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LEAPFROG LIGHTING | Jamais Cascio

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Evan Mills wants to change the world one lumen at a time.

Mills is a scientist at the Lawrence Berkeley Lab's Environmental Energy Technologies Division, specializing in the ways in which developing regions provide lighting. As we've noted from early on, lighting is one of the less-obvious but still critical parts of development. Kerosene, wood, candles and the like -- so-called "fuel-based lighting" -- pollute the air in homes, can be energy-intensive to gather, and often provide insufficient illumination for extended work or education. But Mills sees a solution in solid-state lighting: LEDs. Light-emitting diodes are definitely worldchanging, and Mills argues that LEDs are the ultimate source of leapfrog illumination:

> *"As they modernize, developing countries can select better technologies, and in so doing surpass levels of efficiency typical of industrialized nation. The latest improvement is the solid-state white light-emitting diode [WLED]." In recent years, R&D performed by private industry as well as the Department of Energy has made these light sources suitable for task illumination.*
>
> *Mills also points out that LED systems are well-suited to developing nations—they are rugged, portable, use direct current, have long service lives, and run on widely available "AA" batteries.*

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> *"Evaluated in terms of total cost of ownership, (purchase plus operation), WLED systems emerge as the most cost-effective solution for off-grid applications," says Mills. He estimates that solar-powered WLEDs could appear on the market for $25 without need for subsidy. The annual fuel saving for each lantern is on the order of a month's income for the poorest one billion people of the world, who often subsist on less than $1 a day.*

Fuel-based lighting is common, but incredibly inefficient:

> *Although about one in four people obtain light exclusively from fuel, representing about 17% of global lighting energy costs, they receive only 0.1% of the resulting lighting energy services (lumen hours). [...] The total annual light output (about 12,000 lumen-hours) from a simple wick lamp is equivalent to that produced by a 100-watt incandescent bulb in a mere 10 hours.*
>
> *By virtue of its inefficiency and poor quality, fuel-based light is hard to work or read by, poses fire and burn hazards, and compromises indoor air quality.*

Globally, fuel-based lighting results in carbon dioxide emissions on the order of one-third of the UK's total annual CO2 output, so the environmental benefit of an aggressive move towards WLEDs is considerable. In addition, solid-state lighting can be more rugged and reliable than fluorescent systems, making the technology more appropriate for rural and developing world use.

Although the article is behind a subscription barrier at *Science*, Mills has made it available on his LBL website (PDF). The article is worth downloading in particular for the abundant "hypernotes," linking to reports on electricity and lighting in the developing world, problems with "fuel-based" energy, and ongoing progress with LEDs. Moreover, the illustrations in both the *Science* article and the LBL summary article come from Mills' own website, which has a variety of photographs from his trips to China, Bhutan, Cambodia, India and Vietnam, looking at the problems of rural illumination and energy.

(*Via TriplePundit*)

Posted by Jamais Cascio at June 10, 2005 04:57 PM | TrackBack

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comments

I worked with Evan on this project a teeny bit at Stanford (and before

that worked with him at LBL, though on different stuff), and he's absolutely right--this is definitely something that needs to happen, and when it does, the face of the third world will permanently change.

However...

The problem that we found in the Stanford group is that we couldn't get the initial cost of the device down enough so that people could afford it. Sure, it's saving them money in the long run, but it requires an enormous investment (perhaps 1/3 of a year's wages) to buy, and the target users don't have savings like that to spend. So it would require a local business infrastructure for financing the purchases.

A related group in Canada (which was doing this even earlier) is Light Up The World: http://www.lightuptheworld.org/ . They've actually gotten stuff out in the field, done extended user testing, and have a little hobby-business in Nepal manufacturing them, but not at a profitable point yet.

Previous WC articles about Light Up The World:
http://www.worldchanging.com/archives/002804.html
http://www.worldchanging.com/archives/000099.html

Posted by: Jeremy Faludi at June 10, 2005 05:14 PM

Greetings to Jeremy,

Actually, much has happened since the classroom-level experiments at Stanford.
One spin-off group has established low-volume production in India at about $50/unit, and these costs should go to about $25/unit with any kind of serious volume (plus streamlined design/fabrication).

This puts the price point within reach for hundreds of millions of people, without need for subsidy. The payback time (when viewed in the context of avoided kerosene costs) is well under a year in many cases.

If you bring in market-based innovations like microcredit, the lantern can easily save more than enough money on a monthly basis to cover the debt service and be paid off within a year or so.

Posted by: Evan Mills at June 10, 2005 05:51 PM

Treehuger (http://www.treehugger.com/files/2005/06/demotech.php) has a post on Demotech (http://www.demotech.org/) who have been working on the Night Reader, "Two LED-lights, attached to a box with

batteries... placed on the page or paper to be read. The LED's only illuminate a few lines of text, not attracting insects.. little light is enough when shining only on the part of the page one is reading or is writing on."

In fact, you can modify existing single LEDs and booklights as solar reading lights. You can even do it with single LEDs powered by button batteries that double as keychain lights in the USA and Europe and reading lights accessible to every child in the world.

In 1988, I was in Gaungzhou, China. One night, I saw men in the doorways standing by small folding tables. They were refueling, refurbishing, and reselling disposable plastic cigarette lighters. I'd like to see a solar reading light as readily affordable and available as that so no child in the world can be reasonably deprived of the light to read. .

Posted by: gmoke at June 10, 2005 08:54 PM

There is no question that the 2 billion people who are using fuel-based lighting will have their lives improved through the use of solar LED lighting. We have been working to get a useful and durable product for that market, and now have our Edulight (1W solar, 10 Wh battery and 1W LED bulb in a desk lamp format) at a price of CAD $40.95 (~USD $33). These are now in 13 countries and we are working with Rotary clubs to establish micro-banks so that the people who need them might be able to get them financed. Typically, less than a year should be required. We hope to help people use less fuel, endure less indoor air pollution, save money, experience fewer fires, and avoid eyestrain.

Posted by: Glen MacGillivray at June 16, 2005 08:05 AM

Or they could just go to walmart and buy a flashlight you shake to power for under 10 bucks... Shake shake shake read page shake shake shake read page. In bulk id bet you could get those right from the factory for under a buck each. Specialy the smaller models they now make.

Posted by: wintermane at June 18, 2005 11:47 AM