HTS
facade analysis assignement
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Inter 14

SOLAR LEAF - te bioreactive facade

The solar leaf facade was first tested and insalled on a large scale building in the BIQ house at the IBA in Hamburg in 2013. In total, 129 bioreactors have been installed on the south-west and south-east faces of the four-storey residential building to form a secondary façade.
The facade was created in colaboration of ARUP Group Limited (engeeniring) and Colt International (bio technology) based on a bio-reactor concept developed by SSC Ltd

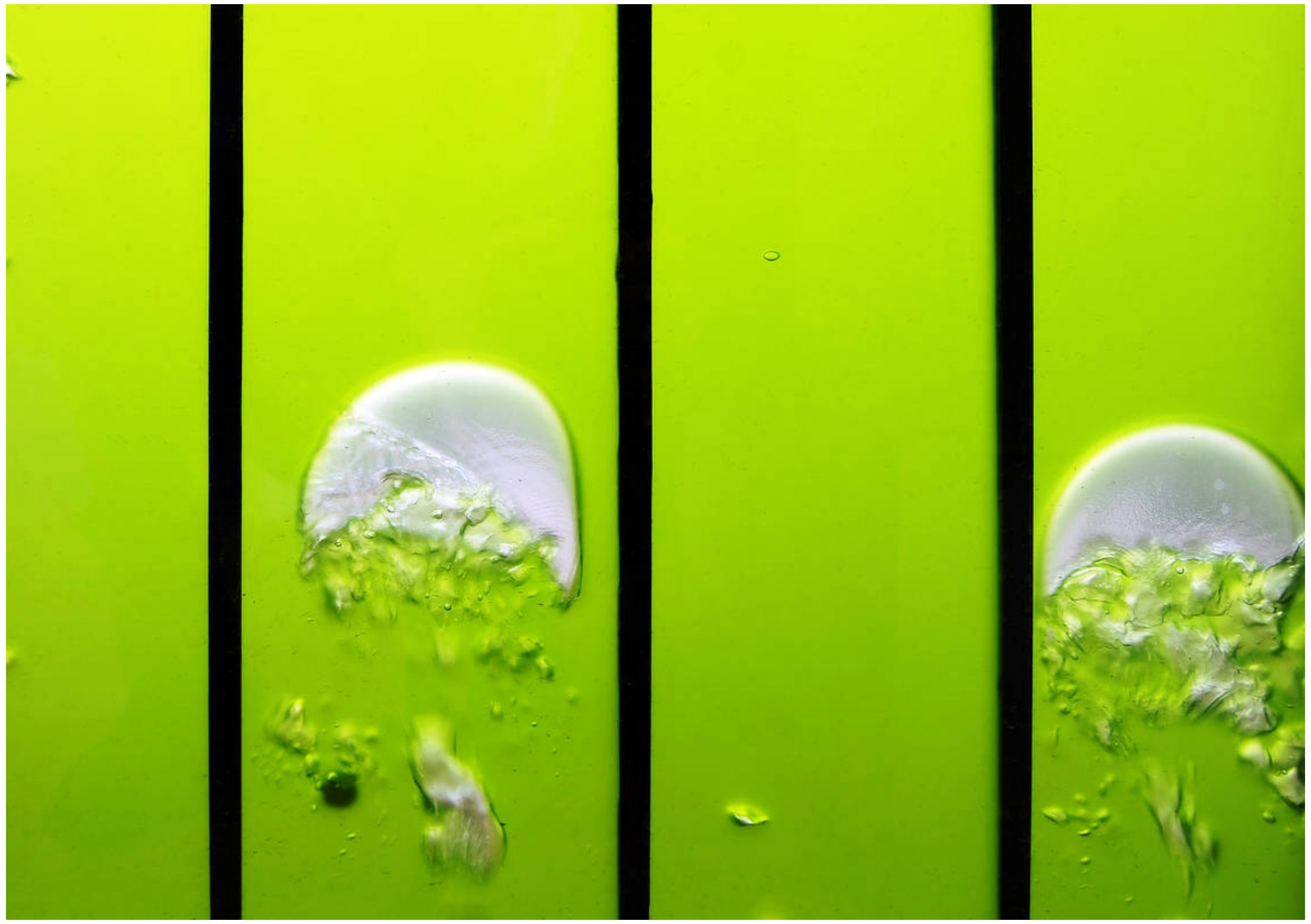
The facade is built from integrated photo-bioreactors. It aims to provide shade and a renewable fuel source for the experimental apartment. This revolutionary solution has multiple advantages and functions. It provides dynamic shading, thermal insulation and noise abatement,

The heart of the system is the fully automated energy management centre where solar thermal heat and algae are harvested in a closed loop to be stored and then fermented to generate hot water.

The biomass and heat from facade panels are transported by a closed loop system to the building's energy management centre, where the biomass is harvested through floatation and the heat by a heat exchanger. The excess heat from the photobioreactors can be used to help supply hot water or heat the building, or stored for later use.

Panels work perfectly as dynamic shading devices since microalgae absorb daylight. The cell density inside the bioreactors depends on available light and the harvesting regime. When there is more daylight available, more algae grows providing more shading for the building.

SolarLeaf provides around one third of the total heat demand of the 15 residential units in the BIQ house.



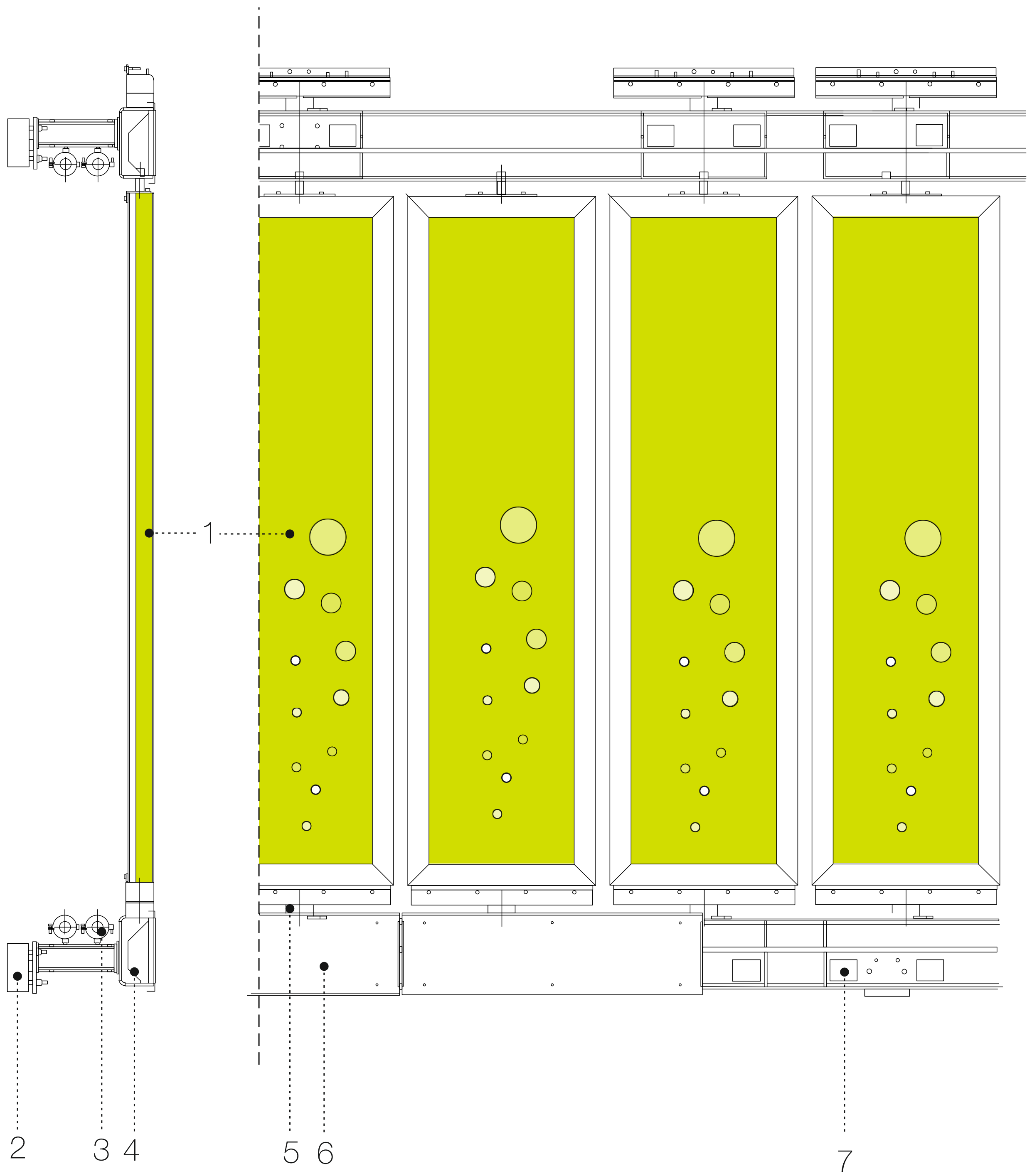
How does it work

Flat panel glass bioreactors measure 2,5m x 0,7m. They are filled with water containing nutrients which convert daylight and Co2 to algal biomass through the bio-chemical process of photosynthesis; at the same time the water is heated up by solar-thermal effects. The biomass and heat generated by the façade elements are transported by a closed loop system to the plant room, where both forms of energy are exchanged by a separator and a heat exchanger respectively. The temperature levels of the heat generated can be increased by using a hot water pump for the supply of hot water and for heating the building. Excess heat can be stored by use of a geothermal system.

The biomass has high energy content, and can therefore not only be used for generating energy but also processed and used by the food and pharmaceutical industries.

Cultivating microalgae in flat panel PBRs requires no additional land-use and isn't unduly affected by weather conditions.

Feeding agaes: the carbon can be taken from any nearby combustion process (such as a boiler in a nearby building).That provides short carbon cycle and prevents carbon emissions entering the atmosphere and contributing to climate change.



1.Solar leaf external louvre
2.Brackets with thermal breaks for the transfer of loads to the primarysubstructure
3.Pipework for the medium to enter and leave
4.Sub-frame, rolled steel U-section
5.Pivot fixing allowing rotation
6.Metal cladding
7.Supply of pressurised air, controlled by magnetic valves