

Lagi 2014

Copenhagen bio-electric farms

Natural resources may run out one after the other and bring many problems across the planet. **New ways to produce energy need to be developed, and local production is to think about and prioritize.**

Community involvement in power generation would stress the significance of our energy resources. The bio-electrical farms project is setting relations of ideas that affect the energy, the food supply and the community, which create a network that provides **a local response that would act on the global issue.**

Today, it is necessary to look for new sources of inspiration, **by studying nature** and natural systems that could answer to contemporary issues (biomimetics). As well as to bring forward new technologies that will be **tomorrow's standards.**

"Nature is everything and does everything." - Montaigne

Electricity is everywhere in nature, we can produce with the sun, with the wind, with water ... But all these energies have their limits, on a economic or a visual point of view.

The energy must now be produced locally, and the integration of these generators in urban areas is a major challenge today.

Another challenge of our time is the production of

food as it asks the same questions as electricity does, and as it is **the energy of humanity**.

By combining food and electricity production while integrating it into the urban environment, the bio-electric farms project meets the **primary needs of the contemporary man**.

The greenhouses **shape follows the old factories footprint**, while opening a new public space in its centre, offering a viewpoint on the old Copenhagen and the Little Mermaid .

The alignment of the greenhouses deforms itself according to circulations, that allow a new porosity and new **framings on the city**.

This north / south orientation allows to direct the growing areas by **maximizing the surfaces exposed to the sun**.

The new public space at the centre of the project is a shared space between physical activities, leisure, an outdoor market and various production areas (planting, maintenance and harvesting).

The shape is feminine, in reference to the Little Mermaid, and organic at the same time. Reflections of different plants and various greens, give a changing composition depending on the weather and the seasons.

Experiments on fruits and vegetables have shown the ability to **generate electricity with fruits and vegetables**.

As it is shown in the work of Caleb Charland (see photos), a simple connection of an apple with anode and cathode, can generate enough electricity to power one to three LEDs.

The fruits and vegetables were selected based on their electrical potential and consumption by the local population (based on a study of the consumption of

fruits and vegetables in Denmark).

The greenhouses shape follows the one of plant growth : from seeding to composting / biogas production, through the growth of fruits and vegetables and the production of electricity.

The **plants are placed on conveyors** which move with plant growth. Each underside of a conveyor is equipped with an **LED system** imitating the sun course and balancing the natural light.

The walls of the greenhouses are made of an **ETFE system**, which helps to regulate the temperature as well as the input of the sun. ETFE, by its lightness, allows the use of **a lighter and finer structure**.

ETFE is a good alternative to glass, it has a 1.7 density structure and it is lighter than glass ($d=2.5$). It transmits light more efficiently and its cost is 24-70 % cheaper. It is capable of supporting 400 times its weight.

Moreover, it has a high wear resistance and is usable in a wide temperature range (-80 to 155°C). Finally, it is recyclable.

The estimated electricity production is based on a simple calculation that evaluates the amount of fruits and vegetables production by the estimated electricity production average:

$1\ 000\ 000 \times 18.5\ \text{w/h} = 18\ 500\ 000\ \text{w/h}$ + the caloric energy produced by the consumption of fruit and vegetables by man.

"Nature, to be commanded, must be obeyed." - Francis Bacon