



3D Printed Solar Energy Trees

AISSATOU BARRY

Electricity
harvesting tree



Motivation

- ▶ Solar energy is one of the fastest growing source of alternative energy
- ▶ However, one of the main problems currently faced with solar production is the requirement of a vast amount of land.
- ▶ Construction of large scale solar plants are costly and time consuming
- ▶ Production of solar energy is feasible mostly in areas where real estate is not costly or rooftops of buildings can be used to place solar power energy equipment.



Background

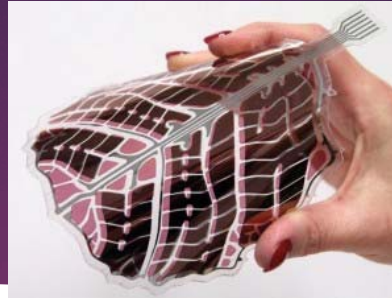
- ▶ The idea of artificial trees that harvest energy is a process known as Solar Botanic was founded by Van der Beek, whose previous profession was teaching alternative medicine.
- ▶ Solar Botanic involves bringing together three different energy-generation technologies: solar power, thermoelectric and piezoelectric, all in the shape of a leaf on its stem
- ▶ 3D Printed solar energy cells originates from The technical Center of Finland(VTT), Which is the largest multi-technological applied research organization of the Northern part of Europe.
- ▶ The main goal of the 3D printed solar energy cell is to eliminate the need for land space to harvest solar energy.



What is it

- ▶ The goal is to produce a space ultra-thin, lightweight and flexible solar cells that can be customized to any size, shape and electrical performance required in the end-use device.
- ▶ The trees can be placed both indoors and outdoors to harvest energy
- ▶ Electricity is stored internally until it is ready to be used
- ▶ Although the current forms of these trees cannot yet power large scale structures, they are currently capable of powering small devices such as smartphones, thermometers, LED lightbulbs and other household appliances and gadgets

The leaf



- ▶ Each leaf's solar panel is just 0.2 mm thick
- ▶ Consists of electrodes and polymer layers
- ▶ The leaves and its layers are 3D printed and each leaf includes detailed connections for the wiring and photovoltaic cells.
- ▶ The surface area of these cells is approximately 0.0144 square meters.
- ▶ According to the company 200 of its leaves can output about 3.2 amperes of electricity.
- ▶ If they are placed on an outdoor location, one square-meter of leaves can generate 10.4 watts – in case of a sunny climate.
- ▶ Each "leaf" is affordable and consumes very little raw material.

The Trunk

- ▶ The trunks of the trees are 3D printed with the use of Wood-based bio composites
- ▶ A wood-based composite is a composite material that is created from wood with only a few percent resin and other additives.
- ▶ Bio composites often mimic the structure of the living material
- ▶ Although the solar leaves are not a 100 percent environmental friendly, the wood based filament is environmental friendly material





How it works

- ▶ Trees are made from organic cells
- ▶ The connected leaves within the tree creates a unified electronic system that feeds the harvested solar energy into a converter before it is able to be used to power small devices
- ▶ Multi converter system allows the collection of energy from various sources such as solar
- ▶ Increase in solar panels in trees leads to an increase in harvested energy
- ▶ Because the Trees are mass producible, they can be infinitely replicated

Why organic Cells

- ▶ Organic cells are used due to the ability of the layers to be solution-processed in an ambient atmosphere and at room temperature using R2R printing or coating techniques.
- ▶ There is no vapor deposition process in OPV, extensive soaking stages or high temperature steps are required.
- ▶ Compared to other thin film Technology, OPV can provide
 - ▶ Flexible, lightweight and ultra-thin ($\sim 200\text{ }\mu\text{m}$ in total)
 - ▶ If printed (not coated), unlimited designs on any shape is possible, giving true design freedom
 - ▶ Large or small area modules possible – customized electrical performance
 - ▶ Low-cost production
 - ▶ Environmental sustainability

Life Time



- ▶ Normally We expect trees to grow new leaves every year, However the 3D printed tree does not have that ability
- ▶ The leaves of the artificial tree has a life time of a few years, The leaves must then be replaced
- ▶ According to the scientists working on this project at VTT, The leaves can be fully recycled, resulting in new leaves being created from the material of the old leaves.
- ▶ Due to their roll-to-roll manufacturing method, they can produce up to 100 meters of leaf rolls (see image above) per minute.



https://youtu.be/_QswunfBC8U

References

- ▶ <http://www.scientificamerican.com/article/artificial-trees-harvest-sun-a>
- ▶ <http://www.3ders.org/articles/20150218-3d-printed-solar-energy-harvesting-tree-can-charge-smartphones.html#nd-wind-energy/>
- ▶ <http://www.slideshare.net/sahityk/energy-harvesting-trees>
- ▶ <http://www.alternative-energy-news.info/3d-printed-solar-energy-trees/>
- ▶ <http://www.vttresearch.com/services/smart-industry/printed-and-hybrid-manufacturing-services/printed-oled-and-organic-solar-cells>
- ▶ <http://3dprinting.com/news/3d-printed-generates-solar-energy/>



Questions?

https://youtu.be/_QswunfBC8U