**the more. [LAGI 2014 competition proposal TM1303ST]**

Introducing ‘balanced energy’, the design seeks for a global challenge in midst of a variety of thematic fields. Evolutional processes and constant changes in every fragment of life on our blue planet demand for constant innovation. Contrasting exuberance and deficiency, redistribution becomes the term for all layers. Rethinking the interconnectivity of sufficiency, consistency and efficiency strategies in sustainability, do we need to position ourselves? What will the future view on renewable energy be like? How can we imagine and influence our landscape and urban environment?

Facing a core aspect of the difficulties with renewable energies – constant inconsistency – the design provides a platform for discussing the integration of storage technologies into the energy grid. LAGI 2014 provides the opportunity to take a look at a future after tomorrow. In between pragmatism and aestheticism we need to draw a linking line. Already today, the European energy grid produces surpluses which have to be alleviated by shutdowns – or less bad: By storage. Let us speed up and go ahead with not only one step, but more.

*integration.*

The installation reveals a flight through Danish history and presence, of its types and typologies. Landscape affected by former deforestation, urbanity awarded for its liveability and a modern open-minded culture is reflected by the real-time rendering of the European energy grid by water-operating storage pistons. Its function as an interactive urban landscape integrates it into the contexts of Refshaleøen and greater surroundings, providing spaces for visitors to promenade, linger and broaden their horizon. Expressing the urgency of the topic, there will be no opportunity pass by ‘the more’, but entering it and get an insight. The narrative effect of the changing topography will move visitors emotionally and induce a feeling of thematic reverberation. The focus is still laid on the local qualities staying subtle in addressing all ages.

*form.*

The overall form is created by the parametric control of 7810 storage pistons reacting to the energetic surpluses by renewable energy production. The charging level is shown and the redistribution of energy leads again to a public space as an initial shape. The 2.0 m grid and the maximum height of 8.0 m have the ability to play with density and proportion triggering an idea of topography and passing zones of different scales.

‘Imagine an open space, a clearing in the forest, a levelled city.’

Rem Koolhaas

The piston form is developed by its technical requirements and harbour history and context. Keeping a flat surface if not in motion, all pistons are built in-ground. The lighting design comprises one line of light each facing the western plot boundary as a variable beacon guiding towards the installation. Colour accents with red as one of the Danish national colours set up a numeric impression of the energetic capacity. Each Danish household whose energy demand is completely supplied by the stored energy will be represented by such a red line.

*energy.*

Energetic storage as artwork functions by its accessibility, thus the storage is divided into plenty of small sections. Each pumped storage element is incorporated into a common and water circuit supplied by filtered water from the Lynetten waste water facility. Energetic surpluses in the grid are transformed into potential energy by lifting the massive pistons up and retransforming them back to electricity by sinking down again. The capacity and efficiency depends on technical factors (height, diameter, weight, friction [piston, pipes, turbines] resistance of conductors) and on softer influences, such as frequency of fluctuations in production and demand. The visitor gets into direct contact with energy amounts translated into a spatial experience. Changing topographies and images can be generated by the parametric control so that the Burmeister & Wain infrastructure or individual two or three dimensional images or spaces can be created. Cut-outs in the flooring show the ‘backend’ of the installation. Turbines and piping are shown to express speed and direction. Energy functions a link between technology, society and ecology. Climate and human development are interconnected with art and space.

*impact.*

The energetic effect of ‘the more’ is inconstant. The value rises with a growth in frequency of saving and distributing with the consequence that the actual amount will grow with the percentage of inconstant energy producers (renewable energy). The impact is relatively low, but underlines the importance and urgency of storage technologies. With the actual installation the calculation results in a complete energy supply of 117 Danish households for one year (excitation frequency: every third day). The return of embodied energy is fulfilled by usage of the electricity which would have been lost if not stored (e.g. shutdown of windmills).

Storage technologies of this kind scaled to a diameter of 30 to 100 metres and a depth of up to 1000 metres would provide a capacity of several hundred MW with relatively low costs and surface impact (modified piston movement -> under ground level; GravityPower, LLC). Direct impact concerning the used material and construction effort is minimised by re-using the soil excavation for filling up the piston mantles. Considering the urban environment and comparing the surface impact of a typical pumped storage hydro power station, ‘the more’ reaches an efficiency factor of 17:1 due to its surface/height relation.

Safety issues are faced with motion sensors on top, interrupting movement if people are near. The goal is to keep the plot open without restricted access areas (exception: transformer station inside), for maximum contact with the public.

*construction.*

The construction of the installation would be possible by setting up prefabricated parts. It could be built in several phases if needed and concerning simplicity and accessibility of construction and maintenance the piping is near the surface level. The storage itself is constructed with a double layered wall of recycled steel allowing the water to flow just under the plots surface and providing a maximum of longevity. Resistances are minimized by a hierarchical grid, focussed on several turbine spots. The pistons are made of a metal mantle filled by the excavation during the construction process. Turbines follow the technology of GravityPower, allowing water to flow bidirectional and become an artistic element being installed visibly into the Sønder Hoved ground. A glass-construction flooring enables the visitors to hover above the transformation process from motion into electricity. By these architectural accents the industrial history of the site is re-interpreted and thus stands in direct dialogue with the processes on all scales. The plots surface is divided into sealed and non-sealed areas creating contrasting zones in which nature seems to recapture the urban environment.

calculations.

energy redistribution 6.963 MWh/y

embodied energy 536.636 GJ

embodied energy return dependent (RES-shutdowns)

co2 savings dependent (RES-shutdowns)

main materials steel, concrete, plastics [minimized] - (all recycled)

technology pumped-storage hydroelectricity (PSH)

dimensions plot size, maximum height 8.0 metres, 0.55 m diameter