

### *The Use of Artificial Leaves and Solar Cells for the Sequestration of Carbon*

The dangerously rising levels of carbon dioxide (CO<sub>2</sub>) in our Earth's atmosphere pose serious threats to our environment. One of the major issues associated with increasing amounts of CO<sub>2</sub> that many scientists are concerned about is global warming. CO<sub>2</sub>, whether it is emitted from cars, factories, or electricity generators, is one of the leading greenhouse gases causing the greenhouse effect. As people continue to expand the industrial sector of the world, the environmental consequences are at times underestimated. It is imperative that we increase our awareness of these consequences and reduce the amounts of CO<sub>2</sub> in our atmosphere. PHS Beleaf was prompted by this challenge, and researched and designed a plan that combines the use of the artificial leaf and solar panels to increase photosynthetic productivity and use natural sources of energy as a means of reducing CO<sub>2</sub> levels.

Recently, the artificial leaves have been gaining hype among environmentalists. They contain chloroplasts that facilitate photosynthesis just like a real leaf. The difference is that these leaves are far more ductile than real leaves so they can adjust to very rigid surfaces. The artificial leaves do require water and sunlight for photosynthesis to occur, but do not require soil or fertilizer to maintain activity. In addition, each leaf absorbs about 0.0007 pounds of carbon dioxide per year, and photosynthesizes 49 percent more efficiently than an actual leaf<sup>1</sup>. The PHS Beleaf plan includes placing these artificial leaves all over the tops of buildings. In doing this, more of the carbon dioxide in the air could be taken in and used for photosynthesis. At the same time, the tops of buildings would also serve a new, environmentally-friendly purpose. In Manhattan, New York, one of the most densely populated areas in the United States, the area of

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<sup>1</sup> <http://www.bbc.com/future/story/20121004-fake-trees-to-clean-the-skies>

the roof of a typical building is approximately 2,192,000 square centimeters, and there are about 67,700 buildings<sup>2</sup>. This would mean that if artificial leaves covered every single building in Manhattan, an average of about 9 million pounds of carbon dioxide would be taken in every year which would account for CO<sub>2</sub> emissions from about 510,000 cars<sup>3</sup>.

Solar panels have been around ever since the mid to late 1900s when they were implemented in space. Now, many people use them to naturally generate electricity in their homes and to reduce the need to generate electricity through the burning of fossil fuels which emits more than 90 percent of greenhouse gases including carbon dioxide<sup>4</sup>. PHS Beleaf would like to implement solar panels comprised of polycrystalline silicon solar cells. These are 19 percent efficient<sup>5</sup> and are less expensive than monocrystalline silicon solar cells. In addition to placing the artificial leaves on the roofs of buildings, PHS Beleaf would like to place these solar panels on the barriers that typically block off the sides of the rooftops of most commercial buildings. This would contribute to the mitigation of CO<sub>2</sub> emissions as the electricity for the building could run on solar power instead of burning fossil fuels. Generally, about 500 tons of coal must be burned to generate 1 gigawatt per hour. In turn, this would emit about 1,430 tons of carbon dioxide into the atmosphere. In New York, a total of 60,000 gigawatts of electricity are consumed<sup>6</sup>. If solar panels are used on top of buildings to generate electricity instead of burning coal, approximately 450,450 tons of carbon dioxide could be saved from entering the atmosphere.

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<sup>2</sup> <http://www.citylab.com/tech/2013/09/map-shows-ages-million-buildings-new-york-city/6932/>

<sup>3</sup> <http://www.epa.gov/cleanenergy/energy-resources/refs.html>

<sup>4</sup> <http://www.epa.gov/climatechange/ghgemissions/sources.html>

<sup>5</sup> <http://www.gizmag.com/record-19-percent-efficient-solar-cells/14964/>

<sup>6</sup> <http://ny-sun.ny.gov/About/NY-Sun-FAQ>

It is crucial that carbon dioxide emissions in the atmosphere are reduced. If we fail to realize the severity of this situation, the issue of global warming will quickly worsen. After researching and analyzing the problem, the PHS Beleaf team has designed a plan that could be the answer to mitigating the issue. The use of the innovative artificial leaf would increase photosynthetic activity, and solar cells would provide an alternative, natural means of generating electricity while decreasing the need to burn fossil fuels to provide electrical power to buildings. By choosing to utilize these on the rooftops of buildings, there is little concern for space limitations and no need to make immense changes to the current structure of the buildings. Additionally, each building would become more environmentally friendly. The benefits of this plan bring us closer to a better, healthier environment. Although global warming cannot be completely prevented, there are ways to prevent activities that contribute to global warming, and encourage activities that help reduce it. The PHS Beleaf team firmly believes in the potential of the implementation of the artificial leaf and solar panels to achieve exactly that.