

The cases that are shown in this section provide an overview of art works that have used photovoltaic systems in a functional and/or aesthetic way. All the works presented here have been made after 2000 and -although the aim was to illustrate the use of various technologies- most of them use the predominant Si-based technologies.

As the focus of the research is on the off-grid use of PV, all the works presented are not connected to the main power supply. Where possible it is indicated if battery storage was foreseen.

Within this context the aim was to provide also a mix in terms of type of (art) work, the ideas behind it and the setting (indoor or outdoor).

More examples can be found in the general *PhoEf-overview*.

EarthSpeaker

Jeff Feddersen

Installation - NY, US – 2006/2007

PV-Set up: Off-Grid; Storage: not specified

PV-Tech: Not specified

www.fddrsn.net

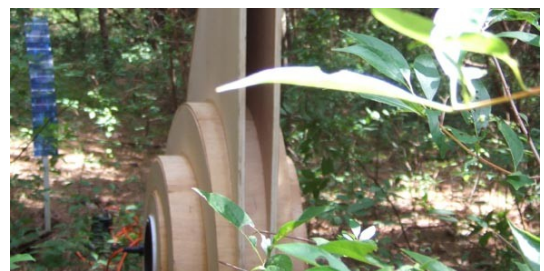
Earthspeaker consists of a set of large solar-powered nocturnal acoustic sculptures for the free103point9's Wave Farm in Acra (NY). The sculptures (*see images below*) absorb solar energy thanks to the built-in solar panels during the day and re-radiate the energy at dusk as amplified VLF (very low frequency) sounds coming from outer space lightening and human generated waves (i.e.: geophones) by its own integrated speakers. A prototype developed through a residency at Eyebeam, New York, was installed in the summer of 2006.



Earthspeaker_1



Earthspeaker_3



Earthspeaker_2

Frontier Mythology,

Nadir, Christine; Peppermint, Cary

Installation - NYC, US – July 2007

PV Set up: Off-Grid; Storage: not specified

PV Tech: Monocrystalline Si panels

www.ecoarttech.net



Frontier Mythology

A mobile, solar-powered environmental digital video and FM radio installation made of recycled shipping pallets. Three portable multimedia players inhabit a primitive, lean-to structure displaying videos of diverse contemporary environments while a transistor radio picks up a pirate radio transmission reciting quotations from classical works of U.S. Literature that both develop and critique the frontier myth that informs American constructions of land, nature, and wilderness. Originally designed to be located along a remote section of the Appalachian Trail.

Wilderness Trouble V1.0

Cary Peppermint, Christine Nadir

Video - NY, US - Summer 2006

PV-Set up: Off-Grid; Storage: not specified

PV-Tech: Polycrystalline Si panel

http://greenmuseum.org/content/artist_index/artist_id-136.html

Quicktime documentation of a solar-powered environmental sound installation involving over 30 international artists selected to create a sonic field of information imagining human-nature sonic communication.



Still from video 'Wilderness Trouble V1.0'

"Wilderness Trouble V1.0 " is one of various short Quicktime videos made with collaborator Christine Nadir. It revolves around their experiences living on a rural property in New York State. A haunting computer generated voice recites a steady litany of tech/rural contradictions as images of forests, subways, deer and solar panels jitter and flash by. "Concepts of wilderness, space, the American frontier and environmental ethics" clash with and inform how "new media technologies both limit and expand our conceptions of nature and the environment."

"Wilderness Trouble V1.0 " is part of Wilderness Information Network. Through his work with "The Department of Ecology, Art, and Technology", Cary Peppermint and his collaborators document, transmit, remix and cross reference the many "restless" links between nature and digital technology. Through immersive multimedia installations, collaborative events, performance, sound art and the Internet, Peppermint seeks to "artistically and creatively imagine non-primitive, ecologically sustainable futures".

SOH19 States of Nature

Alex Vermeulen – Syndicaat

Landscape Sculpture – Campus Technical
University Eindhoven, Holland – 2006

PV-Set up: Off-grid; No storage

PV-Tech: 88 Si-panels

www.syndicaat.org

SOH19 States of Nature is a landscape sculpture consisting of a levitating Buddha powered by solar energy. It consists of a pond of 1700 m² with 88 floating black eggs and is one of the biggest art works in the Dutch public space.

Each egg is equipped with a solar panel and the produced electricity generated by all eggs is converted into a magnetic field. This magnetic field makes a human figure, placed within a transparent cylinder in the middle of the pond, levitate and moving up and down. The amount of generated power depends on the strength of the sunlight, the wind and clouds, and dictates how high the central figure rises. In the morning it will appear from under the water surface. "*SOH19 States of Nature*" is a powerful image of the dynamic relationship between the forces of nature, technology and art.



Together with the sculpture comes the book "*SOH19 States of Nature; Sun enlightenment*". It covers the history of the conception of the work, with a focus on the different disciplines that converged during the creation; physics and art, technology and spirituality, solar cult and sustainable energy, biological processes and social interaction.



During 5 years, about 30 students of the *Technical University of Eindhoven* (Holland) have worked together to make this project happen. It is being supported by the university, diverse companies, art-foundations and governmental organizations.

SOH19 States of Nature is one of the episodes of *States of Humanity* (SOH), an overall work of art containing several episodes that started in 1996. The egg-

shaped anthropomorphic figure that appears in the sculptures forms an archetype, a metaphor for the themes of the SOH project. The various facets of SOH are created as a consequence of each other, but also independently of each other in harmony or disharmony - seemingly without any connection or closely linked, just like life in a metropolis.

Various Works

Bjoern Schuelke

www.schuelke.org

Bjoern Schuelke is a multimedia artist based in Cologne. His 'machines' combine elements of surveillance technologies, robotics interactive video and sound. Schuelke's kinetic sculptures question the way in which we interact with modern technology: on entering the installation site, the audience becomes part of the 'system' as the works (some freestanding, others suspended) monitor or react to the human element. His electronic sound and video machines provide us with a sensory experience, yet one in which we are not always in control, rather his machines react to or observe us. Since 2000 he created five 'kinetic objects' using photovoltaics as a key functional and aesthetic element.

Drone #2

Autonomous observing system –
Köln, Germany, 2002

PV-Set up: Off-Grid; No storage

PV-Tech: Solar panels; type not
specified

www.schuelke.org/drone.html

The futuristic appearance of "Drone #2" seems like a requisite from a science fiction film. The autonomous hi-tech construct, consisting of solar cells, heat sensors, propellers, video chips and a TFT monitor is suspended from the ceiling and reacts to the "warmblooded" spectator without him or her being able to directly influence its movement.



Drone #2

At first glance finely structured and fragile, *Drone #2* mutates, once activated, into a menacing surveillance apparatus whose function is nothing but permanent observation.

Other works with photovoltaics:

[Solar Kinetic Objects](#)

[Spacebell](#)

[Spacestick](#)

[Planet Space Rover](#)

References:

<http://johncurtingallery.curtin.edu.au/exhibitions/archive/2004.cfm>

www.artcal.net/event/view/1/6133



Planet Space Rover

CO2LED

Jack Sanders, Robert Gay, and Butch Anthony

Installation - Rosslyn, Virginia, US - June 6-15, 2007

PV-Set up: Functional use, Off-Grid, Storage: unknown

PV-Tech: Si

www.thoughtbarn.com/CO2INFO.html

552 solar-powered LEDs (light-emitting diodes) secured to rods of varying heights, each topped with a reused plastic drink bottle, illuminate the traffic island between North Lynn Street and Ft. Myer Drive. The poles' slight flexibility, combined with the LEDs' nebulous glow underneath the ridged surfaces of the plastic drink bottles, create a soft, undulating cloud of light.



CO2LED

A native American prairie grass, little bluestem, is planted beneath the poles and stands in contrast to the grid upon which the poles are installed. At the exhibition's conclusion, the plants will be transplanted to sites throughout the County and all project materials will be recycled. All the materials are purchased in collaboration with local materials suppliers. CO2LED was developed in conjunction with [Planet Arlington](#), a year-round cultural programming initiative designed to explore issues of immigration, globalization and the environment through the lens of the arts and humanities.

London Oasis

Laura Chetwood

Installation – London, UK – June 16-25, 2006

PV-Set up: Hybrid PV/Wind; Off-Grid; Storage:

Hydrogen fuel cell

PV-Tech: not specified

www.thelondonoasis.com

The London Oasis is a demonstration of sustainability and renewable energy working with aesthetic architecture to provide a tranquil space – an oasis for London.



London Oasis

At the base, the Oasis has five 'pods' inside which people will be secluded from the noisy and polluted surroundings, enjoying cleaner cooled air, and relaxing sounds. There are also further areas providing social rendez-vous and a stage for entertainment.

The 12 meter high kinetic structure mimics the design of a growing flower: its photovoltaic 'petals' open and close in response to the sun and moon utilising daylight to generate power. This is supplemented by London's first hydrogen fuel cell in a public area integrated with photovoltaics and a wind turbine, to make it self-sufficient. Rainwater is collected for irrigation and cooling air.

The London Oasis opened on June 19 on Clerkenwell Green, London EC1, as part of the London Architecture Biennale 2006 and national Architecture Week (June 16 - 25).

PowerPLANTs and PowerSEEDs

Nik Hafermaas (UeBERSEE INC.)

Bionic and sustainable artistic light installation –
Pasadena, US - 2007

PV-Set up: Off-Grid; Storage: unknown

PV-Tech: not specified

www.uebersee.us

PowerPLANTs and the PowerSEEDs is a sustainable, dynamic and poetic artistic intervention and landmark in a former industrial area.

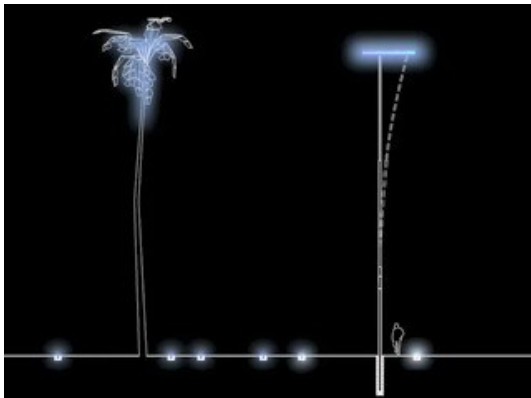


PowerPLANTs

Through the PowerPLANTs project, visual communication is taken from literal messaging to the abstract exchange flow of information, adding a new poetic dimension to the environment. Dynamic and animated, sending light impulses through an entire area, visualizing the ubiquitous yet invisible information network. Merging natural, random behavior (plant-like movement, swaying/turning in the wind) with electronic impulses of an organized swarm of lights.

Each unit is designed to be completely self sufficient using photovoltaics without the need for wiring, cables. The PowerPLANTs project integrates additional light sources that are connected to the programmed network: PowerSEEDs that are embedded in the sidewalk-pavement and illumination for the real trees that are in the area.

Research revealed that this specific neighborhood and their inhabitants have suffered from decades of neglect — a common phenomenon in urban areas in the U.S.. The main goal of the artistic installation is to create a new pride of place in this community.



PowerPLANTs & SEEDs - Movie Still



PowerSEEDs

Individual units are planted and replanted according to the further development of the entire area. Distributed ownership of individual plants through an "Adopt-A-PowerPLANT" program, where donors' names will accompany the installation of each new unit, more will be added on an on-going basis.

This multidisciplinary project involved the knowledge of structural engineers, solar energy and computer science specialists and city planners.

Regent College Wind Tower: PV art glass

Sarah Hall

Stained glass with PV installation - Vancouver, Canada – 2006

PV-Set up: Off-grid; Storage type: not specified

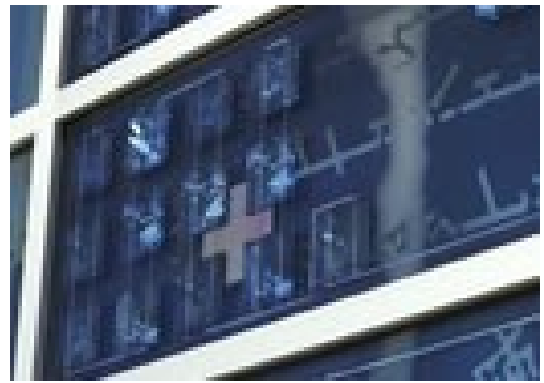
PV Tech: Thin Silicon Cells

www.sarahhallstudio.com/photoglass

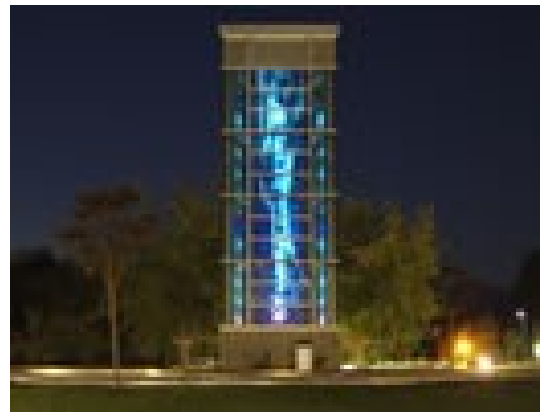
Sarah Hall created the first stained glass installation in North America to utilize photovoltaic cells. It is the central element of a Wind Tower built in 2006 as part of the mechanical system of the new library at [Regent College](#) on the campus of the [University of British Columbia](#) in Vancouver (Canada). The highly visible and publicly accessible 40-foot-high wind tower incorporates 144 square feet of photovoltaic art glass embedded in the tower's window.

The photovoltaic array, is composed of thin silicon and metal cells that convert sufficient sunlight into electricity to illuminate the wind tower's colored LED lighting system, also designed by the artist. The idea is to combine beauty and function to present a clear message about art, science, and social responsibility.

The window components (art glass, photovoltaic cells, tempered glass, and LED's) are combined using a patented method. The solar cells are sandwiched between two panes of extra-clear tempered -laminated- dichroic glass making it heat-strengthened, completely transparent and totally reflective. This produces rainbows – in both transmitted and reflected light – constantly changing as the glass reflects the trees, sky, sun, clouds, shadows and moonlight. This way the window provides insulation through double-glazing at the same time generating electrical energy that can be stored for later use (illuminate the interior at night or else directed into any number of designated illumination requirements).



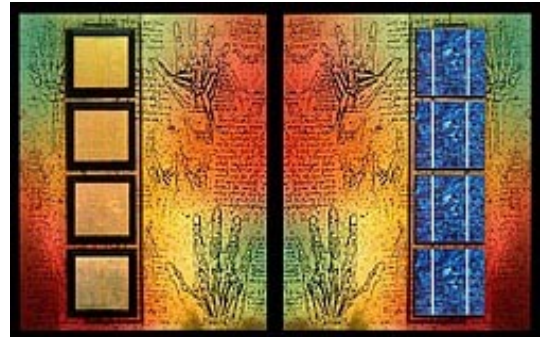
Regent Wind Tower. Photo: Ken McAllister
©2007 Regent College



Regent Wind Tower. Photo: Ken McAllister
©2007 Regent College



'Blue Vine' - PV art glass by Sarah Hall.



PV art glass by Sarah Hall

In 2005 Sarah Hall started integrating PV- elements into architectural art glass. The geometric arrangement and spacing of the PV-cells is designed and integrated into the artwork itself, giving varying degrees of transparency and sun-shading. The artwork layer of glass may be coloured, sandblasted, airbrushed, gold-leafed or hand-painted.

ELFs

Pascal Glissmann and Martina Höfflin
Installation (2-part) – Germany - 2007
PV-Set up: Off-Grid; No storage
PV-Tech: not specified
www.electronic-life-forms.de



ELFs

'Elfs' are small mechanical systems powered by solar energy that behave as natural living systems in many aspects. 'Elf' is a two-part installation developed in the context of artists' research project 'electronic-life-forms'. On one hand, the 'elves' are documented in their natural habitat, and the fading contrast of electronics and nature gives the scenario a surprising common impression. On the other hand, the imprisonment of these life forms in Weck-Preserving-Glasses reminds one of childhood adventures, exploring and discovering the world around us. The light-sensitive 'elves' desperately use their chaotic sounds and noisy movements to call the attention of the outside world. Even though their abilities are very limited, the immediate compassion for these life forms is an amazing experience.

"Robots still do not have the abilities, science and fiction promised us. Therefore our work is focused on very simple life approaching systems. It is fascinating to use very un-organic material, put it together in a way that it is still recognizable but adding some simple pure function that gives this living expression. The whole idea of this project is the exploration of technology and putting it in a new context / environment/ perspective which questions the relationship between technology, nature and humans."

Bonding Energy

Douglas Repetto and LoVid

Energy Network Project - NY, US - Oct. 07- Oct. 08

PV-Set up: Off-Grid; No storage

(Sunsmile) and Grid-connected (computers).

PV-Tech: Not specified

<http://transition.turbulence.org/Works/BondingEnergy>

Bonding Energy is an electrogeography and data visualization project that consists of a set of devices that collect and measure electromagnetic radiation (solar energy) from seven geographically distributed sites around the New York State. The light energy reaching the solar panels of these Sunsmiles fuels a collaborative real-time data visualization on Turbulence.org.

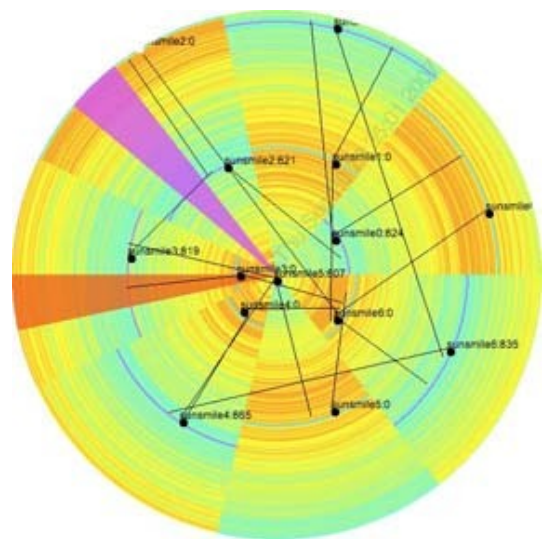


Sunsmile #1, free103point9 Wave Farm]

Bonding Energy is inspired by ideas associated with micro-credit loans and distributed computing applications such as SETI@home. It presents a model system for distributed microenergy generation in which geographically dispersed devices collaborate to analyze a large scale phenomenon (light levels) using solar panels. In a microenergy system these panels would also harvest energy from the light they measure. Bonding Energy's live graphical representation of luminance readings suggests the utopian possibility that many such small local energy collecting devices could produce a greater effect than the sum of their parts, helping contribute to energy independence.

A group of geographically distributed media arts institutions in New York State participated in Bonding Energy by hosting one of the Sunsmile devices that measure and send solar data to a central server.

"In keeping with our general CCRT working method, the physical form of the devices was determined by our interpretation of a previous generation of solar data manually collected in our studios each day during January 2007. The 31 data points were used to cut acrylic rings for the bodies and to create molds for the cast plastic bases. Each Sunsmile holds a printed circuit board and has a small solar panel sitting on top."



*Real-time data visualization-
Turbulence.org*

Every ten minutes each Sunsmile device takes a reading from its solar panel and sends the data to the turbulence.org server. When a viewer visits Bonding Energy they are presented with a live visualization of the data collected from the seven devices. Data from each device is represented by a wedge in an animated circle. The colors in the wedges change as the data from the previous seven days is played back; oranges represent low light levels, yellows medium, and blues indicate high ones. Highlighted bands indicate maximum and minimum data values, and a rotating line of text displays the date and time of the data being displayed in the center of the circle at each moment. Shapes overlaid on the animation represent changing data relationships between and within the Sunsmile devices."

Walk

Laurie Anderson

Series of installations – Aichi Expo 2005, Japan
PV-Set up: Off-grid; no storage (Aimulet LA) &
Grid-connected (other system components).

PV-Tech: Spherical Si

www.kyosemi.co.jp/product/pro_ene_sun_e.html

http://staff.aist.go.jp/r.kaji/aimulet-la/index_english.html



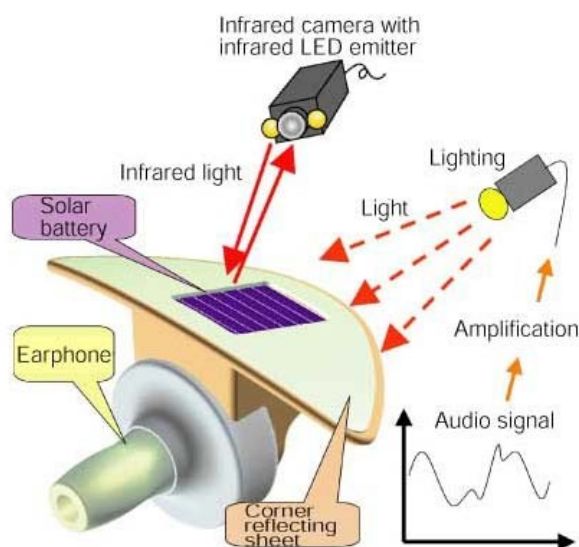
Aimulet LA

www.expo2005.or.jp/en/event/event04/0403/by_dates2-89a82e37d822a07a49256fd2003bfbf8-open.html

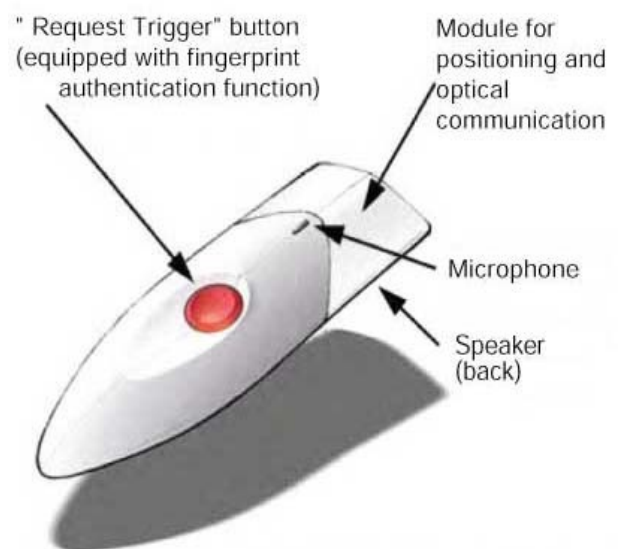
Walk is a series of outdoor installations created by Laurie Anderson consisting of a series of visual installations and a binaural piece of music as you walk in a huge Japanese style garden. An infrared system lets the visitor access poems in four different languages on tiny wireless cards called the Aimulet LA.

Laurie Anderson designed the AimuletLA in collaboration with Japanese designers. The device is made out of bamboo, is slightly larger than a credit card and is to be held up to the ear like a cellphone. As soon as one stands over special LED emitters set into the ground, Aimulet LA receives the infrared light signals via an array of spherical micro silicon solar cells (called 'Sphelar' by manufacturer Kyosemi) set into the bottom of the handset. Aimulet LA translates the signals into audio messages that are transmitted through a tiny speaker in the device. It requires no battery. One may simply point the AimuletLA at an item of interest in an exhibition powered by [SphelarVoice technology](#), and infrared light carries audio information that is decoded by the card.

According to manufacturer [AIST](#), the technology at work in Aimulet LA can be put to use in public spaces such as outdoor exhibits and events, amusement facilities, train stations and parks, where it can be used in interactive media or entertainment. In addition, the low cost of the device means it could also double as an entrance ticket, annual pass or ID card.



The Compact Battery-less Information Terminal (Aimulet ver. 1)



Aimulet

The Portable Light Project

Sheila Kennedy in collaboration with MATx (KVA).

PV-Light in textile – Michigan, US / Sierra Madre, Mexico – 2006

PV-Set up: Off-Grid; Storage: unknown

PV-Tech: CIGS (flexible thin-film)

www.portablelight.org/

www.kvarch.net

The Portable Light Project consists of textiles and non-wovens using sunlight to harvest electrical energy. They provide a completely self-contained source of renewable power and light that can be deployed at a global scale where ever energy-efficient electrical power and illumination are needed.

The textiles are highly adaptable and utilize lightweight nanotechnology which can be integrated by local communities into traditional cultural artifacts and carried from place to place.



a Huichol family gathers around the table with a Portable Light Unit - Photo: Kennedy & Violich Architecture, LTD.



Portable Light Units integrated into traditional Huichol carry bags. - Photo: Kennedy & Violich Architecture, LTD.

The project was first introduced in the Mexican Sierra where ancient Meso-american weaving traditions of the Huichol people were integrated with flexible CIGs based thin-film photovoltaics and solid state lighting to create adaptable models for portable, energy harvesting textiles as shawls, bags and other textile products.

The energy efficiency of high brightness solid state lighting (HBLED's) means that a bright digital light of 80 lumens/Watt -bright enough to read, work and illuminate areas at night- can be produced by a single miniature diode and powered by small areas of flexible photovoltaics.

The idea is that even in small amounts, digital light can help to expand educational opportunities, improve community literacy and health and increase daily household economic production. The people who will benefit the most from the introduction of these technologies are women and children who live in the world's poorest countries.

Portable Light is based upon the principle that global needs for technology development are inevitably interconnected. Knowledge, techniques, market solutions and data produced by the project benefit the "third" world and the "first" world where the need to imagine, design and develop energy efficient alternatives to the centralized and increasingly costly electrical grid is becoming ever more important.

The Portable Light Project is a non-profit initiative that was initiated in 2003 by Sheila Kennedy in collaboration with MATx, the pioneering materials research unit of Kennedy & Violich Architecture, Ltd. (KVA). The interdisciplinary project team includes architects, anthropologists, engineers and medical doctors.

Forest Rising; Barefoot College: A House

Marjetica Potrc

Installation works – Various locations – 2002 and 2007

<http://potrc.org>

Marjetica Potrc developed a number of installations involving PV-systems based on practices of self-sustainable technologies by Brazilian communities, *The Barefoot College* and the *Burning Man Festival* practice.

Barefoot College: A House

Building materials, energy infrastructure - [Max Protetch Gallery](#), NYC, US - 2002

PV-Set up: Off-Grid; Storage: not specified

PV-Tech: Si-panels



The Barefoot College: A House

The structure is based on houses created by untrained architects for Barefoot College in Tilonia, India. Equipped with solar panels and able to harvest water, these houses make it possible for the settlement to generate its own energy. This combination of local knowledge, high technology, and the principle of self-sufficiency has won the Barefoot Architects international recognition.

Forest Rising

Tree trunks, building materials, energy and communication infrastructure

The Curve, Barbican Art Gallery, London - 2007

PV-Set up: Off-Grid, Storage: unknown

PV-Tech: PV-panels, type not specified

A rural school, equipped with satellite dish and solar panels, stands on an island elevated by tree trunks. Visitors walk beneath a satellite, the elevated island and a helicopter platform. The project is based on practices developed by Amazonian communities in Brazil in response to the most pressing social, economic and environmental concerns of the 21st century. Their ideas for the future include the development of small-scale economies, a new citizenship, the University of the Forest, the protection of knowledge, the protection of territories, and global connectivity.



Forest Rising

Also see *Xapuri: Rural School* and *Burning Man* on <http://potrc.org>

FUTURE PROJECTS

The great New-York Oyster Project

Mara Haseltine

'Living' installation - New York City McNeil Park

College Point Queens – June 2007

PV-Set up: Off-Grid; No storage

PV-Tech: Ongoing research

http://calamara.com/transcriptease_2.html

In June 2007 Mara Haseltine created and installed her first oyster reef. The idea is to bring back the *Crassostrea Virginica* to New York, which would create a natural filtration system that cleans the waters and simultaneously reintroduce biodiversity that has been missing in New York's waters and estuaries since the Industrial Revolution.



Detail of Reef, Day of installation at Low Tide (Pre-Oysters), June 2007

The concept was to create a modular design in metal, using PV-panels to send low volts of electricity to metal and thus causing mineral accretion to occur as calcium carbonate formed on the structures (a positively charged anode and a negatively charged cathode suspended in sea water with an electric current flowing between them combines calcium ions with carbonate ions that adhere to the structure (cathode)). Corals adhere to CaCO_3 and grow quickly. In this prototype the pre-existing wooden pilings served as a structural support to create vertical structures.



Detail structure with tagged oysters

In the wild, oyster larvae typically settle on oyster shells which are composed of calcium carbonate or limestone. So with this experiment the calcium carbonate covered surfaces of the metal will in time become ideal settling spots for oyster larvae. The process is called "[Biorock](#)" and was originally developed by Architect Wolf Hilbritz and used worldwide for coral reef restoration

Oysters are the backbone of the benthic habitat and can act as natural water treatment plants. The average oyster filters 5-25 gallons of "nutrient" rich water per day. The restoration of 100 square miles of reef would filter twenty seven billion tons of waste water that flows into New York's Waterways annually. The reef would not only be a haven for oysters but would quickly become a diverse habitat for aquatic life of all forms from gastropods to Stripped Bass.

This cross-disciplinary project involves marine biologists, Environmental Scientists, Community Activists, Oyster Farmers and Gardeners work to find the best solutions for restoring oyster beds which have historically graced New York's Waterways in abundance.

Bamiyan Afghanistan Laser Project

Hiro Yamagata

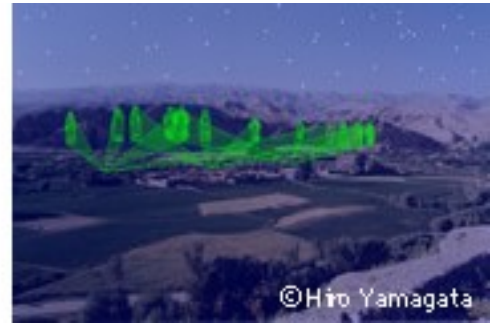
Laser Installation - Bamiyan City, Bamiyan,
Afghanistan - opening in June 2012

PV-Setup: Hybrid wind/PV; Off-grid; Storage

batteries: not specified

PV-Tech: not specified

www.bamiyanlaser.org



The concept is to create original images of Buddha and project them with the most unique, powerful and cutting edge laser technology of today onto the site where once the ancient Bamiyan Buddhas stood. Thus we will be able to revive the great creative spirit of mankind which produced the Great Buddha of Bamiyan centuries ago. A collaboration of ancient and new art will become a cultural icon of revived civilization in Afghanistan.

The laser systems will receive electricity from wind turbines and solar power plants. A part of this power is meant to provide light and electricity for the people of Bamiyan.

The original Bamiyan Buddhas were created approximately 1500 years ago, as one of the most significant historical monuments of mankind. By permanently creating an artwork of laser system installation in Bamiyan, we intend to stimulate both the land and the people of Bamiyan.

Over 250 laser systems installed 500m, 1km and 5km in distance from the Bamiyan hills will project multiple layers of 160-240 original Yamagata Buddha images drawn in striking colors. The laser images will be projected for 1 hour after sundown, 6 days without Friday.



The laser systems built specifically for this installation will shoot long range green beams and short range multiple color beams, designed to create a striking contrast to the purplish red hue of the Bamiyan sunset and the black mountain shadows.