An Electric Gauge Shifting Approach to Tap Free Electricity From Live Plants And Germs

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Abstract

Energy is a matter of life and death for all living beings on earth, let alone its crucial role on the rise and fall of human civilization. And almost all life forms on this planet can trace their energy sources back to the ultimate sole origin, the solar energy. For generations, mankind has never ceased pursuing means to directly convert sunlight into electricity, and yet has only achieved meager excitements on solar panels. On an alternative front, siphoning electricity from the green plants -the largest solar light harvesters globally, has essentially scored no noticeable success. In this work, a novel gauge manipulation approach is proposed to this end and proved feasible.

Keywords: Ground, Electricity from plants, Electricity from germs, Solar energy, Rectification

1. Introduction

Being an obligatory process well adapted by plants and other organisms, photosynthesis converts light energy from the sun into chemical energy that is then used to fuel the plants' activities associated with metabolism and the making of biomaterials. The average rate of energy capture by photosynthesis globally is immense, approximately 130 terawatts [1-3], which is about six times larger than the power consumption of human civilization [4]. Other than energy, photosynthesis also accounts for the source of carbon in all organic

compounds within living bodies, namely, it is estimated to convert around 100–115 thousand million metric tons of carbon into biomass each year [5, 6].

However, photosynthesis itself does not provide electricity in an extrinsic manner for the mankind. That is, significant flows of electrons and ions present in all biochemical reactions, only occur within plants or organisms. Tapping electricity externally from spots of positive and negative potentials at a plant's surface would harvest only minimal currents. That is, typical voltage differences fall in the range of 0.1 V to 1 V, and drawn currents on the order of 0.01 μA to 0.1 μA, according to experimental observations. This is because a plant with its large internal resistance is never a good battery itself. For this reason, up to the moment, burning plant biomaterials continue to be a viable, though tawdry, means for heat or electricity generation on this planet. Likewise, abundant charge carriers constantly sloth back and forth within the bodies of germs, bacteria, virus, etc., and yet only trickling flows can be drawn to the external world (e.g., as was also evidenced lately on a marine bacteria *Shewanella oneidensis* using minerals-like iron oxide for respiration through shuttling electrons across their cell membranes in a still unclear manner [7]). In short, pragmatically, deriving noticeable currents directly from either green plants or micro-organisms remains a far-fetched dream up to this day.

Nonetheless, if the whole matter is viewed from an electric gauge perspective, practical current tapping from green plants and germs instantly becomes not that difficult but straightforward. The reason is to be addressed below. Prior to that, however, an elaboration of the earth's ground is in order.

Electrical engineers are generally accustomed to treating local electrical ground, and ultimately the earth's ground, as an ample ubiquitous "neutral" reservoir of positive and negative charges. Namely, as if tacitly assumed plausible, a ground not only takes up dumped charges from any circuit outlets but also serves as an authentic datum for defining electric potentials, such as in the pedagogical example of a full-wave rectifier bridge for converting AC signals to DC ones (See, Fig. 1 for the rectification of a sinusoidal signal or radiation input, with the current path from the ideal earth ground indicated during the negative half-cycle). However, though with its seeming role routinely valid to almost all electrical engineers, the earth's ground potential can actually be a surprisingly capricious quantity owing to the dynamic charge non-neutrality rendered by both the artificial and natural causes. In other words, the real picture in the above full-wave rectifying depicted in Fig. 1 may essentially become what's described in Fig. 2 where the ground becomes more negative (even though this specific issue has been properly resolved in electrical engineering by applying instead, e.g., a center-tapped transformer secondary and diodes or other means [8]).

All the more, within modern cosmopolitans, buried grounding electrodes are routinely installed notwithstanding to make the connection to the earth. Hence, a particular modern concern in the design of

general electrical facilities has been the earth potential rise (EPR) [9]. That is, when very large fault currents are injected into the earth, the area around the point of injection may rise to a high potential with respect to adjacent or distant points. In rural areas, on the other hand, the so-called Single Wire Earth Return (SWER) AC electrical distribution systems, in which only a single high voltage conductor for the power grid is installed while routing the AC return current through the earth, are often employed to save cost, under the specious assumption that large earth currents will not otherwise cause hazards. In a similar fashion, some high-voltage DC power transmission systems use the ground as a second conductor, much like that in the circumstances where submarine cables use well-conductive sea water as the ground path.

In short, the proclaimed "ground" is in fact of a highly volatile and erratic character in both space and time. Obviously, men may easily invent ways to extract surplus energy from among or between these points of different ground potentials. However, this scheme is normally associated with undesirably, or inconveniently, large spatial coverage. Here, instead, an elegant local approach is presented in which extra electron flows can be extracted straightforwardly to the external world from living plants undergoing photosynthesis, or from germs in darkness, without having to worry about any detailed biochemical reactions and mechanisms involved within these living systems. This is achieved by making use of the aforementioned shifted ground potential technique. In other words, with the now increased area below the rectified signal curve and above the new negative datum level (manifested and maintained by negative potential points on the plants or germs), the seemingly undesirable situation depicted in Fig. 2 now actually turn to our favor.

2. Proposed Shifted-Ground-Potential Method and Experiments

2.1 Method

It is proposed that point B of the above full-wave rectifier of Fig. 1 be floatingly connected to the most negative potential point on a plant, or several plants in parallel or serial connection, via surface-penetrating iron wires. Then, as long as this negative potential is sustained by the plant(s), its (or their) electrons can be constantly siphoned out to the exterior as electric current source to mankind (See, Fig. 3 for $V_{plant} < 0$ V). Note that, this is true for either $|V_{plant}|$ is larger or smaller than the absolute value of the input signal (e.g., solar radiation) amplitude. The thus-caused surplus of positive charges within the plant(s) are then scavenged (or neutralized) by the earth's ground. Recall that the plant itself can never be a good battery (if driving two electrodes into it), but through providing only its negative potential (while getting compensated at the root from the earth's ground), it offers its best contribution of electricity, according to our experimental observations to be disclosed in details below. As a side remark, a positive diode clamp was also shown implemented near the input side (See, Fig. 3) (as a common denominator for cases with and without plant energy extraction) to further enhance the harvest of electrical power in experiments of all cases.

2.2 Experiments

Three experiments were conducted to examine the validity of the proposed theory. In the first two, the adopted input signal was the normally unfavorable electromagnetic radiation from an off-the-shelf fluorescent lamp composed of four T5 fluorescent tubes under a common metal roof and operating at 110 V, 60 Hz. With the structure of this lamp intact, the output from the bridge-rectifier of Fig. 1 (with point B connected to the local earth ground) was characterized by a short-circuit current (I_{sc}) of 0.5 mA, an open-circuit voltage (V_o) of 98 V, and thus a power output of about 50 mW (See, Fig. 3 (b)). However, when with point B floatingly connected to the most negative potential point of the series-connected four small plants of *patchouli* (*pogostemon cablin benth*) rooted in soil (See, Fig. 3 (c), which was simultaneously irradiated by a tiny 100 mW/m^2 flux of artificial sunlight under a constant CO_2 supply maintained at about 800 ppm concentration level), the output was 105 mW (I_{sc} = 1 mA, V_o = 108 V). Namely, a more than 110% increase in power output was evidenced to sustain more than 10 minutes before the occurrence of a gradual drooping in power tapped from plants.

In the second experiment, Yeast germs under no sunlight were employed to replace the green plants above. Ten grams of dry Yeast powder were resolved in 100 ml of pure water and then equally distributed into 12 glass cups each equipped with two far-separated iron wires dipping in the solution. These cups in turn were electrically connected in series, in correct polarity, to play the role of the above plants. Resulting curves in Fig. 4, when under the loading of 100 kΩ, indicate that a power increase of more than 60% was achieved by the germs alone, and a raise of about 125% was rendered by further feeding the germs with 0.05M glucose solution.

In the third experiment, the input device became a 12 cm by 12 cm single crystal silicon solar panel under the AM (air mass) 1.5 level solar radiation (i.e., 1 kW/m^2, or 100 mW/cm^2 over the full solar spectrum). When the earth ground alone was used with the full-wave bridge, the result was: V_o = 4.62 V, I_{sc} = 400 mA, and thus $P_{o(max)}$ = 1.85W. After applying the floating negative datum from 72 small plants of *patchouli* in series (themselves under the same sunlight), the outcome was: V_o = 4.65 V, I_{sc} = 440 mA, and thus $P_{o(max)}$ = 2.05 W, signifying a more than 10 % increase in power. Despite the situation lasted only around 2 minutes before the tapped green power started to dwindle, these little plants reclaimed their vigor a day later. Additionally, when with the plants replaced by one liter of *patchouli* extract (through spin-grinding 20 g of plants) contained in a shallow plastic tray (itself under the same sunlight) equipped with two far-separated iron wires dipping in the solution, the result became: V_o = 4.63 V, I_{sc} = 410 mA, and thus $P_{o(max)}$ = 1.90 W (i.e., an increase of more than 2.5%), though sustaining only 2 minutes roughly.

3. Summary and Conclusions

As an essential means for harvesting solar energy, which in turn facilitates nearly all forms of life on earth, the biosynthesis process taking place in green plants does not provide direct electricity to the mankind. Efforts attempting to draw sizable electric currents from plants have been in vain. Here, a novel method to tap significant electricity freely from living plants or germs, during the process of rectifying an AC input, is provided and verified. In short, by changing the ground gauge to a negative potential manifested and maintained by a living plant (or a series of them) or germs, via connecting the datum port of a full-wave rectifier to where this negative potential is, extra electron current can be derived from the plant(s) or germs. The demonstrated effectiveness of this method signifies a milestone for mankind to extract free electricity from essentially all kinds of living plants and micro-organisms for the first time, without the tradeoff of needing to know the manifold complex biochemical details involved within these living systems. Lastly, more effective plants or germs should be continually explored for even better results.

4. Ethics

Although this current work aims to provide a viable means for siphoning free electricity from living plants or organisms (including chlorophyll extracted from algae), it is never an intention of the authors to cause significant damage, or even life threat, to potential plants or living creatures involved in such proposed applications. On the contrary, there should devise proper application limits and regulations by all mankind. In particular, the fashion this method be employed ought to simulate that of extracting molasses from maple trees wherein a benign, mutual benefiting ecology is warranted. Nonetheless, siphoning electrons relentlessly from carcinogen cells might itself constitute a valuable exception.

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Figure Legends

Fig. 1 (a) A full-wave rectifier bridge for converting AC signals to DC ones, with the current path from the ideal earth ground indicated during the negative half-cycle shown; (b) A sinusoidal signal or radiation input; (c) The full-wave-rectified sinusoidal input signal, if the "ground" employed is an authentic datum of potential

Fig. 2 (a) A negatively shifted "ground"; (b) A new full-wave-rectified result owing to a negatively shifted ground, with enlarged area (electricity) under the rectified curve and above the new ground level

Fig. 3(a) The setup of the proposed method, with the "ground" port of the full-wave rectifier floatingly connected to the most negative potential point on a plant or 4 plants in series; (b) With an EM radiation from a 4-tube fluorescent lamp as the input signal, the one with Patchouli (4 in series) negative potential ground rectifying shows 110 % more power; (c) A base containing 7 Patchouli plants

Fig. 4 With an EM radiation from a 4-tube fluorescent lamp as the input signal, the one with Yeast germs (12 beds in series) negative potential ground rectifying shows 60 % more power, and a raise of about 125% was rendered by further feeding the germs with 0.05M glucose solution

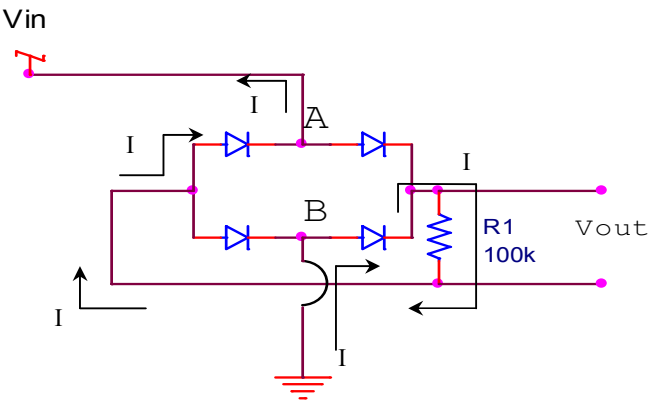


Fig. 1 (a) A full-wave rectifier bridge for converting AC signals to DC ones, with the current path from the ideal earth ground indicated during the negative half-cycle shown negative half-cycle

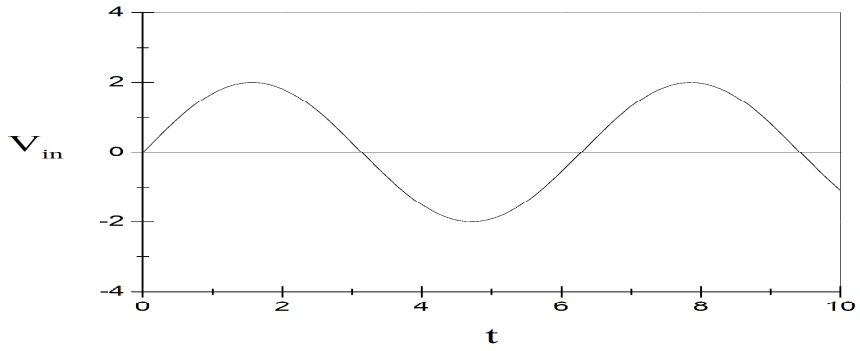


Fig. 1 (b) A sinusoidal signal or radiation input

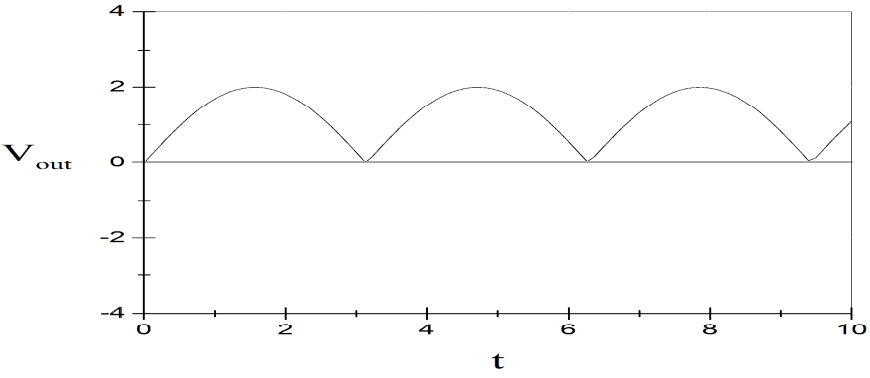


Fig. 1 (c) The full-wave-rectified sinusoidal input signal, if the "ground" employed is an

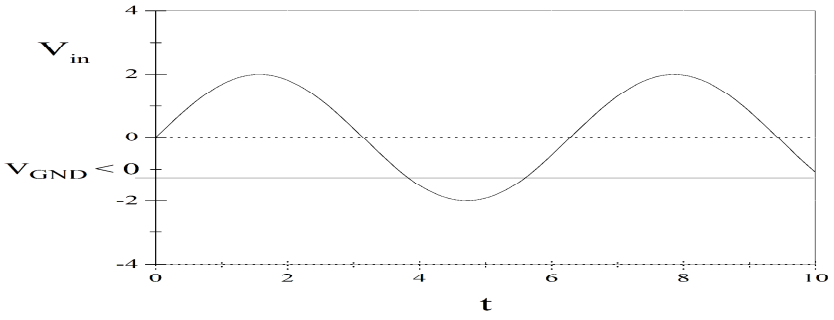
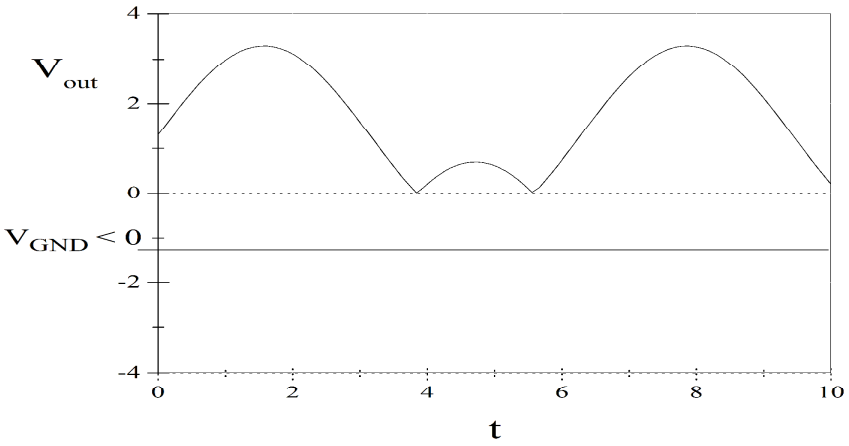


Fig. 2 (a) A negatively shifted "ground"



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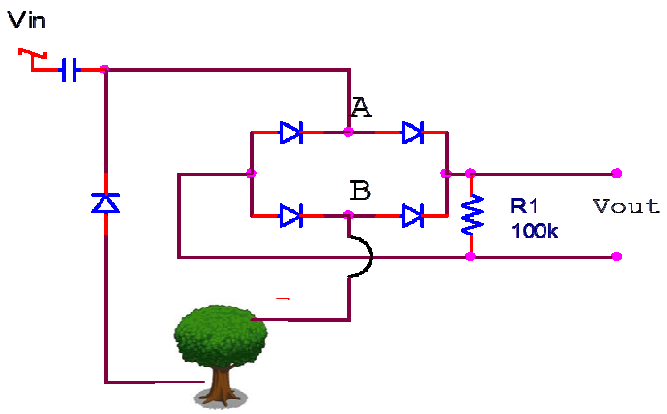

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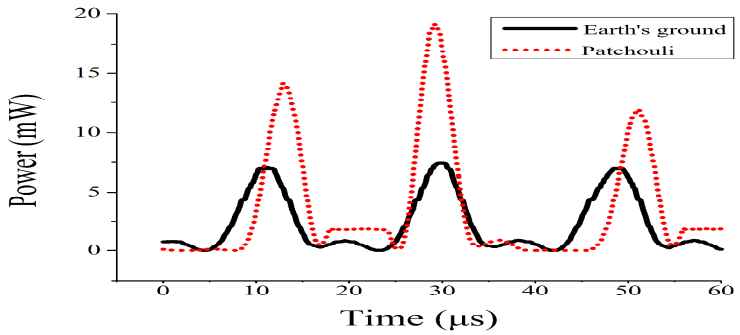

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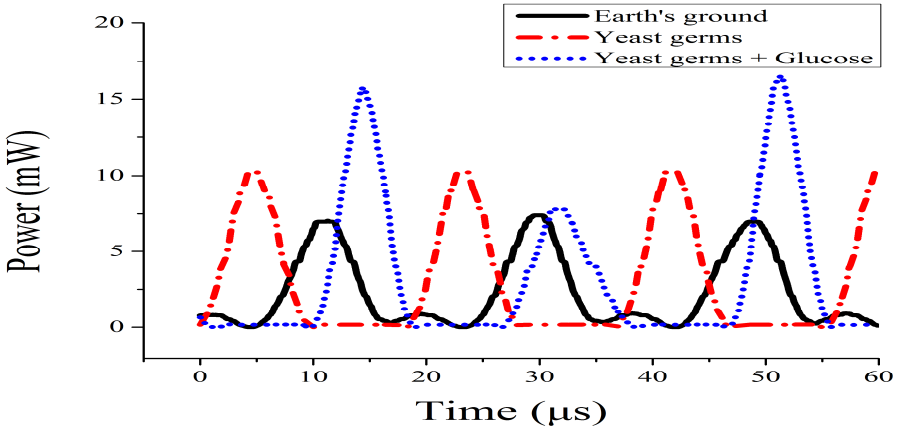
Fig. 3(c) A base containing 7 Patchouli plants



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