Contact: Stella J. Karavas
MagCap Engineering, LLC
questions@magcap.com
(866) 340-2300

PRESS RELEASE - Update

Off-Grid, Inexpensive, Reliable and Clean Battery Alternative
Viable bioenergy harvesting circuit developed

CANTON, Mass., September 26, 2006 – An alternative electric power harvesting system that draws energy from a seemingly unlikely yet abundant, eminently renewable and virtually free power source has been submitted for patenting by MagCap Engineering, LLC, Canton, Mass., in collaboration with Gordon W. Wadle, an inventor from Thomson, Ill.

MagCap's announcement of this innovative technology was featured in a CNN special and generated significant buzz in blogs and internet communities dedicated to alternative sources of energy. While most were fascinated by the implications, some questioned the validity of the announced results and suggested that the mechanism behind this phenomenon was that of the simple electrochemical cell (the science behind the common high school science demonstration of "potato clocks") which would mean that this source would not be sustainable in the long term.

To resolve the issue of the exact mechanism, MagCap sponsored a Massachusetts Institute of Technology (MIT) undergraduate chemical engineering student, Christopher Love, under the supervision of MIT physicist Dr. Andreas Mershin

to investigate the phenomenon in detail via the UROP (undergraduate research opportunities) summer program.

The MIT team, based at the MIT Center for Biomedical Engineering, Laboratory for Molecular Self-Assembly and in collaboration with physics student Rhys Hiltner and Media Lab scientist Dr. Rich Fletcher, confirmed the existence of a voltage difference between the inner parts (xylem) of trees and their soil using custom-built circuits attached to potted trees inside a Faraday cage. After eliminating a number of possible sources such as simple redox reactions due to dissimilar electrodes, streaming potentials due to sap flow, radio frequency pickup etc. they concluded that the most likely mechanism behind the voltage differential is related to the difference in pH between the inner parts of trees and their soil. The pH scale quantifies the acidity (low pH) or alkalinity (high pH) of a substance. Like most living organisms, plants must maintain their internal pH within narrow limits. Trees do so by actively pumping protons in and out of their roots and are capable of surviving in soils of moderately variable pHs. It turns out the methods and circuits Wadle and Chris Lagadinos, president and chief engineer of MagCap, had invented provide a way to tap into and harvest part of the energy trees use to maintain their internal pH levels. The inexpensive circuitry converts the difference in pH into useable DC power capable of sustaining a continuous current to charge and maintain a battery. This process draws energy from the tree but it is no more harmful to it than a mild natural parasite, requiring the tree to compensate by slightly slowing down its growth -an effect which is completely unnoticeable in grown trees. These devices can be buried out of sight in the vicinity of tree roots and would provide hassle-free continuous microwatt, or pulsed higher wattage power for the lifetime of the

tree. “As unbelievable as it sounds, we’ve been able to demonstrate the feasibility of generating electricity in this manner,” said Wadle. Even though the continuous power available is very small, it can be used in pulses of significant wattage.

The available continuous power demonstrated by the MIT team using potted trees is in the microwatt range (up to volts of potential difference and microamps of current) enough to slowly charge a battery or flash a small light every few minutes. While storing the power in batteries or capacitors, connecting trees in series or pooling the power from many trees is certainly feasible and could increase the available power considerably, for the time being, MagCap and MIT are evaluating applications that make use of the core advantages of this bioenergy harvesting circuits. These advantages are the potentially negligible cost of each circuit once mass produced, its small size and ease of operation (plug into tree and forget), the independence on sunlight or wind and their distributed, always-on, quiet and maintenance-free nature.

MagCap’s system would be ideal for distributed environmental, security and fire sensors, RfID (Radio Frequency Identification) tags in remote locations, “smart dust”, blinking LEDs, outdoor electronic pest repellents, as well as research devices for agriculture, seismology and environmental science.

A patent application for this pioneering invention was filed in December 2005 by the developers’ patent counsel, Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C., Boston, Mass.

While the basic concept of this invention – using a tree to generate electric power – seems too incredible to be true, Lagadinos said it can be demonstrated quite simply. “Simply insert a metal electrode through the bark and into the wood of a tree – any tree – approximately one half inch; drive a different metal ground rod six or seven inches into the ground, then get a standard off-the-shelf digital volt meter and attach one probe to

the ground rod, the other to the electrode and you'll get a reading of anywhere from 0.8 to 1.2 volts of DC voltage and .03 Amperes" he said. This demonstration setup yields relatively high but unstable power because in addition to harvesting the tree's bioenergy, it takes advantage of the redox reaction due to the dissimilar metals employed and results in possible deposition of metal into the tree –a potentially harmful side effect if the device is left connected to the tree for long. Following suggestions from MIT, MagCap has changed their choice of electrodes and now employs 'tree-friendly' materials only. What is more, "You can't do anything with it in that form because it is 'dirty' – i.e. highly unstable and too weak to power anything," he added. In order to showcase this energy source, MagCap devised two demonstration circuits: one with three capacitors that were connected in parallel by means of a switch and charged to 0.7 volts each. When fully charged they are switched to a series mode, multiplying the voltage to 2.1 volts and flashing an LED to show that sufficient power could be generated to produce a useable result. The second circuit included a filtering device to stabilize and "clean" the current so it could be used to charge and maintain a NiCad battery. The battery then could be connected to the LED to keep the LED lit continuously.

Headquartered in Canton, Mass., MagCap Engineering, L.L.C. is a leading custom designer and manufacturer of magnetics of all sizes for the broadcast, telecommunication, microwave, military, defense and energy industries. For more information, see www.magcap.com.

# # #