

# Undergraduates develop 'dirt-powered' microbial fuel cells to light Africa

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A team composed of Harvard students and alumni was among the winners of the World Bank's Lighting Africa 2008 Development Marketplace competition, held in Accra, Ghana from May 6 to 8, 2008. The innovation, microbial fuel cell-based lighting systems suitable for Sub-Saharan Africa, netted the group a \$200,000 prize.

According to the World Bank, as only 26 percent of Africa's population has access to grid-based electricity most residents rely upon dangerous kerosene lamps and candles for illumination. To encourage the development of cheaper and safer lighting technologies, the organizers of Lighting Africa 2008 sought practical solutions from around the world, ultimately funding 16 of the original 400 proposals.

The winning Harvard project came to life thanks to an undergraduate course, "Idea Translation", taught by David Edwards, McKay Professor of the Practice of Bioengineering and author of *Artscience: Creativity in the Post-Google Generation*. As part of the course Edwards challenged students to develop an idea that crossed the conventional boundaries of art and science, imagining light engineering as an art form.

"In the course we found what many of us were missing in our lives: A project that combined our love for Africa and our passion for technology," said Harvard College alumnus Hugo Van Vuuren '07, a South African native who took the course as a senior in the fall of 2007. "For all the Pan-Africanism of the last four decades it is quite rare to have young students from South, East, and West Africa, in the same

room without a soccer ball somehow involved.”

Joining Van Vuuren, an economics concentrator, were current undergraduate students Stephen Lwendo '10 (computer science and engineering) and David Sengeh '10 (bioengineering), who are both from Africa, Alexander Fabry '09 (history of science and physics), alumnae Zoë Sachs-Arellano '07 (a philosophy concentrator who co-founded the Namibia Connection Youth Network), and Aviva Presser, a graduate student at the Harvard School of Engineering and Applied Sciences (SEAS).

To translate their idea into a reality, the team collaborated with designer and entrepreneur Richard Kirk. The founder of the London-based Elumin8, and more recently, Polyphotonics, is known for his development and use of a new lighting form based on electrically conducting polymers, akin to luminous plastic sheets. The students then turned to Peter Girguis, Assistant Professor of Biology in Harvard's Department of Organismic and Evolutionary Biology, who pioneered a microbial fuel cell (MFC) energy source suitable for the developing world.

MFCs capture energy produced by naturally occurring microbial metabolism and can generate electricity from organic-rich materials such as soil, manure, or food scraps. By contrast, most renewable energy technologies are based on solar or wind power. Unlike these and other natural solutions for generating electricity, the team says MFCs are more reliable—working day or night, rain or shine—and are markedly less expensive.

The further development of the technology was encouraged by the ongoing mentorship of Aviva Presser, who served as a teaching fellow for the course (and later joined the team as a technology partner at the close of the semester) and Paul Bottino, co-founder of the Technology

and Entrepreneurship Center at Harvard (TECH) and the Idea Translation Lab, based at SEAS. Both Presser and Bottino have been involved with initiating or helping to run start-up ventures.

Such connections inspired the student team to not only enter the World Bank competition, but to go one step further and create a social enterprise, Lebônê Solutions, dedicated to solving the lighting crisis in Africa. In fact, the journey from concept to application to start-up was not a direct path and continued to evolve more than a year after the course wrapped up.

“The original concept in the course started with an idea of lighting London for the 2012 Olympics and then morphed into lighting Africa with the active role of the various advisors,” explains Edwards, who matches the students with idea generators of all kinds, from scientists to visual artists. “Aviva played a lead role as mentor and the Idea Translation Lab and Harvard Initiative for Global Health (HIGH) continued to support the students after the course ended.”

With the prize money from the World Bank competition and additional funding from Harvard Initiative for Global Health, the team will conduct the first field study in the foothills of Kilimanjaro, Tanzania starting in July. They then have plans to test and distribute refined prototypes in Namibia in collaboration with Namibia Connection Youth Network.

Source: Harvard University

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