

PHOEF - THE UNDISCLOSED POESIS OF THE PHOTOVOLTAIC EFFECT.

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ABSTRACT: Grid independency, silent electrical energy generation without emissions, harmless low-DC-power, mobility and new materials with new aesthetics are key characteristics of photovoltaic technologies. Together with new scientific tropes that are emerging in this highly vibrating multidisciplinary field, they have attracted a first generation of 'early adapters' in the arts. It allows for further dynamic exploration of the complex relation between light, electrical energy and the media that can be used to represent it. In their turn, these explorations generate new artistic tropes originating from unexpected set-ups, combinations of materials and contexts of employment that might lead to new scientific questions possibly benefitting the improvement of the PV-technologies. Moreover, in the current reshaping of the organization of access to energy, the arts can and should play an active and critical role.

Keywords: Stand-alone PV Systems; Arts; Collaboration arts and science

1 TWO KEY OBSERVATIONS

2.1 AC RDC

Kinshasa, RDC, 2006 - The electricity infrastructure of the capital of the Democratic Republic of Congo dates back to colonial times. Power cuts or absence of electrical power are a major issue today in this urban jungled sprawl, as it is inhabited by over 8 million souls. As a consequence, creative entrepreneurs connect wires to the main electricity cables pending above the ground, in order to 'rent' the energy further to nearby households. These wires are often lying on the ground open and unprotected, posing a life-threatening danger adding up to the courageous connectivity maneuvers. However, the highest numbers of casualties caused by these micro-economic activities occur when the tropical rains are turning the cities' 'roads' into tiny rivers, freezing most of the means of transport. Consequently people have to walk back home -often at night in the dark- wading through these open gutters. As the electricity wires have become invisible, one estimates that at least a dozen of people get electrocuted at every downpour. An image which gets superpositioned by the one of *Topsy* the elephant, who was electrocuted 105 years ago by [DC] Thomas Edison who tried to prove George Westinghouse and Nikola Tesla's alternating current (AC) was dangerous, whereas his competing direct current was completely safe. [1]



Figure 1: Peket - Part of *Agit A/R*, an installation work by Bartaku based on experiences in RDC (Photo: Bartaku)

1.2 DC Peace Water Pump

Freiburg, Germany, 2007 - At the photovoltaic energy fair *Intersolar*, the middle path was occupied by the 'peripheral' products and services of the solar energy realm. In one of the stands –the most 'Confucian' one- water pumps were being sold. A demo set-up in front of the tent consisted of a black bucket filled with water and some tiny water pumps, and right next to it, an m-Si PV-panel. This lo-fi, poetic 'installation', became highly interactive whilst the sprinkling sweet water responded immediately to the gestures of the hand in front of the PV-panel. This vernacular 'experiment' demonstrated that a PV-panel can function as an actuator -a generator which transforms cosmic old light into electrical energy on the spot- and simultaneously as a light sensor that can be used as a (real-time) controller of an electricity powered device. In this responsive, locative media- context shade is being transformed from an enemy into an important ally.



Figure 2: Controlling a water pump by interaction with solar panel at Intersolar 2007 (Photo: Bartaku)

'shadows are light that is struck out.'
Paul Chan, video artist (US) [2]

This low-power DC device highlights the fact that the number of devices operating on DC continues to rise – partly due to the rise of PV tech [3]-, re-introducing here the idea of a second *War of the Currents*, especially against the backdrop of the 'old' model of centralized top-down distribution being challenged by the model of distributed generation. From a more peaceful angle, this appliance can be seen as a conflict prevention tool,

declining the risk on Fresh Water Wars fought over access to water.

2. PV APPLIED IN THE ARTS*

2.1 Distributed Generation and Energy Independence

Bonding Energy is an ongoing research project by US artists Douglas Repetto and LoVid that started in October 2007. It consists of a set of devices that collect and measure solar energy from seven geographically distributed sites around New York State. The solar panels of these Sunsmiles capture the light energy and the radiation data are sent every 10 min. to a server for real-time data visualization on www.turbulence.org. The ongoing project is based on ideas associated with micro-loans and distributed computer applications and suggests the utopian possibility that many such small local energy harnessing devices could produce a greater effect than the sum of their parts, contributing to energy independence. Bonding Energy is part of Cross Current Resonance Transducer-Project.

Another project that also reflects the possibilities of a distributed generation model based on the combination of renewable energy (PV) with digital media and computer networks is the Solar Collector, made by Gorbet Design Inc. This interactive light sculpture is operating in Cambridge, CA since June 21st 2008. Twelve tall shafts rise at angles from a roadside hilltop of which each has three sets of LED-lights, powered by 24 m-Si solar cells. The BoS-components consist of 12 lead-acid batteries (AGM) a charge controller and a DC-DC-converter. Using simple web-based controls, members of the community compose wave-based patterns that flow across pulsing lights that are spaced along the shafts. At dusk, Solar Collector comes to life with the patterns created that day. The total length of the performance is a reflection of the weather and the seasons, as the shafts use up their energy and fade out late in the evening, one by one. www.solarcollector.ca

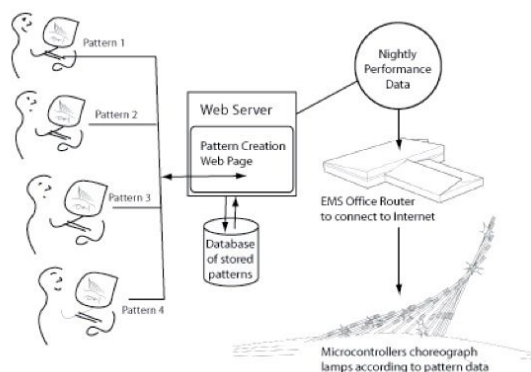


Figure 3: Components of Solar Collector, an interactive light sculpture by Gorbet Design Inc.

2.3 Kinetic Sculptures

Photovoltaics are also used for the generation of kinetic movement. In 2006 Laura Chetwood (Associates) created the London Oasis installation (London, UK). The work demonstrates sustainability and renewable energy

working with aesthetic architecture to provide a tranquil space – an oasis for London. 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 utilizing 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. 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. www.thelondonoasis.com



Figure 4: London Oasis. A kinetic 'growing flower' powered by wind/PV and a hydrogen fuel cell, created by Chetwood Associates.

A PV-system has also been developed for the creation of kinetic movement in public space by Dutch artist Alex Vermeulen. [States of Humanity19]. States of Nature (Technical University Eindhoven, Holland, since 2006) is a landscape sculpture consisting of a levitating Buddha in a pond with 88 floating black eggs. 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. Different disciplines converged during the creation; physics and art, technology and spirituality, solar cult and sustainable energy, biological processes and social interaction. The work is the result of a year-long collaboration with the Technical University of Eindhoven. www.syndicaat.org

2.4 Silent PV & electronic media

New-York-based installation artist/engineer Jeff Fedderson started creating his acoustic sculpture Earthspeaker in 2006/2007. This work consists of a set of large solar-powered (glass polycrystalline cells) nocturnal acoustic sculptures for the free103point9's Wave Farm in Acra (NY). The sculptures absorb solar energy during the day thanks to the built-in solar panels and re-radiate the energy at dusk as amplified VLF (very low frequency) sounds coming from outer space lightning

and human generated waves (i.e. geophones) by its own integrated speakers. The energy is stored in a bank of ultracapacitor modules. Jeff Feddersen teaches renewable energies at New York University. In the summer of 2008 he participated in a DIY-solar tracking project based on the components of a Lego-kit at the Habana Outpost, New-York's first solar-powered restaurant and market in Brooklyn. www.fddrsn.net

The only example of an indoor use of PV in this paper, is from Björn Schülke (Germany). Since 2000 he has been using photovoltaics for his kinetic sculptures and multimedia installations. His 'machines' combine elements of surveillance technologies, robotics interactive video and sound. Schülke'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, it is the machines that react to or observe us.



Figure 5: Drone #2. An Autonomous Observing System by Björn Schülke.

Drone #2 is an Autonomous Observing System with a futuristic appearance making it seem like a requisite from a science fiction film. The autonomous hi-tech construct, consisting of solar cells, heat sensors, propellers, videochips 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. This construction, at first glance finely structured and fragile, mutates, once activated, into a menacing surveillance apparatus whose function is nothing but permanent observation. www.schuelke.org

A third example -returning to natural light- is Walk, created by media & performance artist Laurie Anderson (US). Walk is a series of outdoor installations 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 device in collaboration with Japanese designers of the Information Technology Research Institute at Japan's National Institute of Advanced Industrial Science and Technology

(AIST). The device is made out of molded 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 (Sphelar) 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. http://staff.aist.go.jp/r.kaji/aimulet-la/back_take_english.html

2. New PV for Metabolic Media

Rachel Wingfield is a London-based artist/textile designer who is experimenting with recent, versatile PV-technologies like dye-sensitised solar cells (DSSC) and Organic (polymer-based) PV. With her Metabolic Media project she responds to increasing urban pressures with a modular, textile architecture for growing food, a projection on recent developments in architecture, agriculture, materials and sensor technologies. Using a construction system based on weaving and lace-making -synetics - she plans to create textiles on an architectural scale from new composite materials that reflect the relationship between energy and structure, mirroring ATP, which stores and releases energy.

Metabolic Media is part of the Nobel textiles project which involves a journey into the interface between science and design, a dialogue between leading researchers in both fields. As a research fellow at Central Saint Martins College, Rachel Wingfield is liaised with a Nobel prize-winning scientist John E. Walker -who is specialized in biological energy conversion in living cells- to develop textiles based on scientific discovery. Exploring the possibilities of polymer-based flexible solar cells she also collaborates with Risø DTU, The National Laboratory for Sustainable Energy at the Technical University of Denmark. <http://loop.ph>



Figure 6: Rachel Wingfield's architectural space-frame with organic polymer PV by Risoe (Photo: Simon Denton)

5. CONCLUSIONS

The strong vibrations of the expanding realm of photovoltaics provide many opportunities for the arts to combine aesthetics with function and to present a clear message about art, science, technology and social responsibility. Since the beginning of the 21st century a very limited but steadily growing number of artists -mainly from North-America and Western Europe- has started experimenting with the technology. The diversity of PV technologies -either existing or 'under construction'- remains undisclosed in the poésis, the arts practices where mainly the predominant bulk Si solar cell technology is being used, mainly in an outdoor context using natural light. As the interest in the blend of arts, science, ecology and technology is growing, the need for access to up-to-date information, adapted education and training, access to materials and for collaborative arts/science projects is strongly gaining momentum. As the PV-technologies provide much more freedom in terms of use of time and space in the artistic practice, they also enable the emergence of new relationships between the artworks and their audiences /users.

'Green chemistry is replacing our industrial chemistry with natures recipe box. Its task is to figure out the elegant recipes and create new materials.' [4]

6. ACKNOWLEDGEMENT

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* Unless indicated otherwise, the information about the art works originates from their websites and/or from correspondence/meetings.