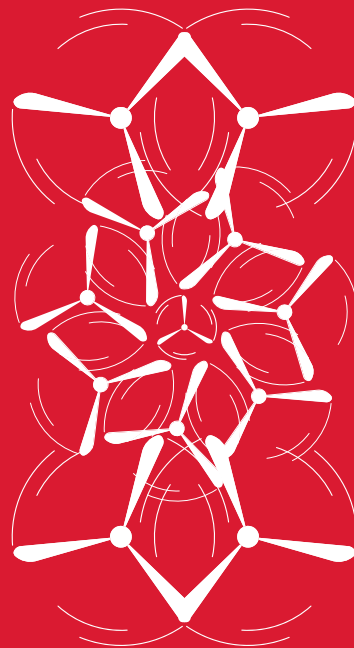
**WIND**  
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landartgenerator.org



# WINDSTALK

ART



*A wind farm without the blades!*

ENERGY TECHNOLOGY  
kinetic energy harvesting  
(from wind) with  
piezoelectric disks

**4,000 HOUSES**  
can be powered by this  
artwork (20,000 MWh per year)

**DESIGN TEAM**

Dario Núñez Ameni, Thomas Siegl,  
Gabrielle Jesiolowski, Radhi Majmudar,  
Ian Lipsky

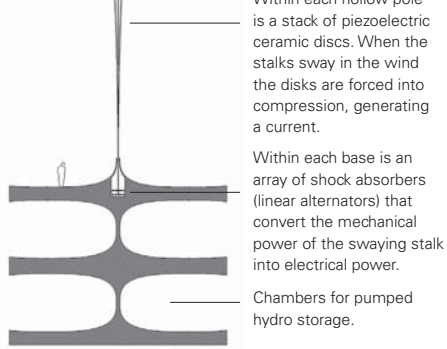


# WINDSTALK

INFO

ENERGY TECHNOLOGY  
kinetic energy harvesting  
(from wind) with piezoelectric disks

*WindStalk* is inspired by the way that a field of grass blades wave in the wind. The artwork consists of 1203 carbon fiber reinforced resin stalks, 55 meters high. The top 50 centimeters of the stalks are lit up by an LED array that glows with the strength of the wind. Like a sunflower, the stalks are arrayed along a logarithmic spiral. Visitors can walk on the bases of the stalks and listen to the sound that the wind makes as it rushes overhead.  
**LAGI 2010 DUBAI / ABU DHABI**



Within each hollow pole is a stack of piezoelectric ceramic discs. When the stalks sway in the wind the disks are forced into compression, generating a current.

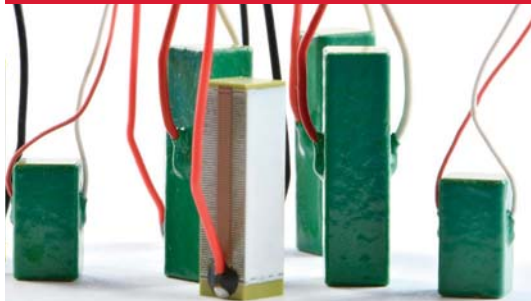
Within each base is an array of shock absorbers (linear alternators) that convert the mechanical power of the swaying stalk into electrical power.

Chambers for pumped hydro storage.



# KINETIC ENERGY HARVESTING PIEZOELECTRIC DISKS

TECH



Kinetic energy (energy in motion) can be harvested and converted into electricity using technologies such as linear alternators and piezoelectric stack actuators. Piezoelectric materials naturally convert the mechanical strain of bending or pressure into electricity. They can be placed in pavers, roadways, or stacked inside long objects that sway in the wind. Linear alternators generate an electrical current through induction—a magnet moving back and forth through the center of a copper coil (solenoid).

**CHARACTERISTICS**

columnar, springy, bending, elastic, movement, coil, action, jump!

**IMAGE ABOVE**

Piezoelectric stack actuators. Image courtesy of Piezotechnik GmbH.

**THIS CARD WORKS WITH**  
WindStalk



# AETHERIUS

ART



*Imagine a kinetic artwork that bellows and flows in the wind!*

ENERGY TECHNOLOGY  
kinetic energy harvesting  
(from wind) with hydraulic  
cylinders

**840 HOUSES**  
can be powered by this  
artwork (4,200 MWh per year)

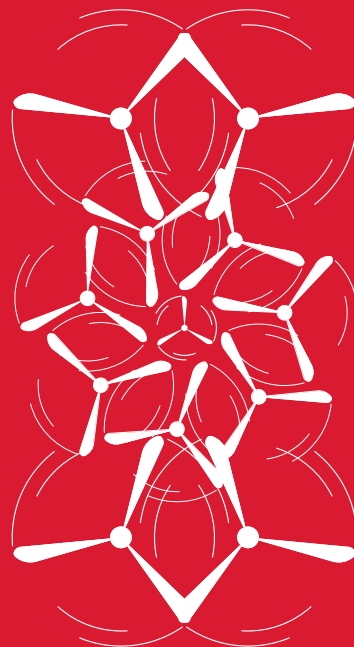
**DESIGN TEAM**

Marilu Valente





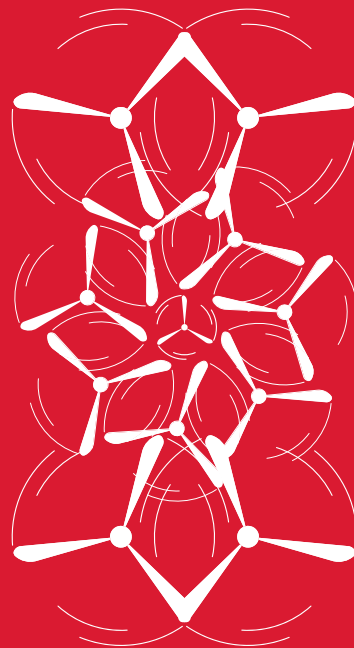
**WIND**  
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**POWER**  
landartgenerator.org



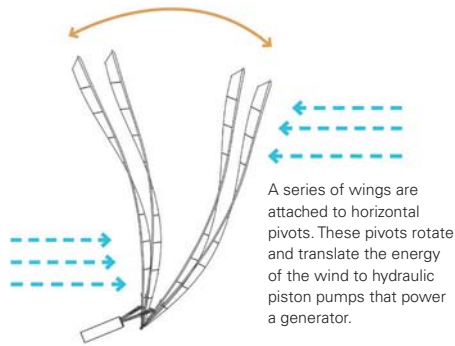
# AETHERIUS

INFO

ENERGY TECHNOLOGY  
kinetic energy harvesting  
(from wind) with hydraulic cylinders

*Aetherius* expresses the poetic potential and beauty of the wind. It moves according to wind speed, frequency, and direction—responding to unpredictability. A series of ultra-light wings move in a synchronized wave as the wind rushes across the surface of the artwork, reminiscent of the way that a fish moves through the water. The undulating façade reflects its environment, generates electricity, and creates a dynamic experience for visitors.

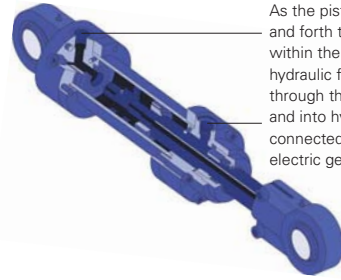
LAGI 2014 COPENHAGEN



A series of wings are attached to horizontal pivots. These pivots rotate and translate the energy of the wind to hydraulic piston pumps that power a generator.



# KINETIC ENERGY HARVESTING HYDRAULIC CYLINDERS



As the piston moves back and forth the pressure within the chamber causes hydraulic fluid to flow quickly through these two apertures and into hydraulic lines connected to a turbine and electric generator.

Hydraulic cylinders or pistons are a way to harvest kinetic energy (energy in motion). A force applied to the piston pumps a fluid through a closed loop to power a hydraulic motor that drives an electric generator. Any force or action that applies repeating pressure, such as ocean waves, wind, or even a playground seesaw can be converted into electricity in this way.

**CHARACTERISTICS**  
linear movement,  
pressure, swinging,  
swaying, shaking

**THIS CARD WORKS WITH**  
Aetherius



# ROTOR IMMERSIVE WIND ENERGY

ART



A circle of spinning mirrors creates the perfect outdoor room.

**21 HOUSES**  
can be powered by this  
artwork (105 MWh per year)

**DESIGNTEAM**  
Louis Gadd, Aimee Goodwin,  
Danny Truong

ENERGY TECHNOLOGY  
vertical axis wind  
turbine



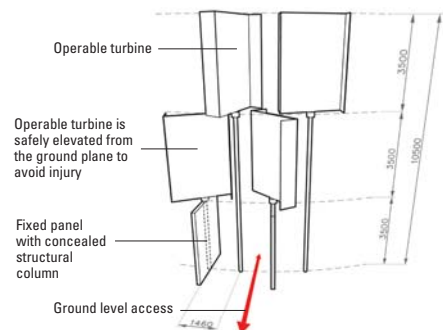
# ROTOR IMMERSIVE WIND ENERGY

INFO

ENERGY TECHNOLOGY  
vertical axis wind turbine

*Rotor* is a circular array of 1.5 kW Savonius type vertical axis wind turbines. The custom rotor is made from stainless steel—polished to produce a highly reflective surface. The result is an immersive artwork that communicates the poetry of wind and engages people in ways that large wind turbines can't. The artwork harnesses the innate beauty of the invisible phenomena of wind and renders it visible to the public.

LAGI 2018 MELBOURNE





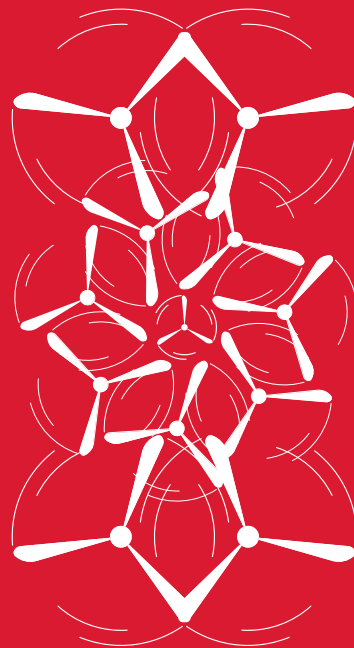
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**POWER**  
landartgenerator.org



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**POWER**  
landartgenerator.org



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**POWER**  
landartgenerator.org



**WIND**  
**POWER**  
landartgenerator.org



## VERTICAL AXIS WIND TURBINE (VAWT)



Vertical axis wind turbines (VAWT) are generally either Darrieus or Savonius in type (named after their early 20th century inventors). A simple distinction is that Darrieus-type turbines use aerofoil blades and Savonius-type turbines use wind scoops. Gorlov helical turbine (GHT) is a variation on a standard Darrieus type. VAWTs have lower cut-in speeds (the wind speed at which they begin to produce electricity) than HAWTs and can be positioned lower to the ground.

### CHARACTERISTICS

spinning, motion, reflective, kinetic, circle, screen

### IMAGE ABOVE

RevolutionAir WT1KW (GHT type design). Image courtesy of PRAMAC. Design by Philippe Starck.

### THIS CARD WORKS WITH

Rotor



## UNWIND



*Energy is at play in the skies over this net-zero public park!*

ENERGY TECHNOLOGY  
**high altitude wind power**

**380 HOUSES** can be powered by this artwork (1,900 MWh per year)

### DESIGNTEAM

David Donley, Michael Cinalli



## UNWIND

ENERGY TECHNOLOGY  
**high altitude wind power**

Each unit in *UNWIND* operates on a system of two kites that cycle in a yo-yo style. As the first kite reaches its maximum height, the second kite begins its ascent. Inside the spheres are two spools connected to ratcheted gears that engage a flywheel, which regulates the sporadic speed of the unspooling kites into a consistent output speed. This rotational energy is harnessed by a generator that produces electricity.

LAGI 2018 MELBOURNE



Section through the frame of *UNWIND*.



## HIGH ALTITUDE WIND POWER



The power of the wind at high altitudes is stronger and more consistent than winds nearer to the ground. However, getting access to this source of energy presents an awesome design challenge. Experimentation has led to a variety of HAWP types including kites, sails, aerostats, airfoils, drogues, rotating blimps, and gliders like the one pictured above, designed to soar through crosswinds in a constant circle while multiple turbines on the wings send power to the grid below through a tether.

### CHARACTERISTICS

dynamic, movement, tied to the ground, soaring in the clouds

### IMAGE ABOVE

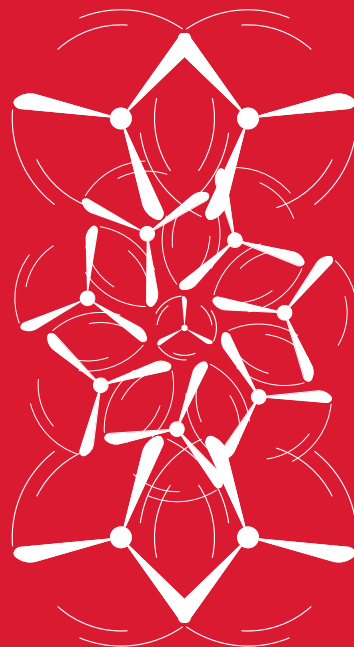
Image courtesy of Joby Energy.

### THIS CARD WORKS WITH

Wind Grazers, UNWIND



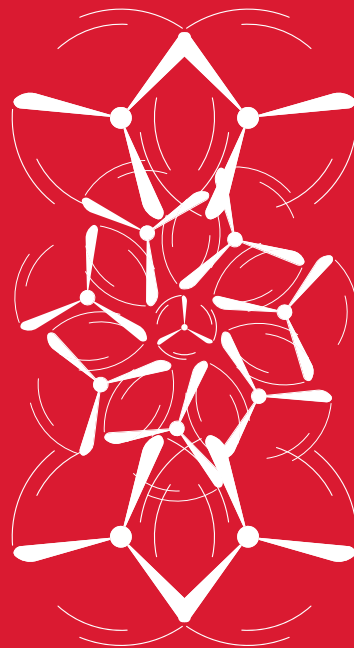
**WIND**  
**POWER**  
landartgenerator.org



**WIND**  
**POWER**  
landartgenerator.org



**WIND**  
**POWER**  
landartgenerator.org



**WIND**  
**POWER**  
landartgenerator.org



## WILD CARD

**TECH**

Play this card with any wind **ART** or **INFO** card.



**DESIGN  
INNOVATION**

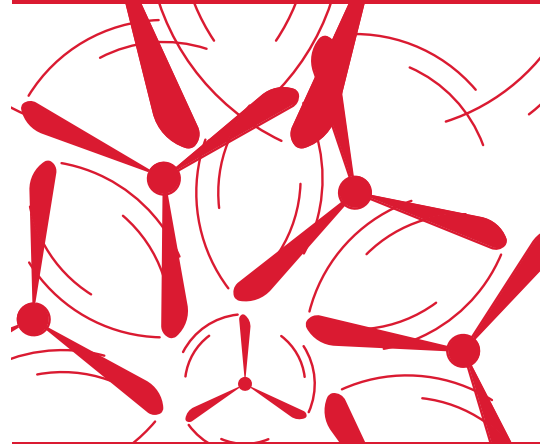
Innovation happens when you dare to think creatively about challenges. The next decade promises to be an exciting time for new energy products and solutions, both in clean generation and in energy storage. New technologies that take advantage of turbulence, wind vortices, and aerostatic flutter can be incorporated into the design of our cities, landscapes, and public art.



## WILD CARD

**TECH**

Play this card with any wind **ART** or **INFO** card.



**DESIGN  
INNOVATION**

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## WILD CARD

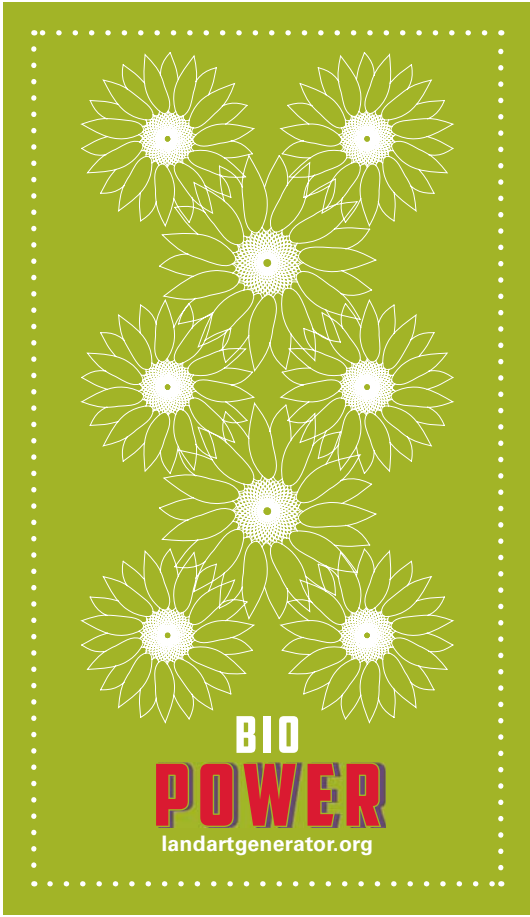
**TECH**

Play this card with any wind **ART** or **INFO** card.



**DESIGN  
INNOVATION**

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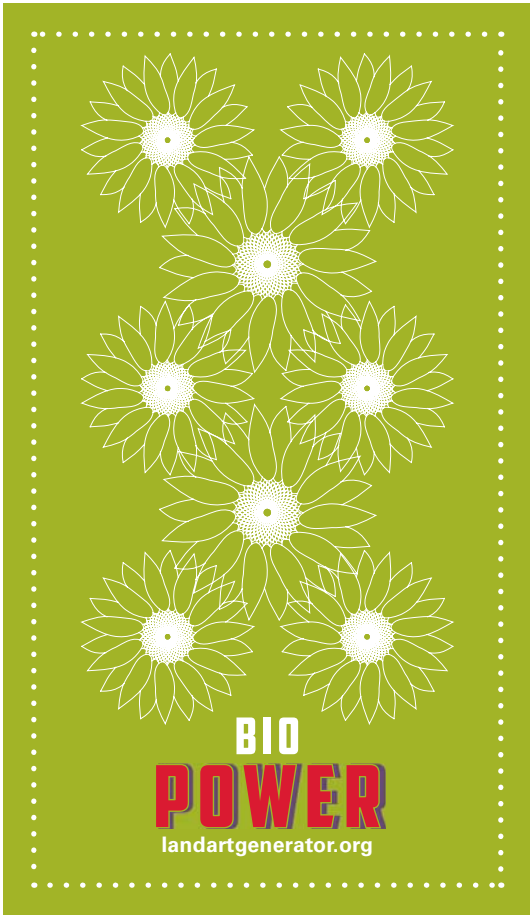
A vertical poster with a lime green background. It features a central arrangement of seven white line-art sunflowers. At the bottom, the text "BIO POWER" is displayed in white and red, with "landartgenerator.org" below it. The entire design is enclosed in a white dotted border.

**BIO  
POWER**  
landartgenerator.org



A vertical poster with a red background. It features a central arrangement of seven white line-art wind turbines. At the bottom, the text "WIND POWER" is displayed in white and red, with "landartgenerator.org" below it. The entire design is enclosed in a white dotted border.

**WIND  
POWER**  
landartgenerator.org



A vertical poster with a lime green background. It features a central arrangement of seven white line-art sunflowers. At the bottom, the text "BIO POWER" is displayed in white and red, with "landartgenerator.org" below it. The entire design is enclosed in a white dotted border.

**BIO  
POWER**  
landartgenerator.org



A vertical poster with a lime green background. It features a central arrangement of seven white line-art sunflowers. At the bottom, the text "BIO POWER" is displayed in white and red, with "landartgenerator.org" below it. The entire design is enclosed in a white dotted border.

**BIO  
POWER**  
landartgenerator.org



TECH

## WILD CARD

Play this card with any wind ART or INFO card.



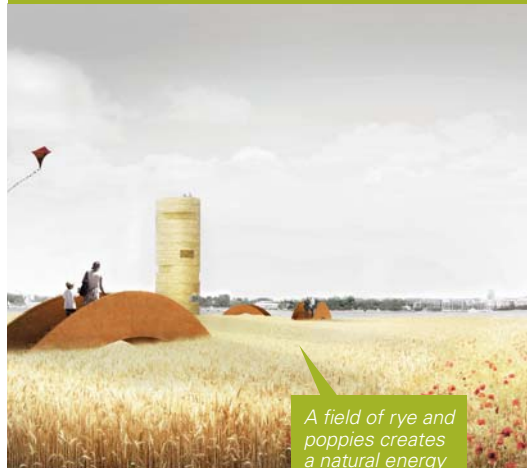
DESIGN INNOVATION

Innovation happens when you dare to think creatively about challenges. The next decade promises to be an exciting time for new energy products and solutions, both in clean generation and in energy storage. New technologies that take advantage of turbulence, wind vortices, and aerostatic flutter can be incorporated into the design of our cities, landscapes, and public art.



ART

## GOLDEN ROOTS



A field of rye and poppies creates a natural energy landscape.

**11 HOUSES** can be powered by this artwork (55 MWh per year)

**DESIGN TEAM**  
Ronny Zschörper, Franziska Adler

ENERGY TECHNOLOGY  
**biomass**



INFO

## GOLDEN ROOTS

*Golden Roots* contrasts the urban environment with the experience of unspoiled nature. A system of paths and bridges guides visitors through a constellation of crop circles, bringing the calm countryside to life in the city. The fields are periodically harvested to generate high-energy biomass as well as to provide rye bales for the construction of observation towers, which change every season. The towers can rise up to 18 meters tall when maximum crop yields are achieved.

LAGI 2014 COPENHAGEN

ENERGY TECHNOLOGY  
**biomass**

### Crossing Bridges

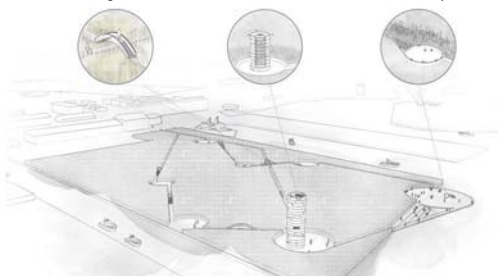
Bridges and underpasses provide barrier-free and unlimited access to the observation tower and the water's edge.

### Observation Tower

The tower provides an additional view point with an altitude of 18 meters above the ground.

### Water Platform

A direct water connection, additional entrance point, and a place to relax with a view of the city.



TECH

## BIOMASS



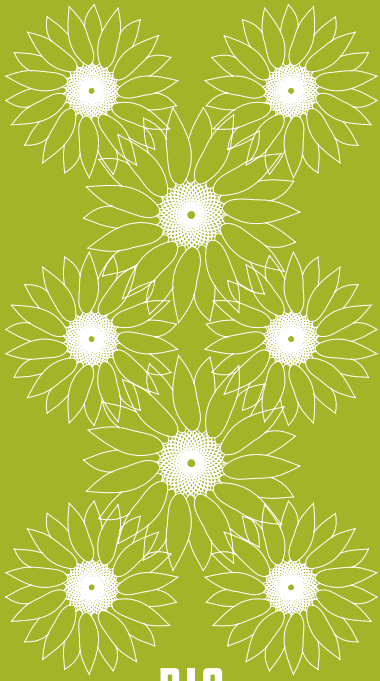
Biomass can be combusted directly as a solid fuel or converted to liquid or gas biofuels. These biofuels can be used in either a combustion engine (conversion to mechanical energy) or in a fuel cell (conversion to electrical energy). Biogas is created through the breakdown of any organic material (biomass) in an oxygen-poor environment, such as a landfill or an anaerobic digester tank. Biogas is similar in composition to conventional natural gas and as such can be compressed or fed into a municipal gas grid and used for cooking, heating, lighting, transportation, and electricity production.

**CHARACTERISTICS**  
hot, organic, fibrous, gaseous, earthy, grassy, fermented

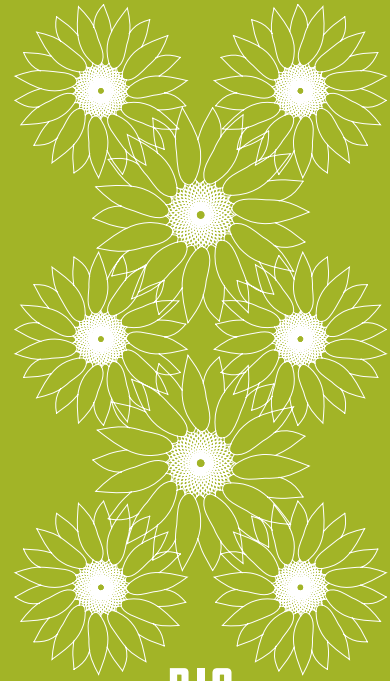
**IMAGE ABOVE**  
Sunflower field in Fargo, North Dakota.

**THIS CARD WORKS WITH**  
Golden Roots

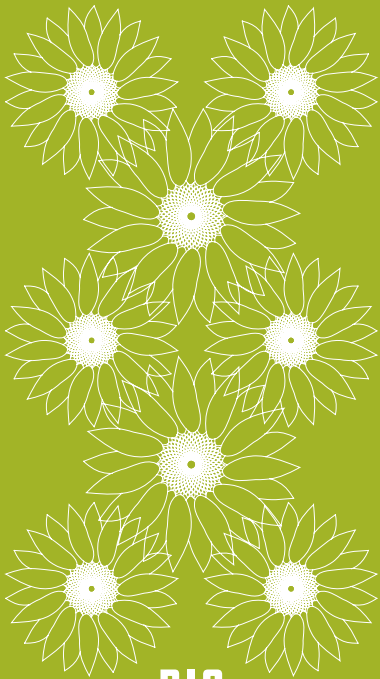




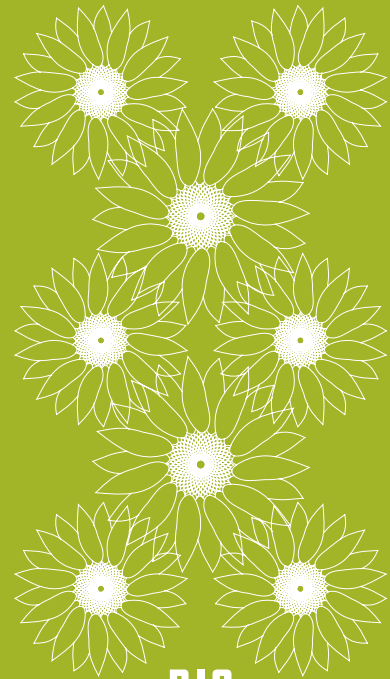
**BIO**  
**POWER**  
landartgenerator.org



**BIO**  
**POWER**  
landartgenerator.org



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**POWER**  
landartgenerator.org



**BIO**  
**POWER**  
landartgenerator.org



# SHIFTING ALGAE FOREST

ART



These trees are made of algae photobioreactors.

ENERGY TECHNOLOGY  
algae photobioreactor

**20 HOUSES** can be powered by each algae tree (100 MWh per year)

**A hundred trees power 1,000 homes!**

### DESIGN TEAM

Jessica Wolff, Abhishek Sharma, Pamela Richot, Ekachai Pattamasattayasonthi

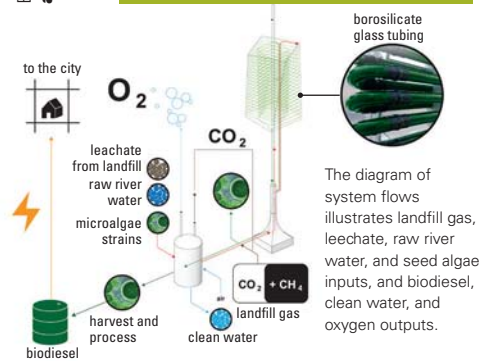


# SHIFTING ALGAE FOREST

INFO

*Shifting Algae Forest* is a celebration of the hybrid ecologies that humans are formulating to protect and ensure the survival of our planet. The algae trees take the harmful legacy of urban waste streams and convert it into a newly productive landscape. As the "branches" of the bioluminescent algae trees glow at night, site users are informed of the amount of carbon dioxide that is actively being sequestered from the landfill during the day.

LAGI 2012 FRESHKILLS PARK, NYC



# ALGAE PHOTOBIOREACTOR

TECH



Biodiesel fuel can be produced from the naturally occurring oils (biolipids) that are found in algae, which can be cultivated by combining untreated waste water with CO<sub>2</sub> that is diverted from emissions streams at power plants, landfills, or other industrial sites. The density of fuel energy per unit of feedstock mass and the portability of liquid fuel makes algae biodiesel an important sustainable energy source for a post-carbon economy.

**CHARACTERISTICS**  
green, saturated, tubes, dense

**IMAGE ABOVE**  
Tubular glass photobioreactor by IGV Biotech via Wikimedia Commons.

**THIS CARD WORKS WITH**  
Shifting Algae Forest



# WILD CARD

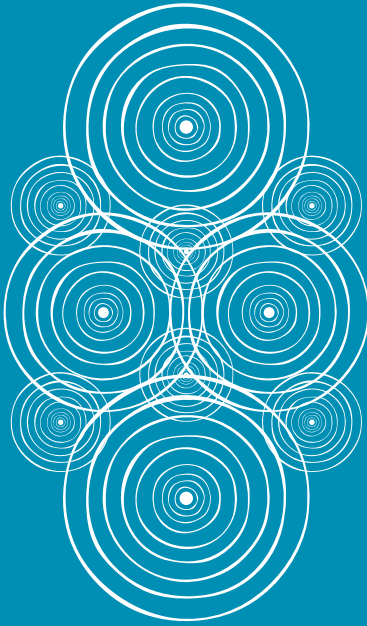
TECH

Play this card with any bio ART or INFO card.

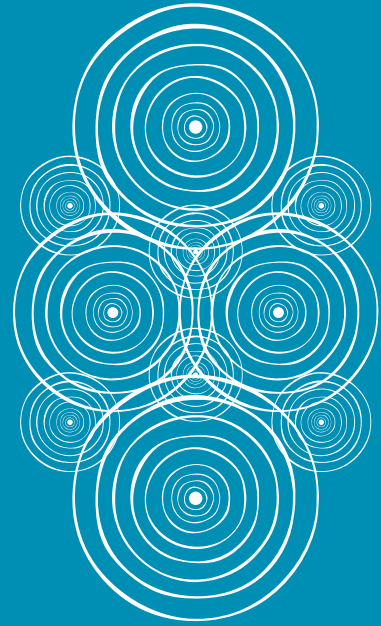


DESIGN INNOVATION

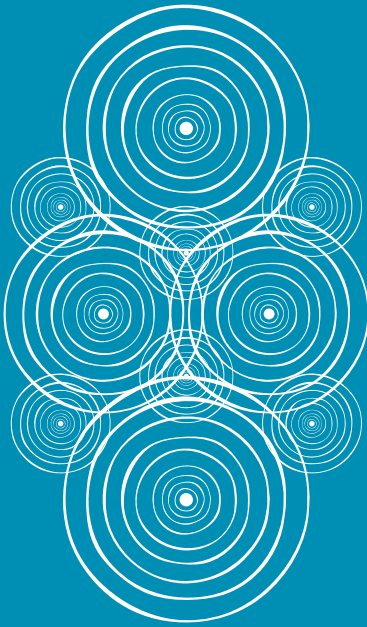
Innovation happens when you dare to think creatively about challenges. The next decade promises to be an exciting time for new energy products and solutions, both in clean generation and in energy storage. Advances in our understanding of organic systems are leading to new energy technologies such as artificial photosynthesis and microbial fuel cells. How can we reveal the way these systems work through art in public space?



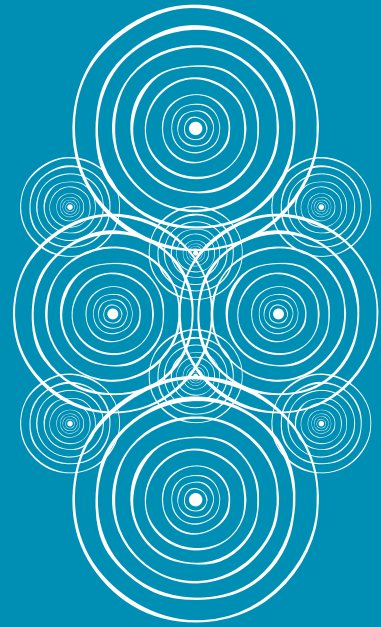
**HYDRO**  
**POWER**  
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**HYDRO**  
**POWER**  
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**POWER**  
landartgenerator.org



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**POWER**  
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## NOCTILUCALES

ART



*A luminescent wave energy power plant!*

ENERGY TECHNOLOGY  
wave energy converter  
(hydrokinetic attenuator)

**840 HOUSES**  
can be powered by this  
artwork (4,200 MWh per year)

### DESIGNTEAM

Ricardo Avella, Andrés Tabora,  
Michael Henriksen, Carla Betancourt,  
Silvia Mercader, Laura Vera,  
Oriana De Lucia, Martin Von Bülow,  
Laura Vivas, Miguel Rosas



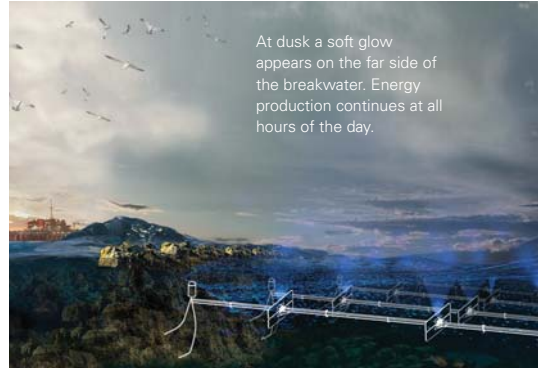
## NOCTILUCALES

INFO

ENERGY TECHNOLOGY  
wave energy converter  
(hydrokinetic attenuator)

*Noctilucales* preserves the horizon line of the ocean. The artwork consists of a network of moving plates installed along cables. The movement of the plates creates hydraulic pressure, which is converted into electricity. Each moving plate casts a subtle glow at night. The energy collectors are seen as a field of lights, producing a bioluminescent effect similar to the one created by natural *Noctilucales* in some parts of the world.

LAGI 2016 SANTA MONICA

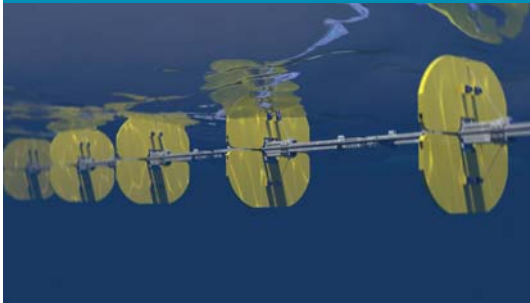


At dusk a soft glow appears on the far side of the breakwater. Energy production continues at all hours of the day.



## WAVE ENERGY CONVERTER HYDROKINETIC ATTENUATOR

TECH



Surface-following (attenuator type) wave generation uses long sets of interconnected segments that create pressure in chambers of oil as the parts shift their position under the influence of waves.

The oil pressure drives hydraulic motors to power electric generators.

### CHARACTERISTICS

rocking, floating, long,  
glowing, serpentine

### IMAGE ABOVE

Image courtesy of  
Wavepiston™.

THIS CARD WORKS WITH  
Noctilucales



## CATCHING THE WAVE

ART



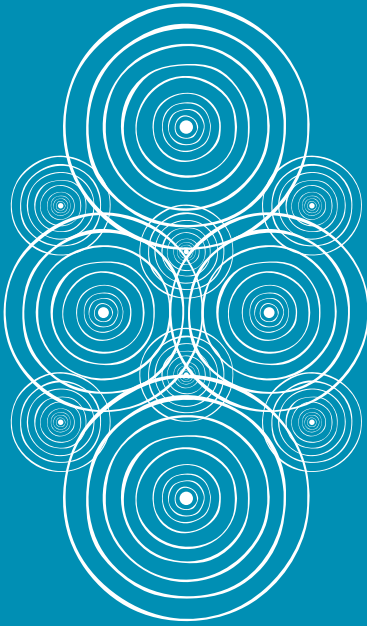
*An inhabitable artwork floats upon the surface of the waves.*

ENERGY TECHNOLOGY  
wave energy converter  
(point absorber)

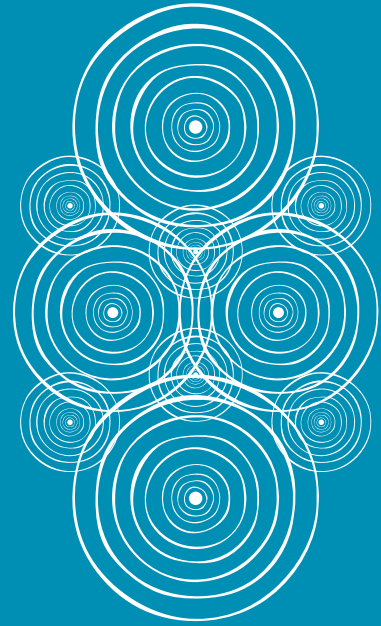
**3,200 HOUSES**  
can be powered by this artwork  
(16,000 MWh per year)

### DESIGNTEAM

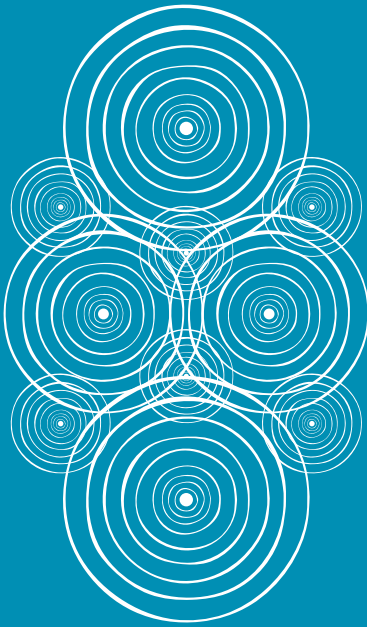
Christina Vannelli, Liz Davidson,  
Matthew Madigan



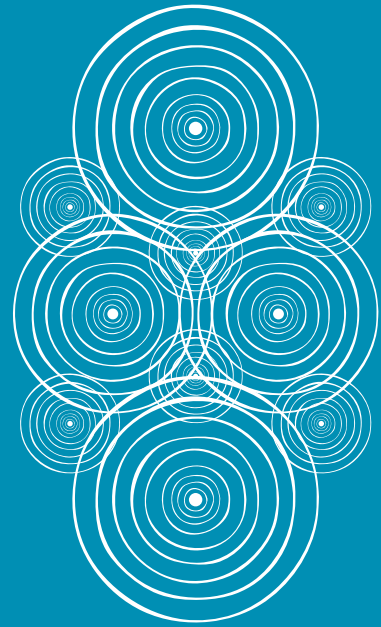
**HYDRO**  
**POWER**  
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**HYDRO**  
**POWER**  
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**POWER**  
landartgenerator.org

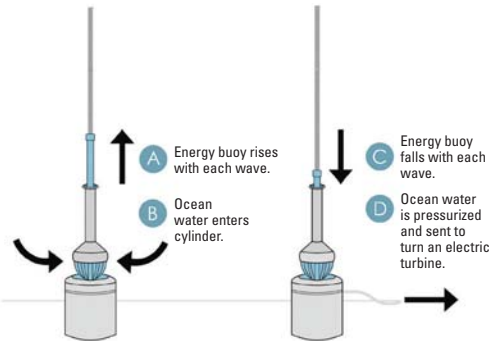


## CATCHING THE WAVE

ENERGY TECHNOLOGY  
wave energy converter  
(point absorber)

The area behind the Santa Monica Pier breakwater was once home to a yacht harbor filled with hundreds of sailboats and moorings. *Catching the Wave* recalls this history by celebrating the relationship of a sail ship and its mooring. The installation is made up of 60 buoys that capture wave energy. Each buoy is connected to a piston mounted on the ocean floor by a flexible tether. The movement of the piston first pulls in sea water, then pressurizes it to power an electric generator.

LAGI 2016 SANTA MONICA



## WAVE ENERGY CONVERTER POINT ABSORBER



Buoy type wave generators use the motion of the waves at a single point. Some use the up and down motion to transfer pressurized liquid or air within chambers to spin turbines.

Deeper water provides longer waves and more regular wave energy without as much potential for damage to equipment from cresting waves.

**CHARACTERISTICS**  
buoy, up-down, bright, water, nodes, interconnected

**IMAGE ABOVE**  
Image courtesy of Ocean Power Technologies, Inc.

**THIS CARD WORKS WITH**  
Catching the Wave, Follies and Fog



## THE CLEAR ORB

ENERGY TECHNOLOGY  
wave energy converter  
(oscillating water column)



*Energy and water come together in this perfect sphere.*

**764 HOUSES** can be powered by this artwork (3,820 MWh per year)

+ 2,200,000 liters of fresh water for the pier!

### DESIGN TEAM

Jaesik Lim, Ahyoung Lee, Jaeyeol Kim, Taegu Lim

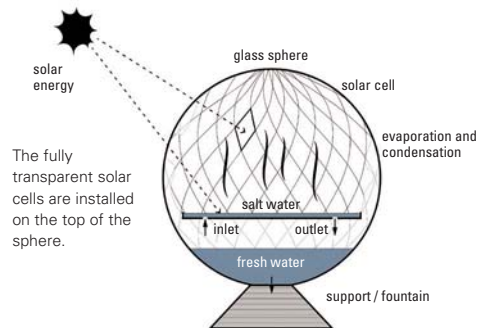


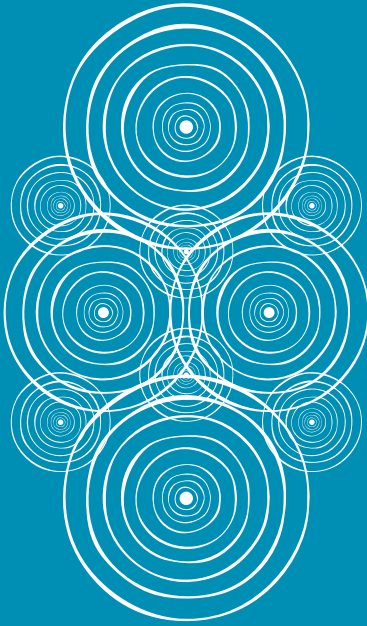
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ENERGY TECHNOLOGY  
wave energy converter  
(oscillating water column)

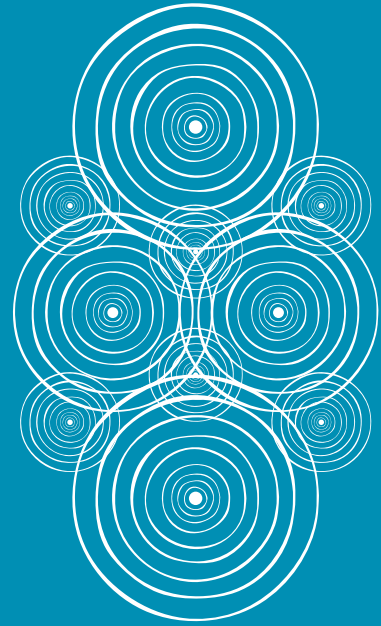
*The Clear Orb* appears to float upon the surface of the ocean. The colors of the sky are refracted through the translucent solar photovoltaic glass upper section, while the lower hemisphere's reflective surface glitters with the sunlight playing on the ocean waves. The *Orb* is a solar still that produces fresh water from seawater through evaporation and condensation. Part of the energy generated by the oscillating water column pumps seawater into the evaporation tray.

LAGI 2016 SANTA MONICA

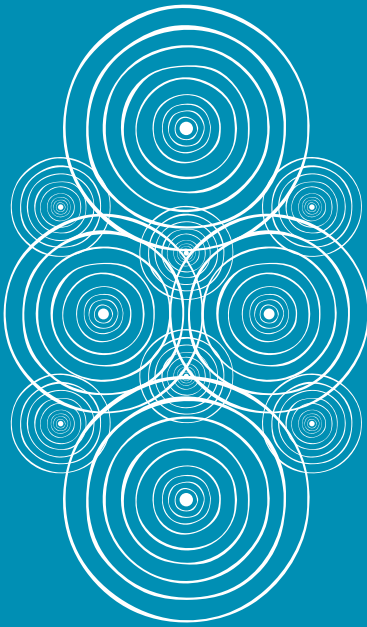




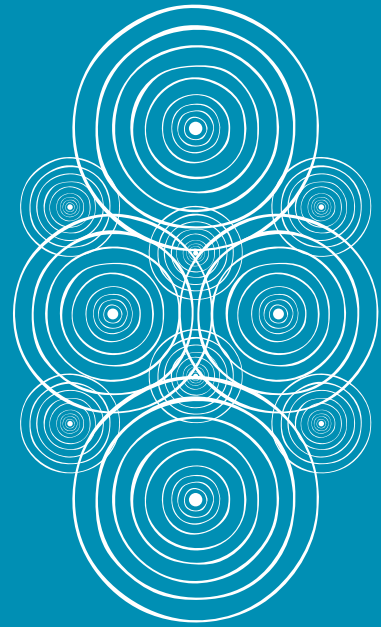
**HYDRO**  
**POWER**  
landartgenerator.org



**HYDRO**  
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landartgenerator.org



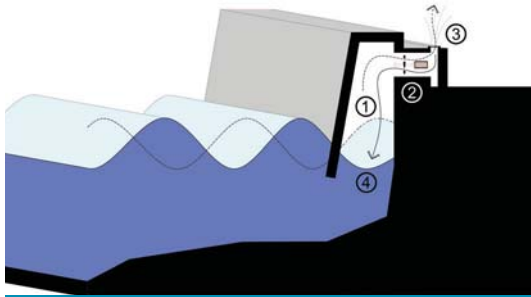
**HYDRO**  
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landartgenerator.org



**HYDRO**  
**POWER**  
landartgenerator.org



## WAVE ENERGY CONVERTER OSCILLATING WATER COLUMN



An oscillating water column wave energy converter harnesses the continuous energy of the waves as they flow into and out of a large air chamber along the shoreline. When the wave rushes in ①, the air in the chamber is compressed and when it rushes out ④, the air becomes very low pressure. As air rushes into and out of the chamber ③ to equalize the air pressure in the chamber, a special type of turbine—a Wells turbine ②—spins continuously in one direction to generate electricity at a relatively constant rate.

### CHARACTERISTICS

crashing, loud, air, water, edge, spinning

**THIS CARD WORKS WITH**  
The Clear Orb



## FOLLIES AND FOG



ENERGY TECHNOLOGY  
wave energy converter  
(point absorber)

**2,600** HOUSES  
can be powered by this  
artwork (13,000 MWh per year)

**DESIGN TEAM**  
Nik Klahre, Brooke Campbell-Johnston



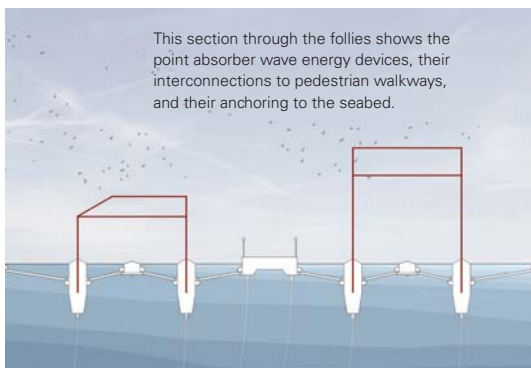
## FOLLIES AND FOG

ENERGY TECHNOLOGY  
wave energy converter  
(point absorber)

The artwork makes visible the hidden activity of wave energy production. Connected to a floating grid of buoy-type wave energy converters are 128 follies. As the amount of energy generation nears peak productivity during periods of intense wave activity, an artificial fog engulfs the artwork in a cloud of mist. As the waves become less powerful, the viewer is able to again see the artwork from the shore as the cloud of artificial fog begins to disburse.

LAGI 2016 SANTA MONICA

This section through the follies shows the point absorber wave energy devices, their interconnections to pedestrian walkways, and their anchoring to the seabed.



## WAVE ENERGY CONVERTER POINT ABSORBER



Buoy type wave generators use the motion of the waves at a single point. Some use the up and down motion to transfer pressurized liquid or air within chambers to spin turbines.

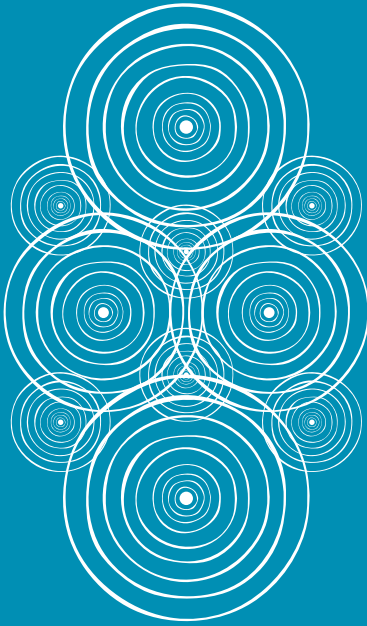
Deeper water provides longer waves and more regular wave energy without as much potential for damage to equipment from cresting waves.

**CHARACTERISTICS**  
buoy, up-down, bright, water, nodes, interconnected

**IMAGE ABOVE**  
Image courtesy of Ocean Power Technologies, Inc.

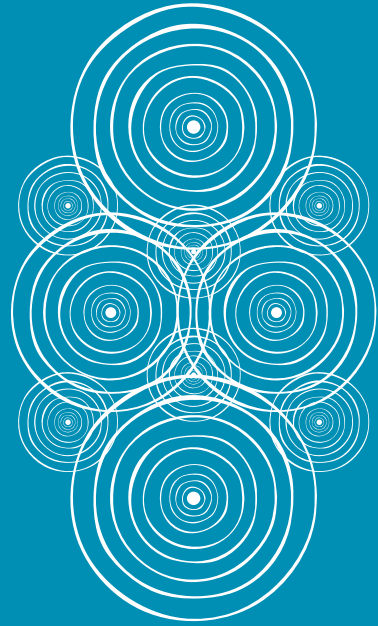
**THIS CARD WORKS WITH**  
Catching the Wave, Follies and Fog





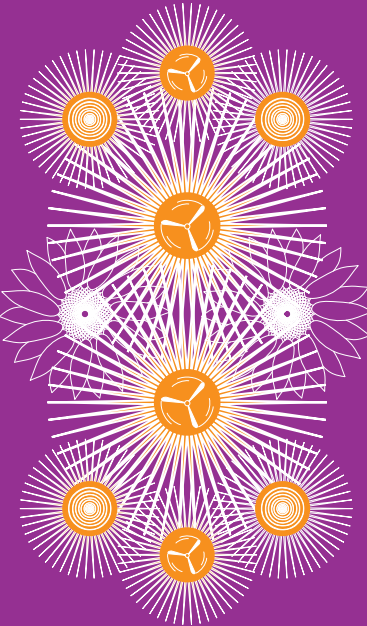
**HYDRO  
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landartgenerator.org



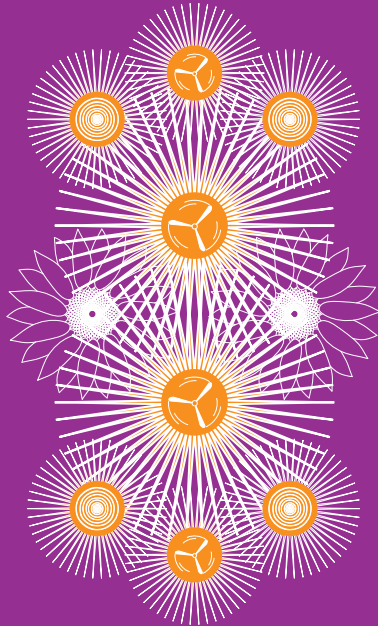
**HYDRO  
POWER**

landartgenerator.org



**KNOWLEDGE IS  
POWER**

landartgenerator.org



**KNOWLEDGE IS  
POWER**

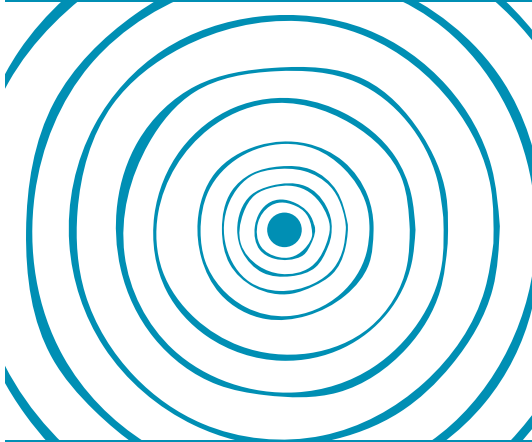
landartgenerator.org



**TECH**

## WILD CARD

Play this card with any hydro **ART** or **INFO** card.



**DESIGN  
INNOVATION**

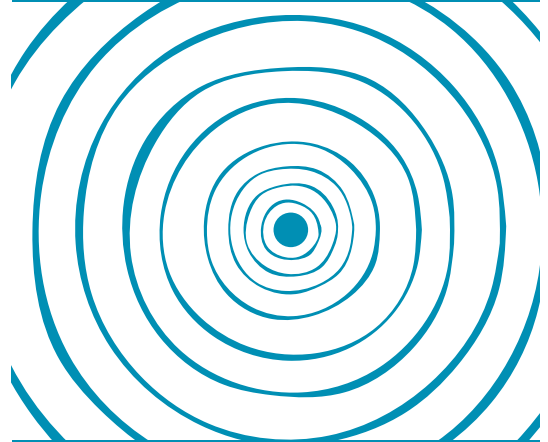
Innovation happens when you dare to think creatively about problems. The next decade promises to be an exciting time for new energy products and solutions, both in clean generation and in energy storage. Biomimetic designs—inspired by the way that fish, eels, and cephalopods move through water—are advancing our ability to draw energy from flowing water without harming wildlife.



**TECH**

## WILD CARD

Play this card with any hydro **ART** or **INFO** card.



**DESIGN  
INNOVATION**

Innovation happens when you dare to think creatively about problems. The next decade promises to be an exciting time for new energy products and solutions, both in clean generation and in energy storage. Biomimetic designs—inspired by the way that fish, eels, and cephalopods move through water—are advancing our ability to draw energy from flowing water without harming wildlife.

2–5 players  
Ages 13 +

## INSTRUCTIONS & GAME RULES

### HOW TO MATCH

Match an **ART** card with its corresponding **INFO** card for a two-card match.

#### EXAMPLE

*Sun Ray* **ART** ①

*Sun Ray* **INFO** ②

OR Match an **ART** or **INFO** card to the **TECH** card that it works with.

#### EXAMPLE

*Sun Ray* **ART** ① or **INFO** ②

*Solar Thermal CSP Linear Fresnel Reflector* **TECH** ③

OR Match a full set of **ART**, **INFO**, and **TECH** cards.

#### EXAMPLE

All three cards together as shown below

A **WILD CARD** can take the place of any **TECH** card in its category (solar, wind, bio, hydro).



2–5 players  
Ages 13 +

## INSTRUCTIONS & GAME RULES

### BEGIN

Each player is dealt five (5) cards.

The remaining cards are placed in a draw pile, face-down.

The first player is the one to the left of the dealer.

Gameplay is in a clockwise direction.

Set a timer for 7-minutes.

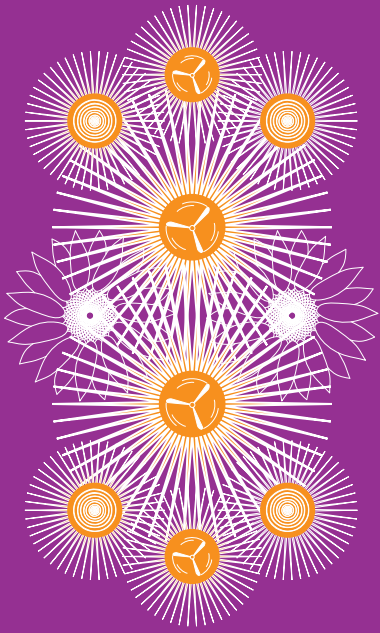
*If you can't transition to renewable energy quickly enough, you risk the whole table losing to a massive climate feedback loop.*

### PLAY

**1.** The first player looks at their hand to see if they can make any matches. If they can, they place one match (either a set of two or a full set of three) face-up on the table. Players can only place one match per turn.

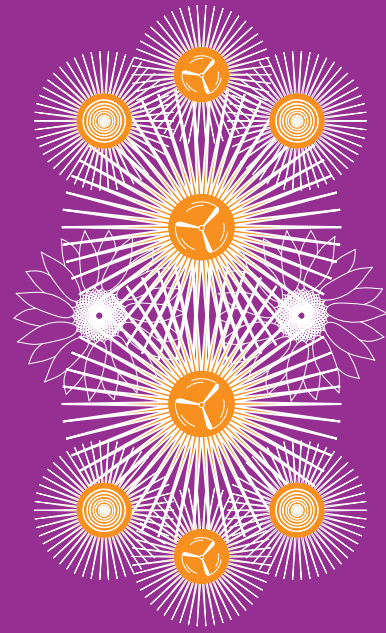
If they cannot make any matches, the same player asks the table if anyone has a **TECH** card that could help them make a match.

**2.** If another player has the requested **TECH** card, that person is obligated to hand that card over and replace it with a card from the draw pile.



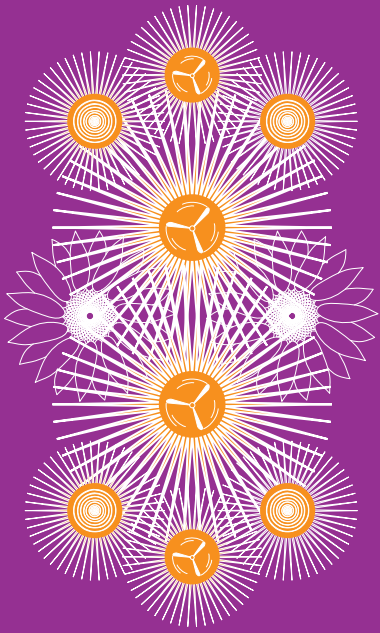
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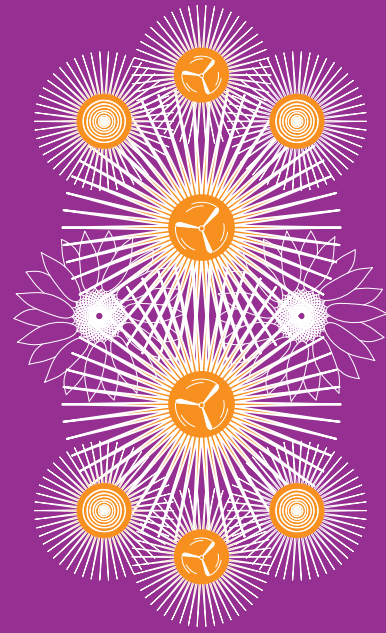
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2–5 players  
Ages 13 +

## INSTRUCTIONS & GAME RULES

Players may only ask the table for a **TECH** card. If the player does not need a **TECH** card, they will skip this step. If successful in seeking a match with a **TECH** card, the player places their match face-up on the table and ends their turn.

**3.** If no player has the requested **TECH** card—or the player still cannot make a match—they draw one card. If the card drawn allows them to make a match, they may do so and place it face-up on the table. If throughout their turn the player is unable to make a match, their hand grows by one card. Players can place only one match per turn on the table.

Play moves to the next person, who follows the same steps.

As soon as there are matches on the table, players may choose to finish a 2-card set by laying the matching card in their hand next to that set, making a full set of three.

Play continues until one person has “played to zero” exhausting the cards in their hand and thus saving the planet, or until the timer goes off.

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## Why play to ZERO?

A prosperous world that produces ZERO greenhouse gas emissions from the burning of fossil fuels will allow our planet to avoid a tipping point of runaway global warming. We can get there, but we have a long way to go. In 2017 we pumped 32.5 billion metric tons of carbon emissions into our very thin atmosphere and the number keeps rising every year. We must turn this around immediately and bring carbon emissions all the way to ZERO by the middle of the 21st century or we are risking the lives of millions of people.

The good news is that we live in a world of plenty and we already have the technology needed to bring about a prosperous and equitable net-ZERO world. If we design it, we can pass along to our children a global “circular economy” powered by the energy of the sun, wind, and water.

A circular economy is one in which we do not pollute our precious environment. Instead we use 100% biodegradable materials and reduce our waste streams to ZERO.

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## How many Homes?

A large and inefficient single family house—poorly insulated with the lights and air conditioning on all the time—will use about 10 MWh per year. That is how much the average home uses in the United States for example.

More efficient single family homes use far less—about 5 MWh per year—which happens to be the average in Australia.

5 MWh per year is the number that we have used in this game on the **ART** cards.



Smaller homes and apartments can use even less than that. The very best home, of course, is the one that uses the least energy or even ZERO energy!



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## MWh: A mega what?

A watt is a unit of measure of electrical *power* equivalent to 1/746 horsepower.

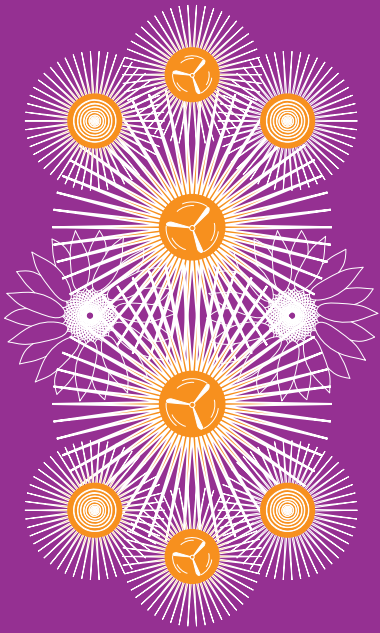
A watt-hour is the measure of electrical *energy* equivalent to one watt of power used or produced consistently over one hour of time.

A kilowatt-hour (kWh) is 1,000 watt-hours, or one kW output or consumption of power over a one hour period of time.

A megawatt-hour (MWh) is one million watts delivered continuously over one hour (or 1,000 watts delivered continuously over 1,000 hours).

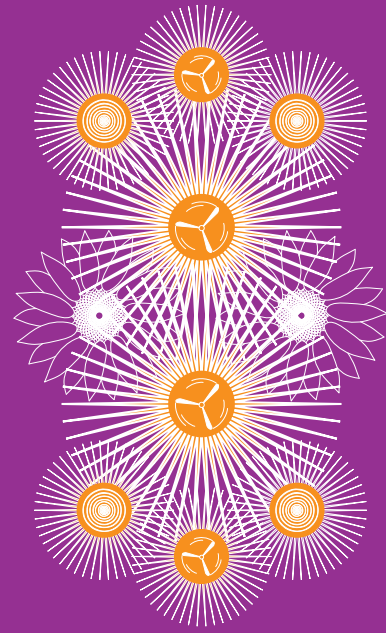
One solar module can generate 300 watts of power when facing the optimal direction on a bright sunny day. Over the course of a year that power accumulates to between 315 kWh–525 kWh of energy per year depending on the climate.

To meet the yearly consumption of a 5 MWh per year home, you can install 10 solar modules if you live in a sunny climate or 16 solar modules if you live in a cloudy climate.



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## About LAGI

The great energy transition will have an impact on our built environment and our cherished landscapes like no other technical advance since the automobile. Our cities and countrysides will look different in 2040 than they do today. At less than 2% share of our energy portfolio, the expanding presence of wind and solar infrastructure has already sparked intense debates about land use and real estate values.

But what if clean energy installations were designed as elegant solutions, appealing to the human need for aesthetics and beauty, for art and high design? What if we could spark the imagination of the world, inspiring the public about the beauty and cultural richness of our post-carbon cities?

The Land Art Generator Initiative (LAGI) is doing that by engaging interdisciplinary creative teams to innovate and collaborate—to design our new energy landscapes as playful works of art in public space.

### **CREDITS**

All images are the copyright as listed in each credit.

### **AVAILABILITY**

This Land Art Generator card game is available for free download in pdf format at [www.landartgenerator.org](http://www.landartgenerator.org)

### **EDITION**

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### **EDITED BY**

Tafline Laylin

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### **THANK YOU**

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