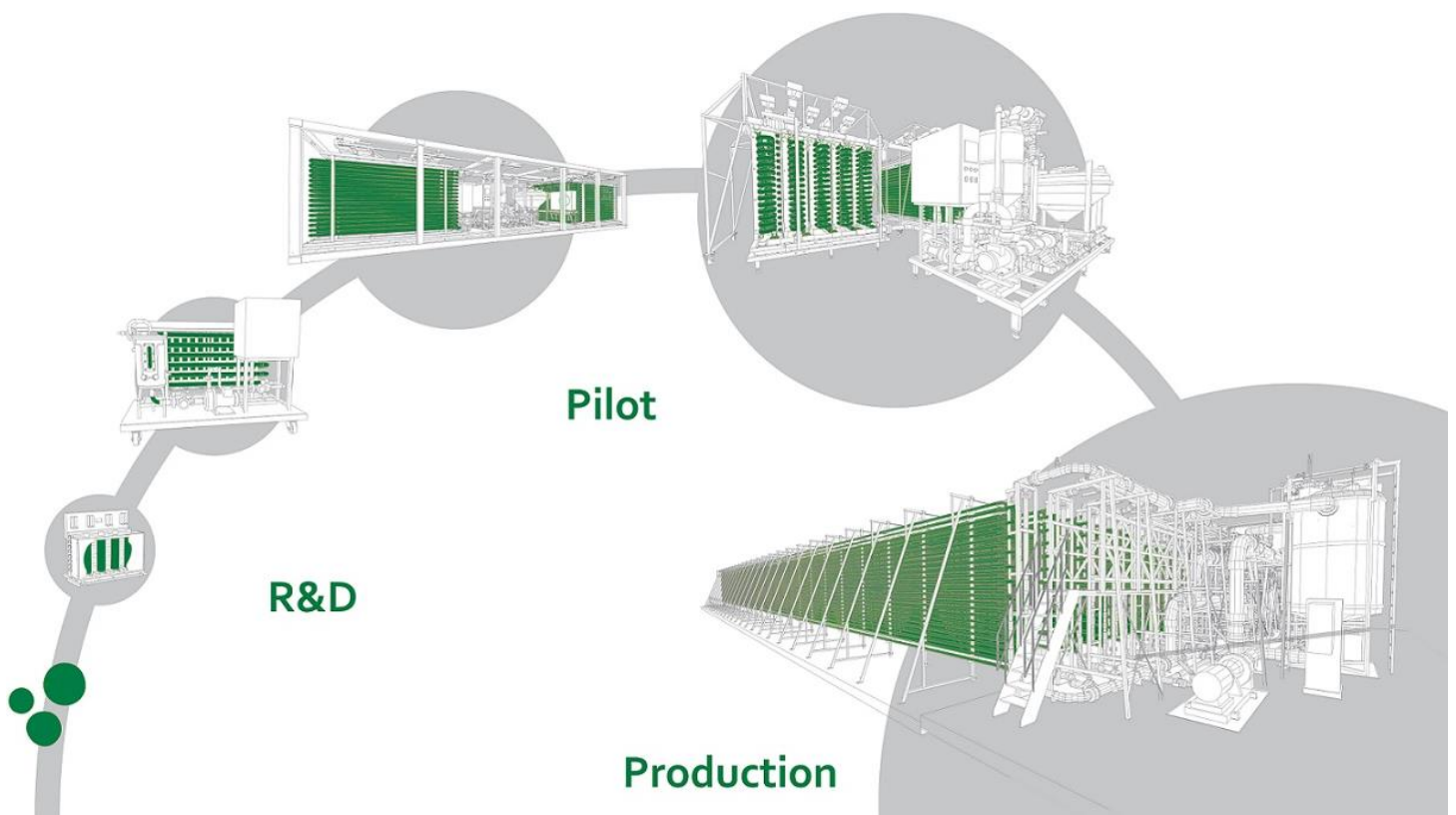


# Photobioreactors with xCUBIO

Proven Tubular Glass Design in Combination with Industrial Quality Equipment for Successful Phototrophic Projects from Lab to Scale



Modular design for flexible scaling options

10 years warranty on glass parts

Prepared engineering for scaled installations

Pharma-certified automation system

Flexible species application

Optional harvest technology

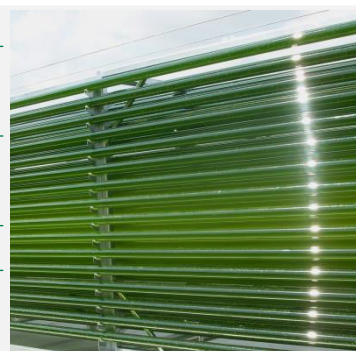
## Lab Scale: XCL 500 Artificial Illumination, Skid Installation on Wheels, In- and Outdoor Operation, Clean Inoculum

Overall Measures	2,300 x 1,800 x 3,900 mm (W x H x D)		
Measures Cultivation Module	2,300 x 1,800 x 3,400 mm (W x H x D) Central system vessel 100 l, bottom outlet, for degassing, sensor installation, level		
Illumination	Standard	No illumination, for outdoor/greenhouse operation	
	Optional	Specific LED arrays or fluorescent tubes	
Mixing System	FC-controlled centrifugal pump		
Sensors	1 x temperature in medium	1 x temperature in thermostat	
	1 x pH	1 x pressure	



## Pilot Scale: XCL 2000 Skid Installation on Wheels, Greenhouse or Outdoor Operation, Clean Inoculum Production

Overall Measures	2,500 x 2,500 x 14,000 mm (W x H x D)		
Measures Cultivation Module	2,500 x 2,500 x 10,500 mm (W x H x D) Central system vessel 250 l, interfaces to harvest system, indirect tempering prepared		
Illumination	Standard	No illumination, for outdoor/greenhouse operation	
	Optional	Specific LED arrays or gas pressure lamps	
Mixing System	FC-controlled centrifugal pump		
Sensors	1 x temperature in medium	1 x temperature in thermostat	
	1 x pH	1 x pressure	



## Production: XCL 50000 Greenhouse or Outdoor Operation, Basic Module for Industrial Installations

Overall Measures	15,000 x 2,800 x 60,000 mm (W x H x D)		
System Volume	App. 50 m <sup>3</sup> Operational volume, split into 8 submodules		
Illumination	Standard	No illumination, only for outdoor/greenhouse operation	
	Optional	Gas pressure lamps	
Mixing System	FC-controlled centrifugal pump, redundant installation as an option		
Sensors	1 x temperature in medium	1 x temperature in thermostat	
	1 x pH	1 x pressure	



## General Options for xCUBIO Algae Cultivation Systems

Gassing/ CO <sub>2</sub> -feed	Standard	Manually pulsed gassing via magnetic valves and rotameters		
	Optional	Automatic controlled gas mix with MFCs with up to 6 gasses		
Cultivation Temperature	Ambient control options project specific			
	Tempering direct and/or indirect			
Automation Display	Touchscreen with 10", up to 19" possible; intuitive menu structure; remote access			
	Multiple control, sequencing and export functions (CSV, OPC, VNC, USB)			
Sensors	Standard	pH (2...12)	Temperature (0...100 °C)	
	Optional	pO <sub>2</sub> (0...100 %)	pCO <sub>2</sub> (0...100 %)	OD (0...4 CU)
		Exh. O <sub>2</sub> (0...25 Vol.-%)	Exh. CO <sub>2</sub> (0...10 Vol.-%)	Many more...
Accessories	Harvest system (harvest vessel, harvest pump, harvest device, separator interface)			
	Additional external pumps and balances			
	Integration of customized sensors, SCADA-connections or analytics on demand			

