

1 **Microalgal bioreactors and the house of the future**

2 An experimental building in Hamburg is testing the world's first glass facade that produces biomass and heat from microalgae.
3 "Urban areas **consume** energy, water and organic matter but they do not produce any **resources**" says Dr Martin Kerner of
4 Strategic Science Consult in Hamburg. "The **vision** is to make urban areas **productive** and algae are one such **possibility**"

5 The Bio Intelligence Quotient (BIQ) is green in every sense of the word. Not only is the exterior painted bright green but the
6 south facing facades are also made of glass **panels** containing green microalgae. The panels are called bioreactors and inside each
7 bioreactor, photosynthesis is at work, **converting** sunlight to **produce** more microalgae, or biomass, as well as heat. BIQ's
8 bioreactor panels also help shade the building in summer, keeping it cool inside the apartments

9 Each of the 129 bioreactors is filled with water and microalgae culture. At **regular** intervals compressed air is **released** inside,
10 forcing large bubbles to slowly make their way through the green microalgae to the **surface**. The biochemical process produces
11 biomass which can be **harvested** for biogas and used for energy, and it **generates** heat for hot water in the building. Dr Kerner
12 says the biomass produced is rich in amino and fatty acids and has a **range** of uses other than biogas: from animal feed to
13 pharmaceutical products. The bioreactors also **compete** well with solar energy technology in terms of their **capacity** for
14 producing heat and energy.

15 Kerner adds that the **innovative** facades on the BIQ house also look good. "They are made in glass, highly attractive. So you not
16 only have a system which produces biomass and heat, but also something that can be used by architects to improve the
17 appearance of urban areas,"

18 **A building like a plant**

19 Within the BIQ house, the algae culture, water levels and temperature in the bioreactors are **monitored** closely. Biomass is
20 collected by filters and a heat exchange system **removes** heat for heating and hot water. As a smart house of the future, the BIQ
21 house **aims** to be energy **self-sufficient** and become a living part of the urban infrastructure and ecosystem. For example, it can
22 reduce carbon emissions from neighboring buildings by using carbon dioxide as a **nutrient** for the algae, or direct any **excess** hot
23 water to local services.

24 Dr Jan Wurm **leads** research in the BIQ project for an engineering firm. He says that decades ago buildings were considered a
25 "closed box" that had to be heated in a **specific** way. But this **approach** led to heat losses and high energy consumption. "The
26 BIQ system uses exactly the same biochemical processes present in every plant, but we use it on a bigger scale for the **benefit** of
27 a **whole** building," says Wurm.

28 The bioreactors are an example of building houses in harmony with their environment. "It is fascinating to see the skin of a
29 building behaving **similarly** to a plant - very dynamic, very interactive to the changing **external** conditions," says Wurm. "This
30 is the first time that technology and the natural cycle of plants have been interconnected to provide energy for a building in this
31 way."

32 As more cities look towards renewable energy, **incorporating** nature into urban areas, and **adapting** spaces such as rooftops for
33 farming, Wurm says he is **confident** the project will send a strong message to the building and construction industry. "This
34 project is saying for the first time: 'yes, we can do it, the technical systems are there, and it works.'" Although it is expensive at
35 present, it's hoped that over time costs will fall - the same way that solar energy technology is becoming more **affordable**.

36 **Smart house of the future**

37 Most of the BIQ's 15 apartments are occupied by "real" tenants, but living in a house of the future also means being part of an
38 experiment. And that's not always a pleasure. Each bioreactor makes a loud **rhythmic** aquatic pumping sound as compressed air
39 is **released** inside. Many tenants in the BIQ house say they don't mind the noise because they feel it is part of the experience. But
40 others admit they would prefer the system to shut down **completely** when they're trying to enjoy the sun out on the balconies.

41 Dr Kerner says that the system is still being refined. The next generation of glass bioreactor panels may incorporate solar
42 photovoltaic cells to produce electricity. And if you're not too keen on the green, you may be able to get your algae in different
43 colors too.