Reflection

Master of Science Architecture, Urbanism & Building Sciences
INTRODUCTION

The assignment for my graduation studio Complex Project is to predict urban structure of Amsterdam in 2050. Our location, an area of 2.1 by 2.1 kilometres, is the space around the Coentunnel. At the moment this area is mostly dominated by big industrial buildings, but for 2050 this location will be transformed to a highly dens living and working area. Only the current Petroleumhaven will remain the untouched for 2050 and we, as a group, decided to transform this into a park that will rehabilitate the polluted soil. The main task for our graduation studio is to create a narrative for a new building in our location. My narrative is to design a nuclear fusion powerplant and incorporate this building into our lives and make it of benefit to society. The source for energy will be one of the main challenges that humankind has to solve for a future without fossil fuels. The impact of burning fossil fuels has resulted in a visible change of our climate. Nuclear fusion is a potential source of safe, non-carbon emitting and limitless energy. So, how will this new type of powerplant look like and how can this building be a contribution to the built environment?

Relationship between research and design
In the first period of my graduation year I have spent a lot of time finding a suitable narrative. In my opinion this research part was a bit too long, because after P2 the design period is pushed in such a small timeframe. It would be nice to start a bit earlier with the design. During the first research period, almost the entire period of MSc3, I did not think about my design. By only thinking of why I want to create a nuclear fusion power plant and not about the possible design, I prevented myself not to limit my own thoughts. In the beginning there was not a relation between research and design, but when I started with the design I wanted to use all the information I had gathered. From the studies I did on nuclear fusion I came up with some design rules and by doing so I limited my design opportunities. This limitation was also pointed out by Olindo Caso during my P2. My proposals for a design were guided by the research I had done during MSc3. For example, the layout of a powerplant is very strict in terms of form and spatial relationships. I started my approach for the design by these strict terms and not by testing and seeking for new opportunities. It was difficult for me to deal with the feedback and to forget the knowledge I had gained. After a while I saw what Olindo Caso meant and started designing by form. By doing this I was able to create a sketch design that appeals to the imagination. This design better suited my location on a broader perspective. Until P3 it was a constant shift between research and design. I looked up architectural theories and examples that I could use for my design. This have varied from the theories like the Fun Palace by Cedric Price to dome structures designed and analysed by Buckminster Fuller. After analysing, some theories were not applicable for my project and both Olindo Caso and Gilbert Koskamp were very helpful by giving me new insights on the theories I have found. I think my research part for Complex Projects was a bit too long, because almost until P2 I did not thought about designing (see figure 1). A lot of projects in Complex Projects are enormous and the program is often difficult to design. Now we approaching P4 and it becomes clear that I cannot fix every corner of my building. If I had started earlier with designing, I would have had more time to do new research in the second period. In the last three weeks before P4 it is almost only designing, because we need to produce products. I tried to spent more time on doing research, but I need some time for research and in the end, time is precious. For the following month this shift between research and design will almost stop. After P4 my design is practical done and for P5 we need to finalize drawings and make models.

![Figure 1: Time spent on Research and design](image URL)

Relationship between graduation, studio, master track, and master programme
For my graduation project I choose the path of the unknown, since this is the last time we can experiment in our educational period. A project can have three futures, namely possible, probable and desirable. During our education Olindo Caso advised us to choose a topic that is ‘possible’. Then the task for us as architects is to create a solution that will makes it (also) probable and desirable. A
nuclear fusion powerplant in Amsterdam will probably never happen. But this research gave me the opportunity to explore new paths. Clean energy sources will be one of the main challenges in the future and as architects we can upgrade these sustainable powerplant and incorporate these types of buildings in our build environment. Adding a public function is one possible solution to upgrade such a building. There are endless functions I could have combined with the powerplant, but I wanted to connect this second function to my main function. Therefore, I choose an educational centre to explain nuclear fusion and to create a platform for space activities. This second function will be an extension to the current NEMO museum in Amsterdam so that it releases the intense stress of tourism in the city centre. A common thread in my master track is to explore new things in the architectural field and in myself. By going to the extreme you find other design instruments and solutions. An example of this in my graduation project is my roof. For my design I have chosen a stepped terraces roof. This roof type is normally used for offices and housing, but it is uncommon above big open spaces. This required me to come up with new possibilities for this roof type.

Research method and approach
With a morphology study on powerplants I was able to learn that the shape of the powerplant changed when new technological improvements were created. The classical rich materialisation made way for cheap functional boxes. By looking at the typology I found out that big powerplants are split up into smaller, more local powerplants. Furthermore, the powerplant of 2050 is not only a place to generate energy, but also a place for activities. Offices like Bjarke Ingels Group, Gottlieb Paludan Architects and Schmidt Hammer Lassen Architects, and Heatherwick Studio are changing the traditional powerplant type to a public one. By looking into the morphology and typology I found new building types and these will make their introduction in the nearby future. I did not only look at powerplants, but also at other types of buildings to learn and adapt their reasoning. Olindo Caso advised me to reflect on theatres. This gave me the idea to transform one of my biggest spaces to a flexible space after the assembly of my powerplant. If Olindo Caso did not pointed me in that direction I would not have looked into theatres and then I would not have found this opportunity. Normally I design with the program I have given myself, but because this is our last chance to test new methods I tried to create a plan with morphology studies. This has resulted in a plan with different routes through a building with volumes made of special shapes, such as circles, triangles and a lot or round object, but the roof had a strong horizontally and vertically grid. I had created two stories and the construction under the roof became impossible. Also, reasons why I had all these special shapes was difficult to argue, because some choices were a bit banal. The method I tried did not work for me and I was forced to look at my plan with a critical eye and change a lot of these volumes to make it one coherent story. My approach for this graduation design is iteratively. In other words, try things and then reflect them with another scale and tools to see if they work. Firstly, I make a rough sketch of an idea, then I will test it in a section, thereafter I create it in a 3D model for example. When the idea was possible on all the scales I integrated the idea into my design. The main reason to work in different scales is to easily test what suits my final design. By working in multiple scales, the sketch becomes reality and I can easily skip solutions that are not working. Another method I used is the study of reference. Sometimes I used references very literally and sometimes a bit more proverbial. Gilbert Koskamp challenges me not to look at solutions too literally. By doing so I found new opportunities for the problems I had. Sometimes the opportunity was not suited after testing them, but with trial and error I was able to seek for other possibilities. This can be a contribution to the scientific world of architecture. At the moment there is not one public powerplant in the world. There are some new powerplants in the make or on the agenda for the following years, but I have my doubts about their sustainability. This graduation design is one of the possibilities for a clean powerplant in the future.

Relationship between the graduation, social, professional and scientific framework
When I went to Belgian for a Fusion Day I found out the interest in my project by professional people working in the fusion field. One of them, Gieljan de
Vries, is very interested in my result, because according to him I am one of the first students doing an architectural research on a nuclear fusion powerplant. He even suggested that I can present my final design in Eindhoven to some fusion science students and he advised me to make contact with the people that are designing the experimental fusion powerplant named ITER and DEMO. Since then I am in contact with the real designers of a nuclear fusion powerplant. They provided me some information and sources for my research. Therefore, this research is not only based on architectural knowledge, but also based on the basics of fusion theory. To use the basics of fusion theory was also an obstacle during my design period, because I also knew what was not possible. Olindo Caso helped me a lot by freeing my mind and to look from an architectural perspective. This research combines architectural knowledge with theoretical knowledge on fusion into a realistic proposal for the future. Even though it is difficult to predict how 2050 will look like. My design can be an example of the public powerplant that attracts people to a curtain place. I hope that my research can be a contribution to the architectural knowledge of powerplants, because in my opinion there is not much literature on this topic.

Ethical issues and dilemmas
When I started my investigation on fusion, I was confronted with some dilemmas. This first dilemma was that nuclear fusion is an unproven technology. In theory this way of creating energy can work, but in reality, it is very complicated. Therefore, the first powerplant that is not experimental will not be built before 2040. This dilemma is not really a dilemma for my design, because we will focus on 2050 and I hope that all fusion challenges will be solved by then. The second dilemma is/was safety. We know that in 2050 the Coenhaven (a harbour next to my location) will be developed into a highly dense urban environment. Nuclear fusion is safe, but experts from ITER and DEMO said that it will probably never happen that a nuclear fusion powerplant will be build next to an urban environment. This confrontation was difficult to substantiate, but Olindo Caso helped me understanding that I am not an industrial designer that is going to create the fusion reactor. I am going to investigate the possibilities for a powerplant of the future. Also, who knows what the future will bring, this research is based on new ideas. During the design period I eventually needed to let go of this practical world and focus on my discipline. One of my biggest architectural dilemma was my pixel roof. The roof is 140 by 140 metres and covers the powerplant, but I did not want any columns under the roof. Other requirements were that it is possible to walk on the roof and that the roof must hold some greenery and some glass elements. The roof is constructed with stepped pixels measuring a tile of 2,5 by 2,5 meters. These pixels were based on a grid, but because I designed my plan with morphology studies, the volumes on the ground floor did not react to the roof grid. All these rules created an almost impossible roof. Gilbert Koskamp helped me by looking at different solutions and tried to blow them up to a bigger scale. Because of all the rules I had created I was not able to find a solution. I have compromised some of my rules and searched for the most truthful solution. This is done by searching for reference and model making, and by testing it on different scales. Gilbert Koskamp pointed me to design with the sections as the main tool. By doing this I was able to design the roof and ground floor at the same time and combine mutual relations into one building.

The final part of my graduation is more focused on the design rather than on the research. Now I need to finalize my design and create nice drawings, a book and models. I hope there will be some time for small researches to strengthen my design. I also need to spent some time on the group model for Complex Projects. And lastly, I need to finalize my presentation for P5, because the audience is a bit different and therefore I need to change my story to make it understandable for them.