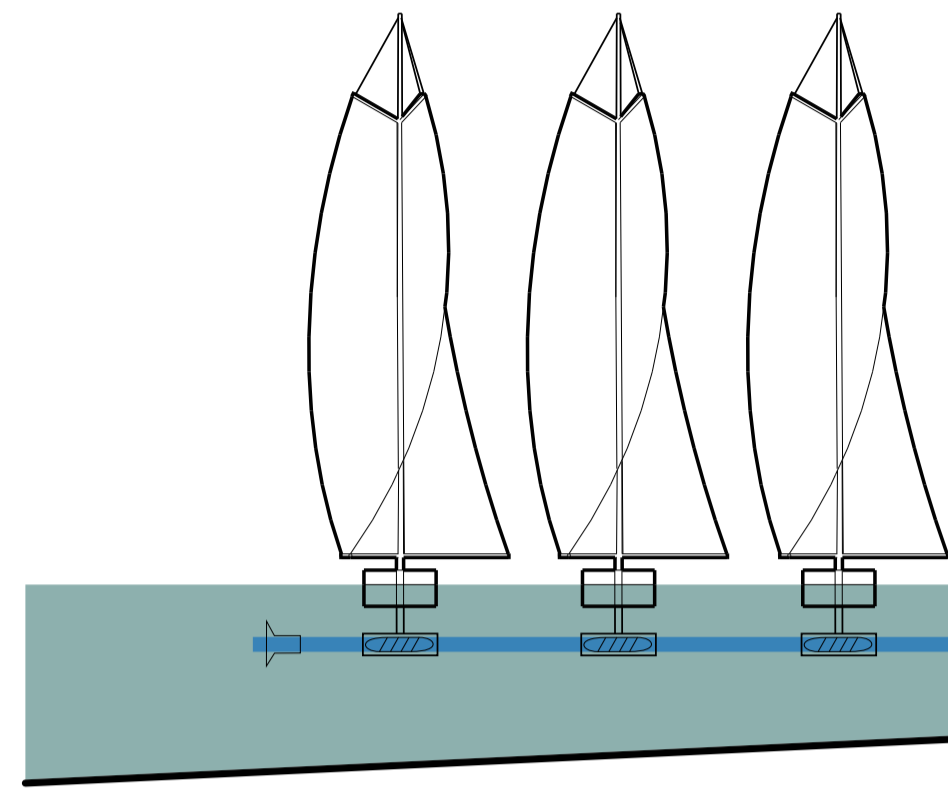


### Wind Power

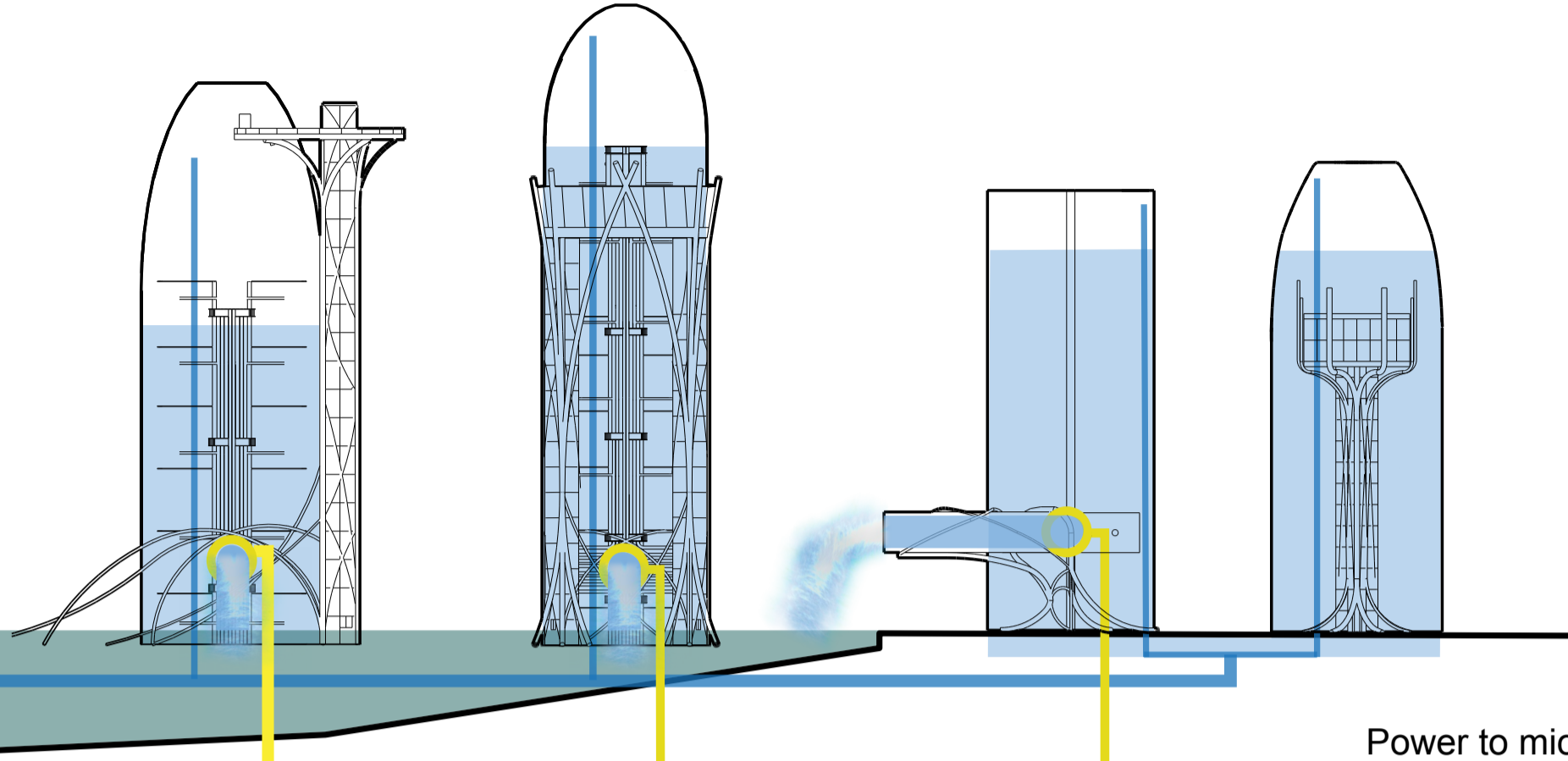
(3) 1.5 MW Equivalent Vertical Axis Windmill water pumps constructed from nautical sails, masts & booms.



Water intake from Copenhagen Harbor

### Water Battery

(4) Tanker water storage containers: 80,000 Cu. M capacity  
Variable Pressure Heads: 120, 95 & 85 M  
Total Energy Storage Capacity: 25,929 KWH  
(enough to power Refshaleøen Micro-Grid for 2.5 days with minimal solar and wind power input)



### Hydro-Electric Power Generation

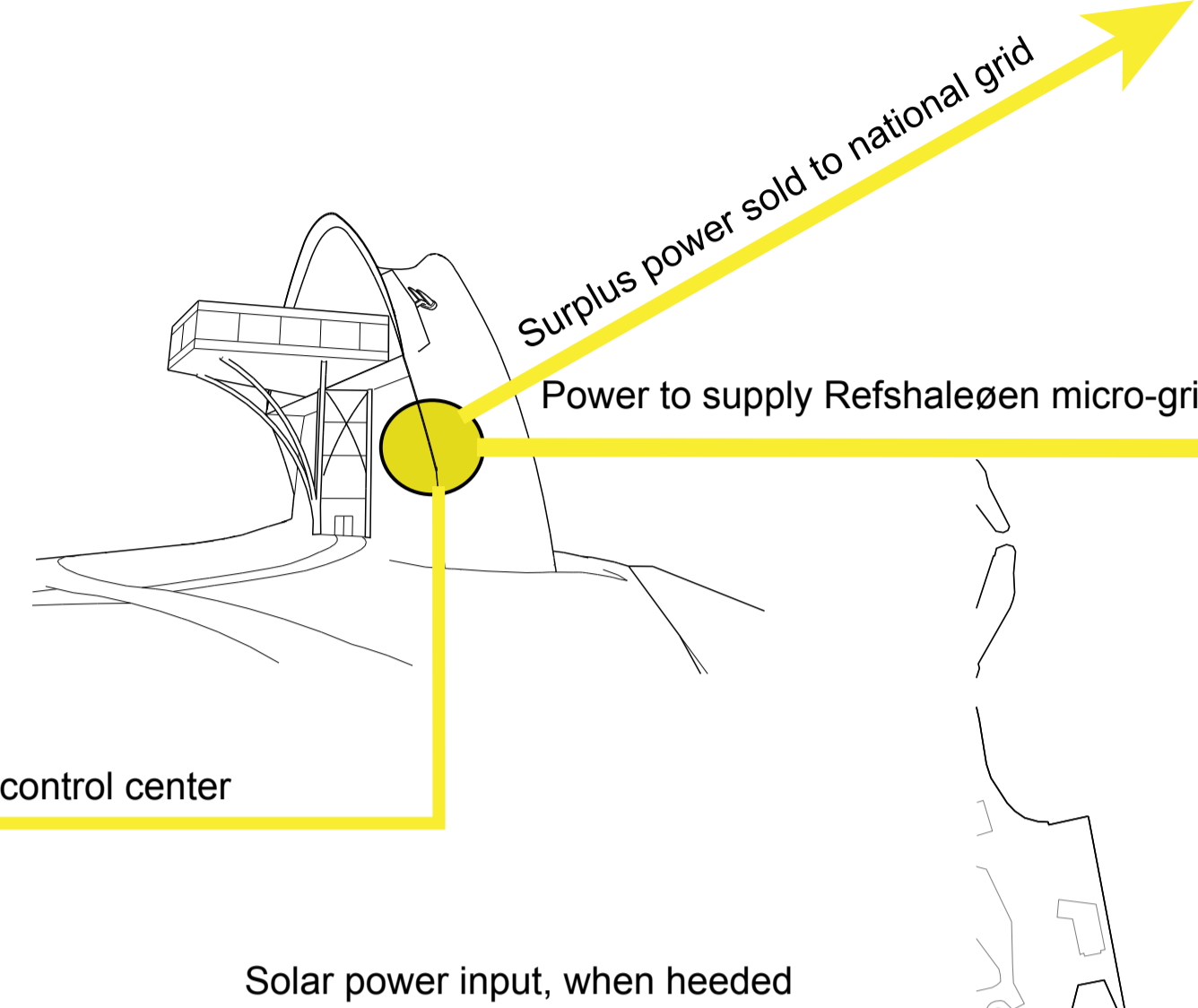
(3) 1.5 MW Francis water turbines generate power and return water to harbor

### Solar Power

Auxiliary water pump supplied by 2MW PV Array planned for Refshaleøen.

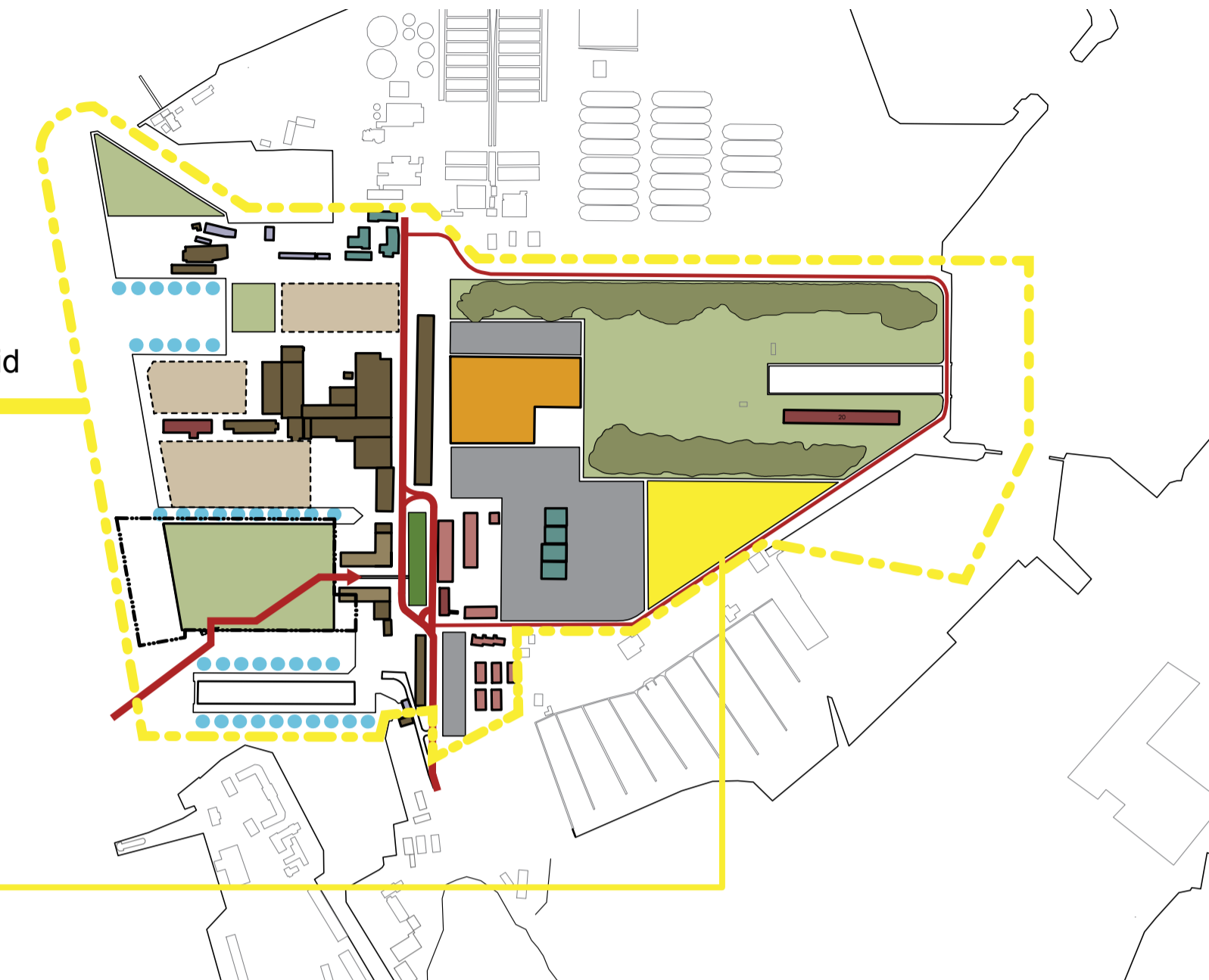
### Micro Grid Control Center

For the proposed Refshaleøen micro-grid. Connects and controls the flow of the energy systems to the micro-grid and houses necessary transformers and electrical equipment. Manages the Micro-Grid and the connection to Danish National Grid



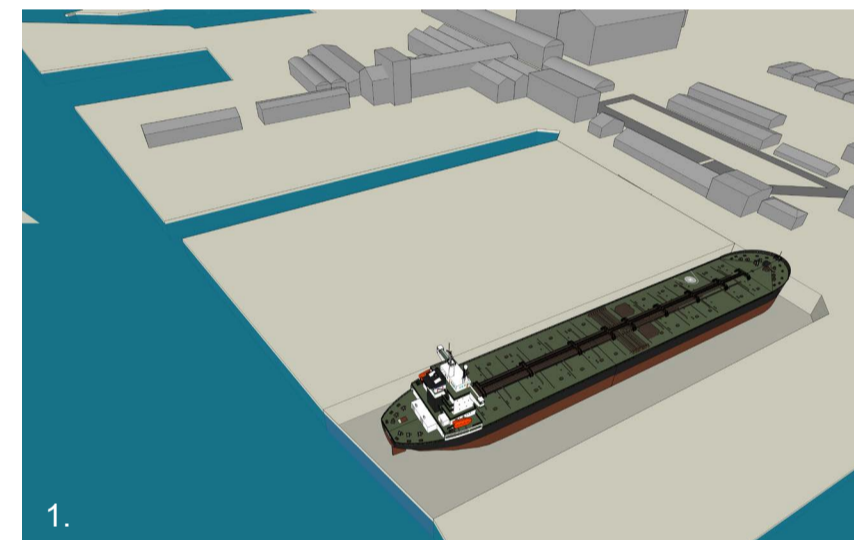
### Refshaleøen Micro-Grid & Master Plan

Total Building Area: 178,000 Sq. M (Renovated + New Construction)  
Mixed Use Building Types  
Estimated Annual Power Consumption: 6,621,863 KWH  
Annual renewable energy production: 8,379,957 KWH  
Energy Surplus for sale to National Grid: 1,758,094 KWH

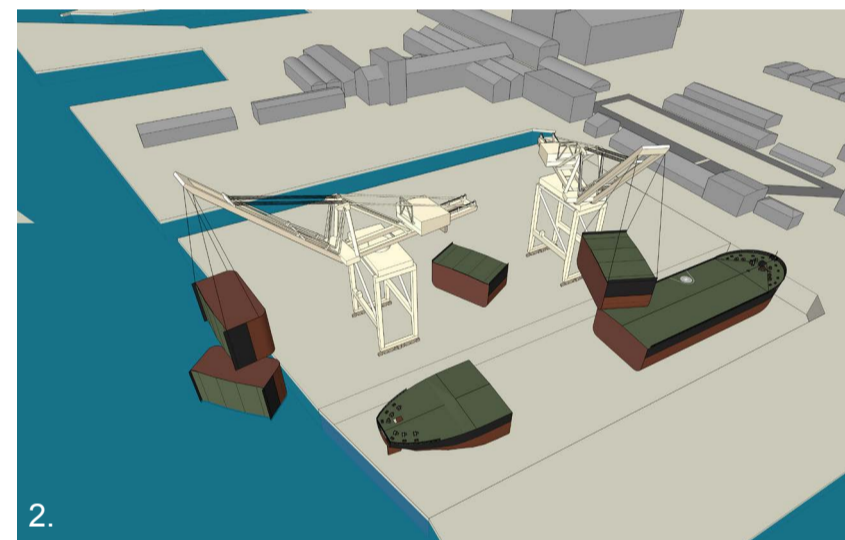


## Energy System Components

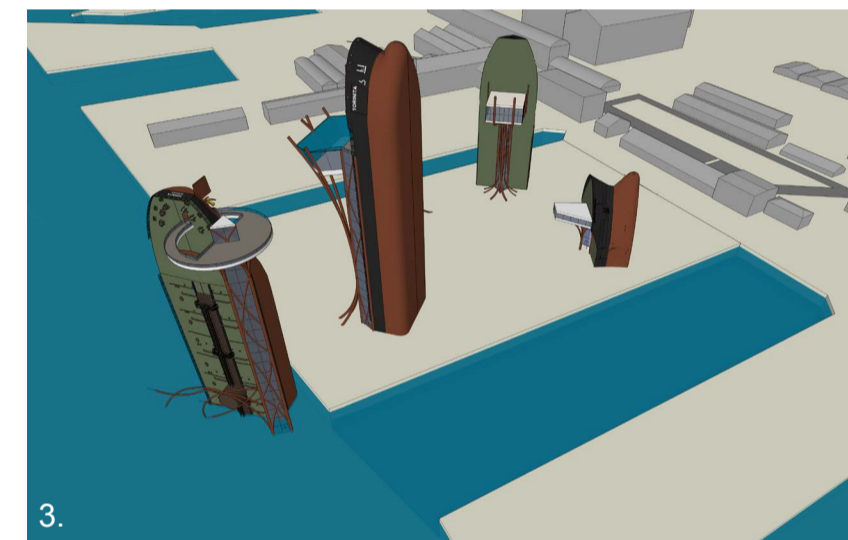
### Construction Sequence



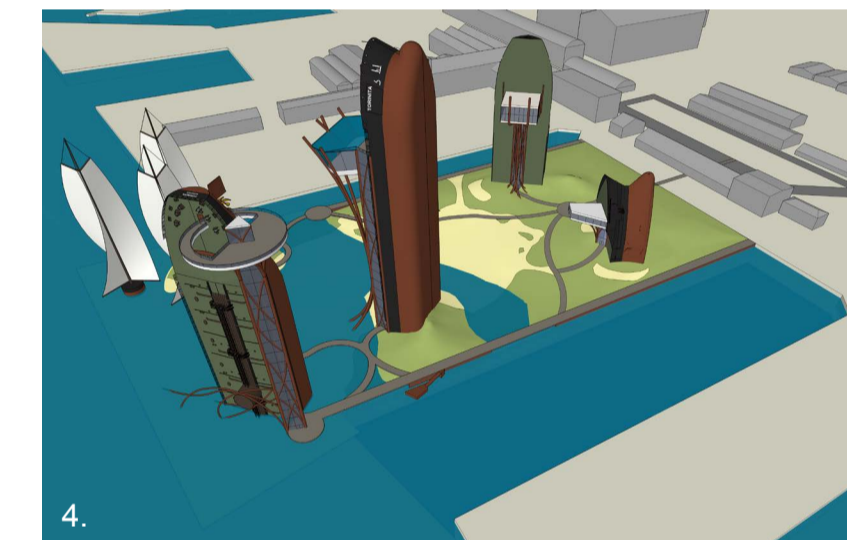
The shipyard facilities at Refshaleøen will be temporarily recommissioned and become a "ship breaking" facility to construct the Battery H2O. The berth adjacent to the site will be converted into a temporary drydock. Two oil tankers that have reached their useful lifespan, and are scheduled for decommissioning, will be diverted for use in the project. Unnecessary equipment and features will be stripped and recycled.



The oil tankers hulls will be cut into their principle sections. These "double hull" sections contain an interstitial space which will be reinforced with additional steel in order to accommodate the new stresses placed upon them. The sections will be cleaned, treated to accommodate saltwater and have necessary plumbing installed. The sections will be assembled into the storage containers with maritime cranes.



Organically inspired corten steel armatures will be added to accommodate the park's programmatic functions and provide vertical circulation. Underground utilities, plumbing and hydro-electric turbines will be installed.



The contours of the site will be sculpted to create a Baltic Sea coastal ecosystem. Pathways, boardwalks, windmills and final landscaping will be completed

### Master Plan Key

- Project Site
- Master Plan Area Boundary
- Plaza
- Mixed Use - Lofts - Commercial
- Residential - Multi Family
- Cultural - Museum
- Concert Hall - Event Space
- Light Industrial
- Marina - Storage - Maintenance
- Proposed New Buildings
- Future Building Sites
- Park - Greenspace
- Parking
- Photo Voltaic Array
- Circulation
- Houseboat Berth Zone

### Energy System

Battery H2O incorporates a pumped storage hydro-electricity system made from the hulls of re-purposed oil tankers. Water from Copenhagen Harbor is pumped to high elevation storage reservoirs in the tanker hulls with three vertical axis windmill pumps. Power from the proposed PV array in Refshaleøen will provide supplemental pumping power allowing both wind and solar power to be stored in the water battery system. The elevated water storage creates pressure heads to power three hydro-electric turbines which in turn provide power to a micro-grid that will be established in Refshaleøen. The micro-grid control center and equipment is located within Battery H2O. This system will monitor and control energy flows in the development and ensures that Refshaleøen will be powered with 100% renewable energy resources and will meet its goal of being carbon neutral by 2020.

### Refshaleøen Master Plan

A Master plan for the re-development of Refshaleøen has been included in this submission and allows the Battery H2O to be sized to meet the power needs of the overall development. The master plan proposes that most of the existing buildings on the site be re-developed as flexible mixed use - loft spaces. Refshalevej will be converted into a major commercial strip anchored by a public square adjacent to the competition site. The Parkland shown on the Local plan will be relocated to the project site making Battery H2O the Primary Park for Refshaleøen and thereby freeing up water front real estate for future redevelopment opportunities.

### A Restorative Waterfront

Unlike most waterfront development, the Battery H2O will have a beneficial environmental impact on its surroundings. In the past, Copenhagen Harbor was dredged to create new land for development. This project reverses that approach by giving some of the land back to the harbor in order restore a coastal ecology, mitigate and adapt to the effects of climate change. In the place of a hard waterfront edge; a permeable shoreline will be created.

## Ecological Zones

### Open Water

A part of the harbor with underwater sea grasses and oyster beds

### Sand Bar

Controls wave erosion with stabilization provided by dune grasses.

### Lagoon

Saltwater marsh situated behind sandbars with wetland plants to provide habitat and nesting grounds for aquatic life and to cleanse stormwater run-off as it enters Copenhagen Harbor

### Beach

Sand dunes sloping down to the water's edge stabilized with dune grasses.

### Woodland

The land slopes up to provide an elevated building platform for proposed new buildings to protect them against sea level rise. Oak, Beech and Pine trees typical of Danish woodlands provide a transition zone to the rest of Refshaleøen.

