S.T.E.V.E.N.

Sustainable Technology and Energy for Vital Economic Needs
414 Triphammer Road, Ithaca, NY 14850 USA. Email jv19@cornell.edu.
Website: www.lightlink.com/francis/stevenhomepage.html

N E W S L E T T E R 2 0 0 9

Greetings! S.T.E.V.E.N. Foundation's 2009 newsletter focuses on several areas of our work during the past year – including [1] a new technology in process of development (family-sized windmills for electric power); [2] some reflections on education and appropriate technology; and [3] reports on our more developed technologies for solar oven-cookers, and a solar icemaker.

A LOW-COST SELF-HELP WINDMILL FOR POWER GENERATION

Jaroslav Vanek

It is a generally accepted notion that neither the world nor the United States can rely indefinitely on irreplaceable energy resources. Ultimately we will be forced to rely on renewable energy, taking the forms of wind or solar radiation through thermal media and heat or direct photovoltaic transformation of sunlight into electric power.

Here we want to concentrate on wind energy; but unlike the power obtained from large and expensive windmills, we want to deal with the other end of the spectrum, the simplest, cheapest and most self-help-based solutions. Because wind energy is based on a highly variable resource, of necessity we must deal with storable energy: whether electricity storable in batteries, or compressed air storable in tanks or other reservoirs. In our practical exploration, we have dealt with both alternatives, but here we will concentrate only on the electricity solution.

The problem with low-cost, self-help windmills is the occurrence of very high velocity winds, call them hurricane winds, which tend to destroy just about all possible windmill solutions. Many of the small commercial wind turbines offer solutions which are complex and often expensive. By contrast, our solution based on very low cost and self-help (a mill constructed and operated near one's home) chooses another approach. This windmill is based on 1] a skeleton structure resisting even the strongest winds, and 2] a set of wings or blades, which are very easily replaced should a strong wind destroy them, and which can be purchased for between ten and twenty dollars for all four blades. Thus our self-help windmill can be totally protected in its skeleton form from extreme wind, and its totality can be secured at very low cost. How low, is one of the principal objectives of our research.

In producing electric power with a simple inexpensive windmill, the problem is that a generator or dynamo usually calls for rather high RPM's, while the rotors and turbines propelled by wind power rarely can turn at such high frequencies of rotation. Thus there arises a need to gear up the RPM's. We perform such gearing up at low cost as follows: to the other extremity of the threaded rod holding the wind rotor, we attach an ordinary bicycle wheel, so that the rim of the wheel (without a tire) becomes one of the gears of the system. An ordinary transmission belt of appropriate length then enables the gearing up. As shown in the photo, using a generator with a one inch gear and a bike wheel of the usual 24" diameter, there will be a rotation of the generator 24 times that of the wind rotor. With a wind that turns the rotor at a speed of one RPS, one can attain an RPM of 60 x 24 = 1440—that is, a frequency of the order of a typical dynamo or alternator. Using old gears from a bicycle, it is easy to increase the RPM's by up to four times. We show this in another photo in a more extensive article.

ENGINEERING EDUCATION AND SUSTAINABLE APPROPRIATE TECHNOLOGY: THE VIEW FROM CORNELL UNIVERSITY

Francis Vanek

Through my work as a Senior Lecturer in the College of Engineering at Cornell, I remain connected to the efforts of students to learn about and promote appropriate technology. First, the project on solar ovens that we started in collaboration with the Engineers for a Sustainable World (ESW) program continues. The students have this year been using the indoor testing apparatus (a bed of high-intensity lights that approximate sunshine) to test the effectiveness of making design changes to a solar oven in use in Nicaragua. They have also been developing parabolic-shaped collectors to increase maximum temperatures while providing a convenient platform upon which oven users can cook meals.

This year also saw a new development with ESW, as a different group of students worked with a local engineer to assist with the delivery of a wood-chip based heating system to the Cayuga Nature Center, a local nature education facility near Ithaca.

The system uses an automatic feeding system to mechanically feed the wood to the boiler, which then heats water and circulates it within the center. The students assisted specifically with the design and building of a wood-chip storage facility that will allow delivery of loads of wood chips which are then transferred to the boiler unit for heating, while learning about all aspects of the technology and its underlying energy source. We expect the wood-chip heating system to enter regular use within a few weeks.

All of these activities are happening in the context of much excitement among the students regarding sustainable energy. There are many design projects around the College of Engineering having to do with solar, wind, sustainable vehicles, and green community design. Students clearly see both the need and the opportunity to work on this subject. It is a stimulating time to be teaching in this field – I look forward to reporting more in subsequent newsletters.

OLDER S.T.E.V.E.N. TECHNOLOGIES: SOLAR OVEN, ICEMAKER

Our solar oven-cooker, along with other similar designs, continues to find new users, both in parts of the world where cooking stoves or fuel are too expensive, and here in USA where people enjoy being liberated from the kitchen stove, in season. See the reference above to a Cornell student project in Nicaragua. In USA, one of our interesting requests this year came from an organization in Texas that will make solar ovens as a father-son project.

WE STILL HAVE 3-M MYLAR FOR SALE. Our limited supply comes on 5-foot rolls, from which we can cut portions for reflectors for one or several ovens (or reflectors for a solar collector to power an icemaker). We ask $1. per square foot, which includes preparing and shipping costs in USA. Please contact us by e-mail with your request.

As to our solar icemaker: unfortunately, we can only report that no one here has had the time to move forward with the work needed to convert the icemaker into a true refrigerator. At the same time, a review of the e-mails sent to S.T.E.V.E.N. this past year showed that *most of the requests concerned the icemaker*. Clearly, this is a technology that could be useful in many parts of the world. We continue to hope for progress that will make the icemaker more useful to more people.

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