

Final reflection

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Description of project and approach

The goal of the project is to see if it is possible to develop a transferrable modular building system that can be used to find new purposes for refineries and chemical plants that are (or will be) decommissioned. The port-city interface of Dunkerque in France is investigated because it has a problematic economic situation due to loss of employment and industry, which also caused some social issues. Dunkerque has two decommissioned refineries. The project tries to find a way to reconnect these private former heavy industry sites to the city and people that once used to work in these factories and experienced the positive and negative externalities from it. As ports and city grew apart over time, this connection has been lost. The goal is not to create a new money machine for the city, but to design something that is really of common use and common benefit for the local/regional people, has a strong social aspect and is flexible in such a way that it's not too dependent on big investors or profits.

The design project tries to tackle a lot of issues that are most apparent on the global scale and are part of complex systems. Most issues the project is dealing with could be considered wicked. The research that has been done in the first semester of the studio also mainly focused on understanding these wicked issues and the global context they exist in. Many of the issues from the studio and that I chose to base my design thesis on are also rather intangible and abstract. It is therefore quite difficult to come up with design solutions that are directly connected with the global issues that the entire research is based on.

The main approach to achieve this goal is to make a temporary project that spans and expands over a couple of decades. In this period the site can be cleaned up by means of phytoremediation, i.e. the clean-up of a site with organic materials such as plants, trees, and fungi. However, to make this a feasible business case, meanwhile the site needs to be reused. The current strategy with decommissioned refinery installations is processing the structures into scrap metal or incarceration. I believe there is more possible with such structures. So the main design question is: How can we *grow* the soil clean and at the same time *use* the old installations as a base to design a new piece of architecture that serves the purpose of business case for the project and as new link between the disconnected port and city interfaces.

The relationship between research and design

With this approach in mind I started the design process. I soon discovered there is quite a bit of scientific research regarding phytoremediation, but it has barely been implemented in combination with reuse of these sites at the same time, let alone on the scale I'm working with. About the reuse of old chemical plants there is even less information available. I found some examples of repurposing of former brownfield sites, but I did not find any examples with an approach like my project. I concluded that the demolition, clean-up and then the new program of former brownfield sites is usually strictly separated. I really needed scientific research on these topics to find a way to integrate these ends into a landscape, technical and building use plan.

In the case of reuse of polluted industrial sites there's little research done in the field of architecture. There are also next to none references of large-scale polluted sites that have been redeveloped and remediated at the same time. Parts of the old refinery installation are reused, and it has been clear that the design of the site landscape is almost fully based on the research about cleaning up polluted industrial sites. This is eventually also what led to the program of the building. The program of the buildings consists of a series of laboratories that do research and innovations around phytoremediation and biobased materials. The building program was quite clear from an early design stage, but the building envelope and the landscape design developed simultaneously until the very end. Every time I demolished something on the original site I researched ways how I could reuse the materials in the building or

elsewhere on the site. Also, every time I needed a new material or technical installation, such as composites, or air filtering, I started researching how I could do this in an biobased way, with plants or plant-based materials, and researched what plants could to produce materials could when saturated with pollution be used to create these materials rather than incinerating them. This resulted in a site with a patchwork of different phytotechnologies that can be used as productive landscape while cleaning up the site.

The relationship between the graduation topic, the studio topic, Master architecture

The studio focusses on vulnerable sites along the North Sea coast, that are prone to changes in ecological, environmental, or socio-political changes. The studio had six lines of inquiry to build a framework of research about the studio theme. Since the start I focused on researching the oil industry and infrastructure, as it highly shaped the North Sea and bordering countries as we know it today. During this research phase I could conclude that the oil and gas industry has a huge infrastructural legacy, that due to the energy transition is bound to go to waste. At the same time biobased engineering and living is emerging and become more dominant. As we are in the middle of these two phases of diminishing of the oil industry and rise of biobased approaches, I thought that the oil & gas infrastructure could be a good match to bridge these two, and help to boost each other. By trying to close resource loops and use local production and knowledge, I could touch upon all the important studio topics from the field of ecology, environment, and socio-political issues. Especially in the field of architecture where we are still relying on traditional building materials and techniques, this project could be a showcase how to use the knowledge we already have in a new innovative and future-oriented way.

Relation between project and wider social, professional, scientific framework & transferability

I chose to design the building envelopes with a modular building shell. There were a couple of reasons to do this. The idea to emerged this was when I saw the very rigid steel structures that house the refinery installations around the world. They are usually built within a three-dimensional, evenly spaced steel grid, which I though made the perfect base for a modular system. Another reason for the use of modules is that project is phased and is supposed to grow and shrink in time, based on need and success of the project. For this to be possible you would need a building shell that can be partially dismantled quickly to, for instance, add a new wing to the building shell.

Creating a modular system also meant that it would be easier to transfer the system to other former industrial sites that houses such steel skeletons. Ideally, you would just need to change the vertical and horizontal dimension of the module and you could fit it to another structure. However, what I didn't realize was the complexity of the steel grid, because of it's former use. There are quite a lot of knots that would need special modules, and in reality there would be a bit more variation in the grid spacing, in all dimensions. This would mean that you would need more module types than expected, and at some point there will be a turning point where it's not efficient anymore to work with a modular system. However, this could be overcome with some deeper engineering of the system, which would be beyond the scope of the project. In truth, the engineering of the modules would be a bit more tailor made per project site, but the concept is certainly transferrable. Another issue I came by is that more modern refinery sites have more free-standing objects and thus are less suitable for a building system like this. In my opinion, this can best be done by making a repeatable design that in theory could be transferred to many other refineries/ chemical plants and other similar factories with steel skeletons.

(Ethical) issues and dilemma's

One of the main issues in the design stage was to find a way to involve the local people in the project. As the buildings itself will house innovative research laboratories they will attract more scientific people. However, the city of Dunkerque always thrived on labourers. It would be good for the city to bring

higher educated people to the city as well, but what is in it for the people of Dunkerque? Therefore, I have continuously tried to find ways to make this a low tech, local project on a big scale. In the design of the modules I constantly tried to engineer them in such a way that they could be manufactured on site, by local carpenters. The materials that are used can either be harvested on site (in the case of plants) and some of the building materials could even be produced on site. I tried to reuse refinery installation materials in such a way, that e.g. the steel could be reused with easy modifications. As the people of Dunkerque are involved in this project they will also be educated as the innovations that are done on site can directly be applied in the project when expanding the buildings or further remediating the site. The goal is that this local cycle of growing, using, and reusing of resources and knowledge will make this into an innovation hub that feeds itself, thus resulting in the growth of the project and positive impact on the city.

The above could also be described as a circular approach. What was challenging about working with circularity is that when you go for it in a project like this, you want to maximize its circular potential. Near the end of the design phase I had to back off from this idea a little bit and had to accept that it's difficult to make this or any project 100% circular in the current society. You are limited by the constraints of what is already there, which makes it more challenging to reuse materials, as you do not have the architectural freedom of designing a building from scratch.

Planning towards P5

Most of the design decisions are made, but I need some time to define the relation between the buildings and its landscape a bit better, mainly by improving the narrative. I spent most time researching the site remediation and engineering the modular system, but the challenge towards P5 is to bring the whole story to life and to connect all different scales I worked with together.