COST C8 *Best Practice in Sustainable Urban Infrastructure*
Draft Case Study

CASE STUDY TITLE: The Kolding Pyramid

SECTOR – WASTE WATER COUNTRY – DENMARK

BACKGROUND

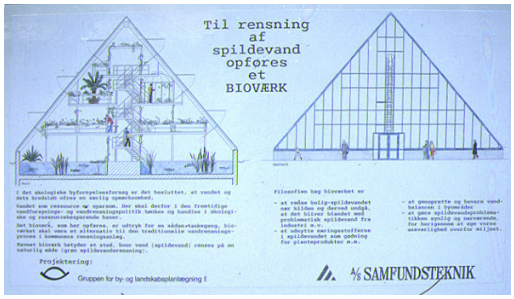
Urban ecology – the creation of more sustainable cities – was discussed much in Denmark in the late 80ties. Most of the initiatives to project were taken by private persons and NGOs. These initiatives were characterised by being:

- Small scale
- Transparent, simple technology with great symbolic value
- Single sector – not integrated – efforts
- Lack of documentation and evaluation of results
- Lack of systematic recording of experiences and collection of knowledge

This project can be seen as a reaction to this. It is a top-down, large scale, integrated project with emphasis on documentation.

The Pyramid is situated in the Hollændervej/Fredensgade block in Kolding. All sewage in the block is collected, pre-treated in a small underground mechanical-biological sewage treatment plant, sterilised in an uv-ozone filter, pumped to the Pyramid, where the sewage are further cleaned by algae and plants. The total surface of the tanks is 840 m^2 and the total tank volume is 460 m^3. From the Pyramid, the sewage is 'polished' in a reed-bed and infiltrated in the ground. In principle, no wastewater leaves the block. The Pyramid was operational in 1994

The Pyramid is situated in the courtyard of a mid-size Danish town

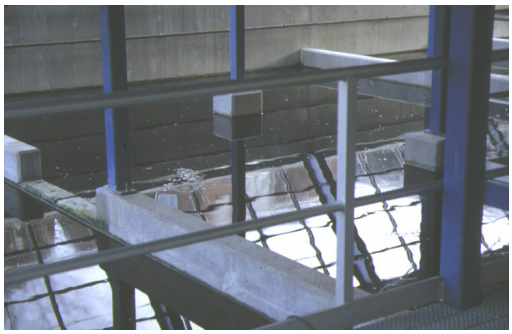


Poster in the courtyard showing the principle of the Pyramid 'green' sewage treatment plant: Plants and algae cleaning the sewage

The block comprises of 129 apartments with approximately 250 residents
The Pyramid 'green' sewage treatment plant is the most spectacular element in the entire project. However, the project comprises of

- Energy savings in the dwellings
- Passive solar heating
- Photovoltaics
- Water saving installations
- Use of rainwater for toilet flushing
- Renewed courtyard
- Use of sustainable materials
- Composting of organic waste
- Recycling of paper, glass etc

One of the original basic ideas was to use the Pyramid as part of the common space for the residents in the block.



Phytoplankton, zooplankton, crayfish and fish play a decisive role in the waste water treatment. Danish fish like roach and bream are grown in the pond – together with imported carps.

Indicators

For the waste water part of the part the project a number of indicators are used:

- Use of heat
- Use of electricity
- Nutrients in the water
- Bacteria in the water
- Visits and media coverage

Visits and media coverage was used to illustrate the impact in the surrounding society.

Plants are being irrigated with the sewage and thus reducing the content of nutrients
Fern, ivy and bamboo grow in the Pyramid. The plants are sold for decoration in private homes.

Evaluation

The evaluation of the project is still going on. Most of the following facts are based on an early official evaluation in 1997. However, the Pyramid has been subject to a number of rather critical evaluations, mostly carried out by senior students.

All the sewage from the block has been cleaned and infiltrated. The block produces approximately 11000 m^3 of sewage per year. The sewage is cleaned sufficiently to satisfy the rather strict Danish regulation – except for phosphorus. Approximately 40000 plants have been produced per year.

The quality of the air was corresponding to the quality in a clean room.

The energy used for heating was 237 MWh per year – with a temperature of 19.5 °C in the room. Lately, heating of

the Pyramid has been given up – it is considered to expensive. The electricity consumption is not mentioned in the official evaluation report from 1998. However, the evaluation report suggests that the plant lights and the uv-ozone filter are dropped, reducing the use of electricity to 35 MWh per year, which correspond with the measured electricity consumption in 2001. The electricity use is approximately 3 kWh per cleaned m^3 of wastewater.

BENCHMARK DATA

There are no agreed benchmark data. An estimate of the energy consumed in a traditional central sewage treatment plant is 0,5 kWh per m^3 of sewage. In the early period, the electricity use in the Pyramid is 6 times higher than in a traditional facility. However, one could argue, that the heating and the electricity used for plant lights would have been used in another greenhouse if it had not been used in the Pyramid. The use of land is approximately 1,8 m^2 per person versus 0,2-0,3 in a conventional plant.

DRIVERS

The Kolding Municipality, The Ministry of Housing, the Danish Town Renewal Company and two consulting firms took the initiative to make a more integrated solution, demonstrating the state of the art, back in 1991. The block Hollændervej /Fredensgade was chosen, because it was the next block in Kolding entering the town renewal process.

The marine aquatic environment was much in focus in Denmark in the late 1980'es. Hence, there was focus on sewage treatment plants too, and a need for demonstration and full scale testing of 'alternative' technologies. It was decisive for the team to demonstrate a 'green' sewage treatment technology in the block. Lack of space in the courtyard forced the team to build a greenhouse in several stories, ending up with the pyramid shape.

LESSONS LEARNT

Much can be learned from the Pyramid case. The point of view is decisive when the Pyramid is evaluated: is it a project, demonstrating possible 'alternative' technologies, or is it the best solution for the sewage problem in the Hollændervej/Fredensgade block. It is quite obvious that the project has to be seen as a demonstration project, demonstrating a technology that could be used in other places – places without possibilities of connection with a central sewage treatment plant, for instance remote villages and villages on small islands.

An important lesson learnt is about the conflicts between visions of sustainability and health hazards. The original vision was that the Pyramid could be used of the local residents for growing their own vegetables. Health authorities, however, would only let people with an exam in sewage handling enter the Pyramid. Furthermore, they would not let any kind of human food grow there due to the risk of epidemics (even though the sewage is sterilised before it enters the Pyramid)

A lot has been learnt about how to treat the algae, the plants and the fish. One of the general lessons learnt is that the persons responsible for the Pyramid have to be

very well trained and it takes time before they have sufficient experience in running the facility. The rather extensive use of energy suggests that the winter in Denmark is to dark and to cold for a technology based on growing algae and plants. The residents have accepted the project, but it has proved very difficult to engage them fully in this basically top-down driven project.

The Pyramid project has meant a lot of PR for the Municipality of Kolding and the other actors involved in the project. It was used as one of the examples on sustainable urban renewal in the Danish National Report to Habitat II.

The final, but perhaps most important lesson learnt, is about transferability. Some kinds of urban infrastructure technologies are rather sensitive to the specific local conditions. Not only the climate, but also the sunlight conditions in wintertime and the soil structure is quite important here

APPLICATION

The Pyramid project has not been copied directly in any other Danish town, but there is still focus on a number of different 'green' sewage treatment technologies.

TRANSFERABILITY

The local conditions have to be taken into consideration, when transferability is discussed. However, it seems like conditions further South in Europe could be more favourable for the Pyramid project, with less need for artificial light and heating in wintertime.

IMPACT ON SUSTAINABILITY AREAS

Environmental	- High, if placed on the right locality.
Social	- Medium, no direct involvement, but basis for local network
Economic	- Unknown, - the prototype rather expensive
Institutional	- High, creating platform for discussions between departments

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