Open Classroom
VISIONING DOCUMENT

A Project Of
TULANE UNIVERSITY

A Collaboration With
THE TULANE CITY CENTER

Sponsored By
TULANE SCHOOL OF ARCHITECTURE
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VISION
The project envisions a multi-purpose open classroom on the former site of a 9/11 Memorial, a project doomed by the aftermath of hurricane Katrina on Tulane University’s Uptown Campus. It is a reincarnation of the memorial as a Temple of Sustainable Technology and Education, reflecting the milieu of the post-9/11, post-Katrina society.
The proposed project is located on the former site of a 9/11 Memorial on Tulane University’s Uptown Campus.

The pavilion consists of a roof canopy, a floor deck and operable screen walls. It pays homage to the 9-11 Memorial by resurrecting the abandoned foundation.

The canopy functions as an armature supporting a solar energy collection system. The harvested energy will illuminate the structure, feed the fleet of electric golf carts and a digital display system showcasing the University’s commitment to sustainable campus development.

Operable screen walls create a series of covered teaching-learning space(s) that can be configured to accommodate various groups and their gathering styles. It also transforms the pavilion into a stage for occasional all-campus scale gatherings.

Site work mediates the edge condition between existing building and the pavilion, reshaping perception of the campus grounds. It is a passageway connecting the parking to the quad as well as an ADA ramp to the building entrance and a raked seating for the pavilion.

A “digital kiosk,” a solar powered message board displaying the University’s community initiatives and service activities will accompany the structure. It will be designed as a freestanding element, deployable in other locations and will incorporate a permanent donor insignia acknowledging those who supports the cause.
PHOTOVOLTAIC TECHNOLOGY
The efficiency of a solar cell depends on the incident spectrum and the temperature of the cell as well as the concentration of the light. Photovoltaic cell technology has made a tremendous advance in the last 30 years. In particular, cells based on Gallium-Arsenide multi-junction technology are achieving substantially higher efficiencies than other cell technologies, operating very close to the theoretical limits. The layering of multiple materials, each suitable for absorbing a specific spectrum of light allows the conversion of nearly all of the solar spectrum. In general, the photovoltaic cell technology will continue to advance and will hit the ultimate efficiency limit, converting 100% of solar spectrum (energy) into electricity under an ideal condition.

Similar to the situation with CPU2 of computers in the 60's issues governing the PVC technology are not simply about the efficiency of the cells themselves. They are about the overall performance measured in economic terms, $/watt produced. There are numerous ongoing investigations dealing with how to bring the cost of solar energy in line with the cost of more traditional sources of energy, a crucial factor for the technology to survive and to take-off.

A more fundamental and long term investigation is in the area of alternative materials and fabrication methods. The goal is to find materials and methods to produce an inexpensive and mass deployable PVC's of any efficiency. For instance, imagine a compound that is cheap and robust enough to mix into the asphalt pavings along with a transmitting infrastructure. We can turn the entire highway system into an energy generating surface as we repave the highways year after year. Even with a very low efficiency rate the impact will be massive. (Low energy density, large surface area)
On the other hand, immediately applicable innovations to meet today’s economic demands are in the area of light concentrating technology. The idea is to combine still expensive but highly efficient PVC’s with inexpensive optical solar concentrating devices. The goal is to yield more electricity with less PVC surface. Due to the optical nature of the technology, a mechanical solar tracking device is necessary as an integral part of the system. Unfortunately, the application is still limited to large scale developments to achieve the scale of economy for cost and maintenance. (High energy density, minimum surface area)

A few noteworthy investigations regarding the architectural scale deployment of PVC is still in an experimental stage. The approach falls somewhere between the above mentioned investigations, benefiting from both.

surPLUShome, the winning entry to the 2009 Solar Decathlon by Technische Universität Darmstadt adopted a thin-film photo voltaic cells laminated in glass as shingle cladding system for the facade. Thin-film technology achieves higher energy yields in low solar radiation compared to typical mono-crystalline cells, thus suitable for vertical surfaces. Also, it’s manufacturing process lends to a large, monolithic uniformly black look, visually suitable for architectural cladding.

Skyline Solar / High Gain Solar Panels
www.skyline-solar.com

surPLUShome
www.solardecathlon.tu-darmstadt.de/home/home.en.jsp
A more ambitious approach to the application of PVC in building facade is demonstrated in an IC (Integrated Concentrating) Dynamic Solar Facade system4 invented and currently being tested by the Center for Architecture Science and Ecology (CASE), a research institution established by Rensselaer and SOM. The system is promoted as a dynamic shading system for new and/or retrofitting existing curtain-walls. It consists of small, high efficiency multi-junction PVC coupled with a cooling system and the optical concentrating lens produces electricity and recovers unconverted solar radiation as thermal energy. The translucent enclosure transmits diffused daylight for illumination while maintaining the visibility out. The necessary solar tracking system doubles as a mechanism for a dynamic shading system, keeping the illumination level consistent throughout the day.
Another unique investigation with major potential is conducted by Convalent Solar, a start up company by MIT researchers. A simple discovery that a sheet of glass coated with translucent organic dye can act as an efficient solar concentrator has enormous implications on PVC technology. The dye coated on one side of the glass absorbs light and reemits it in a certain wavelength. The reemitted light bounces along the surface within the sheet, channeled towards the glass edge the same way the fiber optic cable channels light over a long distance. PVC suitable is mounted at the edge of the glass sheet, converting the concentrated light into electricity. Multiple positive implication can be identified:

1.) simple and inexpensive to manufacture.

2.) responds to light from various direction, requiring no solar tracking mechanism.

3.) organic dyes can be tweaked to emit specific spectrum of light to match the material characteristics of the semiconductor used in the PVC.

4.) transparency of the concentrator allows multiple layers in a single panel assembly, each tweaked for specific spectrum of light with matching PVC to maximize the conversion efficiency, a much cheaper alternative to manufacturing process of multi-junction PVCs.

5.) transparency allows various architectural applications, turning every conceivable building surface into a energy generating or recapturing surface.

Glass coated with translucent organic dye
www.covalentsolar.com/technology.html

Principle of waveguide photovoltaics
Alok Jha. Dyes turn windows into powerful solar panels. guardian.co.uk

Sunlight hits window, visible light passes through

Dyes absorb and then re-emit light outside the visible spectrum

Much of the re-emitted light is trapped inside the glass by internal reflection

Solar cells set into the window frame collect the energy
The last technology introduced is commercially available from a company called Solyndra and a good match to the proposed project. It is an intelligent update to the typical rooftop PVC panel designed to address performance and deployability issues. As a result, it exhibits unique tectonic qualities suitable to an architectural application.

The heart of the innovation is in the design of cylindrical thin-film PVC modules encased in a glass tube. It is capable of a 360-degree photovoltaic surface converting direct, diffused and reflected solar radiation into electricity. This configuration increases the morning and afternoon performance without the solar tracking device and eliminates the need for the panel tilt by capturing the reflected light off the roof surface. Horizontal panel installation translates to significantly denser rooftop coverage, enhancing the energy conversion over the system’s lifetime.

Another significant advantage to this configuration is the ease of installation. It requires no mounting attachment nor ballast to withstand the wind due to the porous design of the panels, ideal for the hurricane prone Gulf-coast. Airflow around the cylinders also cools the PVC, improving the performance. The porous, screen-like design also contributes to the visual elegance unusually compared to the typical PVC panels. Our project intends to fully explore this potential tectonically.
CONCEPT
The project envisions a multi-purpose open classroom on the former site of 9/11 Memorial as a Temple of Sustainable Technology and Education reflecting the milieu of post-9/11, post-Katrina society.

The canopy top is a harvesting garden that grows solar energy as a crop. It is also a dry landscape garden (kare-san-sui) representing an abstract miniature landscape when contemplated from the upper floors of the adjacent buildings. The topography consisting of cylindrical PVC's and the altered canopy surfaces evoke multiple impressions, such as a group of islands in the ocean or an armored back of a dinosaur swimming in the water, reflecting our state of mind.

The cuts and folds to the canopy surfaces act as light scoops, filtering through the northern light, gently animating the underside of the canopy. Ever changing shade and shadows heightens the sense of time and place.

At night, a gentle glow of the light scoops illuminated by the solar energy harvested during the day will transform the structure into a light house on campus.

A pair of sliding screen panels configure the space in infinite variation by continuously recalibrating our relationships to the surrounding environment.

The overall design intention is to refresh our consciousness of the surrounding environment by drawing attentions to the transient quality of the space, the temporal nature of our existence.
Top from left to right: Serpentine Pavilion (Sanaa), Rice University Brockstien Pavilion (Thomas Phifer and Partners)
Bottom: Interior view of the Open Classroom
Top from left to right: Roofscape of Rice University Brochstien Pavilion (Thomas Phifer and Partners), Rock Garden at Ryogen-in, Dinosaur Armor
Bottom: Roofscape of the Open Classroom viewed from Dept. of Earth Science building
FEATURES

Photo-voltaic Cells
Charge Capacity

*PV System Performance
Peak performance rating of 200Wp per panel (18sf).
3600 sf roof area / 18sf x 200 = 40000w = 40kw
Assume 8 hr/day operation @ avg. 50% efficiency
(conservative estimate) - 40kw x 8 x 50% = 160 kw/h expected
To fully charge typical golf cart requires 1.6 kw/h of energy.
160/1.6 = 100 golf carts per day

Light Scoops
Metal Roof

Steel Roof Framing
Perforated Metal Ceiling

Light Niches
Stationary Screen Wall
Steel Tube Columns

Digital White Board Display
Decking

Planting Bed
Existing Foundation

Sliding Screen Wall
+ Retractable Projection Screen

Ceiling Fan
Retractable Projection Screen
Sliding Screen Wall

Raked Seating

ADA Access Ramp
Adj. Building / Open Classroom
## BUDGET

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**Total**                                                                 $589,360.00

**General Conditions**                                                  $58,936.00

**Total**                                                                 $648,296.00
AKNOWLEDGEMENTS

CLIENT
TULANE UNIVERSITY

CONSULTANT
TULANE CITY CENTER
Kentaro Tsubaki, RA. Assistant Professor, Tulane University
CREDITS

Project Research
Kentaro Tsubaki
Kevin Tully, TCC intern

Project Design
Kentaro Tsubaki
Nathaniel-Thomas Stevens, TCC intern

Booklet Design
Kentaro Tsubaki