



UT ZERO

THE UNIVERSITY OF TENNESSEE

COLLEGE OF ARCHITECTURE + DESIGN



S.P.E.E.D.

(Solar Platform for Excellence in Energy Design)

OUR VISION

UT Zero is a multidisciplinary team with the goal to develop new technologies for zero energy building for the University of Tennessee and the state of Tennessee. Our desire is to promote zero net energy consumption and zero carbon emission technology. Our mission is to bring students and faculty from various programs together to collaborate on UT Zero Energy projects.

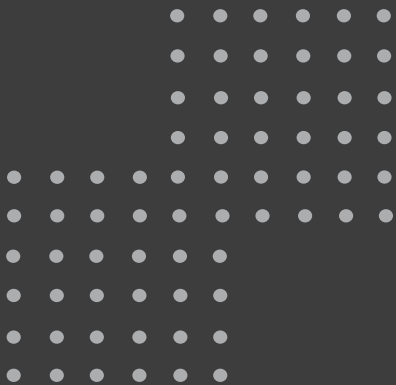
The S.P.E.E.D. Project at the University of Tennessee is proposed for a 375kW photovoltaic solar panel array to be mounted on the rooftop of the Art & Architecture Building.

The project's mission is to incorporate the most innovative and sustainable design elements with the leading photovoltaic modules manufactured for clean, energy efficient grid-tied solar power generation, while allowing for student involvement across multiple disciplines.

The SPEED Project will provide lasting environmental benefits for the warranted life of the system (25 years) by offsetting dangerous greenhouse gases by the following amounts:

- 16,846,875 lbs of CO₂ – the leading greenhouse gas attributable to global warming and climate change
- 25,313 lbs of NO₂ – detrimental to human health, main ingredient in smog.
- 77,813 lbs of SO₂ – causes acid rain and destroys plant and animal life.

The proposed system will provide a comparable offset to planting 2,344 acres of trees. The result will create collaborations between schools in the university, opportunities for student and faculty research, and an iconic symbol of UT's commitment to sustainability.





UT ZERO

THE UNIVERSITY OF TENNESSEE

COLLEGE OF ARCHITECTURE + DESIGN



S.P.E.E.D.

(Solar Platform for Excellence in Energy Design)

Investment

This budget for the solar design and installation of PV Panels and systems includes labor to set the panels. The cost of the SPEED Project is estimated to be \$3 million. Structural steel, roofing and consulting fees are not included, due to on going analysis.

Revenue

With a fixed-position system, the solar array will generate approximately 450,000 kWh of annual energy output. The generated energy from this program is estimated at \$.22 per kWh for a total of approximately \$99,000 annually. Along with the revenue, there will be available research opportunities so that students will have a greater connection to other fields of study.

The Facts

- 373 kWh PV Panel Array
- 450,000 kWh Annual Energy Output
- 305 Fixed Solar Panels, Efficiency 18.7% (Sun Power)
- Roof Area Covered 373,000 SF
- 16,846,875 lbs of CO₂, Green House Gas Offset
- Annual Estimated Revenue \$99,000 (\$.22 per kWh, May 2009, TVA Rate)
- Cost for SPEED Project Estimated
 - \$3M PV System including Installation
 - Structural Steel, Consulting Fees (Cost Estimation in Progress)

Potential Funding Resources

- American Recovery & Reinvestment Act of 2009
- Stimulus Package for Tennessee
- Stimulus Package for UT
- Third Parties
- Tax Break Incentives
- TVA Green Switch Partnership

Solar and Federal Stimulus

America Recovery and Reinvestment Act of 2009 (ARRA) is aimed squarely at expanding renewable energy and will establish U.S. leadership in clean technologies. The State Energy Program has \$3.1B in grants to State Energy Offices, however preliminary plans were due late March 09.

Conservation Block Grants have \$3.2B in grants to states, counties, and cities with categories of eligibility broadly defined. The goals of these grants are directly in line with the SPEED project. City and County plans are due June 25.

ARRA Program	Funding to	State Energy Offices	May	June
State Energy Program	State Energy Offices	Contact State Energy Office or www.NASEO.org	5-12-09 State Submittal	
Conservation Block Grants	Cities/Counties/ States	Contact City, County or State Energy Office for more information http://www.eecbg.energy.gov/	5-26-09 State Submittal	6-25-09 City/County Submittal



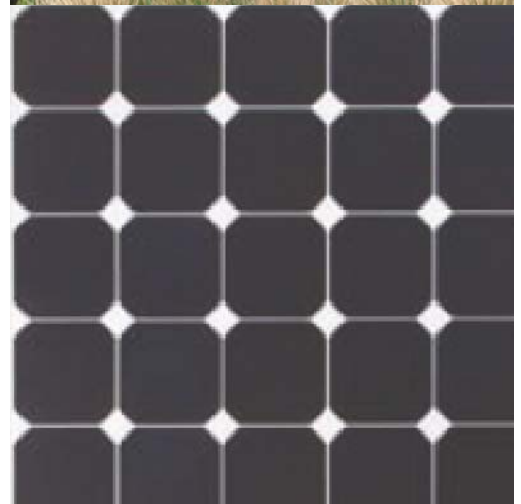
Green²

Our proposal for S.P.E.E.D. is formatted to not only include room for a green roof, but Green² facilitates both the green roof's growth and solar array's productivity. Because of the translucency of SANYO HIT Double™ bifacial photovoltaic modules, the reflectivity of the plants increase the PV efficiency. Green roofs reduce the heat island effect, while the panels will prevent more direct solar gain. A solar array shading a roof garden in this way is a new opportunity for research.



SANYO HIT Double™

SANYO HIT Double™ has an increased power generation compared to conventional single-sided panels at any angle and any direction. In vertical installations, faced south, power generation is increased 34%. SANYO HIT Double solar panels are a double-glass structure with aesthetics that allow brilliant light and shadows to shine thru the panels. HIT Double panels can capture additional back side ambient light, and increase system performance up to 10% or more. Costs using fewer support materials, wiring, and spend less time installing.



SPEED. Project Energy Estimation

Month	Solar Radiation kWh/m ² /day	AC Energy kWh	Energy Value
1	2.56	23,360	\$5,139.20
2	3.37	27,665	\$6,086.30
3	4.48	39,925	\$8,783.50
4	5.39	45,420	\$9,992.40
5	5.73	48,321	\$10,630.62
6	6.19	49,358	\$10,858.76
7	6.07	49,959	\$10,990.98
8	5.49	45,178	\$9,939.16
9	4.69	37,911	\$8,340.42
10	4.17	35,922	\$7,902.84
11	2.9	24,152	\$5,313.44
12	2.48	21,883	\$4,814.26
Year	4.46	449,055	\$98,792.10





Team Members

The S.P.E.E.D. project is composed of an enthusiastic team. Everyone is encouraged to press goals within their own field, but aware of the future of sustainable moves that can be made in our community.

Edgar Stach	Architecture Faculty
James Rose	Architecture Faculty
Leon Tolbert	Engineering Faculty
Faete Filho	Electrical Engineering Ph.D. Student
Wyn Miller	Masters of Landscape Arch. Student
David Chen	Master of Architecture Student
Alan Reece	Graphics and Communication

Support:

McCarty Hosaple McCarty Inc. Architecture, Knoxville, TN
 LightWave Solar Electric LLC. Nashville, TN
 Ross Bryan Associates Structural Engineering Nashville, TN



UTZero Energy House Prototype 01 current Construction Progress

Potential Projects in the Future

- Design Team moving towards a Solar Decathlon Entry
- ORNL Research with Moonis Ally Energy Calculations (D.O.E. Funding)
- UT Zero China with Tsinghua University
- Collaborative Team Light & Space Academy at Helsinki Metropolia University of Applied Sciences, Finland

Teaching

- Architecture
 - Undergraduate & Graduate Design Studios
 - Materials Methods and Construction
- Mechanical Engineering, Stan Johnson
- Electrical Engineering, Leon Tolbert
 - Graduate Studies
- Landscape Architecture

UT Zero Current Projects

UT Zero is continually trying to pushing new projects. The SPEED project strives to be a blueprint in which UT can move forward in making this campus a landmark for sustainable energy in the U.S.

Future Structures for S.P.E.E.D.:

- Sports Facilities
- On Campus Offices and Labs
- Parking garages
- Shading canopies
- Energy Plus Facades
- Retrofitting Facades

Contact: Edgar Stach, Associate Professor | Email: utzero@utk.edu
 The University of Tennessee, Knoxville | College of Architecture + Design
 1715 Volunteer Boulevard | Room 457 | Knoxville, TN 37996
 Phone: 865.974.6713 | Fax: 865.974.0656 | Web: <http://utzero.utk.edu>

UTZero Energy House Prototype 01 with Energy Plus Facades, Translucent Solar Cells embedded in Windows. This project advances new construction techniques and solar energy development as a multidisciplinary team project. Our summer course will finish the Prototype as a piece to use, test and display as an engineered student collaboration.

