I J C T A, 9(16), 2016, pp. 8095-8100

A Novel method for the development of Solar Energy through Nature by Nano-piezoelectrical Materials

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ABSTRACTP

With a drastic increase in price of fossil fuels, we needs alternative resources to go on with even our daily activities. Several renewable sources are considered as an alternative for the present energy crisis. However, they have some limited applicability. Hydro energy, wind energy and solar parabolic energy- are all renewable applications. But, several drawbacks are posed by these sources like expensive manufacturing, high installation and maintenance cost, environmental dangers, decrease in property and land values etc. Thus, there is an immediate call to switch over to a better, eco-friendly, affluent energy resource, which eliminates the problems faced by a traditional solar panel fields, i.e., non-availability of solar energy during cloudy or rainy days and during nightfall. While we scratch our heads thinking of various ways to lower up our carbon foot print, solar botanic has come up with a unique solution called energy. Harvesting trees that will offer renewable electricity through solar and wind energy using artificial trees. In case of solar botanic trees, the movement of Nano-leaves depends on the excess availability of wind. More the wind, greater will be the movement of Nano-leaves. Wind that moves large number of Nano leaves which are tiny Nano piezo-electric elements cause mechanical strain in the petiole, twigs and branches when used in tree canopy, these have the ability to generate electricity of the order of millions of pico watts as these Nano leaves move back and forth due to strong wind. Stronger the intensity of wind, higher the "flap" frequency, and thus the watts generated in the petiole, twigs and branches are in abundance. The similar case is of energy during rainfall, the mechanical vibrations in the small generators produce electricity due to movement caused by wind or falling raindrops.

Keywords: Fossil Fuels, Nano Leaves, Piezo-Electric, Renewable Source, Generators, Energy, Solar Botanic Trees**.**

1. INTRODUCTION

BIOMETICS- It is an inspiring solar energy technology development through nature. Our solution is primly based on the principle of 'distributed generation'[1-7]. This solution is loosely based on the principle of biomimicry. Biomimicry [8-9] is a latest discipline that takes into consideration best ideas that the surrounding nature provides and then uses these designs and processes to solve the various difficulties faced by mankind. It is the practice of developing sustainable [6-7], human technologies that are inspired by the nature. We have numerous examples around us inspired by nature like Bionic Car: Daimler Chrysler [10] has developed a new concept car from Mercedes-Benz based on the shape of an odd tropical fish - the Bionic Car. Using the shape of the tropical biofish, designers achieved an aerodynamic ideal that boasts 20% less fuel consumption and as much as an 80% reduction in nitrogen oxide emissions. The diesel-powered compact will get about 70 miles per gallon, and can run just fine on biodiesel fuel.

Self-Healing Plastics: Imagine how great it would be to see if the body' uses its own power to heal itself and get rid of the wounds/bruises. Similarly, a light polymer composite can be used to synthesis aircraft fuselage. The composite materials hence used to achieve the above mentioned process are called self-healing plastics.

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2. SOLAR BOTANIC TREES

Solar Botanic as shown in Figure 1 will introduce artificial trees that make use of renewable energy [4-5] from the sun and wind, they are an efficient clean and environmentally sound means of collecting solar radiation and wind energy.

This plan involves bringing together three different energy-generation technologies. They are:

- Photovoltaic (PVs) are arrays of cells containing a material that converts solar radiation into direct current electricity. Materials presently used for photovoltaic [11] include amorphous silicon [12], polycrystalline silicon, microcrystalline silicon etc.
- Thermoelectricity [13] refers to a class of phenomena in which a temperature difference creates an electric potential or an electric potential creates a temperature difference.
- Piezoelectricity [14-15] is the ability of some materials (notably crystals and certain ceramics, including bone) to generate an electric field or electric potential in response to applied mechanical stress [16].

Figure 1: Botanic trees

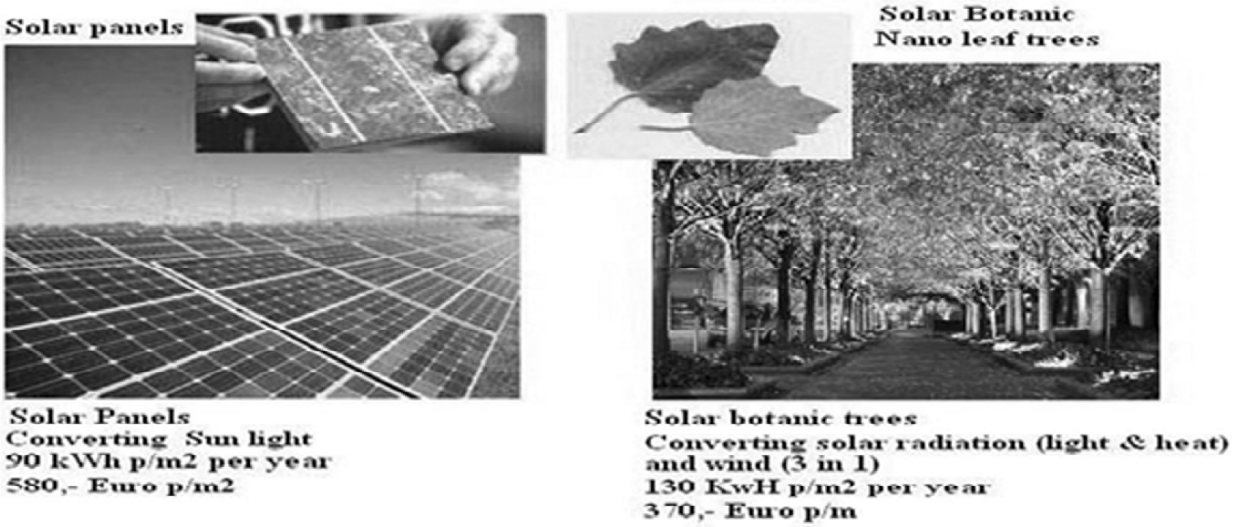

Figure 2: Solar panels versus solar botanic trees

- Harness the power of the sun, Figure 2, integrate all aspects of a tree from leaf, branch and twigs and convert solar to electricity to power cities, autos and highways. In this biomimicry concept our trees are fitted with Nanoleaves [17-22], a combination of Nano-photovoltaic [23], Nano- thermo voltaic [24] and Nano-piezo generators[25] converting light, heat and wind energy into green electricity [26-27].

3. NANO LEAF

The main component in this technology is Solar Botanic's artificial leaf called the 'Nano leaf', as shown in Figure 3.

- It consists of a very thin photovoltaic film on one side, which converts the light from the sun into energy.
- Another thin thermo voltaic film on the other side of the leaf converts the heat from the solar energy into electricity.
- In addition to solar power, as wind or rain will cause disturbance to the false leaves then Nano generators could generate small amounts of piezoelectric power.

A Nano leaf is like a thin natural looking leaf. When forces like the turbulence in air sways the Nano leaf and they sway back and forth, mechanical stresses appear in the various parts of the tree . Flapping of large number of Nano leaves has the ability to generate electricity of the order of millions of pico-watts. The Nano leaves reflect only a fraction of the sunlight that strikes them, most of the green light of the spectrum is efficiently converted into electricity.

Apart from converting the visible light, Figure 4, Nano leaves have the capability of converting the invisible part of the spectrum especially the infrared radiation, which we can't see but only feel. The typical

Figure 3: Photo voltaic conversion in nano leaves

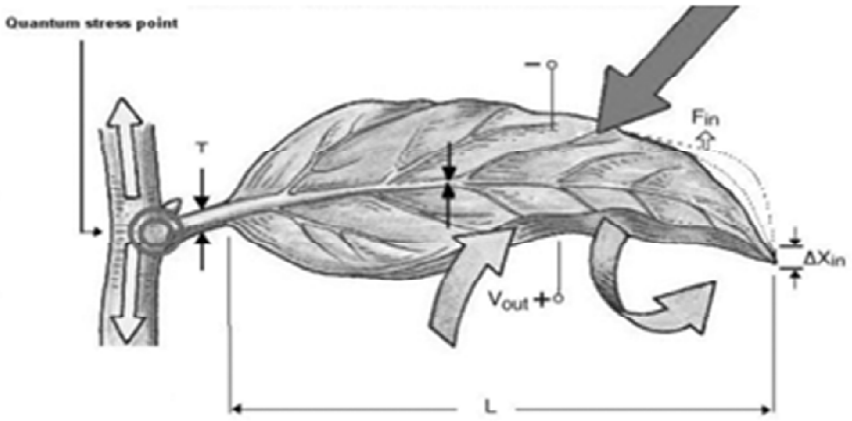

Figure 4: Process of Green Energy Provider

combination of photovoltaic and thermo-voltaic processes in the Nano leaves the conversion of light and thermal radition into electricity is achieved easily, even if there is no sunlight. Stronger the wind ,greater is the movement of Nano-leaves. More the wind, higher will be the "flap" frequency, and large amount of watts will be generated in the petiole, twigs and branches.

The advancements in the field of Nano technology, the materials such as photovoltaic, thermo-voltaic and piezo electric are becoming highly efficient and intergrated in one system it will further efficiency and soon, Solar Botanic will be a new green energy provider, with higher reliability, will be cheaper and also better looking.

4. TYPES OF NANOLEAFS

The different types of nanoleaf's discussed in the literature are given below:

- Broad Leaf trees- These trees can provide between 3500 kWh and 7000 kWh per year. These species provide shade, cooling the air, green ambiance.
- Ever green trees- They can provide between 2500 kWh and 7000 kWh per year. They can be used as single trees to fence gardens.
- Shrubs, Plants, Roof, Wall and Fencing- Nano leaf roof Carpets can be installed easily on any roof design. Wall carpets can be applied as fencing.

5. CAPACITY OF BOTANIC TREES

A small tree with a canopy of 6 sq. meters can very easily create adequate energy to provide for the needs of an average household and a tree with a 20 ft. solar canopy will be able to generate enough power between 2000 kWh and 12000 kWh per year. An unremitting operation over two decades could produce 1, 20,000 kWh of energy. It is possible that a kilometer of solar botanic trees would be able to generate nearly 350,000 kWh per year, enough electricity to power around 60 average size houses. Solar Botanic solutions offer up to 50% more power than conventional solar systems.

6. APPLICATIONS

The main applications of the botanic trees from the study conducted in this paper are found to be as follows:

- Urban and Rural
- parks
- housing estates
- resorts and Golf courses
- Coastal areas
- Highways
- Airports
- Deserts
- Penthouses, balconies, verandas, private gardens
- De-forested areas
- Islands
- Ponds, lakes, seas and oceans
- Protection of Crop
- Solar Botanic flowering plants

Solar Botanic [28-33] can be used for: Windshield [34], Shade, anti-glare, objectionable views, sound barrier, windbreak, wind obstruction & much more.

7. CONCLUSION

India being the 2nd largest country in the world, the rise in the demand of the energy has forced the mankind to find a solution which will be efficiently and abundantly available source of energy. As the solar botanic trees is a non-conventional [35] source, we have many advantages of producing electricity compared to the other resources. Green Energy is the need of the hour and it is our responsibility to ensure a safer planet for the future generations. It is therefore vested on the shoulders of the citizens of the earth, or shall we say Earthlings to think smart and take the right decision. Everything starts with an individual, co-operate with the government and see your progeny enjoy the fruit of your actions and make life favorable for sustenance for mankind.

REFERENCES

[1] What are "Renewable Resources"?, by A. John Armstrong, Esq. & Dr. Jan Hamrin, Chapter 1, The Renewable Energy Policy Manual, Organization of American States, undated. Retrieved 2013-01-05.

[2] Walding, Richard, Rapkins, Greg, Rossiter, Glenn (1999-11-01). New Century Senior Physics. Melbourne, Australia: Oxford University Press. ISBN 0-19-551084-4.

[3] Helman, D.S. (2011). "Catching lightning for alternative energy". Renewable Energy 36: 1311–1314. doi:10.1016/ j.renene.2010.10.027. Retrieved March 5, 2013.

[4] Vincent, Julian F.V.; Bogatyreva, Olga A., Bogatyrev, Nikolaj R., Bowyer, Adrian, Pahl, Anja-Karina (21 August 2006). "Biomimetics: its practice and theory". Journal of The Royal Society Interface 3(9): 471–482.doi:10.1098/rsif.2006.0127.

[5] Vincent, Julian F. V. (November 2009). "Biomimetics — a review". Journal of Engineering in Medicine. Proceedings of the Institution of Mechanical Engineers. Part H 223 (8): 919–939.doi:10.1243/09544119JEIM561.

[6] DaimlerChrysler AG – The History of Daimler-Benz AG". Retrieved 27 January 2011.

[7] Terry, Mason L.; Straub, Axel; Inns, Daniel; Song, Dengyuan; Aberle, Armin G. (2005). "Large open-circuit voltage improvement by rapid thermal annealing of evaporated solid-phase-crystallized thin-film silicon solar cells on glass". Applied Physics Letters 86 (17): 172108.doi:10.1063/1.1921352.

[8] Pathak, M. J. M.; Pearce, J. M.; Harrison, S. J. (2012). "Effects on amorphous silicon photovoltaic performance from high-temperature annealing pulses in photovoltaic thermal hybrid devices". Solar Energy Materials and Solar Cells100:199203.arXiv:1203.1216.doi:10.1016/j.solmat.2012.01.015.13.http://www.britannica.com/EBchecked/topic/ 591626/thermoelectricity.

[9] Le Letty, R.; Barillot, F.; Lhermet, N.; Claeyssen, F.; Yorck, M.; Gavira Izquierdo, J.; Arends, H.; Barillot; Lhermet; Claeyssen; Yorck; Gavira Izquierdo; Arends (2001). "The scanning mechanism for ROSETTA/MIDAS from an engineering model to the flight model". Proceedings of the 9th European Space Mechanisms and Tribology Symposium, 19–21 September 2001, Liège, Belgium. Compiled by R. A. Harris. ESA SP-480, Noordwijk, Netherlands: ESA Publications Division 480: 75–81. Bibcode:2001ESASP.48075L.

[10] Ronald L. Huston and Harold Josephs (2009), "Practical Stress Analysis in Engineering Design". 3rd edition, CRC Press,634 pages. ISBN 9781574447132.

[11] Nanosized Titanium Oxides for Energy Sto-rage and Conversion (Aurelien Du Pasquier).

[12] DNA Biosensors Based on Nanostructured Materials (Adriana Ferancová and Ján Labu-da).

[13] Metal Nanoparticles: Applications in Electroa-nalysis (Nathan S. Lawrence and Han-Pu Liang).

[14] KinematicSelfReplicatingMachines. By Robert A. Freitas Jr . and Ralph C. Merkle . (xxi + 341 pp, 189 illustrations and tables, 3278 refer-ences. Landes Bioscience: Georgetown, TX. 2004)

[15] Prospects in Nanotechnology: Toward Molecu-lar Manufacturing. Edited by Markus Krum-menacker and James Lewis (Hardbound, xviii + 297 pages. Includes bibliographic references and index. John Wiley & Sons, Inc.: New York, Chichester, Brisbane, Toronto, and Sin-gapore. 1995)

[16] Nanostructured Hydrogen Storage Materials Synthesized by Mechanical Alloying (Miec-zyslaw Jurczyk and Marek Nowak).

[17] Assefa, Solomon; Xia, Fengnian; Vlasov, Yurii A. (2010). "Reinventing germanium avalanche photodetector for

nanophotonic on-chip optical interconnects". Nature 464 (7285): 80–4.Bibcode:2010Natur.464...80A. doi:10.1038/nature08813. PMID 20203606.

[18] WIPO (2009-03-02). "(WO/2005/016850) Nano-laminate-based Ignitors". Wipo.int. Retrieved 2010-03-03.

[19] Gurdal, Erkan A.; Ural, Seyit O.; Park, Hwi-Yeol; Nahm, Sahn; Uchino, Kenji (2011). "High Power (Na0.5K0.5)NbO3-Based Lead-Free Piezoelectric Transformer". Japanese Journal of Applied Physics 50 (2): 027101. doi:10.1143/JJAP.50.027101. ISSN 0021-4922.

[20] Leighty and Holbrook (2012) "Running the World on Renewables: Alternatives for Transmission and Low-cost Firming Storage of Stranded Renewables as Hydrogen and Ammonia Fuels via Underground Pipelines" Proceedings of the ASME 2012 International Mechanical Engineering Congress & Exposition November 9–15, 2012, Houston, Texas

[21] Holte, Laura L.; Doty, Glenn N. ; McCree, David L. ; Doty, Judy M. ; Doty, F. David (2010). "Sustainable Transportation Fuels From Off-peak Wind Energy, CO2 and Water". 4th International Conference on Energy Sustainability, May 17–22, 2010. Phoenix, Arizona: American Society of Mechanical Engineers. Retrieved September 7,2012.28.energymatters.com.au/index.php?main_page=news_article&article_id=452.

[22] inventorspot.com/articles/renewable_energy_24285

[23] news.discovery.com/tech/artificial-trees-111119.htm .

[24] http//:www.solarbotonics.com

[25] http://www.asknature.org/product/f0efe88ff818b542a13f35826cfd3273.

[26] www.youtube.com/watch?v=3wI0P4zyg1k

[27] Cognard, Philippe (2006). Handbook of Adhesives and Sealants. Elsevier. ISBN 978-0080447087.

[28] energymatters.com.au/index.php?main_page=news_article&article_id=452.

[29] inventorspot.com/articles/renewable_energy_24285

[30] news.discovery.com/tech/artificial-trees-111119.htm .

[31] http//:www.solarbotonics.com

[32] http://www.asknature.org/product/f0efe88ff818b542a13f35826cfd3273.

[33] www.youtube.com/watch?v=3wI0P4zyg1k

[34] Cognard, Philippe (2006). Handbook of Adhesives and Sealants. Elsevier. ISBN 978-0080447087.

[35] Demirbas, A. (2009). "Political, economic and environmental impacts of biofuels: A review". Applied Energy 86: S108–S117.doi:10.1016/j.apenergy.2009.04.036.