TIDAL FLUX COPENHAGEN

Tidal Flux Copenhagen introduces the phenomena of tide to Copenhagen, transforming this condition into a source of renewable energy and a site of land art.

Renewable energy is produced through a cycle of filling and emptying the historical shipyard dock of B&W.

A costal landscape made up of cliffs, rocks pools, caves, lagoons and beach are flooded and revealed to allow the visitors to discover and interact with the reinterpretation of the former industrial site.

The land art installation is in constant flux as the water level ebbs and flows, and so to does the type of activity that can occur; from open-air performance to scuba diving, from plug holes for gathering to plunge pools and sandy beach.

A single windpump tower emerges from the dock, a landmark that houses the windpump and a public viewing platform at the top. The light structure marks the future development of Refshaleøen and the former B&W shipyard as an icon in Danish industrial history.

The Tidal Flux Copenhagen is a self-contained habitat, contributing and linking the harbour development of Copenhagen with a new form experiential land art that celebrates history, nature and technology.

TIDAL ENERGY

The creation of the tide through the flooding of the site, is created by dividing the dock into three chambers, with each dividing wall holding five water turbines. During the day, water from the harbour is released into the site through the turbines, and at night, with lower energy demands, water is pumped out by the windpump integrated in the tower. Energy is created by the flow of water between the three chambers making use of both the flooding and the emptying of the site.

Alstom Bulb turbines are proposed for their high level of power capacity ratio for low heads acting as generators in both flow directions for tidal plant applications. The Bulb turbine is designed for a horizontal water passage in the draft tube, improving the hydraulic behaviour of the bulb unit and also results in a lower need for excavation. The turbines are all provided with a security mesh and side flow so to avoid harming the harbours aquatic life.

The energy cycle of the dock stores energy by pumping water out of the lowest place in the dock and allowing it to flow back into the dock turning a turbine to generate electricity. This electricity can then be sent to be part of the city’s grid.

The emptying is staged through the windpump tower at night at times of lower demand and higher levels of wind, the windpump is driven by a vertical axis wind turbine.

SOCIAL AND ENVIRONMENTAL BENEFITS

As a contained habitat functioning as a holistic infrastructural complex for generating hydroelectric power and social recreation, Tidal Flux Copenhagen, rather then being a facility that simply avoids damages to the existing environment, supports the creation of new marginal aquatic habitats and ecosystems.

As a piece of land art the site encourages the collective creation of cultural and recreational activities.

The project opens up for the possibility of proposing a lab and a research centre for marginal aquatic habitats and ecosystems at Refshaleøen, placing the project within funding streams for renewable energy, culture and education.

Tidal Flux Copenhagen is:

- acting as a strong urban landart that increases the value of real estate as well as the livability of Refshaleøen.

- placing it self as a landmark and a destination and thereby a generator for tourism and future local commerce

- celebrating aqua culture and contributing to a more diverse urban flora and fauna

- improving water quality in the harbour by the circulation of water and by reducing the risk of urban flooding and thereby polluting the harbour.

- providing possibilities to divert local rainwater and gaining energy. (esp. seen in the context of a new development of the Refshaleøen.)

- a test site of high-class technology.

PRIMARY MATERIALS

The existing materials from filling the dock is re-landscaped and supplementary structures are achieved with

on-site casted reinforced concrete.

Each terrace is designed with a pattern related to its program and to play with the flow of water.

Sand is used for the upper part of the dock acting as a transition from grass to concrete.

The tower holds a concrete staircase and core, leading to the viewing platform. The façade is draped with a steel mesh allowing transparency and water to be part of its appearance and alludes to the shipbuilding on site.

ESTIMATED ANNUAL kWh GENERATED

The estimation is calculated on the basis of a daily cycle.

The annual kWh is estimated on filling and emptying the site daily, though the project propose a rhythm balanced on the activities of the space.

Harbour to Basin 1

head height 4 meters

volume 16,000 m3

fill time (@ 10 m3/ s flow rate) = 0.5 hr

Total mWh 900

Basin 1 to Basin 2

head hight 3.5 meters

volume 11,500 m3

fill time (@ 10 m3/ s flow rate) = 0.32 hr

Total mWh 460

Basin 2 to 3

head hight 8 meters

volume 71,500 m3

fill time (@ 10 m3/ s flow rate) = 1.986 hr

Total mWh 5720

**Estimated Single Cycle = 8.5 gWh**

**Annually = 3,100 gWh**