

## Cost-Reduction Strategies Developed by Various Photobioreactor Manufacturers

Company	Cost-reduction strategy	Key strategy
<p>Algasol Renewables SL  (Spain)</p>	<ul style="list-style-type: none"> <li>● Algasol Renewables has successfully launched its novel and flexible polymer photobioreactor with a fully integrated internal aeration system.</li>   <li>● The new internal aeration system has lowered production cost of algae oil with 10% and the results in terms of productivity and biomass density are very promising.</li> </ul>	<p>Maximum scalability, a low-cost material and design, a large reactor volume and an internal aeration system</p>
<p>Solix Biofuels (USA)</p>	<ul style="list-style-type: none"> <li>● The AGS system comprises a network of thin, vertical panels buoyantly supported in a shallow water bath.</li>   <li>● The algal culture is contained in these panels; the vertical orientation provides “extended surface area” which allows illumination of more surface area at lower intensity per unit area, thus maximizing photosynthetic efficiency.</li>   <li>● Marginal cost of large-scale production using the current technology is approximately \$1/liter (\$150/barrel); with a defined path to reducing the production cost by half over the next 2-3 years.</li> </ul>	<p>Thin, vertical panels that provides “extended surface area”</p>
<p>W2 Energy (USA)</p>	<ul style="list-style-type: none"> <li>● The SunFilter is a tubular algae bioreactor designed to sequester greenhouse gases.</li>   <li>● The Sunfilter has optimum light distribution because of the diameter of the tubes and its novel construction. The modular system</li> </ul>	<p>Low power ultraviolet lights, diameter of the tubes for optimal light distribution.</p>

	<p>can be built from one unit (cell) to multiple units occupying many acres.</p> <ul style="list-style-type: none"> <li>● W2's SunFilter (algae reactor) is low cost, scalable, has high productivity, uses less water, has less harmful contamination, and maximizes sequestering of CO2 and other feed gases.</li> </ul>	
Simgae™ (USA)	<ul style="list-style-type: none"> <li>● Simgae™ offers a system that makes cost and simplicity the driving variables instead of creating elaborate architectures.</li> <li>● The system uses unique thin walled polyethylene tubing, called Algae Biotape®, similar to conventional drip irrigation tubes.</li> <li>● All the supporting hardware components and processes involved in Simgae™ are direct applications from the agriculture industry. Re-use of these practices avoids the need for expensive and complex hardware and costly installation and maintenance.</li> <li>● Preliminary estimates are that Simgae™ capital costs will be less than \$20k per gross acre and is therefore expected to deliver a roughly 5X - 50X of reduction in capital costs.</li> </ul>	Thin-walled polyethylene tubing that avoids the need for expensive and complex hardware
Bodega Algae (USA)	<ul style="list-style-type: none"> <li>● Bodega Algae's primary product is a self-contained algae photo bioreactor. The product utilizes proprietary optics to offer efficient, cost effective cultivation of micro algae on a small footprint.</li> </ul>	Low-cost internal light delivery

	<ul style="list-style-type: none"> <li>• The algae photobioreactor developed by Bodega increases the quantity of light required for efficient algal photosynthesis.</li> <li>• Bodega PBR delivers solar energy internally within the photobioreactor. The result is a highly efficient photobioreactor capable of delivering large amounts of algal biomass with minimal use of real estate.</li> </ul>	
OriginOil (USA)	<ul style="list-style-type: none"> <li>• OriginOil has filed a Patent Cooperation Treaty application for a system that provides efficient light utilization with comparatively low energy cost in algae photobioreactors.</li> <li>• The system provides light at closely spaced intervals within a photobioreactor so that light is provided throughout the photobioreactor rather than just at the surface and at the interfaces between culture medium and photobioreactor wall.</li> <li>• The invention addresses challenging problems in the culturing of microalgae, including high energy utilization, fouling of light emitting surfaces, and diurnal growth cycles.</li> </ul>	<p>Light system at closely spaced intervals within a photobioreactor for optimal light distribution</p>