# IN PROCESS

A study for a new process for Detailed Development Plans in Sweden with special interest in energy and daylight.

Amanda Markgren
Master Thesis
Spring 2020

Examiner: Emilio Da Cruz Brandão
Supervisor: Shea Hagy
Co-supervisor: Joaquim Terrásso

Chalmers University of Technology
Department of Architecture and Civil Engineering


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*MSc Design & Construction Project Management*

*2020*

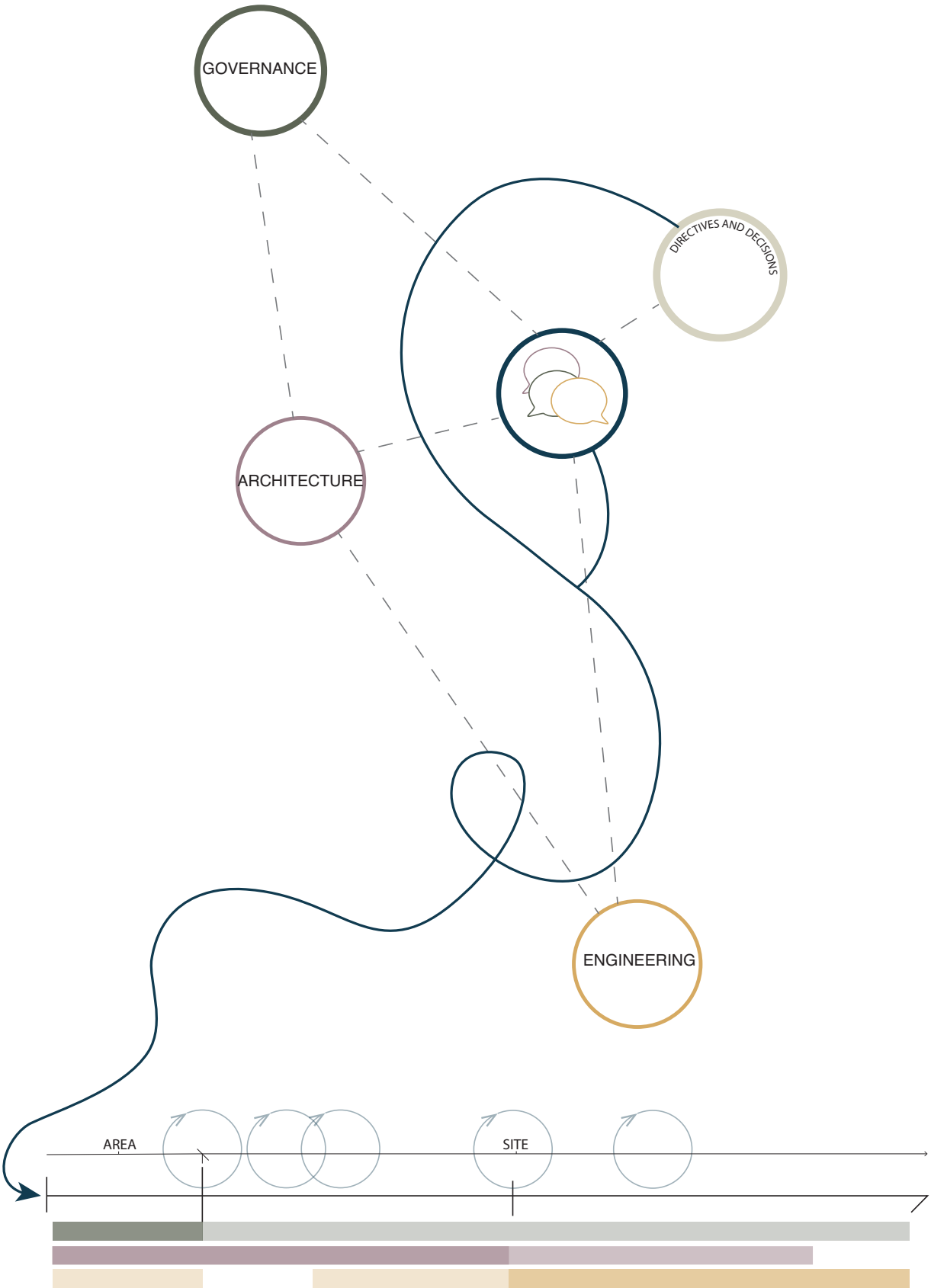


figure 01. *graphical manifesto*

## ABSTRACT

The construction industry has during the latest decade grown more and more accustomed to adapting buildings after environmental certifications. In parallel to this, as a response to the housing shortage in Sweden, the cities are also increasing in plot-ratio. This together have led to a larger awareness of the building performance parameters (BPP) impact on the building's sustainability. But also led to the result that many set Detailed Development Plans (DDP) are not optimized for obtaining the building performance result aspired.

This thesis has been conducted in a collaboration between Chalmers University of Technology and Bengt Dahlgren AB as a continuation of previous master thesis development of a tool called BeDOT. The thesis is also performed in close collaboration with the engineering students Julia Andersson and Sara Jonsson and their further development of the tool.

The thesis continues the concept of the tool; early implementation of building performance parameters. This meaning that the thesis has investigated the possibility to optimize the building performance by implementing them in the DDP process. This is done through a proactive addition of the building performance parameters Energy and Daylight through the tool and a change in the process and how the tool could be implemented. The addition is made in the DDP process in a Swedish context. Further the thesis aims to map some of the possible incentives for innovation that could help the proposed process implementation. But also, the incentives created by the implementation of a new process.

The result is threefold; First, a continued development of BeDOT. Second, a proposal of a new DDP process and a discussion regarding innovation which can come through this. The third result is a proposal of a new design method for DDPs done with the implementation of the new DDP process. The implementation of BBP in the process is not new in concept, but the aspired result is a change of perspective. This in itself work as a strong incentive for innovation and collaboration within the process.



Keywords: Building Performance, Detail Development Plan, Building Planning Process, Innovation, Optimization

# STUDENT BACKGROUND

## ACADEMIC BACKGROUND

Architecture and Civil Engineering, Chalmers University of Technology
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Introductory Law, Gothenburg University
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Architecture program, Chalmers University of Technology
Gothenburg, September 2013 – June 2016
*BSc in Architecture. Theories, methods and tools of Architecture at a Bachelor level.*

## PROFESSIONAL BACKGROUND

Teacher in Architecture and Sustainable development, Designgymnasiet
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*Teacher at a high school level. Practicing the pedagogy of architecture and design through learning others.*

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# 1.

*Introduction*

## BACKGROUND

This thesis is based on the student's interdisciplinary background within Architecture and Project Management. Therefore, the focus is laid on the process, more directly the detailed development plan (DDP) process in Sweden and how it can be developed to help find more innovative solutions towards a more sustainable process.

The Construction industry is often referred to as conservative and lacking in innovation (Orstavik, 2015). This has become the ground for the thesis questions. The focus is not to call the construction industry conservative and boring, but rather investigate how a changed process might give incentive for more innovation. Which in a prolonged perspective can help the industry become more sustainable (Goodman, Korsunova & Halme 2017). The thesis background also bases on the existing development of the tool called BeDOT. This tool is a type of Building Performance Simulation tool which is created at the office Bengt Dahlgren AB (BDAB) through earlier theses.

When looking at the increasing demands regarding the climate the need for a more sustainable construction industry is clear. As a response to develop more sustainable buildings, the construction industry has during the latest decade flourished in ways to certificate buildings according to environmental certifications. These certifications handle different parameters, one main category frequently used is Building Performance Parameters (BPP). This is due to a further understanding in the longer perspective on a building's life cycle and the building performance strong connection to sustainability.

In parallel to this, as a response to the housing shortage in Sweden, the cities are also increasing in plot-ratio . As Forss (2019) and Wäppling (2019) discovered in their thesis, many decisions that affects the building performance are made before the architect receives the project. They also highlight the DDPs important part for creating the correct prerequisites for the building performance.

From this background this thesis will investigate the early planning process of the construction industry in Sweden today to see how it could be changed to be more aware of the end result in the earlier stages. The change is made both in the DDP process but also within the further development and implementation of the tool BeDOT.


figure 02. *thesis placement*

## Objective

This thesis aims to propose a developed DDP process to get a more aware industry. This is accomplished by adding a perspective on questions which are more commonly discussed later in the entire building planning process. And by this, get a more holistic thinking earlier in the building process and awareness of how the early decisions affect the later parts of the process. Further the thesis will investigate how new tools such as BeDOT can help the design process and lead to better building performance through its implementation. And by this implementation, propose a new method to obtain better building prerequisites This is also the hypothesis of the thesis.

The thesis will further have focus on Sustainable Innovation (SI). In this focus the thesis aims to map both the environmental, social and financial aspects of why a change of the DDP process is needed. In addition to this the thesis aim to locate what is needed for the kind of implementation of such a tool.

That there is a lack in communication between actors in the built environment is something known for most of the actors. Therefore, this thesis is NOT about whom to blame. This thesis is NOT about other actors. But instead this thesis IS about how architects can start with themselves (myself). To understand the holistic process an important thing to remember is the RISK you yourself bring to the table. This risk can be a lack of cometence in an other discipline but also an un-collaboorative attitude.

This thesis is however NOT a risk analysis in the wider sense of the term. But rather a tool to help you think in how the competence of an architect can help in other scenarios than “just” in design.

figure 03. *written manifesto*

## Processes and abbreviations

Throughout the thesis there are several of processes and abbreviations mentioned. To clarify these the figure below (figure 04) and following list of words/names is created as support for the reader.

The figure is a simplified illustration of the entire building process with some of its important sub-processes, documents and outcomes highlighted as reference points. Between these there are several of steps not mentioned, and this is on purpose. The building process is not easy to simplify and there are several of methods and tools used within the industry today. Therefore, the highlighted outcomes and documents mentioned in this thesis are mainly the ones which are legislated to be part of the process. And as a result of this, mutual for all processes.

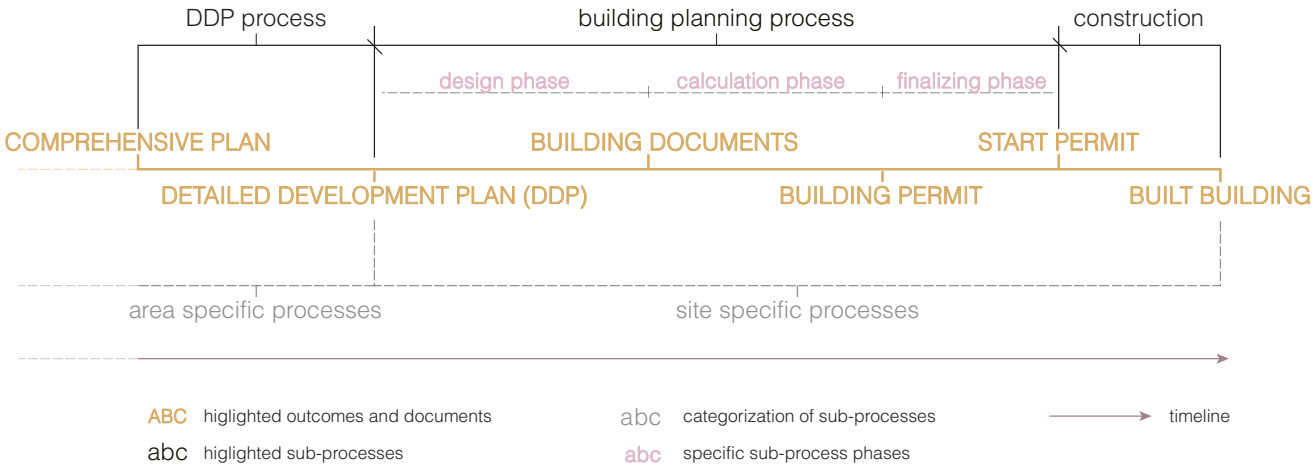



figure 04. *Building process overview*

## Common abbreviations

| | |
|---|---|
| DDP | Detailed development plan |
| BDAB | Bengt Dahlgren AB |
| BPP | Building performance parameters |
| BPS | Building Performance Simulations |
| BPA | Building Performance Analysis |
| BTA | Building gross area (*known as bruttoarea in Swedish)* |
| EPpet | Primary energy number (see more on page 58) |
| MKB | Environmental Consequence Description (*known as miljökonsekvensbeskrivning in Swedish*) |
| VSC | Vertical Sky Component |
| plot-ratio | the total value of building gross area (BTA) divided by the total value of the building's footprint area. |

## Research questions

Based on the objective for the Thesis the research question becomes divided into two:

**Q1:** How can the DDP process be implemented with the help of Building Performance Parameters, and how would that process look?

**Q2:** How would this implementation function as Incentive for innovation when applied in the early stages of the design process?

However, this is not the kind of thesis that will praise all new thinking as a solution for innovation and sustainable development. This thesis will instead focus on how new information can help the architect to see a more holistic product.

The thesis will be focusing on a Swedish context to be able to describe the full context of the process, both the methodology behind it and the legislation.

## Delimitations

This thesis delimitations are presented in the figure below (figure 05). They are sorted by category and relevance with the most relevant at top.

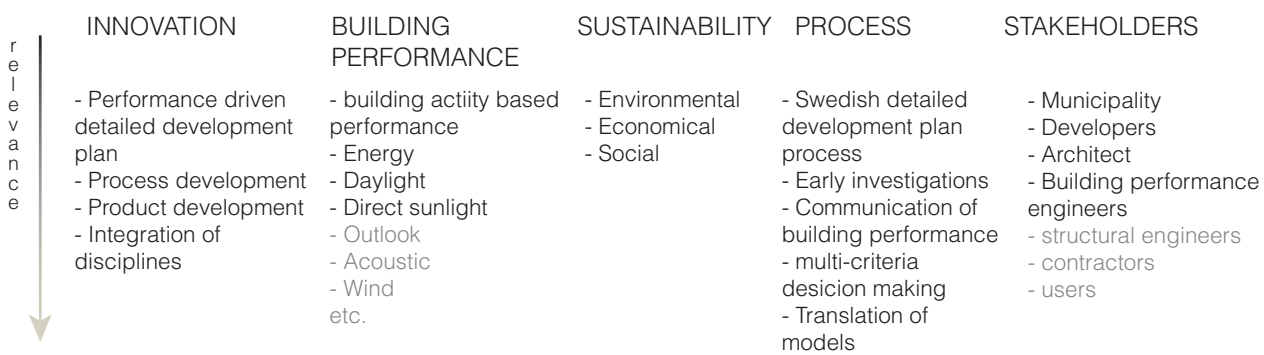



figure 05. *thesis delimitations*

## Thesis Structure

This thesis is conducted at Bengt Dahlgren AB (BDAB) with a collaboration with Skanska AB. As mentioned in the thesis background (page 10) the thesis is based on earlier theses at BDAB and their development of the tool. Due to this the thesis is also a further development of the tool BeDOT. This development is done in collaboration with Julia Andersson & Sara Jonsson two civil engineering students from Chalmers University of Technology. Due to this structure this Thesis have been conducted both in collaboration with the other students and certain parts have been individual. The result of the collaborative thesis will be in two reports. This, surrounding the process and design methods and the other report by Andersson & Jonsson surrounding the further technical development of the tool.

The thesis is divided into six different chapters (figure 06). (1) An introduction with a brief explanation of the thesis context and background, with a description of the existing tool and its role in the thesis. (2) An identification of the existing Detailed Development Plan (DDP) process and its legislation. (3) The theoretical framework gathered by both literature study and interviews. (4) The findings from the theory and the formulation of the proposed DDP process. (5) is the Case study which have been conducted together with Andersson and Jonsson (2020) with the aim to find how the proposed process would result. (6) the review of the thesis done by a discussion.

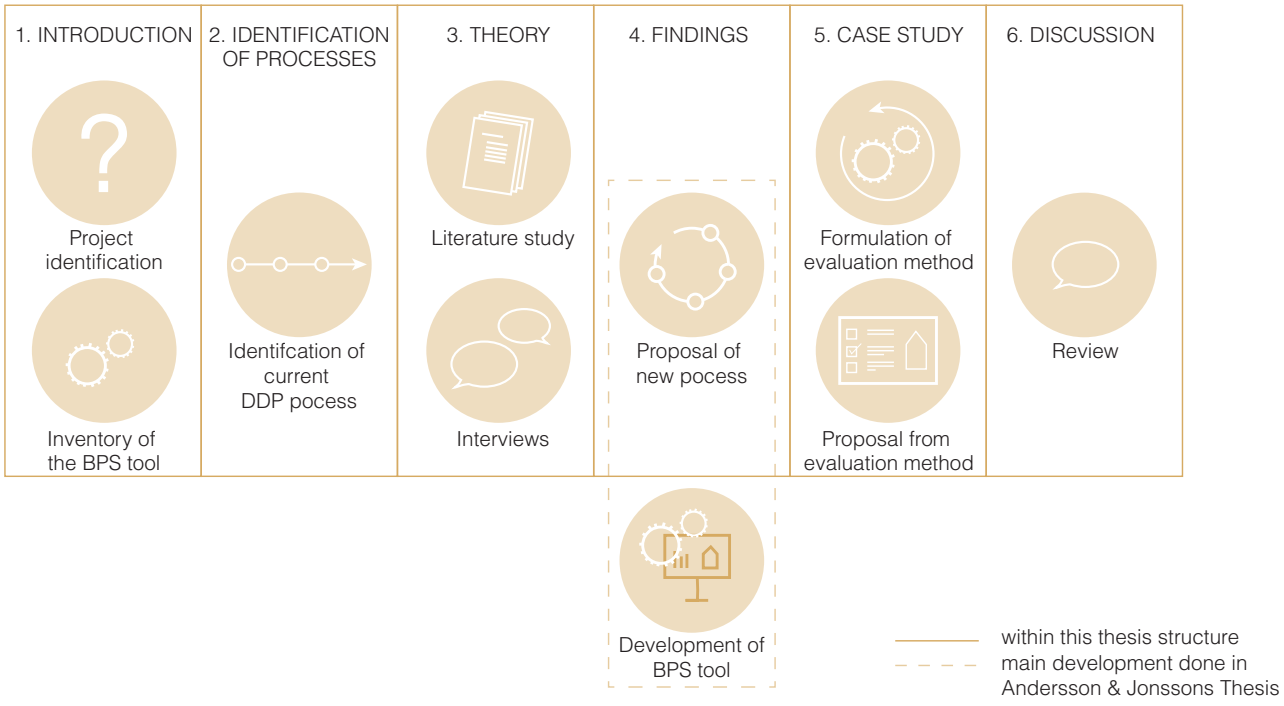



figure 06. *thesis methods*

# INVENTORY OF THE TOOL – BEDOT

BeDOT is a tool developed by earlier master theses at BDAB. The focus has mainly been on energy and how energy calculations can be adapted to be used earlier in the processes. The first prototype of BeDOT was developed by Bergel & do Amaral Silva (2018) as a tool to calculate energy calculations in an earlier stage of the building planning process. The problem identified by them was that energy calculations generally came at a late stage in the process and could not be used to make the drastic changes that could have helped optimize the building performance. Based on this, Bergel & Do Amaral Silva (2018) developed a tool to be used in the early design phases of the building, Building energy Design Optimization Tool – BeDOT.

As a further investigation on this tool Wäppling (2019) and Forss (2019) investigated on how BeDOT could be used as a communication tool between the Architect and Performance engineer, this still in the early design phase of the building. However, BDAB is striving to make it a tool used in even earlier stages as well.

For the development during this thesis the study will see how this tool works towards the demands of the DDP process and how it can be developed further to meet them.

Today BeDOT is mainly a component in the whole script for energy parameters. However, the modelling environment shown below (figure 07) gives it a great possibility to develop with more parameters. This gives it a flexibility in its function that may offer the client parametric calculations specific to their project needs. More can be read about this in the next section.

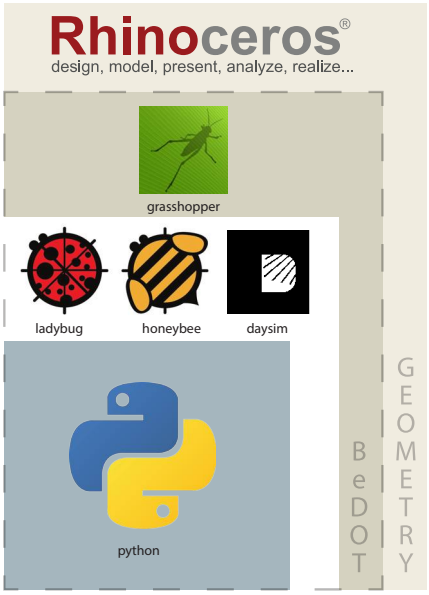



figure 07. *BeDOTs modelling environment*

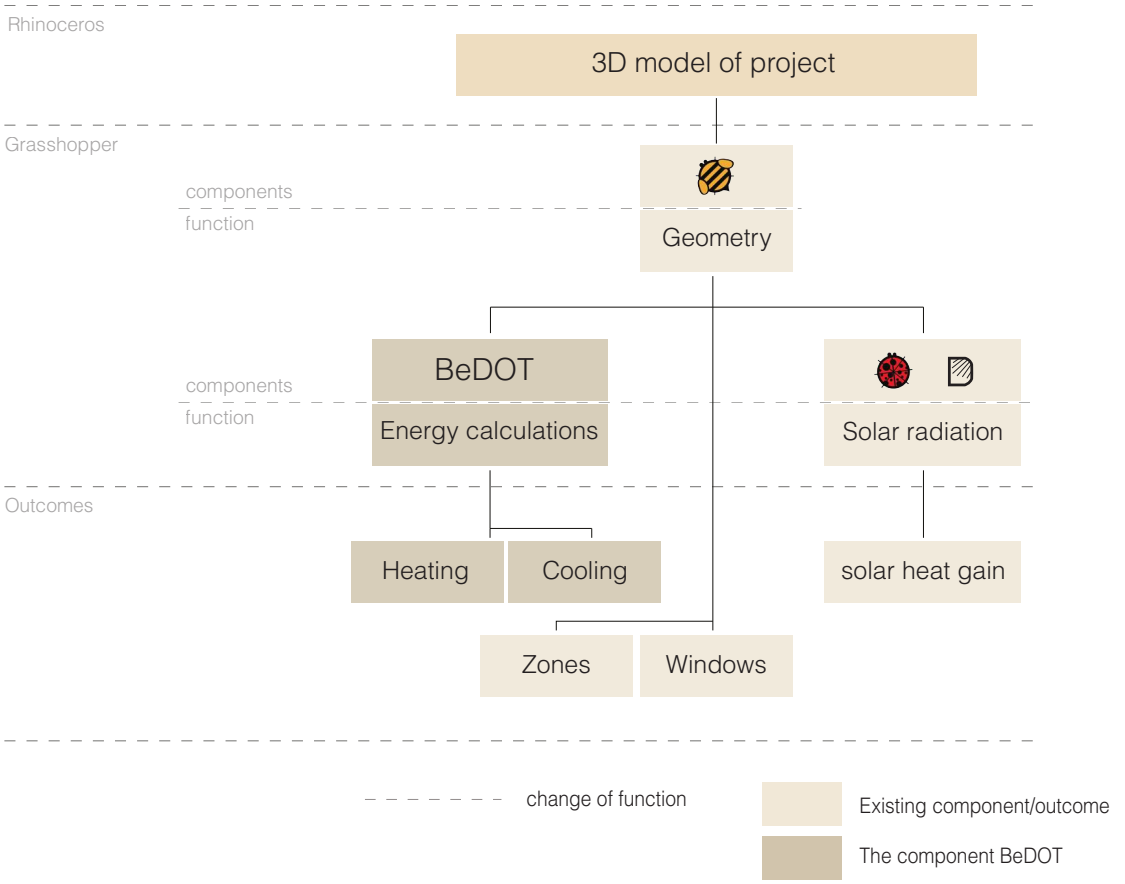



figure 08. *BeDOTs infrastructure and outcomes today*

BeDOTs modelling infrastructure is schematically illustrated in the figure above (figure 08). The 3D-modelling tool is Rhinoceros which is a tool part of the python family. After the model is done, the plug-in grasshopper contains the components which translate the results can be translated into both visualization in the 3D-model and also as script/data for creating diagrams and tables. As can be read from the figure (00) the entire tool is dependent upon the 3D-modell done in Rhinoceros which highlights the need for an actual 3D-model. In addition to this some data is imported through excel files into the grasshopper script to give correct calculations, e.g. isolation values for calculating energy (Forss, 2019).

As seen in figure 08 there are three main categories of outcomes from the tool today, each of them is built with different components in the plug-in tool Grasshopper. The tool today creates the outcomes described in the third layer of the figure (08). These indicators/parameters are shortly described in the following paragraphs.

*Heating, cooling*
To be able to have a comfortable indoor climate different levels of heating and cooling is required. These indicators are dependent on both geographical location and weather direction. Also, on the volume of the building.

*Solar heat gain*
This indicator measures the heating of the sun and its effect on the indoor climate. It gives a measure on when there is need for additional heating or cooling in the building.

## BeDOTs role in this thesis

As a tool BeDot is mainly used in the design process today. Wäppling (2019) and Forss (2019) states in their theses the application of BeDOT in the design phase is a solution for simplifying the communication between the Architect and Engineer. This thesis will further investigate BeDOT, but instead of using it in the early stage of the design process this thesis will investigate its function in the part before the design phase of the building, the detailed development plan process. The thesis will work as a prolonged investigation on how energy parameters can help the building planning process in both a short and long-term perspective (figure 09).

For the development during this thesis the study will see how this tool works towards the demands of the detailed development plan process and how the tool can be a viable choice for the future.

Further, figure 08 highlights the need for a 3D model. Due to the DDP today is mostly in a 2D format this becomes an important issue to think about if the tool is to be implemented in the DDP process.

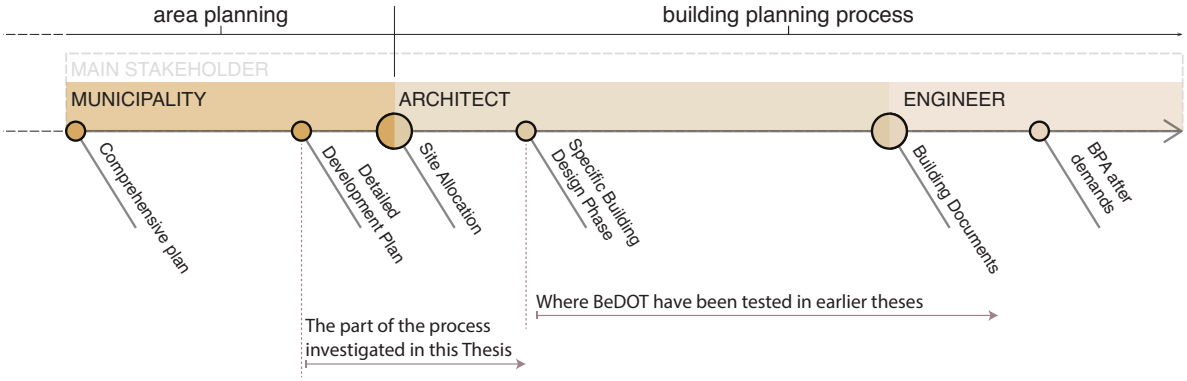



figure 09. *BeDOTs role in the building planning process*

# 2.

*Identification of existing DDP process*

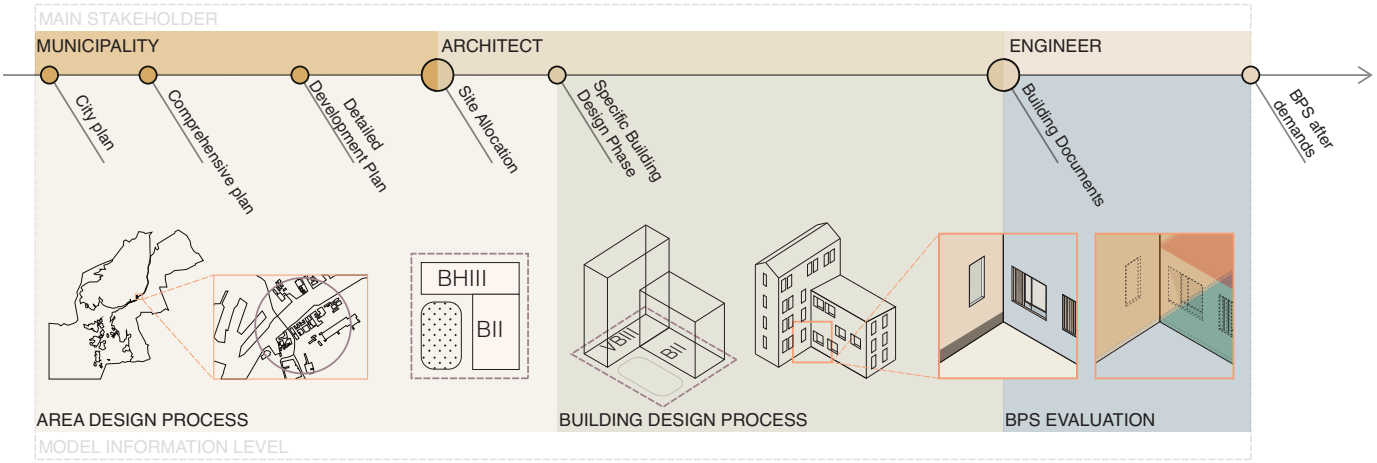



figure 10. *diagramme over the building planning process and its different level of details*

As shown in figure 10 there are several steps within the whole building process, all of them with different layers of detail in the outcomes.

The figure above (figure 10) introduces the fact that the building process does not start at the point where the design phase of the specific building starts. This meaning that, at the start of the building planning process there are several parameters which are already set. These parameters vary in how they affect the buildings result. However, as this thesis investigate further into the detailed development plan (DDP) it becomes highly relevant to understand what is being decided in the DDP process today. Hence, the following section is a summary of the Detailed development plan (DDP) process in Sweden today. This is to understand where and how the Building Performance Parameters (BPP) tool can help the process.

The legislation for the process

In Sweden there are several legislations for the built environment. The main ones are Planning and Building Act (PBL) and the Environmental code (Miljöbalken). Both gives directives to what the built environment different planning processes should look like. PBL regulates the process to decide which ground and water usage an area should contain, the environmental code regulates every activity that can affect the interest which the environmental code acts to protect (Adolfsson & Boberg, 2019).

> "2 kap. 1 § PBL Where issues are addressed under this Act, consideration must be given to both public and private interests."
> (Swedish National Board of Housing, 2018)

The PBL legislation brings up the assessment underlying every planning process: To plan for both the public and private interest. This leads to several aspects to consider when working with any level of the plans. Due to this, there is also a need for weighing which aspect to investigate more and which to investigate less during all planning for the built environment. Something which Negendahl (2016) brings up as highly important to do correctly, read more on page 40.

## Before the DDP process even begins

Before the DDP process starts there are several of different plans already existing, see figure 11. The earlier plans contain information for a larger area and together with the DDP they form the area specific governance, in other words the binding settings for the area. It is however not until during the DDP and the Area regulations that the plan reaches a level of detail to start establishing blocks and plots (Adolfsson & Boberg, 2019).

Another thing to remember from this figure is that there are three plans that together forms the binding information before the application for building permit is done, the comprehensive plan, DDP & area regulations. Of these three plans the comprehensive plan exists in combination with one or the other, not all three at the same time. Amongst the other two the detailed development plan is more common than area regulations (Adolfsson & Boberg, 2019). Thus, this thesis is not going to investigate the area regulations further.

All the plans shown in the figure are developed by the municipality, this is regulated by Kap 1 §2 PBL (Swedish National Board of Housing, 2018). This makes the municipality the main stakeholder of the process, leading to them having a larger part in what is being decided in the different plans.

Between the different layers of plans there exists a need for coherence. However, there is no specific regulations on what information a specific plan should contain. Instead, they are regulated by quite open formulated demands. As a result of this, there are situations where the comprehensive plan is too detailed, and some parts of the DDP process becomes obsolete. Further, there are situations where the DDP contains too much information and becomes hard to plan after (Woldu & Wolf, 2010).

Due to the different layers of detail in the building process (see figure 10) this thesis has focused on the first sub-process where the plans establish the plots and in short, the building prerequisites. This is found to be the DDP process. This is also the reason for not looking into even earlier parts of the building process.

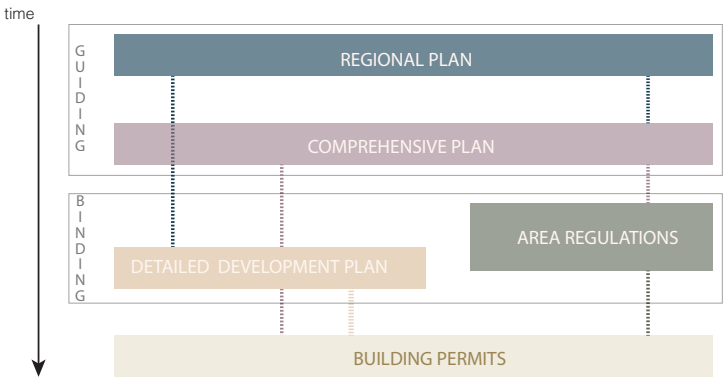



figure 11. *overview of the different plans and their postion in regard to each other (adapted from Adolfsson & Boberg, 2019)*

The detailed development plan (DDP) process is complex due to its many open parameters. In addition to this, there are many different legislations that affects different types of DDP processes (Adolfsson & Boberg, 2019). The processes are briefly illustrated in figure 12. The different processes that exists today range from a simplified process (see number one (1) in the figure) to a prolonged process (see number four (4) in the figure).

Due to the many different types of processes there are different level of detail in the result. For instance, in the first (1) process the outcome might just be a plan, while from the processes three (3) and four (4) the outcome is more likely to have both a set program with several of analyzes and the main plan. As a result of this it is important to identify what kind of process is needed. Further it is important to decide upon what kind of analyzes are of importance to gain the desired result for a specific area. (see page 25 for more information of results from the processes.)

As the figure 11 describes there are several common steps when going through the DDP process. To understand the entire process, the following section contain a summary of the steps for a prolonged process as it contains all possible legislated steps for a DDP process today.

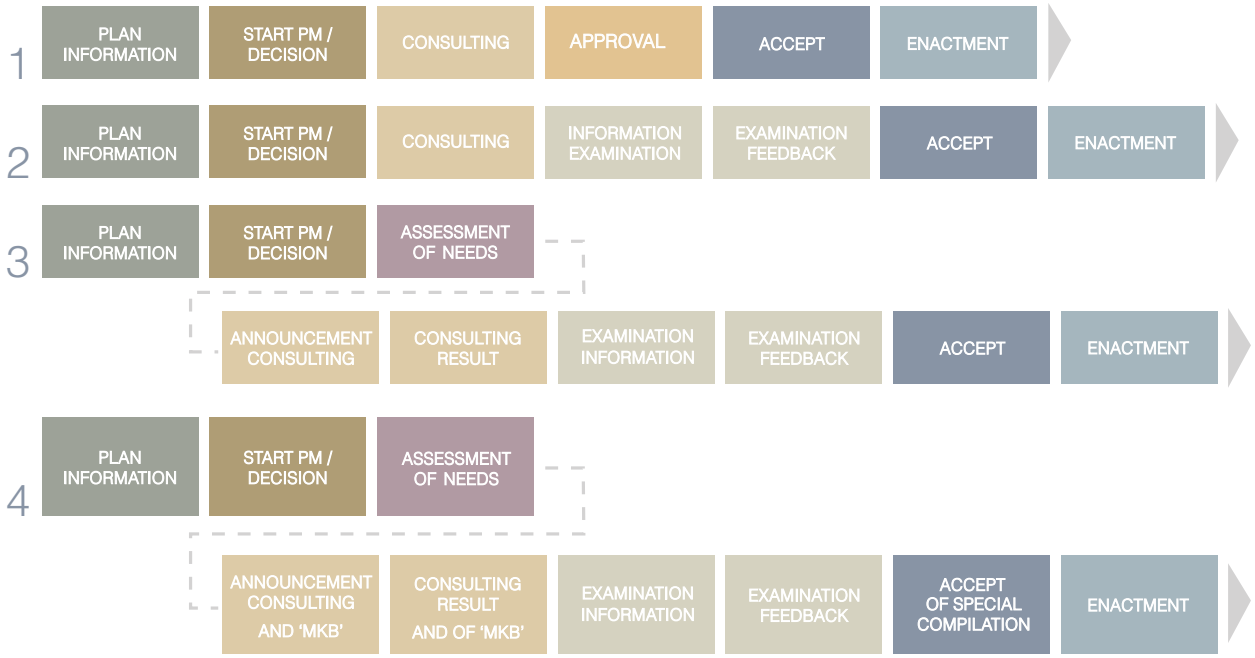



figure 11. *The detail plan processes adapted from detaljplanehandboken (Adolfsson & Boberg, 2019)*

PLAN INFORMATION

## 1. Plan information

For a detailed development plan to be developed the municipality either receives an application or they set one in action for their own area (Adolfsson & Boberg, 2019; Woldu & Wolf, 2010). The initiative can be taken by either a private landowner, developers or the municipality. After a received application, development for the specific area is further discussed in the next stage.

START PM / DECISION

## 2. Start PM

The start PM is a pre-study that is done by the municipality together with the landowner. This is later sent to the responsible municipal authority, the city planning authority. It is when this authority has received the PM that the decision on whether the planning of the detailed development plan is to proceed or not (Woldu & Wolf, 2010).

ASSESSMENT OF NEEDS

## 3. Assessment of needs / program

This step is optional and is initiated when there is a need (5 kap. 10 § PBL, Swedish National Board of Housing, 2018). The concept of it is to create a deeper understanding of the need for the area (Adolfsson & Boberg, 2019).

> "A programme can also lead to a more efficient and smoother planning process, due to more strategic questions being discussed in an earlier stage" (edited quote from: Adolfsson & Boberg, 2019)

As the quote above describe, the program is a possible strategic tool to use when an area is complex. There are a lot of aspects to be regarded into a DDP and this tool gives the municipality a chance to get a more comprehensive analysis of an area. As a result of this, the process can be both prolonged and shortened depending on the needs assessed. After this step, the municipality announces if consultation should be done also whether analyzes such as the MKB should be performed (Adolfsson & Boberg, 2019; Woldu & Wolf, 2010).

ANNOUNCEMENT CONSULTING AND 'MKB'

CONSULTING RESULT AND OF 'MKB'

## 4. Consultation

This is one of the most influential parts of the process. The proposal of the DDP is beginning to take form and the municipality presents their plan proposal towards other stakeholders. Based on the information the different stakeholders give their feedback (Adolfsson & Boberg, 2019). The different stakeholders can also help the municipality with their own proposals in this step. The consultation steps are legislated to be held for both in the use of new plans or when repealing old detail development plans.

"The aim of the consultation must be to obtain the best possible decision guidance and to enable transparency and influence." (Kap 5 §12 PBL. translation: Swedish National Board of Housing, 2018)

*MKB - Environmental Consequence Description (miljökonsekvensbeskrivning)*

The consultation step sometimes contains an element called 'MKB'. MKB is regulated by PBL and the environmental code as a part of the detailed development plans which contain a significant environmental impact on the surroundings or in the area. This sort of analysis is done by the municipality after the assessment stage and should contain identification of significant environmental impacts and suggestions of solutions (Kap 6. §11, environmental code, Swedish National Board of Housing, 2018).

If an MKB is needed it will be part of the process for the DDP and further announced in the next stage.

EXAMINATION INFORMATION

EXAMINATION FEEDBACK

## 5. Examination

This part of the process means that the Municipality will gather all the information collected in the earlier stages and create a final proposal of the DDP. When the final proposal is created the municipality shall present it to the stakeholders again and make it possible for them to give more feedback. If this feedback requires the plan to be updated or changed the process of examination is done again.

ACCEPT OF SPECIAL COMPILATION

## 6. Accept

When no further changes are needed to be done the detailed development plan is accepted by the municipality. following this the proposal is sent to County government (Länsstyrelsen) amongst other authorities for review and feedback. If they are satisfied the detailed development plan goes further to the next stage.

ENACTMENT

## 7. Enactment / legal force

From this stage the Detail plan is in order and the landowner can start the planning process for the specific buildings on the various plots

## Result from the DDP process

The DDP is not regulated in how detailed it can be. The regulations regarding its geographic content are three (3) bullets in which the information is up to the reader to interpret (Adolfsson & Boberg, 2019). These bullets are as follow:

> "Kap. 4 §32 PBL p. 1-3
> - A detailed development plan may not cover an area greater than what is needed with re-gard to the purpose and implementation period of the plan.
> - The intended regulation of development, construction works and the rest of the environment must be clearly indicated in the plan.
> - The detailed development plan may not be more detailed than is needed with regard to the purpose of the plan. Act (2011:335)."
>
> (translation by: Swedish National Board of Housing, 2018)

The DDP is also regulated to some extent in what it should contain when it is examined (ref, Kap 5, §21 PBL). This is written in the list below. Especially important is the last point, which opens up for interpretation on what is considered of interest for impact on the plan.

- Programme
- Plan map with ordances (2D)
- Plan description (illustrations, implementation description e.g.exploitation agreement.)
- MKB
- General map
- Property list
- Consultation report
- other planning support that the municipality considers makes an impact on the evaluation of the plan

## Actors within the DDP-process

Within the DDP process stages there are different types of stakeholders involved. As much as the processes differ these also collaborates differently. However, while working with the detailed development plan there are main actors involved. These are categorized in four different groups (figure 13).

Below, these are placed after involvement in the DDP process, figure 14.

The group *other stakeholders* can be both architects and engineers as well as citizens engaging in a dialogue regarding the development. Hence, the stakeholder group contain a wide range of competence. Therefore, this group becomes very important to remember and use in the DDP process.

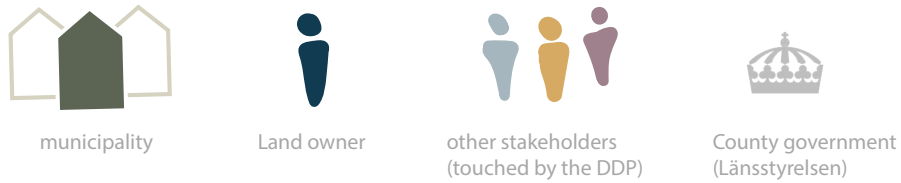



figure 13, *the DDP process main actors*

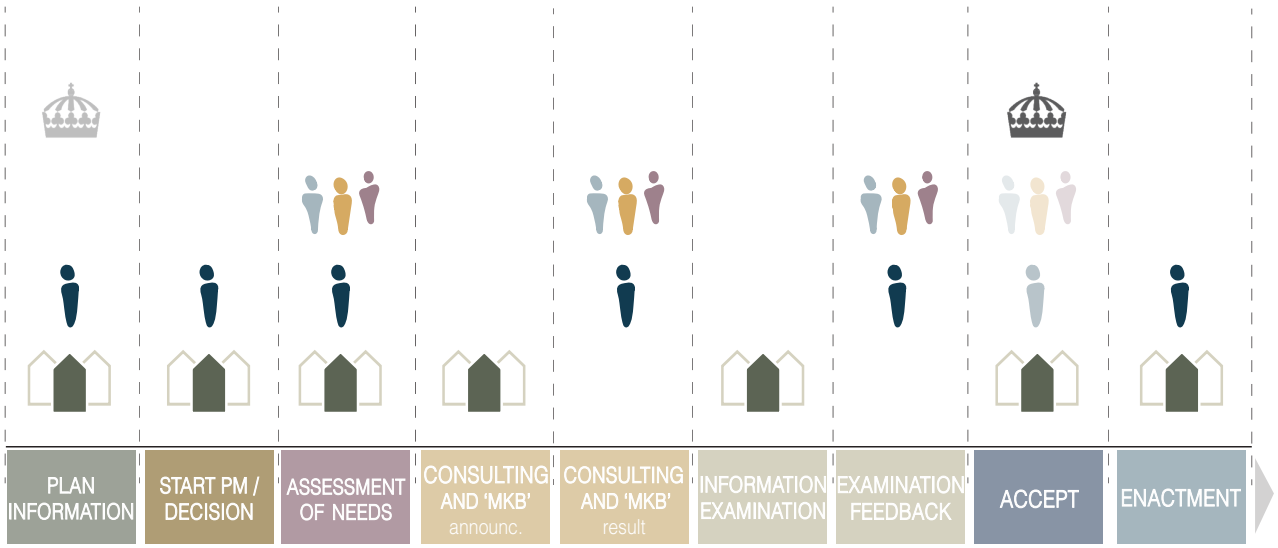



figure 14, *the DDP process with main actors*

## Other regulations

The past years have shown a shortage of buildings in Sweden. Based on this shortage an increasing demand for higher exploitation to meet the need has been growing. (Boverket, 2018a). Added to this equation a response for the global climate crisis is needed. Thus, the construction industry needs to make the necessary adaptations to become more and more sustainable (Brown & Malmqvist, 2014).

Today there are no regulations in Sweden saying that you need to follow any certification, but as the climate debate is growing stronger it has become more of a norm to apply them (Forss, 2019). The environmental certifications are in general a great tool to help the process to optimize and analyzes the result of a building (Sweden Green Building Council (SGBC), 2020a). Although the usage of the certification from its origin is for the building, it is also used a lot for strengthening the buildings selling rate and allure. This has made the usage of them to flourish even more during the past years (Brown & Malmqvist, 2014). As a result of this it has become more clear what parameters that have been lacking in the planning process as well.

There are regulations existing in BBR today which are examined but maybe not to the extent that they should be done. These will become stricter within the coming years. In addition to that there are several other environmental certification programs on both national and international levels which have set scales and demands that should be met in order to be certified. Examples on these are BREEAM, LEED and Miljöbyggnad. Each of these have different processes and set of factors. In the following sections these three examples will be shortly presented.

*BREEAM*

BREEAM is one of the oldest certification systems. It is originally from Great Britain but have made a widespread and is now used globally. To get certified a list of parameters need to be fulfilled. Among these the general topics are; the building's energy use, indoor climate, water management and waste management (SGBC, 2020b). On top of these the certification system also investigates the project management of the building process.

*LEED*

LEED is the U.S. response to BREEAM and is the most renowned certificate program in the world. It measures the building in the aspects of; Location and transport, Sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality. In addition to this the building can gain extra credits for innovation (SGBC, 2020c).

*Miljöbyggnad*

Miljöbyggnad is the certification most commonly used in Sweden today. It measures several of different indicators depending on if the building is new or existing. Among the analysis of the measurements the focus is laid on both the person and environment (SGBC, 2020d).

## Summary of the existing DDP process

The DDP process handles many parameters. Due to this there is a distinct need for analysing which parameters to investigate deeper in the process. Today there exists some tools to highlight these needs, e.g. the MKB. However, there is still a lack of clarity for which parameters that weighs more for certain areas. This is lifted by Adolfsson & Boberg (2019) when they discuss the result of the DDP process. They argue that there are cases where the legislation becomes excessive and also situations where it is not clear enough. Hence, the result of the DDP process varies strongly between areas.

*The creative DDP process*

During the DDP process there are several steps legislated as already mentioned in the beginning of this chapter (page 20). The order and number of steps are all dependable on the need for the certain area. During the inventory of the process a more creative/innovative part of the process were found. This part is illustrated below (figure 15).

Viewing the figure (15) together with figure 14 shows that the creative steps are often the ones with several actors. This opens for collaboration between disciplines to get the wanted result.

Another aspect to remember when looking at the figures together is that the creative/ innovative part of the process is not only when there are several of actors, but when the knowledge is analyzed. For instance, one of the most influential parts in the DDP process today is when the consultation takes part. Further, the Municipality have a governmental impact to affect which analyses is to be done while assessing the needs in the program. This governance can be a valuable tool if used correctly.

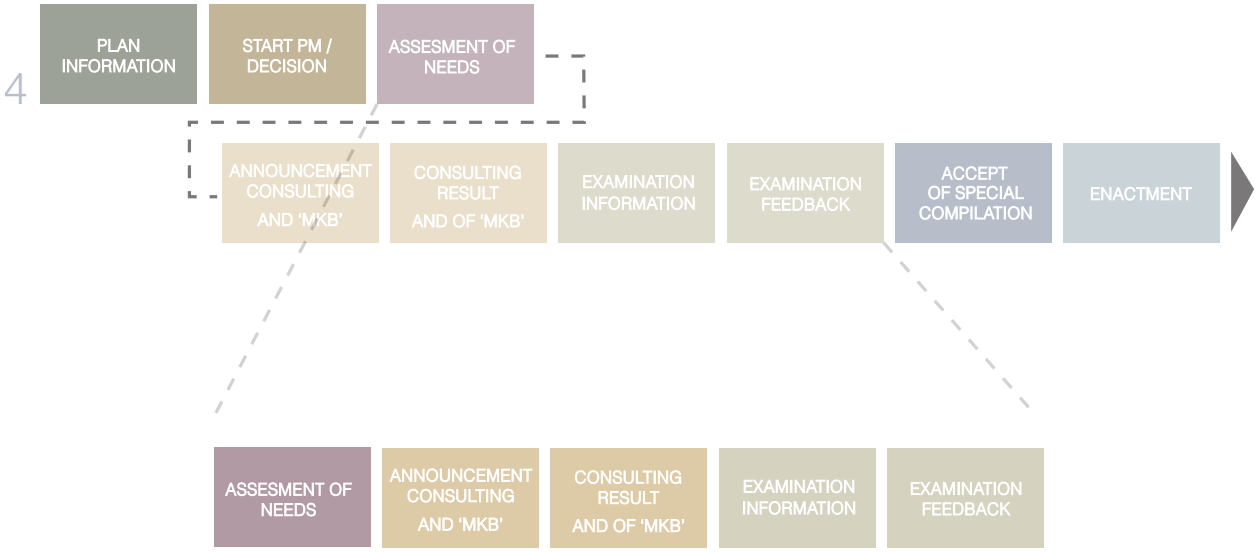



Figure 15, *the identified creative part of the DDP.*

# 3.

*Innovation process & Building Performance Parameters (BPP) in early stages of the building process*

When discussing Innovation there is a need to grasp the meaning of the word. Innovation is by its definition something new. But then the question that remains is, what is new? A common perspective from the technical industry is that innovation is made by the research and development (R&D) departments. Often the result is a physical product which is innovative, thus a type of innovation in products. This is one of the innovation areas discussed in this thesis. But innovation can also be considered as a process, when this is done the R&D is only a part of several of steps in need of innovation (Barata & Fontainha, 2017). For this thesis both innovation as a product and process are discussed.

> "Innovation process incorporates three major activities in the progression from new idea to implementation: envisioning new work strategies, designing the process and implementing change."
>
> - Gambatese & Hallowell (2011, p.555)

## Why innovation?

Looking at the construction industry it is deeply rooted in tradition and a very old industry (Orstavik, 2015). From this perspective many questions regarding the Construction industry's conservative ways have occurred, not only in the society but also in academia. Orstavik (2015) mentions this as one of the main factors to why more stakeholders in the industry needs to look towards innovation. Another aspect lifted by both Orstavik (2015) and Barata & Fontainha (2017) is the financial aspect. They mean that to reach a financial growth a successful innovation can help with creating a business stability for the organizations.

There are several aspects where innovation can help. According to (Goodman et al., 2017) there is a strong link between sustainability and innovation. They claim that there is a distinct need for innovation to receive a sustainable development. This implies an importance to consider the sustainable development within the field of innovation as well. Something which often is referred to as Sustainable innovation (SI); Le Bas, 2016; Yoon & Tello, 2009). This is the innovation which this thesis is further investigating due to its focus on sustainability. Looking at SI in an abstract perspective it covers financial, social and environmental perspectives (Le Bas, 2016; Yoon & Tello, 2009). These categories of perspectives are further discussed throughout this chapter.

## Incentives towards innovation

Innovation needs different types of incentives to be able to thrive in the organizations. While financial and governmental aspects are of importance there is a need for physical drivers to create the environment needed for innovation. Inevitably when talking about incentives the stakeholders involved in the process comes up. This can be to identify stakeholders which are responsible in the existing process or identify the need to collaborate with new actors (Gambatese & Hallowell, 2011; Goodman et al., 2017). The summarized picture is that the incentive of innovation is never the same and is important to recognize and let them take part of the process (Clegg, Kornberger, Pitsis, 2016).

Yoon & Tello (2009) describes four different drivers/incentives for sustainable innovation, Government involvement, Social activism, Customer attitude and demand and Advance of environmental technology . Their description, in short, is that there is a need for government to both ensure compliance but also to create a strong incentive towards improving

environmental impact through regulations. They also mean that the government has potential to promote technological advance. The social activism is important for adapting the customer demand as the customer demand affects the business practice. Finally, advance of environmental technology helps the process to become more and more efficient. As a result of this there is an impact from each driver towards the other. This is shown in the figure below (figure 16). The connection between the incentives/drivers is important to remember for creating the type of innovation you need.

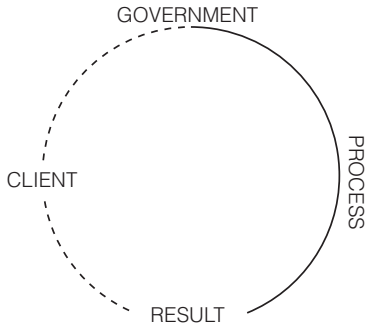



figure 16, *incentives for innovations and their impact on each other*

For the Construction industry there are a few main incentives as Gambatese & Hallowell (2011) describes in their report. These are *idea generation*, *opportunity* and *diffusion*. Their description of these incentives is to give room for creativity and ideas, make sure to try them and even though the result might not be as predicted the winnings are still there.

As mentioned earlier this thesis will consider both the innovation of a product but also the innovation of a process. The innovation of a process will be considered as the implementation of a new tool in the DDP process. Thus, a mapping of the needs for this to happen have been researched, this is presented in the following section.

### Innovation through regulation?!
*The case of Landshövdingehus*

It might sound contradictory to regulate a process to get more innovation. But this is sometimes exactly what nurture innovation. In the case of Landshövdingehus the regulation was to not build taller wood buildings than two levels. The solution to this: Add a new level but in rock instead as a base and the wooden levels on top (Larsson & Lönnroth, 1972).

figure 17, *Landshövdingehus' innovation concept*

Incentives are only one part of implementing Innovation. Innovation is by definition something new and unfamiliar, something that changes the perspective and creates new patterns and/or processes. To implement a innovative solution is therefore a complex task and the keyword here becomes change. One model over how to implement change is the Knoster model. This model divides the implementation into five steps to create a sustainable change/implementation. The five most commonly used categories are as seen in the figure 18 below: vision, skills, incentives, resources & action plan. These are all needed in order to create a successful change/innovation.

The different steps towards change described by Knoster (1993):

*Vision*: A common vision for what kind of innovation that is going to be implemented is needed.

*Skills*: The allocation of knowledge within the existing process.

*Incentives*: What kind of wins is there by implementing this innovation?

*Resources*: What tools and what time is existing for the kind of innovation?

*Action plan*: Direction. What is the aimed result of this innovation and the road there?


Figure 18, *adapted from Knoster model, illustraded by Knoster (1993) showing the different steps of implementig change.*

Clegg et al. (2016) write about Richard Badham's 5 M's when framing change. These are Mind-fulness, Mobilizing, Mapping, Masks and Mirrors. This model refers to both mapping skills such as stakeholders and create actions plans through the M's: mobilizing and mapping. But the re-maining three M's refer to a more reflective part of innovation, and the importance of remember-ing that not all innovations succeed but the trials and outcomes are valuable knowledge. A way to implement this "trial and error" aspect into processes is through design thinking (Brenner et al., 2016). The following section describes this way of thinking.

*Design Thinking*

Design thinking can be seen as both a mindset, process and tool. Often it is used in several of those perspectives when it is applied (Brenner et al., 2016). Examples on design thinking as a mindset is to think unconventionally and new, fail often and early, build prototypes and test. Sounds familiar to innovation? Both Brenner (2016) and Liedtka (2015) connects the mindset of Design thinking to innovation. They also argue that Design thinking methods/tools are successful for implementing innovation.

The concept of Design thinking is setting the human in center for new solutions and therefore a close contact to the customer is principal. Another important aspect of Design thinking is that design never ends. Thus, the process of design thinking is done in cycles. The knowledge learned from the earlier cycles is used in the continuous work in the process (Brenner et al., 2016).

A tool that can be used to describe Design Thinking is the 5 whys which was invented by the founder of Toyota. The tool's concept is to ask why as many times as needed. The result of the tool is aimed to find the root of the problem – to later find the solution. Another tool is the stakeholder map, this tool aims for mapping the important stakeholders for the specific problem (Brenner et al., 2016). Both of these methods are similar to the theory behind change manage-ment seeing that it lifts the reflective thinking behind the 5 M's and also the more planning and knowledge allocation from the Knoster Model.

The most important aspect which all of these methods and perspective lifts is the fact that the outcome is never stated from the beginning. The outcome, however, is always successful if you learn from them. Therefore, a continuous development is another strong key word to remember when managing innovation.

## Innovation Outcomes

The fact that innovation outcomes are unpredictable is strengthen by Clegg et al. (2016), they write that the outcome of innovation is nothing that can be predicted. It is something that requires a lot of trial and errors and the things you learn along the way is equally important. They also write that managers cannot control the innovations success, but they can change the odds. Gambatese & Hallowell (2011) describes this partly as an impact of indirect indicators such as costs and competitiveness. Due to its unpredictability innovation cannot be entirely planned, which might be both scary and challenging. However, the result of innovation can only be determined after its implementation. Therefore, innovation is a lot about courage.

To dare to invest in innovation might be both costly and scary. However, as the literature shows innovation is the way to find the new solutions for the existing and upcoming tasks. And even though the result might not be as first aimed for, the process and learnings along the way may propose new solutions (Gambatese & Hallowell, 2011).

> "the fact that we did not achieve a certain plan by the due date turns into a great step in the innovation process because it helped us realize what we were doing the wrong thing"
> – Clegg et.al. (2016, p.379-380)

## Summary of the innovation process

The innovation process is a novelty in itself. Therefore, it is hard to summarize how it looks or how its result will appear. Nevertheless, there are a few keywords for innovation to remember throughout an implementation of innovation. The first keyword is change. Innovation means something new and this includes to adapt to change. The second keyword is process. When innovation is implemented this can be in the form of a product. However, the innovative product requires an action plan to be implemented successfully. Further this can be described as an implementation process. To plan for this becomes vital in the implementation to obtain a successful result for the innovation. The third keyword is continuity. To work with innovation requires a lot of trial and error. Therefore, a continuous perspective on the implementation process is key for developing innovation (Brenner et al., 2016).

The innovation product can be both a process and product (Barata & Fontainha, 2017). Therefore, there is a need to identify what kind of innovation is required to gain the result wanted for the problem at hand. Therefore, a fourth keyword is communication. To see a current need is complex. In the building process with its many stakeholders a good communication is therefore of great importance to identify the need for everyone (Gambatese & Hallowell, 2011).

This thesis focuses on the Building Performance Parameters (BPP) and its implementation in the Detailed Development Plan (DDP). To introduce how this is contributing to innovation within the construction industry the whole building planning process needs to be further understood. Below (figure 19), the thesis new concept is illustrated regarding BPPs. The figure shows how the BPP is normally investigated in the later part of the process. In this thesis the BPPs are instead acting as an addition to the decision making in even earlier parts of the process. This, through the implementation of the proposed tool concept of BeDOT – to investigate BPPs in early stages. This is done by both developing the DDP process and further develop the tool BeDOT. Thus, an innovation in both product and process. Also, by investigating the BPPs, the addition of awareness in earlier parts is created. Through this, not only changing the process but also giving a new perspective and further understanding the holistic process.

The figure also shows BeDOTs tool concept today (1) in comparison to the new concept which this thesis is investigating further (2).

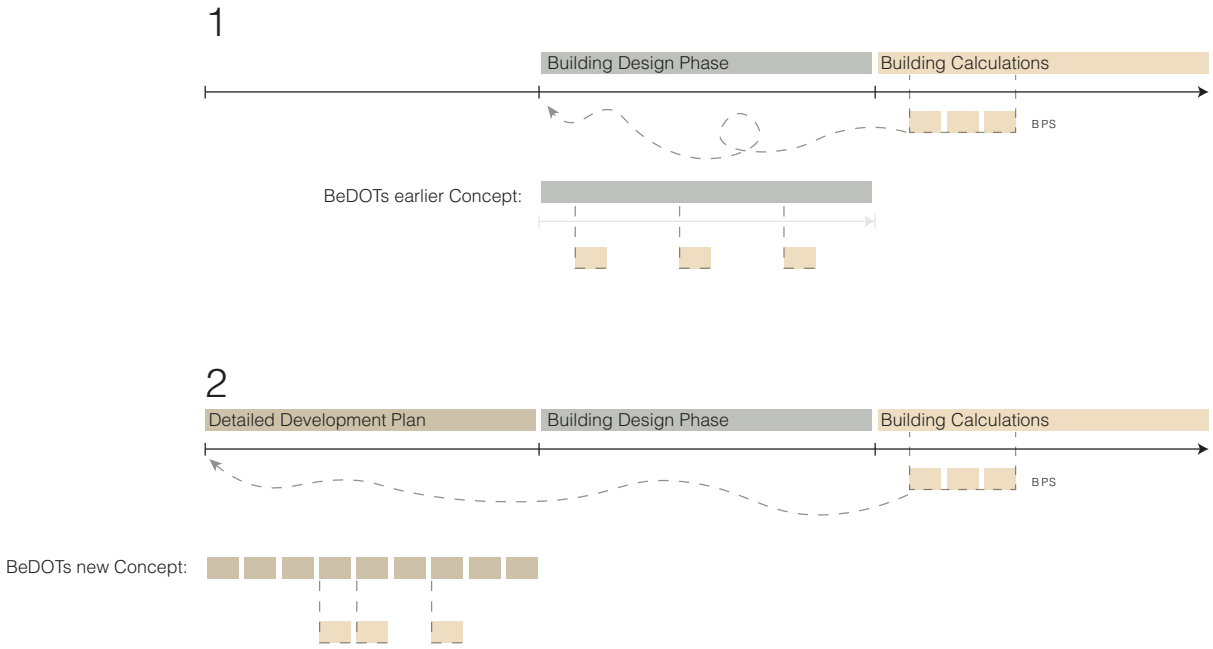



Figure 16, *The innovation concept for the thesis*

## Why Building Performance Parameters?

Figure 19 leaves two main questions, why and which BPPs? Boverket (2018a) mentions that the building demand in Sweden is a lot driven by the market. Thus, there is a great need to plan in the existing city core and the more attractive parts of the cities. To form new parts in the existing cities have created new struggles within the building process, such as adapting to the existing building weave and infrastructure. In parallel to this, as a response to the housing shortage in Sweden, the cities are also increasing in plot-ratio.

Due to this it is important that parameters like height, orientation, width and building activity are correctly calculated to achieve the wanted building performance. These are all parameters that are set in the DDP process. As a result of this, there are several BPPs that could be used to optimize the footprint of the buildings. This is, in connection to the existing building planning process a new addition of the perspective. Thus, a need for connecting the parameters to the early stages is needed. The following section introduces the main categories of BPP that have been the framework for this thesis: *energy* and *daylight*. The focus has been on their plausible impact on the DDP process.

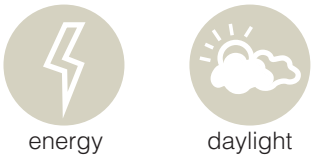



figure 20. *the main categories of BPP in this thesis*

### Energy

Energy is of high relevance when creating more environmentally friendly buildings. The construction industry in Sweden accounts for 40% of the total energy use and 20% of the total greenhouse emissions (Naturvårdsverket, 2019). In the European union the construction industry stands for 40% of the total energy use and 36% of the carbon dioxide emissions (European Union, 2020). Thus, energy becomes not only a financial question regarding which carrier to choose, but also a matter of nature's resources (Naturskyddsföreningen, 2019).

Therefore, the importance of designing more and more energy efficient buildings cannot be stressed enough. This is also seen in the different environmental certification programs which all have much higher demands on the energy aspects than Boverket Building Regulations (BBR). However, BBR, which applies to all new constructions in Sweden, are in the process of harshen the demands as well (Boverket, 2018b).

Buildings consumption of energy in Sweden are dependent on several factors (Boverket, 2018c). Some of them are:

- Ventilation losses
- Heat losses due to thermal bridges
- Weathering losses
- Air leakage trough thermal envelope
- Transmission losses through the thermal envelope *(walls, roof, slab etc.)*

Of these, *transmission losses* and *heat losses connected to thermal bridges* are the ones most connected to the geometric shape of the building (Berggren & Wall, 2018; Nagy, 2014). Thus, these are the ones investigated deeper in this thesis.

*Thermal bridges*

To create energy efficient buildings, it is inevitable to have to calculate the heat transfer coefficients of the building envelope (Berggren & Wall, 2018; Nagy, 2014). This, as well as defining energy parameters and building physics should be made in the early design stage (Nagy, 2014). These heat transfers coefficients include the calculation of thermal bridges. Nagy (2014, p. 2) describes the easiest identifiable thermal bridge as "where the geometry of the building structure changes". Exemplified this translates into both building corners and overhanging structural elements (balconies and external corridors), see figure 21.

When discussing Thermal bridges, the question of material is also important. The first aspect to mention is that material can create thermal bridges, e.g. a pillar in a wall but in the same thickness of the wall (Nagy, 2014). The other aspect on material is that even though the building is designed for airtight envelope and high heat recovery, the shape of the building still matters due to heat transfers (Berggren & Wall, 2018).

*Design aspects with regard to thermal bridges*

Strategies for reducing heating is to create airtight buildings, with high thermal performance and minimized level of thermal bridges (Berggren & Wall, 2018). To design for a low impact of thermal bridges, a building with few structural changes is desirable.

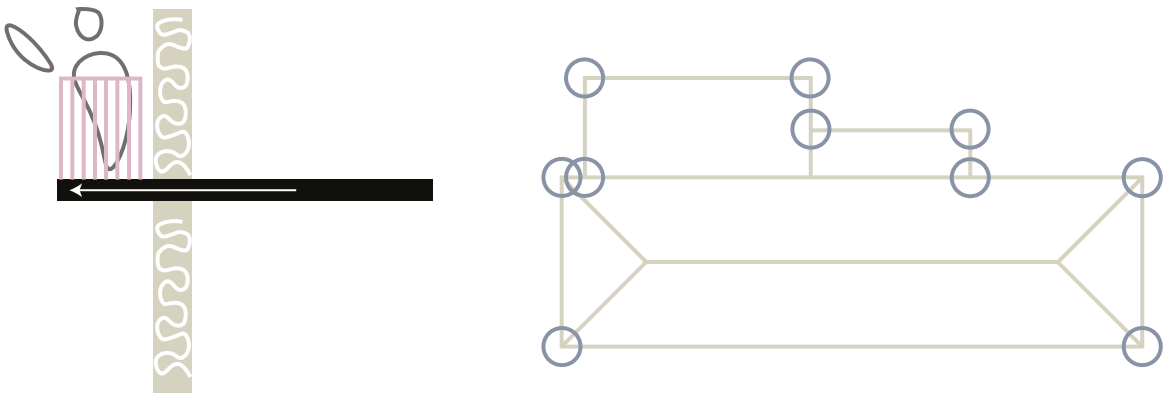


figure 21. *examples on thermal bridges*

## Daylight

As earlier stated in the introduction to this section (page 36) the building demand in Sweden have increased and is also driven a lot by the market. As a strategy for this, Gothenburg (e.g.) have started that the city should grow within the already existing city-limits (Stadsbyggnadskontoret Göteborg Stad, 2020). This means higher plot-ratios and tighter plans, as a result of this the access to day- and sunlight is affected.

During the planning of a new DDP the new buildings should be tested for the demands of health and safety (Stadsbyggnadskontoret Göteborg Stad, 2020). Added to this, research have shown that daylight is connected to people's health the issue of daylight becomes of high importance. A common description of this is the so called "winter-depression" which occurs in Sweden when the days have fewer hours with access to daylight (Folkhälsomyndigheten, 2017).

*Differance between sunlight and daylight?*
The daylight is based on illuminance while sunlight is based on luminance. The difference between those two is that illuminance is based on the overcast sky while the luminance is based on the light from a direct source, e.g. the sun (Eriksson & Waldenström, 2016). An example on usage of Illuminance is Daylight factor, which is calculated on the overcast sky which is illustrated in the figure 22 below. Due to this Daylight analyses are still applicable on a cloudy day and also a new addition to the DDP process.

*Design aspects with regard to daylight*
To design a building with regards to daylight the building should have as high window area as possible and a narrow building shape. This helps the daylight to reach the most parts of the building's internal spaces. To avoid building structures with many *inner corners* is also a desired aspect.

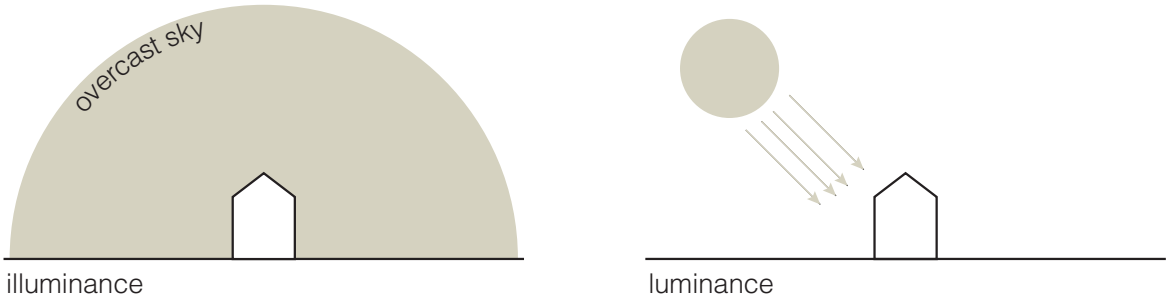



figure 22. *differance between illuminance and luminance*

## Building design and its impact on performance

According to Wäppling (2019) the initial decisions of the design set in the DDP are affecting the final performance. Thus, it is of high importance to set the right prerequisites in the design of the DDP.

The DDP sets parameters such as height, orientation, width and with additional program even more parameters could be set. The following section will describe some of them and their impact on the BPP. These Design factors are also mentioned later in figure 24.

*Height*

As mentioned on page 36, the effects of higher building demand create tighter and higher cities. A higher plot-ratio means higher buildings, higher buildings in a tighter city weave means more shadowing (Boverket, 2018a). This can be seen in the figure 23. With these changes in the city scheme several of the building performance indicators become hard to fulfil.

*Width*

The width of the building affects both the daylight and heat transmission. With a high width the core of the building becomes darker and the heat loss through the building envelope increases. Another factor that both width and height impacts is the shape factor (SF) which is the ratio between the buildings total external surface and internal volume. This factor describes the compactness of the building which have proven to have a good correlation to the energy demand of a building in colder climates (Depecker, P., Menezo, C., Virgone, J., & Lepers, S., 2001).

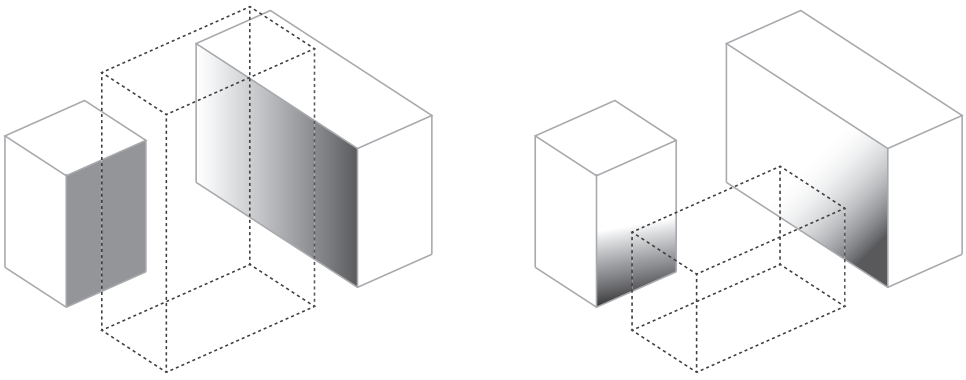


figure 23, *the shadowing impact of higher buildings*

*Orientation*

According to Vasov, Stevanovic, Bogoganovic, Ignjatovic and Randjelovic (2018) the building orientation can help reduce a buildings demand on heating and cooling. They suggest a rotation of +/- 15 degrees towards a southeast/southwest from a south orientation. Their study was done in Serbia which have a similar climate to Sweden.

*Windows*

Vasov et al. (2018) also mentions the importance of placement of windows. This is something that Goia (2016) have investigated more in depth. Windows affect the heating and cooling use of the building, mostly in a negative way (Goia, 2016). However, they are added since the need to have a view and access to daylight suppress the energy perspective. Due to the negative aspect of windows the placement of them become of importance to investigate further to help minimize the negative effects. Goia (2016) did a research with comparison to the Window Wall Ratio (WWR), which is the ratio between area of windows and area of wall. The research concluded an optimized ratio depending on different European climates. This thesis has used the ones for Oslo. These ratios and the earlier mentioned Design factors are summarized in the figure below (figure 24).

| Design aspect | | Source: |
|---|---|---|
| **If aiming for low energy use, the following aspects are:** | | |
| Aim for a low shape factor | | Depecker, P. et al. (2001) |
| Minimize thermal bridges | | Nagy (2014). |
| | As few corners as possible | |
| | Minimize window-, balcony and door connections | |
| | Minimize wall edges against roof and floor | |
| WWR | As low as possible | Goia (2016) |
| Rotation | 15 degrees SE | |
| **If wanting to optimize a building with regard to daylight, the design strategies are:** | | |
| Proportion of windows | as high as possible | Vasov, et al. (2018) |
| Room depth | max 14m | |
| obstruction angle | < 30 degrees | |
| **Optimizing for sunlight**: | | |
| Higer buildings in north | | |

figure 24, *Earlier stated design strategies with special interest in energy and daylight.*

## The financial perspective

The BPPs strongest connection to environmental and social perspectives is described in the earlier sections. Nevertheless, the sustainable innovation which underlies the focus of this thesis lifts the importance of a financial sustainable approach as well (Yoon & Tello, 2009). To describe the financial perspective of an early implementation of BPPs the McLeamy curve (figure 25) is found to be a good model. The McLeamy curve illustrates a correlation between the chance to involve in the buildings design and the cost of making changes at the different process stages. The pattern found was that the longer the planning process had emerged the cost of change became higher, while the impact of the design became lower. This makes the design an important factor to optimize as early as possible in order to lower costs in connection to design (American Institute of Architects, 2007).

The curves are drawn in relation to the design phases of the planning process. Arguably the parameters set as prerequisites before the design process becomes equally as important to optimize as they impact the possibility of the whole design. This is shown as additions in grey in the figure below (figure 25).

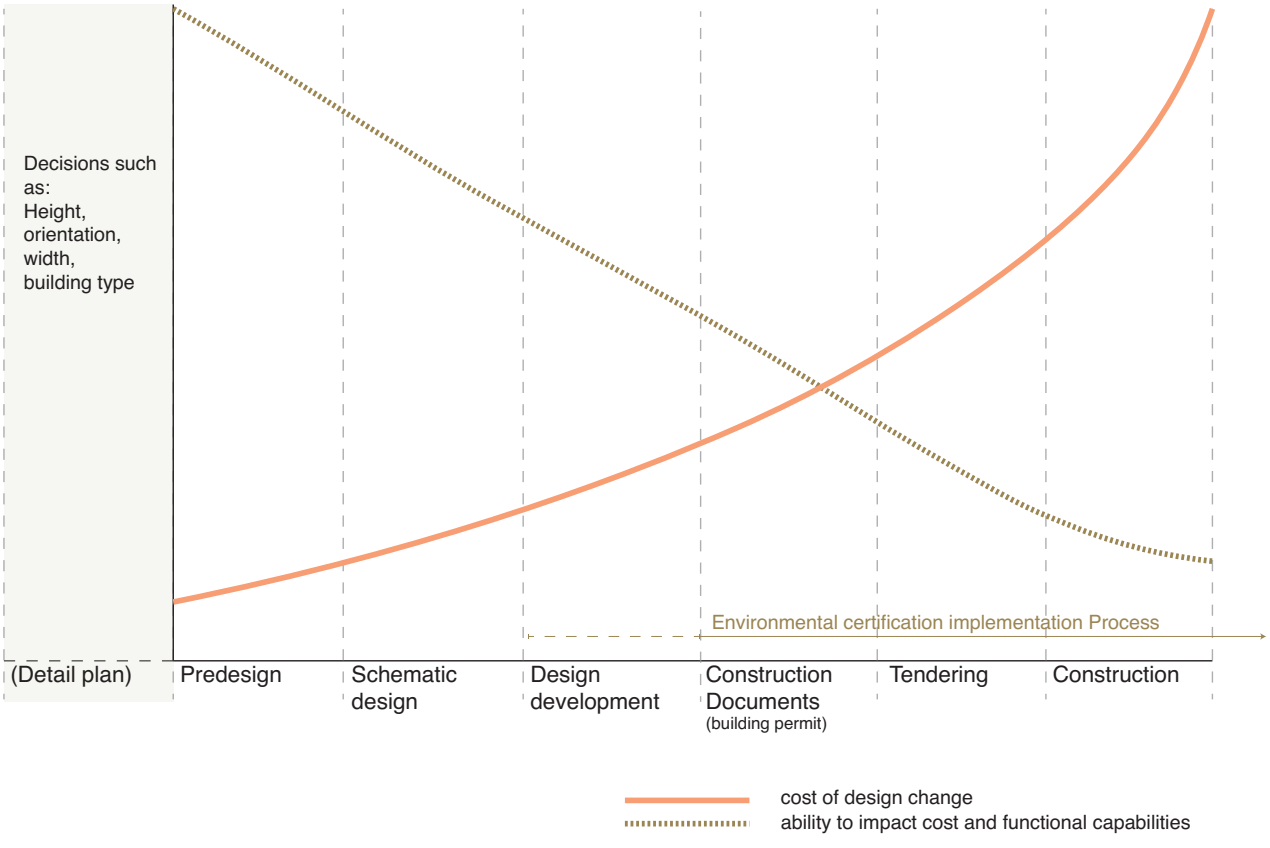
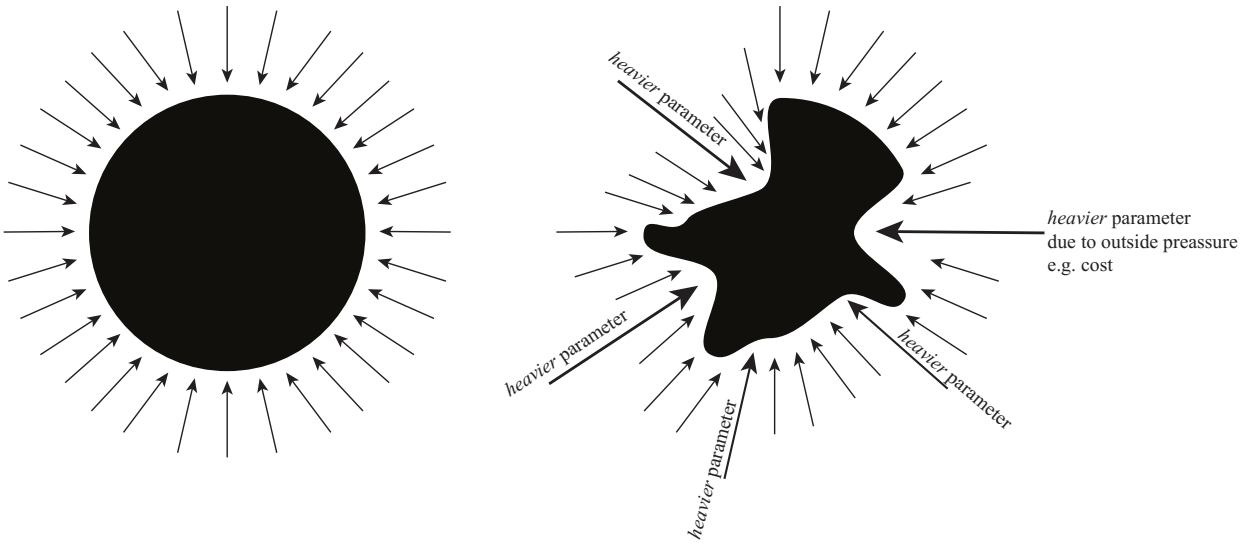



figure 25, *the McLeamy curves adapted from AIA (2007) with additions.*




*Holistic view with same weight on all parameters, shape equally formed.*

*Holistic view with un-even weight on all parameters, shape inequally formed.*

figure 26. *the problem with holistic thinking in design practice and outside pressures. Adapted from Negendahl (2016).*

## What information weighs more?

The existing building process has many different steps and they are connected to different regulations (Swedish National Board of Housing, 2018). Projects are often time-limited, and resources are expensive. Thus, there is a need to identify which parameter that weigh more for the certain project to be able to give an optimized outcome. This in turn will depend from which perspective you analyse (Negendahl, 2016). Arguably there are parameters connected to the process, such as cost, that drives the process in a certain way. So, both a definition on why performance parameters set in the DDP is important for the building performance and how it connects to the users/clients is needed.

At the same time, it is important not to forget the other parameters connected to the building, such as design. As seen in figure 26, Negendahl (2016) highlights this problem with the question, how do we maintain the holistic perspective?

Negendahl (2016) continues to write about how there exists several tools for building optimized buildings regarding energy and daylight. However, very few or none of them considers many design aspects. Thus, a response to these parameters are likely to be neglected. Therefore, it is important to highlight them by other methods.

# INTERVIEWS

## Structure

To fully understand the DDP process the study has been made through both literature study and through interviews with different actors involved in the DDP process. The full interview transcripts can be found in Appendix 1. The interviews and conversations have in total been held with eight different persons and had two main focuses. The first, find out where in the detailed development plan process a tool like BeDOT could be helpful based on the need today. The second was to identify what sort of parameters the field needs to/ can implement today and in the future. To reach this the following main questions have been asked:

**Q1** What actors are involved in the detail development plan? And what responsibility do you have in the process?

**Q2** What common problems are discussed and found in the entire building process that might be able to be discussed in the detail development plan process to help find a solution?

## Interview 1 – The municipal city planning authority, planning architect

(personal communication 2020-02-05)

From this interview the main conclusion is that the constant demand on new buildings in Sweden, leads to the footprints given in the detailed development plan to be "maxed". This in turn leads to a situation where there is no or very limited flexibility in orientation, distance to surrounding buildings and correlation to existing buildings when the detailed development plan is accepted.

For instance, the height of a building can both decide how much BTA a building can provide. This is together with the width of the building. But the height also directly influences other parameters on surrounding buildings. This overlap of parameters is hard to change in later stages of the process since the owner of the facility most likely want to maximize the BTA as much as possible. Thus, one can argue that the DDP is a very important tool in the creation of presets for the building performance.

## Interview 2 – The municipal city planning authority, Daylight focus group
(personal communication 2020-02-18)

The Environmental certifications are not mandatory today. However, they are becoming more or less a standard. In a prolonged perspective they have also made a change of focus within the municipalities in their processes. A comment from one of the interviews underlines this new focus, that the addition of environmental programmes has forced the municipality look deeper into the parameters than ever before

Today several of the problems with the BPS parameters are found in a late stage of the process. Sometimes even in the building permit application. This have led to it being in several cases to late to make an significant change due to important parameters set in the detail plan can not be changed. The changes can only go back to the stage seem fit in the design phase (figure 27).

The environmental certifications impact on the construction industry is both shown in a market-perspective but also in direct result within the process. The interviewees also acknowledged a problem often occurring in the building permit applications. In this case it was the daylight-factor. This was clearly noticed when the applications for building permits for buildings with certifications appeared. With this entering in the process it was made clearer that there were certain values to follow. Thus, the permits applied for either exception for the plot or didn't follow the certification fully.

*Decision making in the DDP*
Another main taking from this interview is the lack of an existing system for deciding which parameters that should be investigated. When proceeding with a DDP there are several processes that can be chosen, as mentioned earlier in this thesis (page 22). The chosen process also leads to different types of information considered relevant for the specific DDP. This became increasingly clearer during the interview with the municipality. For instance, they mentioned the MKB which is not mandatory for all processes so some of the DDP becomes more focused on the environmental aspects while some might be focusing on noise and traffic.

One additional aspect which also makes a difference according to the municipality is the person making the decision to approve a plan or not. So not only is the chosen process affecting which parameters that is taken into consideration, but it can also be the person reviewing the plan, (s)he may have a special interest in a specific area. Thus, it becomes hard to say which parameters that are weighing more or of more interest in the specific area

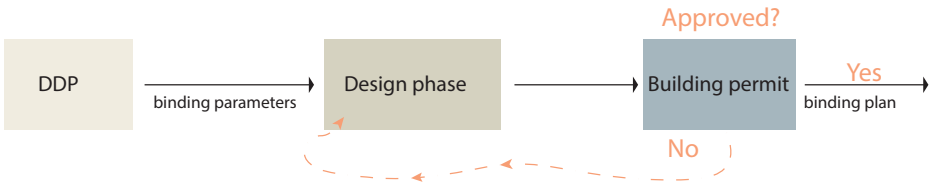



figure 24, *The problem with too late awareness of BPP*

### Interview 3 – Energy and Sustainability responsible at White arkitekter AB (personal communication, 2020-03-11)

The main takings from this interview is how the communication of building parameters today are potentially disturbing for architects. And how the engineers find it disturbing that the buildings aesthetics are not optimized for the demands of performance.

The interviewee describes it as: As it is today the building performance is often investigated between building permit and staring permit. This results in many set parameters that are not changeable. However, when thinking about the parameters during the design phase this often leads to a list of demands for the architects which often leads to irritation and the feel of being too directed.

For the engineer the opposite is often felt, due to their un-involvement their workload often rises at the end of the design process due to re modelling and discussing change of design to reach demands.

This communication issue is something that also highlight the need for a deeper knowledge of building performance in each step of the process. As well as a knowledge in creating an environment where the architect can be creative without being too directed.

### Interview 4 – Business developers at Skanska Hus AB

(personal communication, 2020-03-15).

To identify where Skanska as an actor becomes part of the process is quite different depending on which project you regard. There are many different types of involvement with different actors. In the DDPs which Skanska have been part in developing the result have not concluded in a clearly stated product either. This meaning that the level of detail within the DDPs differ. During the interview they mentioned that sometimes it is enough with just a situational plan and in other cases they have done several analyzes to propose the end plan.

As actors in the DDP process there are several perspectives to consider. The interviewees mentioned the client's perspective several times during the interview and highlight the importance to always have satisfied clients in the end. In the beginning this is e.g. to map the building types that are popular and to set a target group, this is gathered in a so-called market analysis. Later this perspective often becomes a kind of measurement towards the financial aspects of the building (see quote below).

> "As good buildings as possible vs. As many buildings as possible"
> - Karolina Olsson, Business developer (personal contact, 2020-03-15)

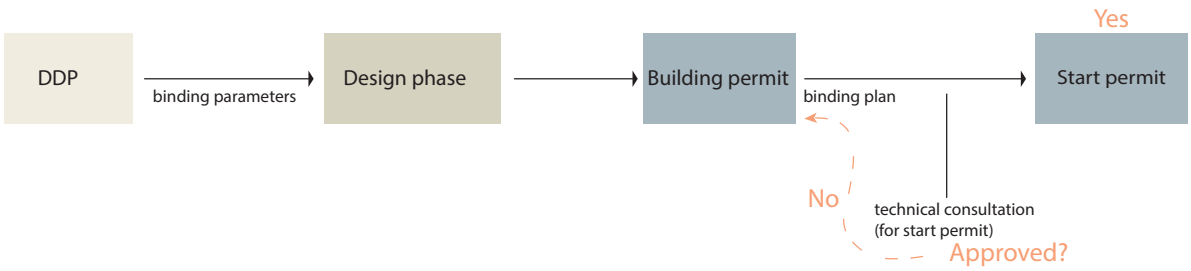



figure 28, *The problem with too late awareness of BPP *developers perspective*

From a building performance perspective, the interviewees mentioned that there has been an increasing focus on daylight and energy parameters earlier in the process since their internal decision to certify all their new buildings according to Svanen environmental certification. This is similar to the findings done in the municipal work and connects the application of environmental certifications as an important problem identifier. However, one of the interviewees mentioned that the implications of the parameters such as daylight and energy shows even more in the stage between building permit and start permit – in the so called "technical consultation" (figure 28).

*Decision making in the DDP*

In Skanska's process today the interviewees described the impact on the buildings volume as a result of discussion between different actors. This can be the Municipality, architect or other such as performance engineers on different levels. The involvement of performance engineers is something which the interviewees later mentioned as a more recent addition but becoming more important now due to the highlighted importance of these aspects.

Another important decisionmaker for the building volume is the market analysis made in the client's perspective as earlier mentioned. This is often a very heavy aspect when deciding the building volume in the end. However, a certain flexibility in the DDP is mentioned from the interviewees, as an example a bit more width in the DDP plot. This flexibility is something that they feel is important to try and secure the possibility for certain building elements, e.g. balconies, which can lead to more satisfied clients.

The issue of maximizing the DDP is something that the interviewees recognized, and the earlier mentioned flexibility is a way for them to try and avoid this issue. However, they also see a need to make more analyzes on daylight and energy in the earlier stages since these are impacted a lot by the volume and shape of the building. The interviewee argued that most of the developers want to be able to maximize the DDP without creating bad products regarding the clients. This also introduce to another important aspect that the interviewees emphasize, that there should be (or might already be on the way) new directions for the municipality/ themselves regarding the building performance in the DDP process.

# 4.

*Empirical findings & Development for the DDP process*

Through this thesis focus placement in relation to the building planning process it aims for creating the needed prerequisites for the building performance but still leaving a big opportunity for design in the coming stages. As Negendahl (2016) mention this is often not considered when optimizing in a later stage. By placing the optimization in an earlier stage, the process instead gives directives for the shape that helps the performance, instead of giving feedback on an already set model. The placement will also result in a more fact-based process which also can have a positive impact on the later stages when they feel more informed. This is also strengthened by the third interview, which proposes a way to optimize buildings without having to backtrack changes.

Going back to the inventory of the process there lies a great strength in the identified creative part of the process (figure 15, 29). This strength is both the many stakeholders and their competence, but also as mentioned the clear governance from the municipality (page 28). This is further strengthened by Yoon & Tello (2009) which mentions governmental impact as a great incentive for sustainable innovation.

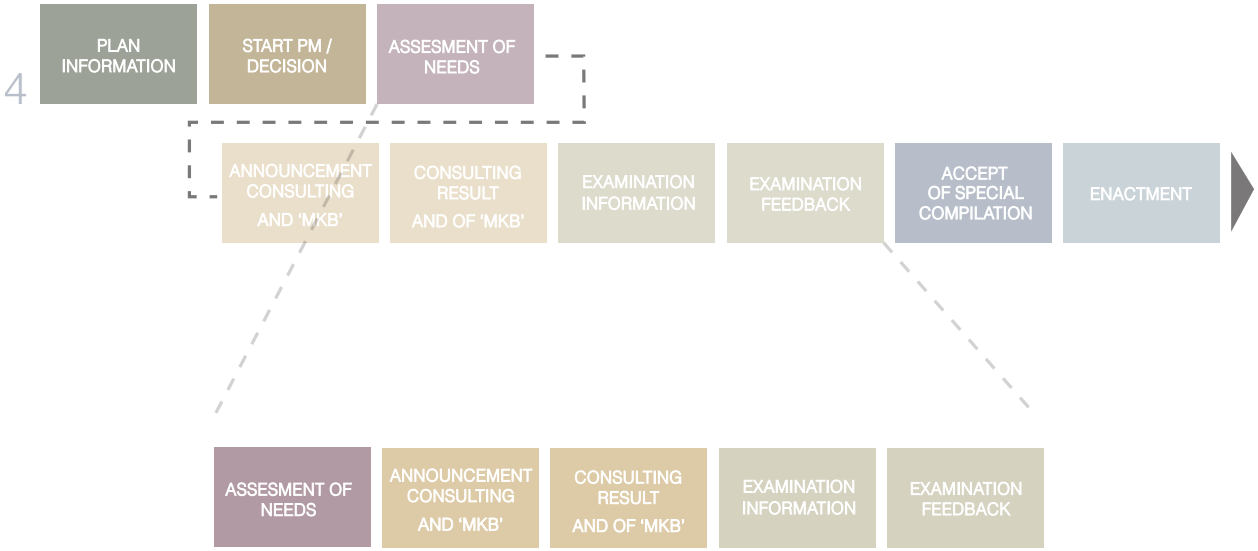



Figure 29, *the identified creative part of the DDP.*

The interviews also showed a correlation between the implementation of environmental certifications and building permits or start permits. This was common both on the developer's side and the municipality. Both parties also mentioned that especially daylight is common for being the reason for not reaching the set targets in the certification, which have led to a higher awareness of the building performance parameters in the earlier process.

This is illustrated in figure 30. Due to the impact of building geometry on these BPP there is a need to investigate them even earlier than done today. Thus, an application of the proposed tool could contribute to the existing process and methods. Which also can help in an financial perspective as shown in figure 31 as an overlay on the McLeamy curve (figure 25).

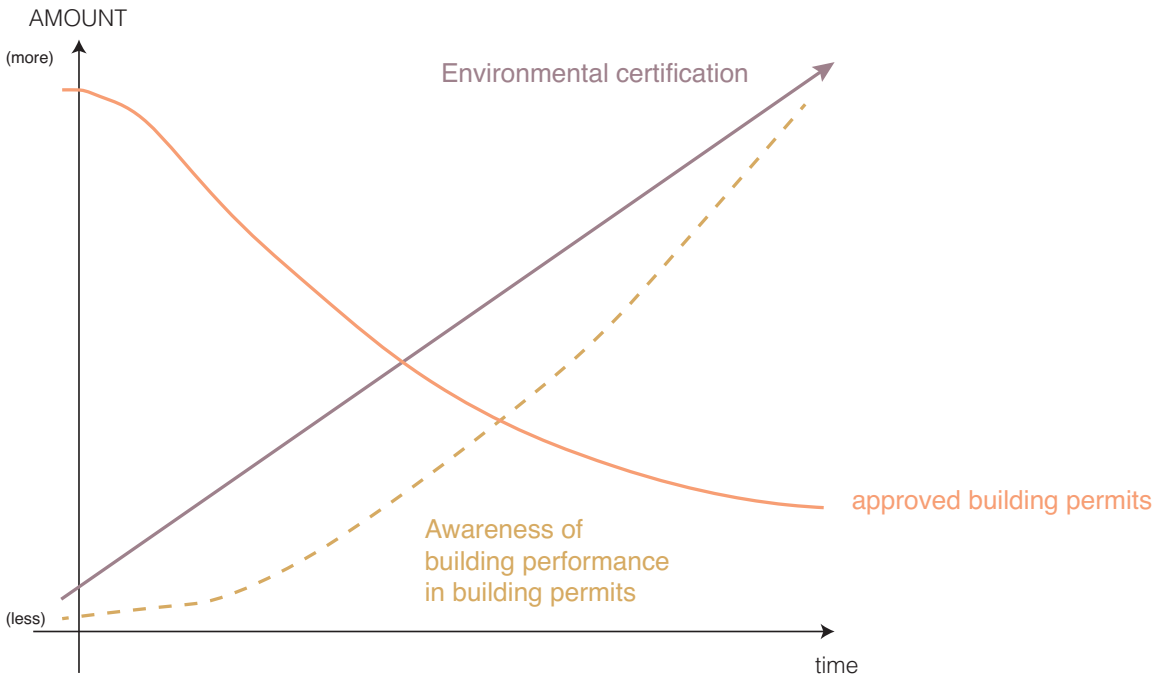



Figure 30, *The correlation between environmental certification and awareness of building performance.*

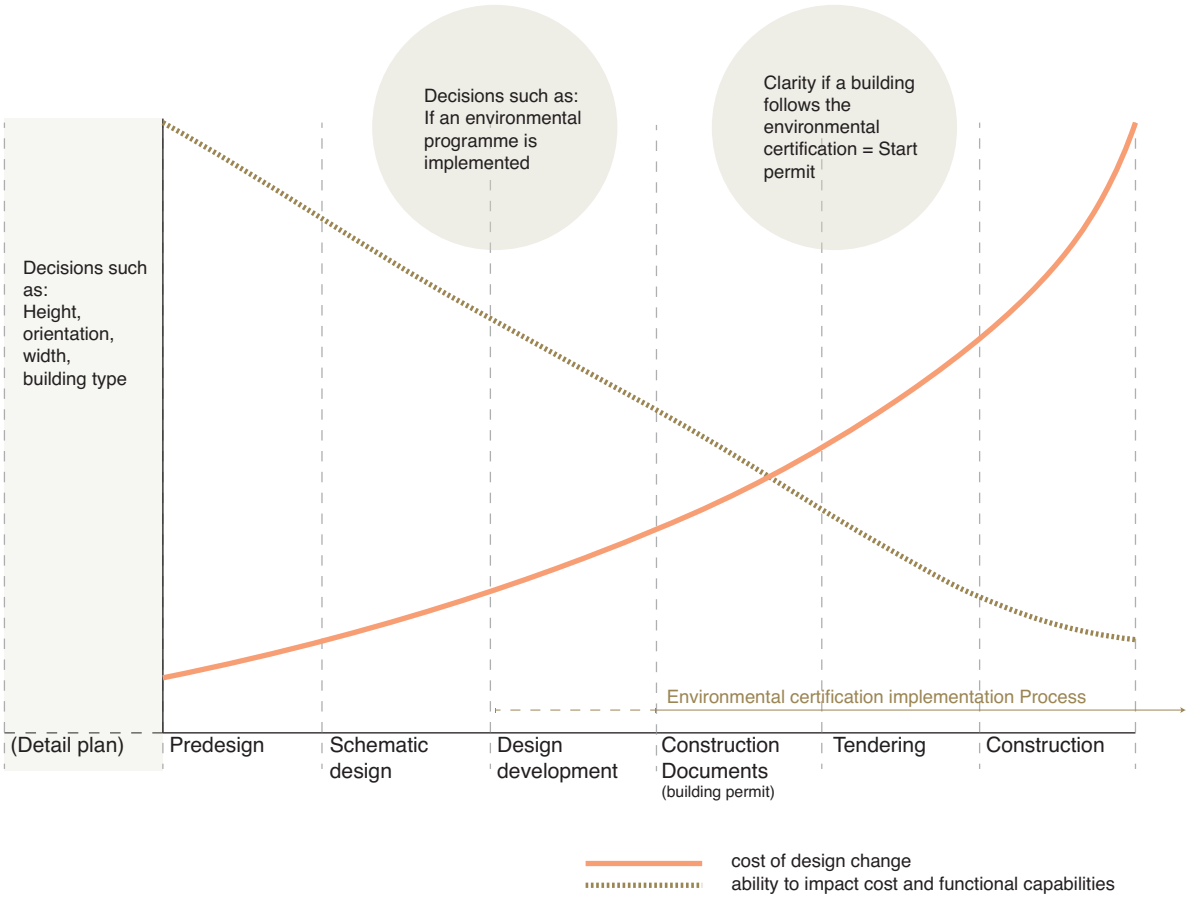



figure 31. *The financial perspective on change during the Building planning process. Curves adapted from American Institute of Architects (2007)*

## The implementation of change in DDP

To implement an innovation/change in the DDP process the key words found in the literature study becomes central. They are illustrated in the figure below (figure 32) and are implemented in the proposed process on page 57.

| Change | Process | Continuity | Communication |
|---|---|---|---|
| Innovation means something new and this includes to adapt to change. | The innovation result requires an action plan to be implemented successfully. Further this can be described as an implementation process. | To work with innovation requires a lot of trial and error. Therefore, a continuous perspective on the implementation process is key for developing innovation | To see a current need is complex. In the building process with its many stakeholders a good communication is therefore of great importance to identify the need for everyone |

figure 32. *The identified keywords for innovation*

The literature on innovation showed that there is no specific method to implement innovation. Neither know what to expect as the outcomes. There are however ways to create the setup for innovation. Arguably there are no right or wrong method to follow when working with innovation, seeing that it is the matter of creating something new. Nevertheless, the literature reviewed in this thesis shows that there is a need to find strategies for implementing it.

Going back to the quote from Gambatese & Hallowell (2011, p.555) there are three steps for innovation process. Envisioning new strategies, designing the process and implementing change. The first two were recognized again in Knoster's (1993) model for complex change. The model however has five steps for a successful implementation. Vision, skills, incentives, resources and action plan.

As mentioned before this thesis can both be discussed as innovation of product and of process (page 30). But the main perspective is to see it as both. As for the thesis strategies the model of complex change by Knoster (1993) is found to be a good way to illustrate this (figure 28). The model is re-illustrated to match the thesis innovation concept (figure 33). Each category is described in the table below:

***Vision:*** Creating the prerequisites for buildings regarding energy and daylight

***Skills:*** Existing actors in the DDP process, but also the existing process legislation creates a possibility to incorporate the stakeholders needed for the result desired.

***Incentives:*** the environmental certifications and the general higher demands on energy and daylight get solved. A change of process with earlier incorporation of BPP creates information-based decisions and a more holistic process.

***Resources:*** The existing tool, BeDOT, and its capability to be integrated with more specific calculations. The Municipality's mandate for governance. It is important to remember the skills as a resource as well.

***Action plan:*** The process proposed in the later stage of this thesis.

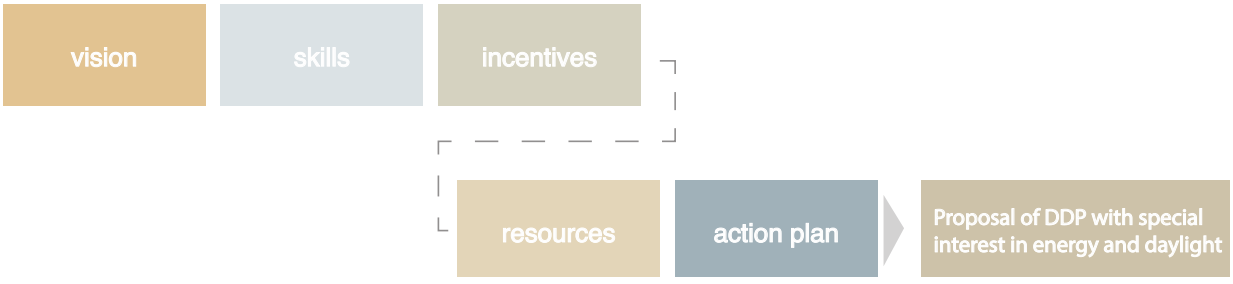



figure 33. *the knoster model for the thesis innovation concept*

## Innovation concept: Handle BPP in DDP

As mentioned earlier in this thesis, the tool developed at BDAB will be further developed. The more specific tool development can be read about in the thesis by Andersson and Jonsson.

The calculations of BPP is most commonly done in a later stage of the Building Planning Process, after a design is set. The literature investigated in this thesis have however mentioned several aspects which can be investigated on an earlier stage of the process. For instance, a buildings footprint and shape factor are both relevant for the Building performance result in both Daylight and energy.

Instead of looking into the early design phases of a specific building, which both Forss (2019) & Wäppling (2019) did during their theses, this literature also strengthens the need to investigate the DDP process. More specifically, the locked parameters which are the framework for the coming Design Phase.

Going back to the earlier presented figure which can be seen again below. This also concludes why the addition of the tool is innovative. Subsequently, this also highlight the need for a new process for the implementation.

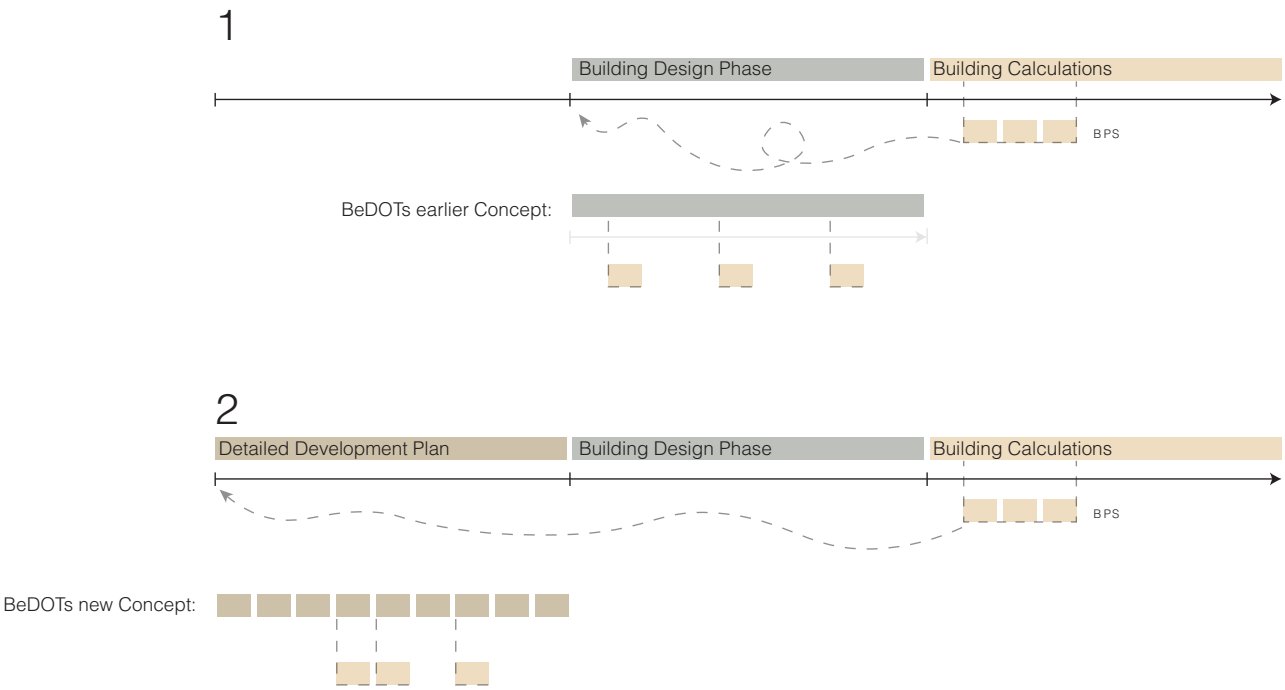



Figure 34, *the thesis innovation concept*

## Which BPPs?

Based on the literature and the interviews a diagrame over the most relevant parameters are listed in the figure below (figure30). As seen in the figure the relevance differs between low/medium/high. This thesis has furthered focused on the ones with the highest relevance.

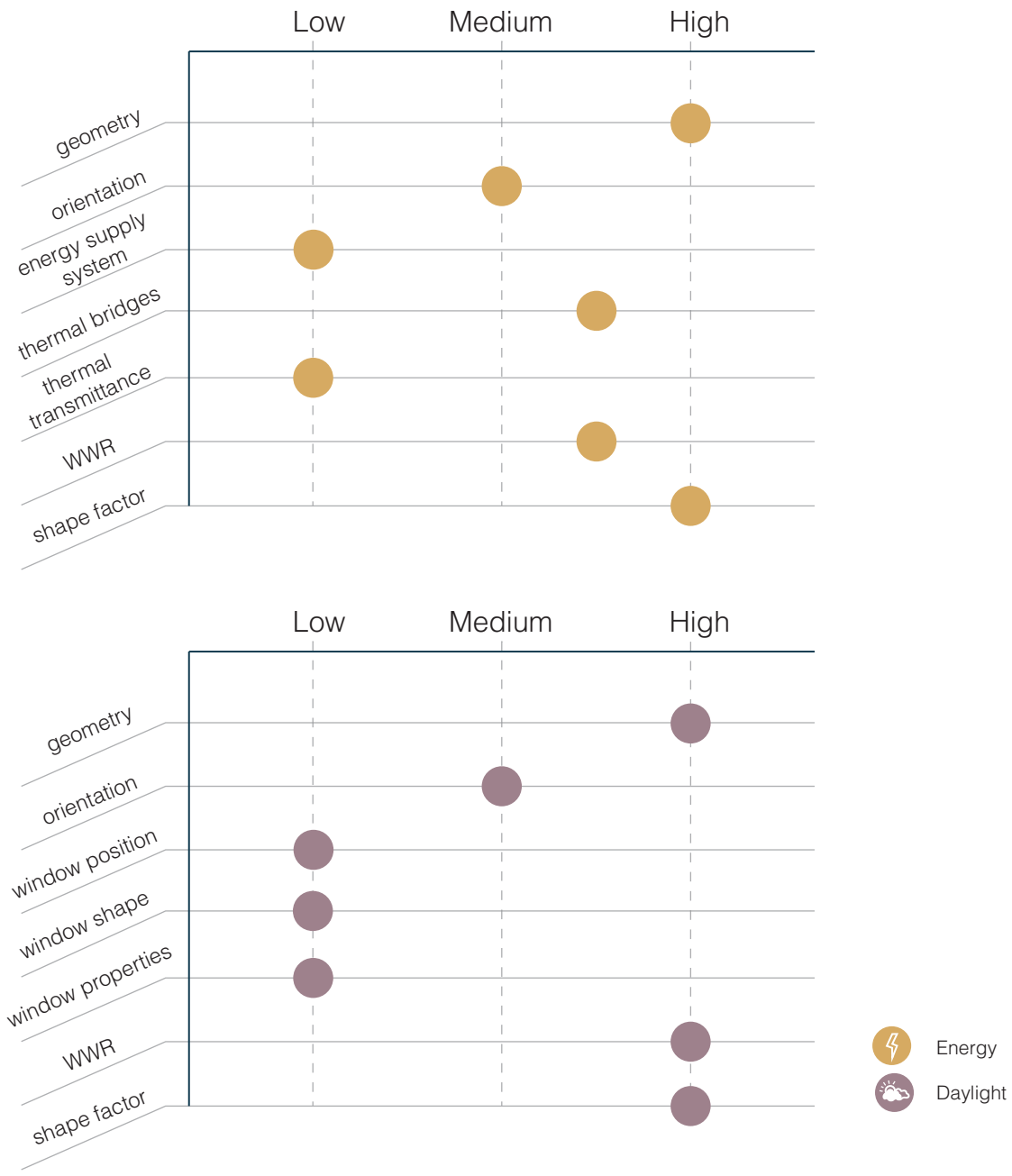



Figure 35, *the relevance of investigating certain parameters in relation to the DDP process*

# THE ADDITION TO THE TOOL & PROCESS

The additions suggested for both the tool and process is presented in the following section. They are mainly based on findings shown in the figures 32, 33, 34 & 35. But one underlying focus is also to incorporate the environmental, social and financial perspective as well. This, with regard to the definition of a *sustainable innovation* given by Le Bas (2016) and Yoon & Tello (2009).

## The addition to the tool

Based on the relevance of certain parameters found in the literature study (figure 35) the addition to the tool have been made in consideration to those of highest relevance. These additions are shown in blue in the figure 36.

### The importance of handling the geometry

This part of the tool is highlighted due to the importance of mass modelling for the investigation. The importance of investigating the parameters orientation, height and width are frequently reoccurring while reading the literature. Due to this a big part of the additional functions relate to the geometry.

For instance, the ability to filter the result by which property is highly relevant during investigating the DDP. This due to that an DDP area often includes several of properties. Thus, a need to investigate certain buildings from the result is highly relevant to find the best solution.

### Thermal bridges and ground flux

Both additions to the tool gives a more specific outcome of the energy calculations. They are relevant both when designing the geometry of the building but also when deciding the activity. E.g. they can help decide whether or not external corridors could be applied to the building.

### Daylight

Sometimes the best thing is not to have all information at once. Therefore, the daylight addition is included by a separate script. This also since it already exists solutions for the chosen daylight analysis VSC.

### Validation

The validation of the outcomes from the tool can be adapted for the current need. For the DDP process the suggested validation methods are further presented in the next chapter of the thesis (page xx).

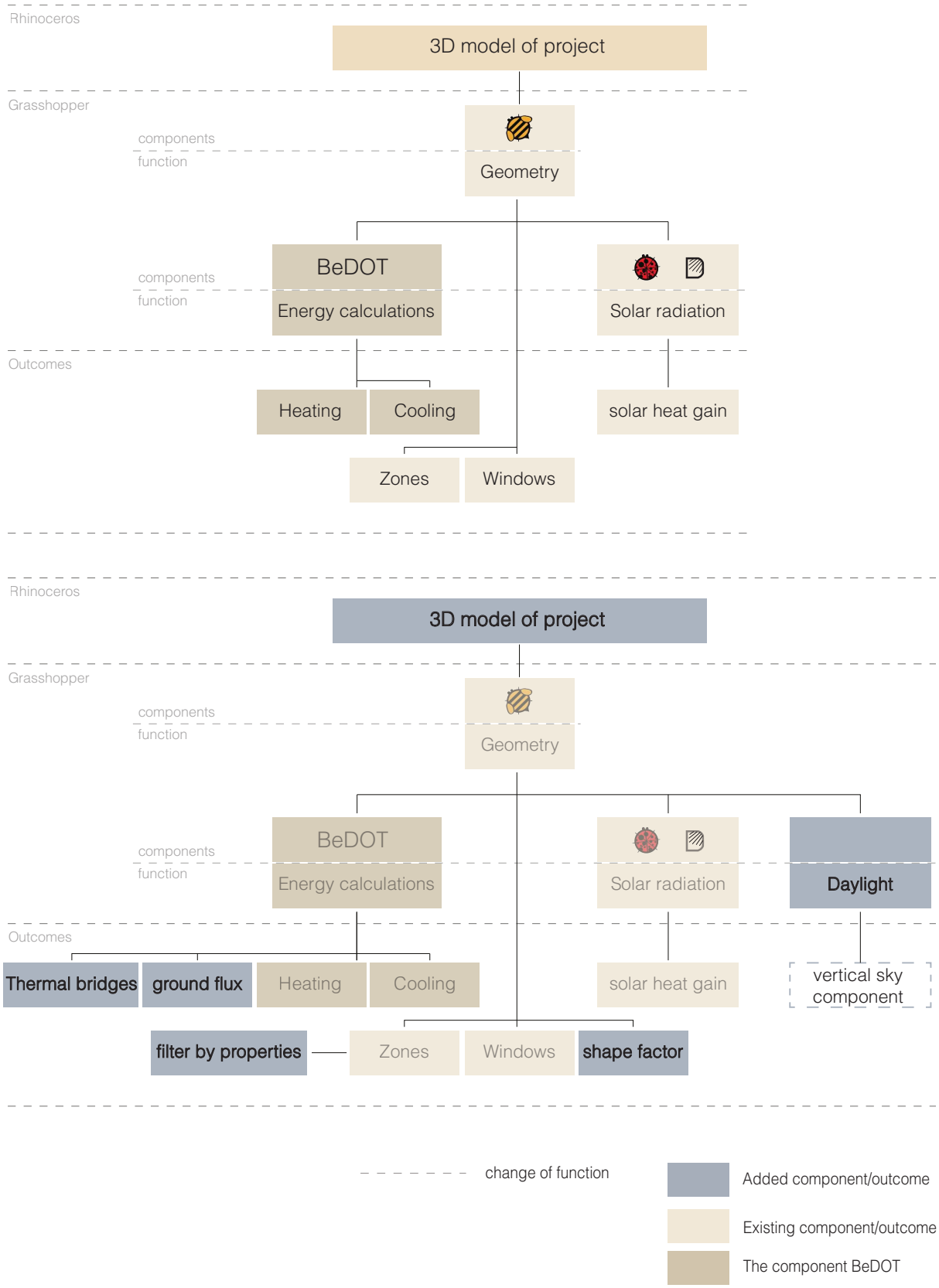



figure 36. *Illustration of the addition to the tool*

## The addition to the process

The proposed process (figure 37) is divided into five steps of change in the existing process. These are described in the following paragraphs.

### 1. Inauguration Of The Tool

The municipality would in this case not be the main user of the tool, however they would act as an incentive for the usage of it.

Yoon & Tello (2009) write that one of the main drivers for sustainable innovation is Governmental impact. This thesis proposes this as a first step in the process, to give directives for the usage of BPP in the DDP. In similarity to how the MKB is legislated it could use some governance to do "as told" and if the municipality would announce consulting with special interest in energy and daylight this could help drive the change of process. This is also connected to the keyword communication, found in the literature about innovation.

The need for this kind of directive was also found during the interviews, there is an existing confusion for whom the responsibility for the analyzes lay on. As a result of this, there are many processes today which could investigate energy and daylight earlier but see it as a gain in time if they skip it. By giving these actors the incentive to do the analyzes the prerequisites however could improve and thus they can gain in time by having a better worked out plan to develop within.

### 2. The Tool For Conslutation

While Yoon & Tello (2009) write about the drivers in general, Gambatese & Hallowell (2011) reflected the incentives into the construction industry. In their findings the incentives called *idea generation* and *opportunity* are central for this step.
The tool that lay ground for this thesis creates an opportunity for a great idea generation. As shown later during the case study, the design methods used for the development of the DDP generates a lot of different models to juxtapose to each other. This follows in the concept of design thinking and the idea that design never ends. To continuously explore and investigate different proposals in the beginning gives both an optimized design but it also generates a knowledge of how the design affects the outcomes. By giving this perspective to both architects as well as engineers supposedly should help the prolonged holistic thinking during the specific building design phase.

### 3. A New Tool = A New Actor?

The addition of the tool should be a contribution to the process and development of the buildings. And during the mapping of actors it was found that the actors involved should possess the competence necessary for such an addition. Meaning that there is no actual need for a new actor to be involved.

However, in the beginning it is very important to see that there is a specific actor mentioned as responsible to see the analysis through and to keep the communication of it in the rest of the process. This is by no means necessary to be a new actor, but one that have the possibility to follow each step of the process is necessary when working between actors. This is to minimize that the analyzes are forgotten. But mainly to see to that the knowledge can be communicated further both within the DDP process and also to the later stages of building planning process.

As identified in the interviews a clear role/ ownership is in need between the actors in the DDP process, the addition of the tool BeDOT is no exception. Therefore, a completely new actor can be identified as a strength, especially in the beginning

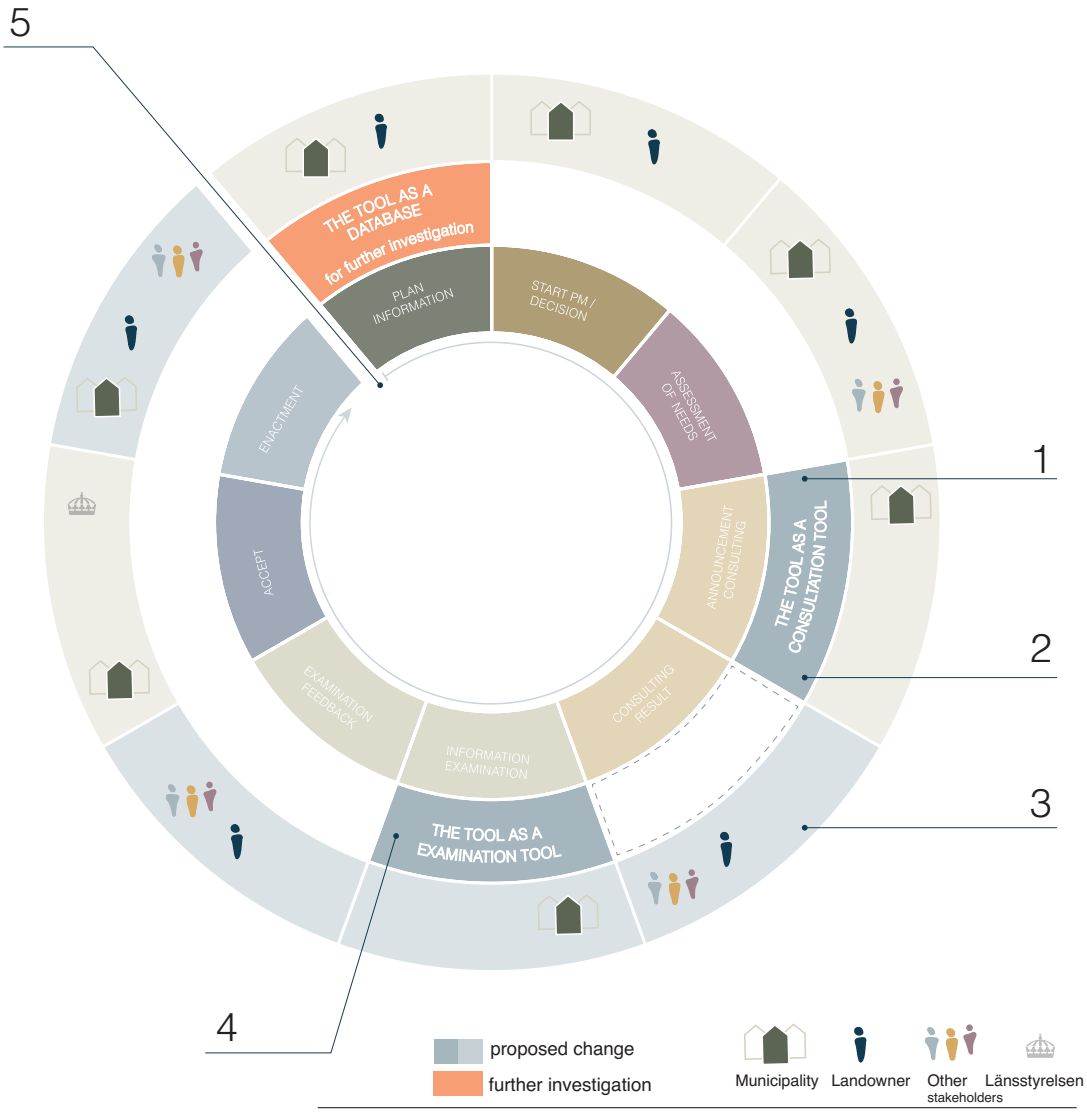



figure 37. *illustration over the proposed process*

of the implementation of the new tool. The foremost identified role for this actor would be as a technical consultant. Within this role the actor would help with both the function of the tool and help develop the results desired from it. Also, the consultant could help create both a clarified governance in its ownership of the tool and its analyses. Thus, helping the communication and process.

### 4. The Tool For Examination

As another option for the municipality to use a tool such as BeDOT they can applicate it as a part during their examination. This is a way to make sure that the option chosen when e.g. holding a contest are the best option in regard to the BPP energy and daylight. This function also applies where the need for the analyzes have not been found until later in the process and the municipality want to reassure the performance of the proposed plan.

### 5. The Importance Of Continuity

As found throughout the literature, the linear process is a common way to illustrate and perform processes in the construction industry. However, there is a great need to keep knowledge between processes and develop each step after the knowledge gained. Thus, there is a need to see the process as a circular process and to find ways to maintain both information and knowledge in the future. This is further highlighted in the keywords in figure 32.

# 5.

*case study*

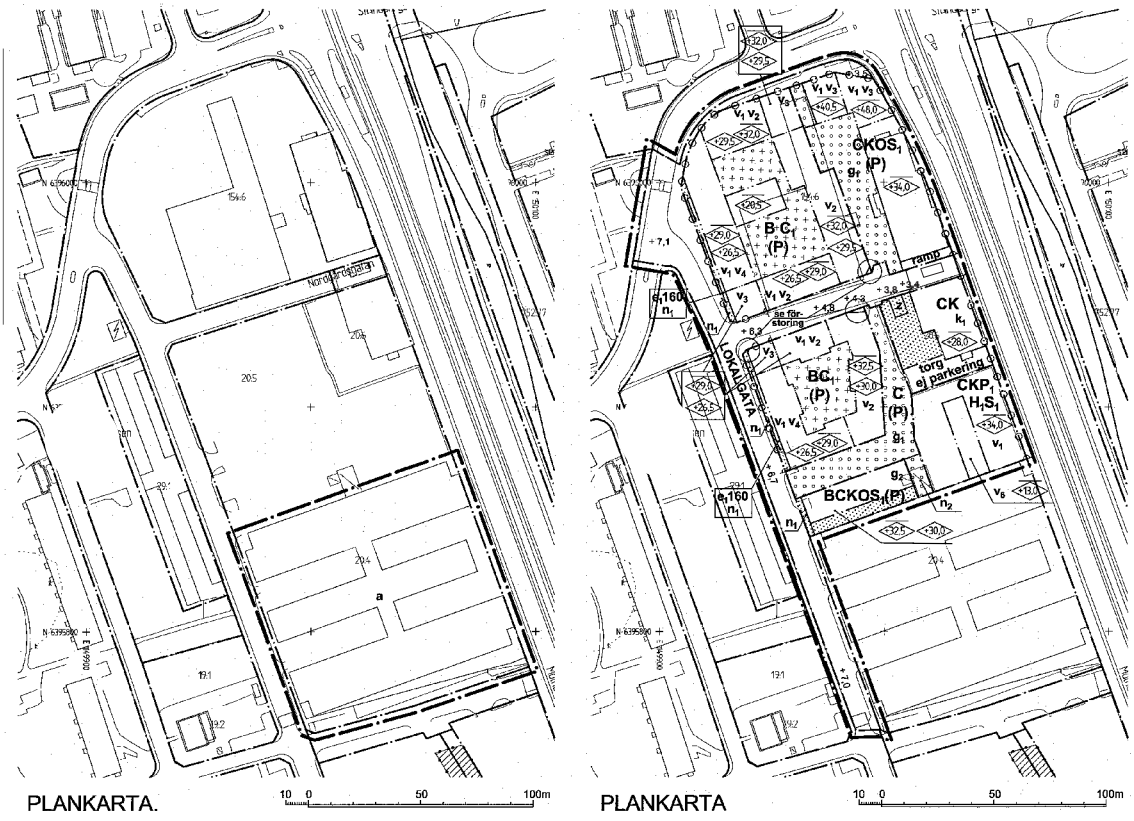



figure 38. *illustration over the case study DDP area*

The site chosen is located in Gothenburg, it is a block of residential buildings with high demands from both the existing buildings and from the scenery. For instance, a high-speed road is located directly in connection to one of the planned buildings today.

Following the proposed process, the case study is following the two usages of the tool in figure xx — as an examination tool and as a consultation tool. The examination part applies on the first iteration, iteration 0, while the consultation process applies on following iterations, iteration 1-4.

Due to acquiring classified information connected to the case-area, some information will be anonymized. This anonymization is furthered described in the figure below (figure xx).

**Remains visible**

Drawings

Illustrations

Models

Municipal program

Although anonymized location the identified problems and themes set in the program will be presented in the case.

**Generalized**

Location

Instead of specific address it is described with orientation, setting and other aspects describing the situation.

**Anonymized**

Valuation from the done projects

Due to the case study being done with a new tool, the parameters presented will be the ones measured in the new tool.

Further, the information on the already done project becomes irrelevant since it is performed at a much higher level of detail, and will therefore not be presented in this thesis.

figure 39. *description over case-anonymization*

## VALIDATION OF ITERATIONS

As already stated, there is no mandatory use of environmental certifications (page, 27). However, the requirements stated in the Building regulations BBR are mandatory. These are continuously updated to fulfil the current demands. Since BBR is the same matrix for all new buildings in Sweden the demands set for this thesis will follow the ones stated for energy in BBR. However, for other environmental certification demands the outcomes of the tool is still relevant.

*Local Regulations*

Since this case-area is placed in Gothenburg it is not only regulated by the specific program for the area, but also Gothenburg municipality's indicators for city-qualities. As part of some municipal strategies there can be local regulation created as additional restrictions. If so, these applies on top of the legislation for the DDP. The regulations for Gothenburg can be read in appendix 2.

### Energy demands is Sweden

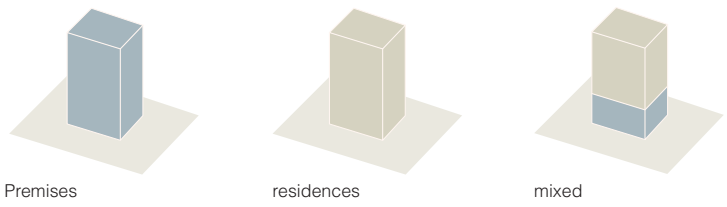
In BBR the new buildings need to fulfil the demands regarding (Boverket, 2018c):

- The buildings primary energy number (EPpet)
- Installed electric input for heating
- Average thermal transmittance
- Average air leakage rate

For the analyzation of the iterations the thesis will use the EPpet as the main indicator for energy demands.

Important to know when analysing EPpet is that the value is not a set value for every building. Rather it is dependent on both what the chosen energy provider is and also depending on the activity in the said building and geographical position. For instance facilities need to be cooled while residences are not constructed for the aim to install cooling.

Due to this there are different values to fulfill depending on the activity. The values the case study is measured to are presented in the figure below. The aim is however to find a plan with the lowest EPpet possible.




| ACTIVITY | Premises | Residences | Mixed |
|---|---|---|---|
| EPpet (BBR) | 97.5 kWh/$A_{temp}$ | 85 kWh/$A_{temp}$ | weighted value depending on % of activity |
| Miljöbyggnad guld | <60% based on the value from BBR | <70% based on the value from BBR | weighted value depending on % of activity |

figure 40. *The different activities and their max value of EPpet. Added conditions according to Miljöbyggnad to compare and contrast the results further.*

## DEMANDS FOR DAYLIGHT IN SWEDEN

There are several of methods to calculate Daylight, the one used in this thesis is Vertical Sky Component (VSC). This due to the level of detail set in the DDP. Other methods like the Daylight factor (DF), which is the method that BBR demands, used requires rooms in the model to be correct. Therefore, the level of detail in the DDP once again creates constraints regarding which methods to use.

The evaluation of the VSC is based on the assessment made by the Urban Planning Department of Gothenburg. They propose that the results should be presented in such way that it is clear which parts of the buildings are within the range of: <10 %, 10-12 %, 12-15 %, 15-25 % and >25 % (Stadsbyggnadskontoret Göteborg Stad, 2020). What the different percentages are indicating is shown in the figure below (figure 41).

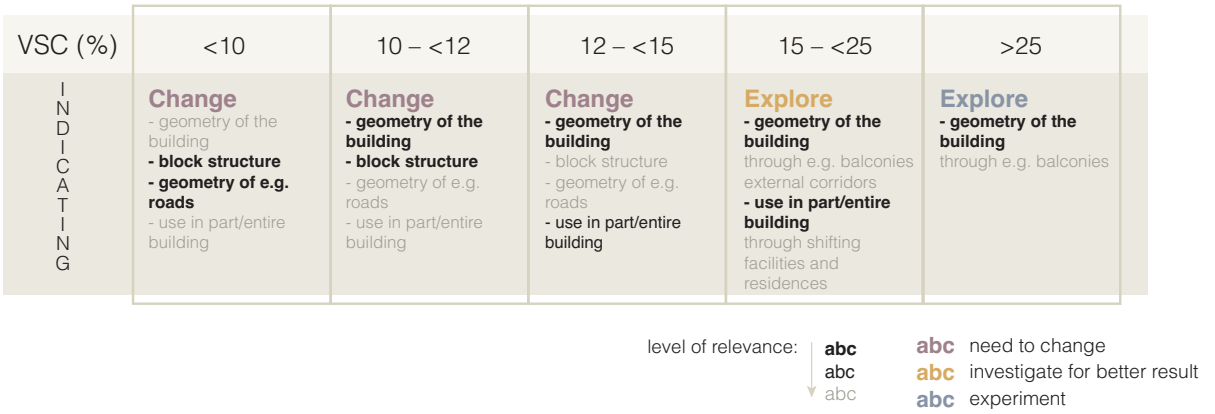



figure 41. *the percentage of VSC and its proposed actions. (understood from Stadsbyggnadskontoret Göteborg Stad, 2020).*

## Iteration method

The results of the iterations are presented in the same way, all after each other, with a joint summary and comparison in the end. The order is as follow:

- Iteration 0: The reference case
- Iteration 1: Tower building block
- Iteration 2: Narrow shaped building block
- Iteration 3: L-shaped building block
- Iteration 4: Block with courtyards

*Result visualization*

As for the results from the different iterations these will be presented in both diagrams and visualization through models. In the report the graphics are partly presented. Additional visualization of the daylight analysis can be found in appendix 2a-2e. Supplementary diagrams and in data for the tool can be found in the thesis report by Andersson and Jonsson (2020). The chosen methods for the iterations and why is more closely described in the following paragraphs.

The first iteration, iteration 0, is as mentioned in the introduction analyzed with the tool as an examination tool. Therefore, the result is not further developed but used to compare with the other iterations. As a part of the result some of the data is further used as a framework to create the other iterations. This framework contains the building gross area (BTA) as well as the percentage of premises and residences planned for in the DDP area.

To be able to investigate BPPs in the DDP a design method for different types of iterations is proposed below. The order of the iterations is only a suggestion, but they are based on the level of relevance of different parameters which is illustrated earlier in this thesis (figure 35).

Similar to the proposed DDP process, the concept of continuity applies on these methods as well. This means that the iterations done in the first step might not be optimized, but the knowledge gained by the result can help to develop the DDP proposal further.

As can be imagined from the vast number of methods, several models are generated throughout the design process. This is one of the strongest connections to innovation and the incentive mentioned by Gambatese & Hallowell (2011), idea generation.

For this thesis the first two proposed iteration methods will be the ones investigated further.

METHOD 1 : TYPE BUILDINGS

As mentioned above, the iterations 1-4 are based on the same BTA that is planned for in iteration 0. The resulting BTA will differ between plans due to different footprints of the buildings. However, the resulting BTA is never planned for less than the existing DDP program.

The first method, which is used to design iteration 1-4, is done by translating iteration 0's BTA into other building/ block shapes. This thesis will be using four different common type buildings in Sweden: Tower building block (Punkthus), Narrow shaped building block, (Lamellhus), L-shaped building block (L-hus) and Block with courtyards (Kvartershus).

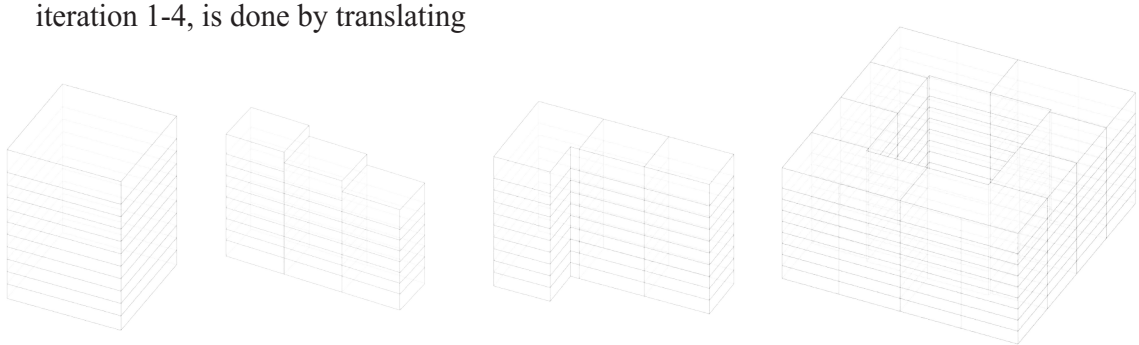


figure 42. *illustration over the different type-buildings used in iteration 1-4.*

METHOD 2 & 3 : HEIGHT

This method calculates the result of increasing and/or decreasing the height of the type buildings tried in method 1. This can be done by two methods. The first, is to add and remove the same number of floors in a model. Given that the footprint of the buildings is the same. The second method is to re-calculate the footprint of the building depending on how you want to change the height. An increased height means smaller footprint. A decreased height means a bigger footprint.

Following these methods several of other design aspects can be iterated. Three proposals are to change the buildings orientation, add external corridors on the exterior, and to try different WWRs. These methods different impact on the building performance is presented in the literature study on page 36-40.

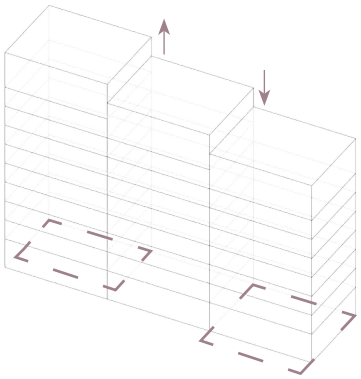


figure 43. *illustration over method 2&3 for the iteration 1-4.*

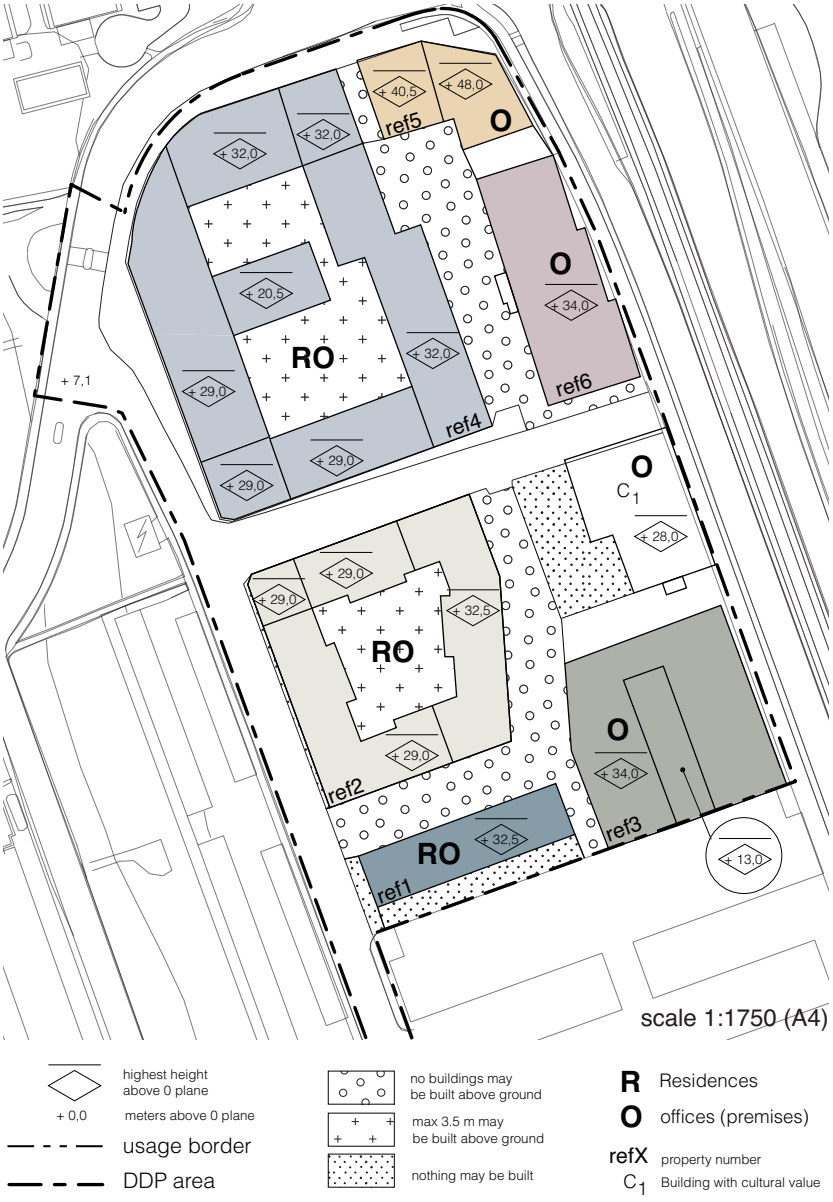
Important to remember

The proposed process of iterations generates several of models to analyze. The additional outcome in BeDOT, the ability to compare various properties creates a possibility to also highlight which buildings that works better in a specific site in the DDP. Furthermore, it creates a possibility to highlight well-functioning premises in different cases, and thus, the ability to combine proposals is both accessible and simplified. Due to this the tool can also be used to try different finished proposals as well as examining proposals to gain an optimized plan where the tool is only used during the examination stage of the DDP process.

## ITERATION 0

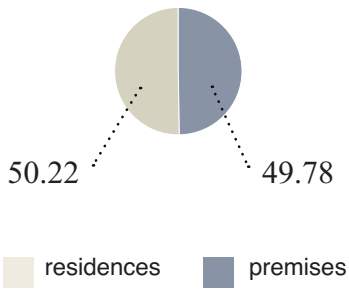
The type of buildings planned for in the area in iteration 0 is a mixed area with residences in closed blocks surrounded by different types of premises in both narrow shaped buildings and tower buildings.

In the following section the results are presented. Due to the anonymization but also its readability the DDP have been redrawn with the information kept shown in the legend.




## INFO

BTA: 71600 m$^2$
Properties: 6
Average levels: 7,04 (max 12)
Ratio of residences/premises (%):



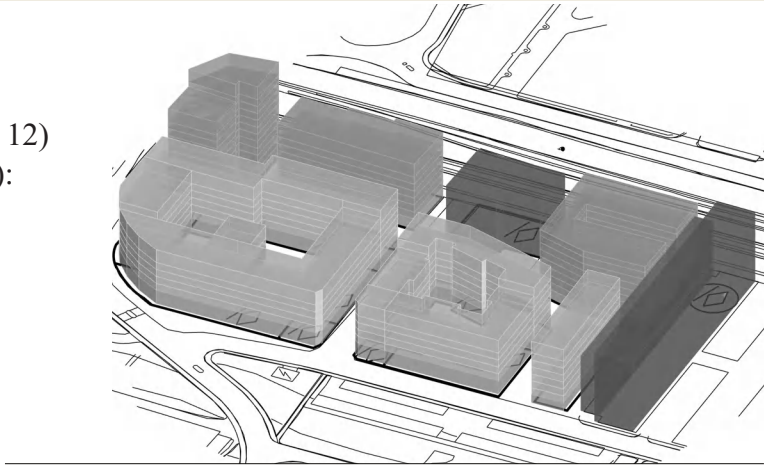



figure 44-47. *figures for iteration 0*

## Energy demand

Iteration 0 have an acceptable average EPpet while comparing it to BBR, however, as seen in figure 77 (page 72) the transmission losses are quite high. This leads to a higher EPpet than necessary.

Therefore, one learning for the further iterations is to aim for this is to find iterations with lowered transmission losses.

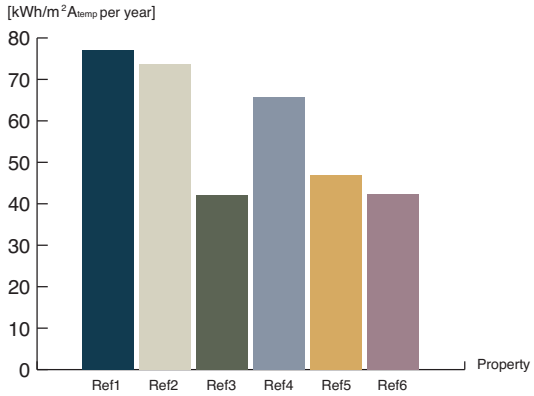



figure 48. *EPpet per each property in iteration 0*

## VSC

Due to the open streets surrounding the DDP-are the VSC results are >25 % in the facades facing them. However, when looking at the VSC, iteration 0 has a high plot-ratio as seen in the DDP and the result of the BTA. This results in narrow streets and courtyards which have a negative impact on the VSC. Therefore, there is room for a lot of improvement in this aspect. For further development in the coming iterations a first method to broaden the streets and opening the courtyards could be investigated.

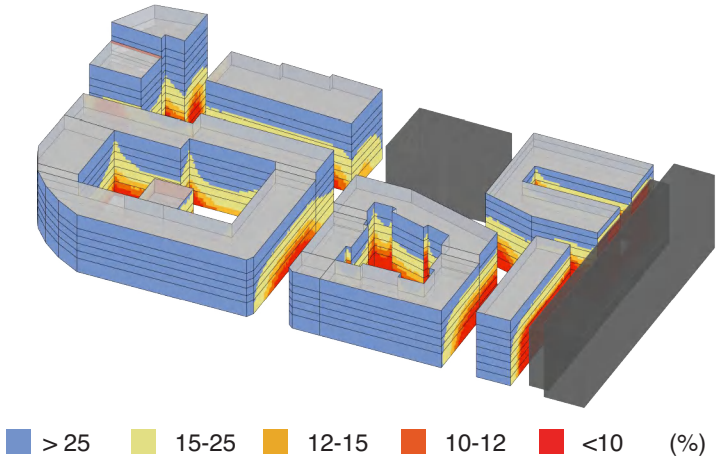
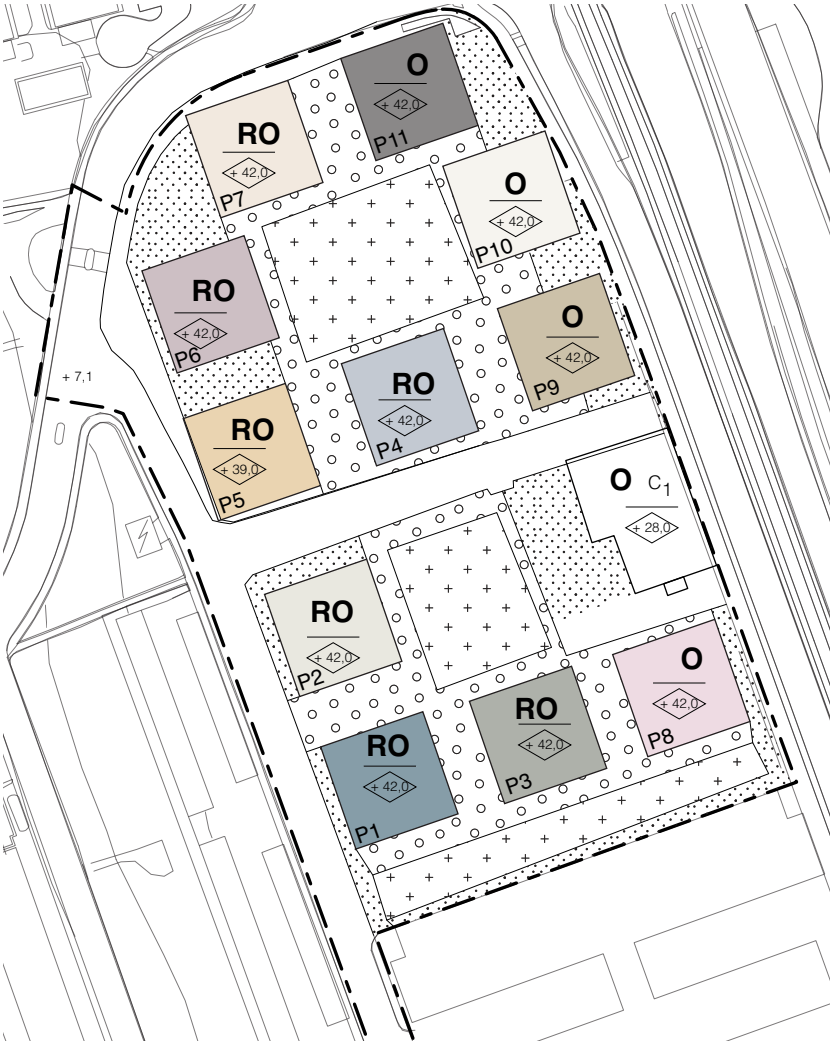


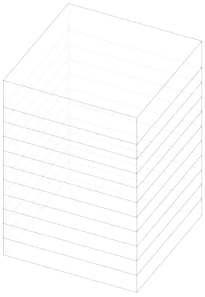

figure 49. *Model over VSC in iteration 0, perspective from an isometric SW view*

## ITERATION 1

The DDP proposal for iteration 1 is based on the four different type buildings mentioned earlier (figure 42). The first to be investigated is the Compact tower block (Punkthus).

The buildings give a high-rise landscape with two central semi-open parks.

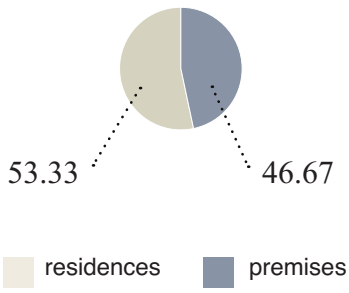


COMPACT TOWER BLOCK
1:1750 (A4)

## INFO

BTA: 75000 m$^2$
Properties: 11
Average levels: 10.41(max 11)
Ratio of residences/premises (%):



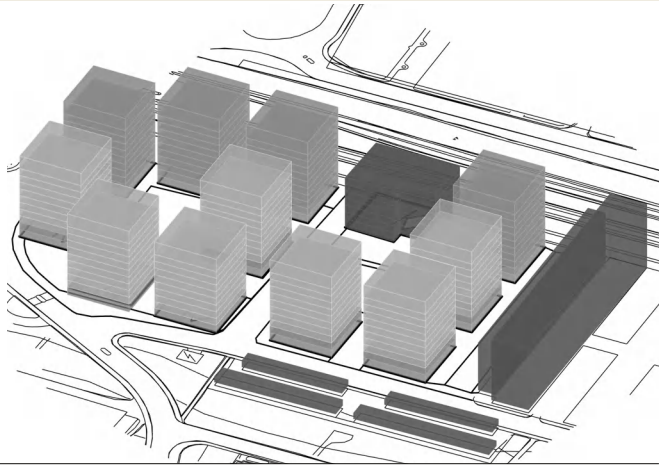



figure 50-54. *figures for iteration 1*

## Energy demand

The small footprint, and high-rise buildings is quite forgiving when it comes to transmission losses. This due to that the losses through the ground and corners (thermal bridges) are lowered. As a result, the transmission losses for the entire building are quite drastically lowered.

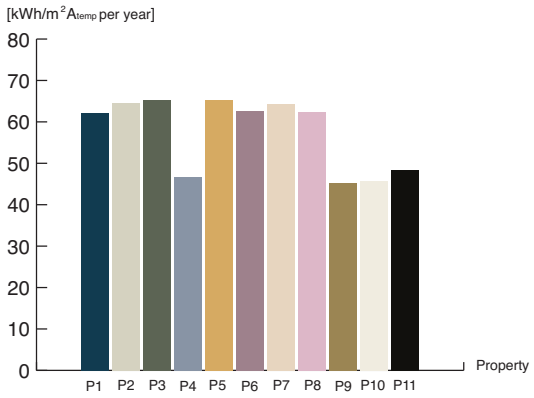



figure 55. *EPpet per each property in iteration 1*

## VSC

The VSC in iteration 1 shows similar results as iteration 0. However, the negative spaces in the plan still is quite narrow in between the buildings leading to more façade with a VSC with <10% in the middle of the DDP-area. As a further development this could be investigated through changing the height and removing some of the properties.

As a further development this could be investigated through changing the height and removing some of the properties.

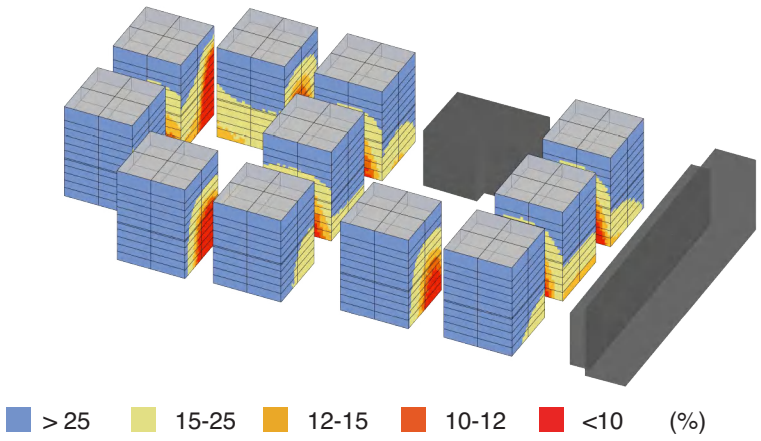
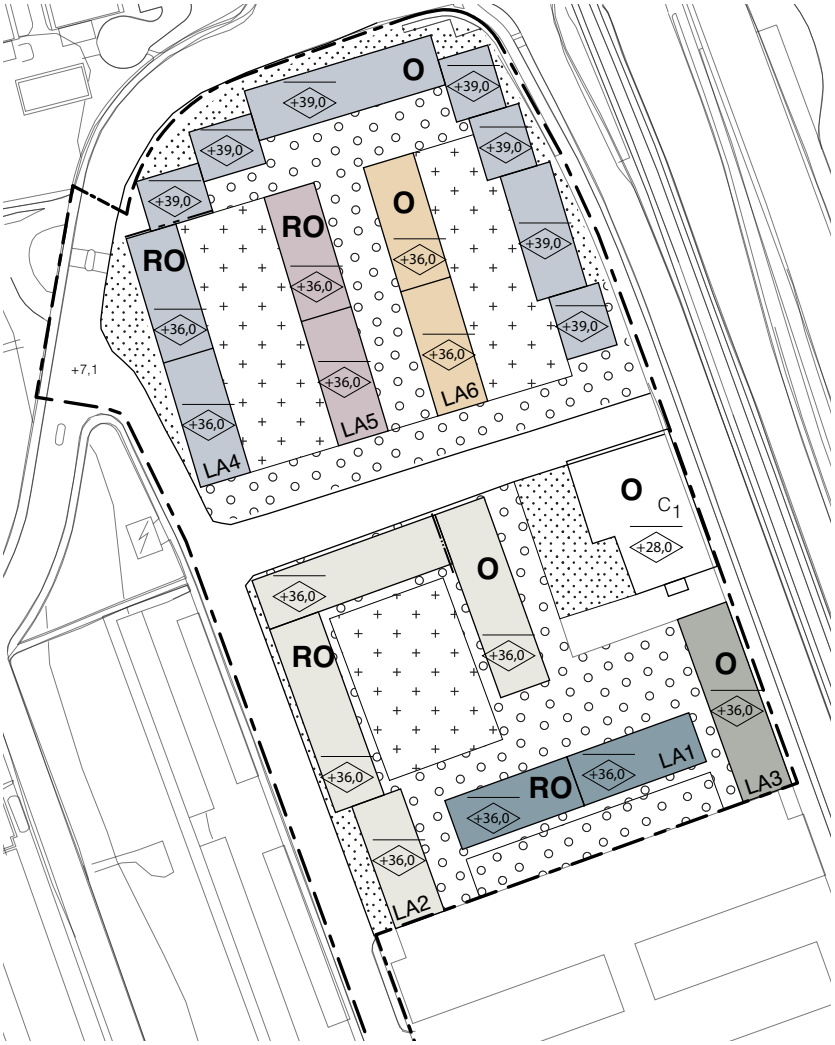


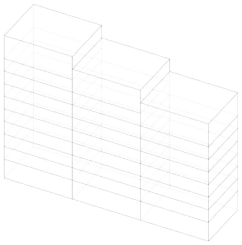

figure 56. *Model over VSC in iteration 1, perspective from an isometric SW view*

## ITERATION 2

In iteration 2 the DDP-area is designed with the type building narrow shaped building block (lamellhus).

The narrow buildings surround the plots in a broken structure, which yields a more varied impression. The structure also creates a lot of open spaces and semi-private courtyards throughout the DDP-area.

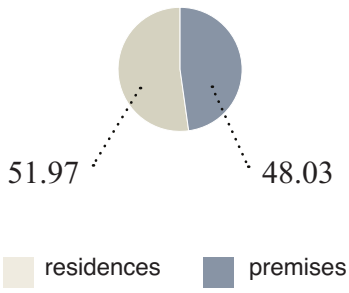


NARROW SHAPED BUILDING BLOCK
1:1750 (A4)

## INFO

| | |
|---|---|
| BTA: | 66 490 m$^2$ |
| Properties: | 6 |
| Average levels: | 9.25 (max 10) |
| Ratio of residences/premises (%): | |



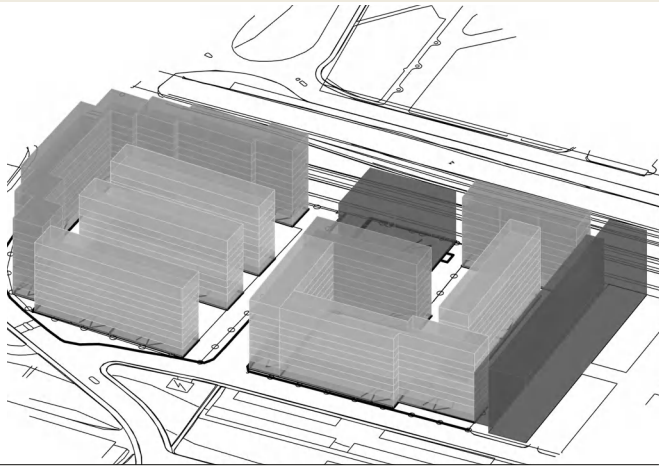



figure 57-61. *figures for iteration 2*

## Energy demand

The result from the iteration shows a quite high EPpet. This could be understood as a result of several aspects. For instance, as seen in figure 77 (page 72) the result for property 2 & 4 have quite high transmission losses through thermal bridges and windows. Further, this can be understood by the geometry of the buildings. The broken structure of the two properties with a high number of corners and changes of height. One other aspect is the heating and cooling demand which follows with a narrow building. The solar heat load increases which also leads to higher cooling demands in the premises and due to high transmission losses, the spaces need more heating.

As a further investigation in the area design this could be investigated through increasing the footprint and playing with the height. Also, try to minimize the additional corners and amount of windows.

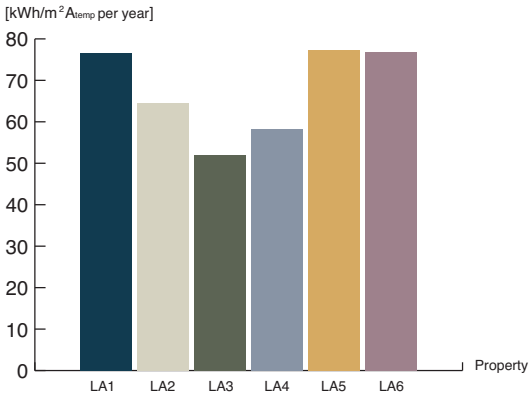



figure 62. *EPpet per each property in iteration 2*

## VSC

The narrow buildings leaves more distance between the buildings which is clearly seen in the VSC result. The amount of façade under 10 % are very low. The average VSC that can be read from the result is quite good. However, due to the quite high energy result the buildings are not optimal in their composition in this plan.

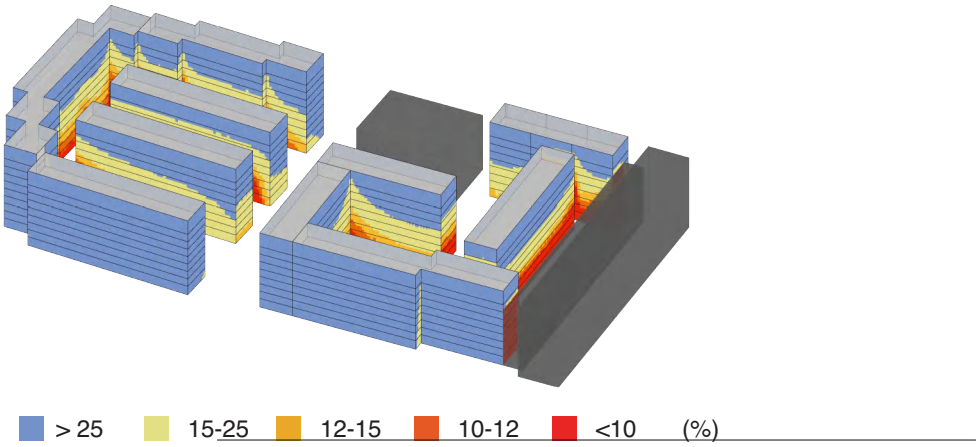
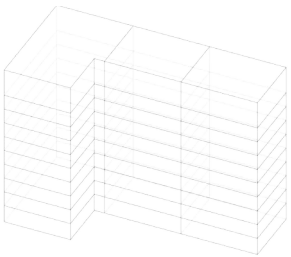



figure 63. *Model over VSC in iteration 2, perspective from an isometric SW view*

## ITERATION 3

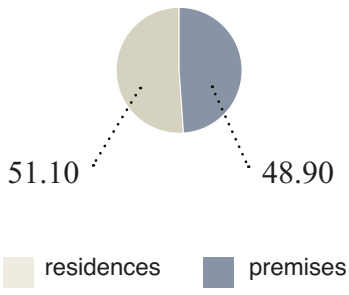
Iteration 3 investigated the DDP-area with L-shaped compact building block. The L-shaped buildings creates a natural framing of areas. In the area they create compact courtyards and natural passages.

L- SHAPED COMPACT BLOCK
1:1750 (A4)

## INFO

BTA: 74730 m²
Properties: 6
Average levels: 8.9 (max 9)
Ratio of residences/premises (%):



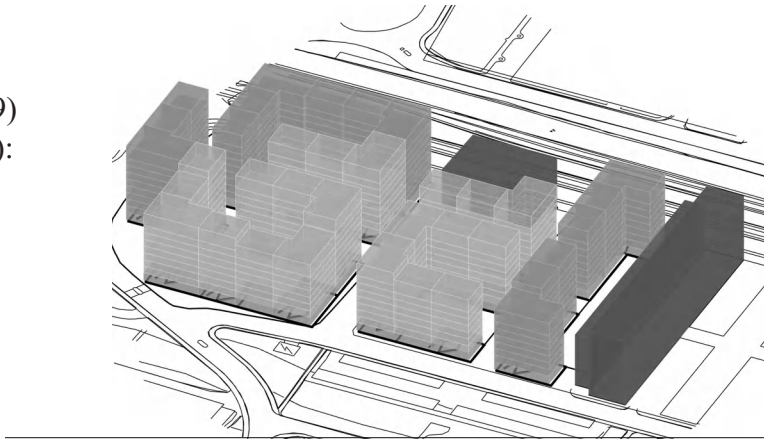



figure 64-68. *figures for iteration 3*

## Energy demand

The EPpet results in iteration 3 are higher than in iteration 0. This can read as an effect by both transmission losses heating. Due to the open block structure created by the properties 4 & 5 the transmission losses are quite high (figure 77). Due to the quite narrow areas in between the buildings the buildings have a higher demand for heating due to lowered solar heat load.

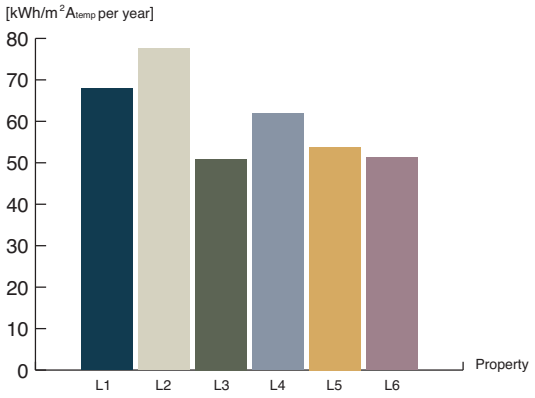



figure 69. *EPpet per each property in iteration 3*

## VSC

The VSC in iteration 3 illustrates the biggest problem with the plan. The high BTA divided in, by comparison to iteration 0, low buildings. This leaves the plan with narrow streets and courtyards which creates a negative impact on the VSC. As seen in the figure xx below there is a lot of areas on the façade which is both <10% but also a lot which is close to the 12-10 % interwall.

For further investigation this could be helped with a lowered amount of properties and higher buildings.

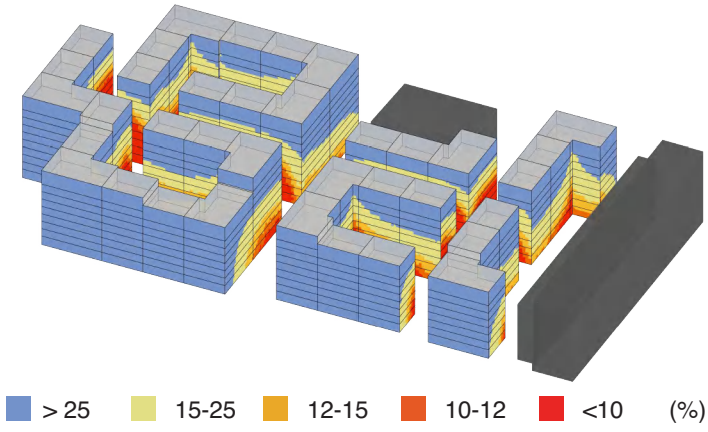
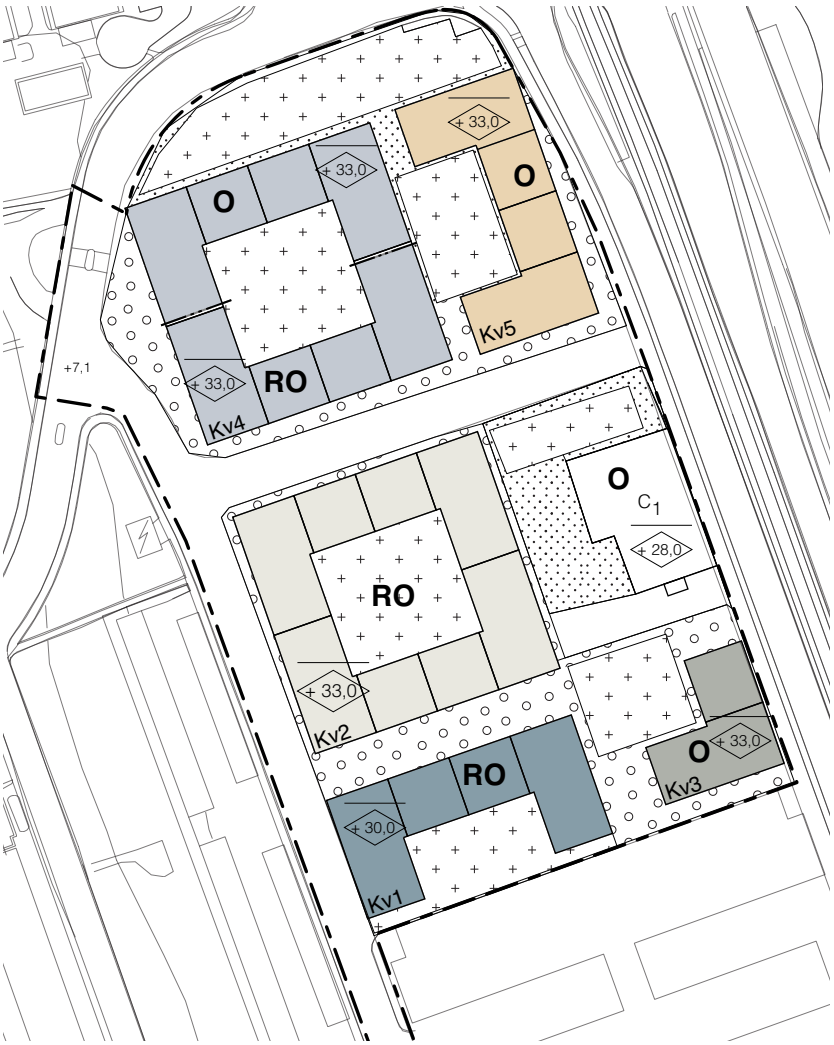
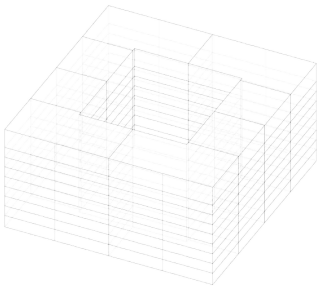



figure 70. *Model over VSC in iteration 3, perspective from an isometric SW view*

## ITERATION 4

Iteration 4 is created with a block with courtyard structure. These buildings create a clear distinction between public and private. The buildings are quite narrow which gives a higher average amount of floors compared to iteration 0, however the qualities in the entire area is quite similar between the both.

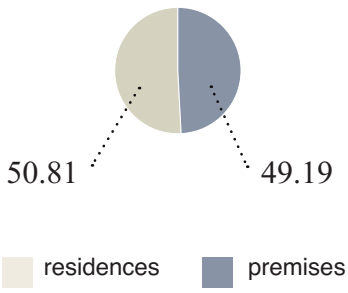


BLOCK WITH COURTYARDS
1:1750 (A4)

## INFO

| | |
|---|---|
| BTA: | 71920 m$^2$ |
| Properties: | 5 |
| Average levels: | 8.74 (max 9) |
| Ratio of residences/premises (%): | |



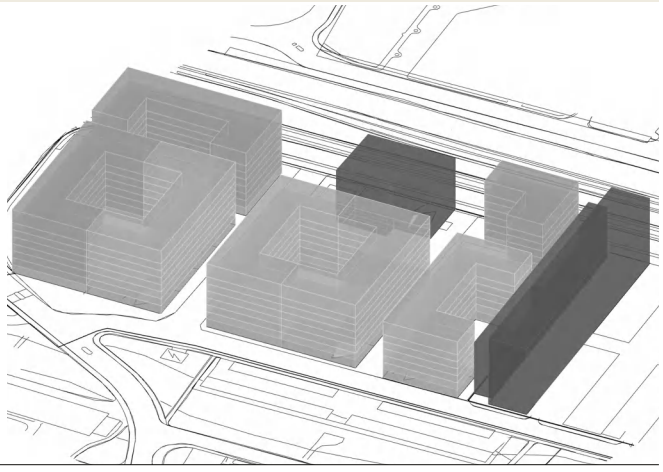



figure 70-74. *figures for iteration 4*

## Energy demand

The EPpet in iteration 4 is lower than in iteration 0, even though the layout has its similarities. This result can be both a result of the smaller number of corners in the properties but also a less varied height throughout the area which in both aspects lower the thermal bridges of the buildings. The courtyards however are smaller, which gives a negative impact on the VSC which can be read into further below.

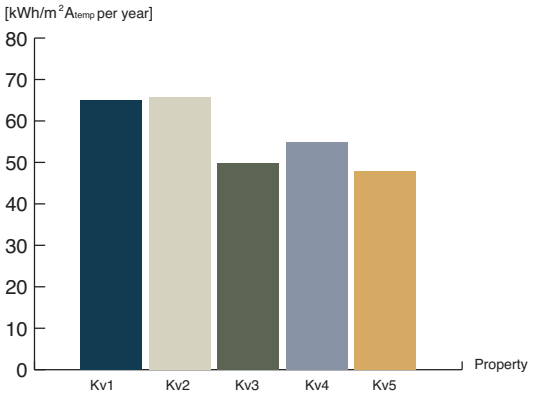



figure 75. *EPpet per each property in iteration 4*

## VSC

The VSC result is quite similar to the reference case. The narrow streets and courtyards are still existing in the plan. However, this could be further investigated by opening up the courtyards by increasing height in north and decreasing it in south. Important to remember then is that EPpet might increase due to higher transmissional losses through thermal bridges.

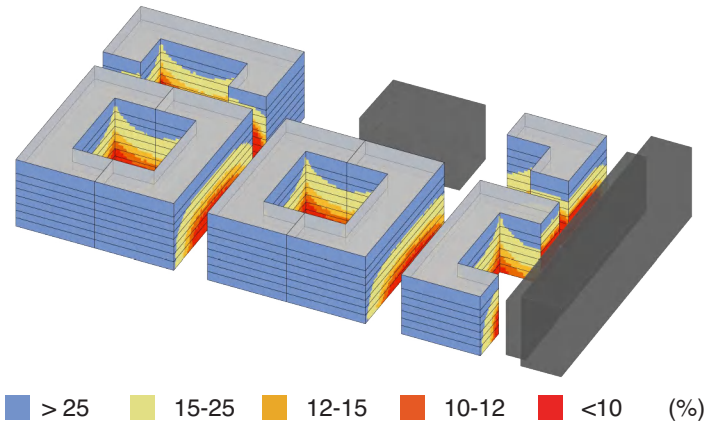



figure 76. *Model over VSC in iteration 4, perspective from an isometric SW view*

## Comparison of iterations

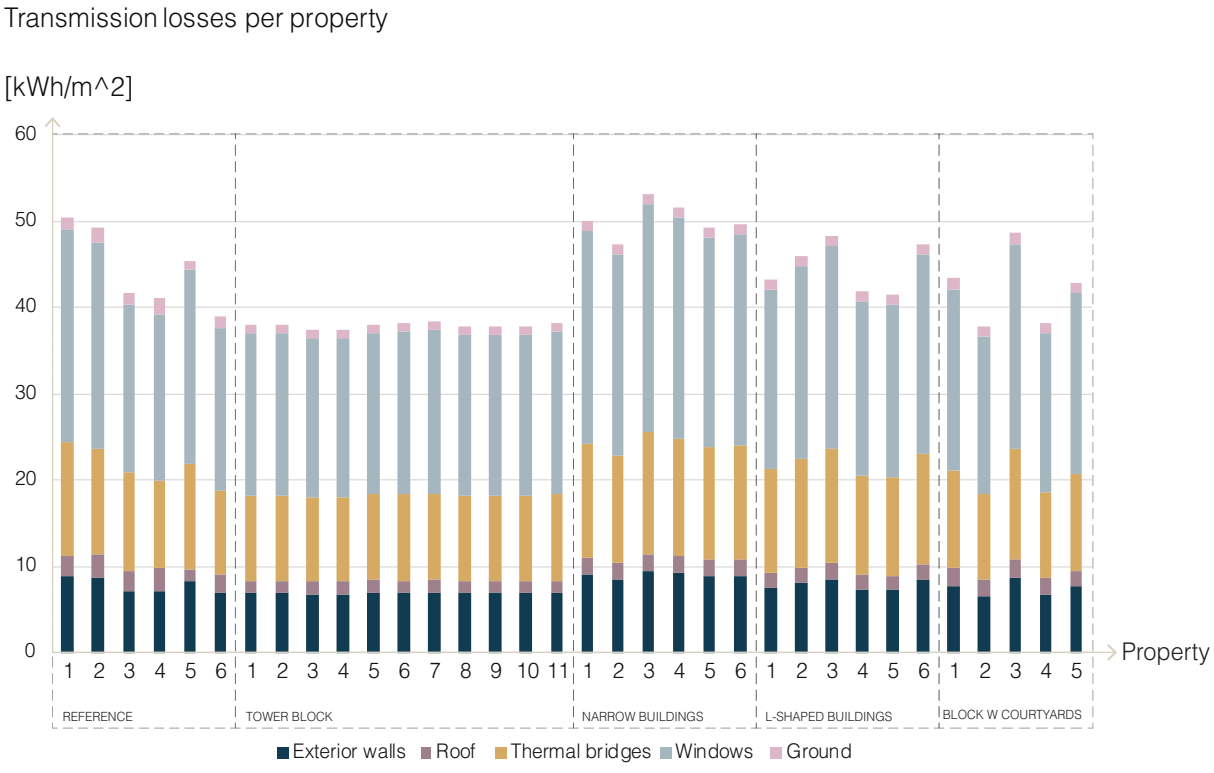



figure 77. *The transmission losses per property/m² in the separate cases*

The geometries impact on the energy outcomes measured in EPpet and VSC highlights the need for awareness of these parameters in the earlier stages of the building planning process.

The different outcomes also give an identification on simple adjustments to change the outcomes through design. For instance, the Lamellhus-case gives a higher EPpet than any of the others, this is mainly through the broken up blocks with narrow width. These blocks give a higher thermal loss through the corners (as exemplified in figure 21), while the narrow buildings create a higher need for cooling and heating depending on season.

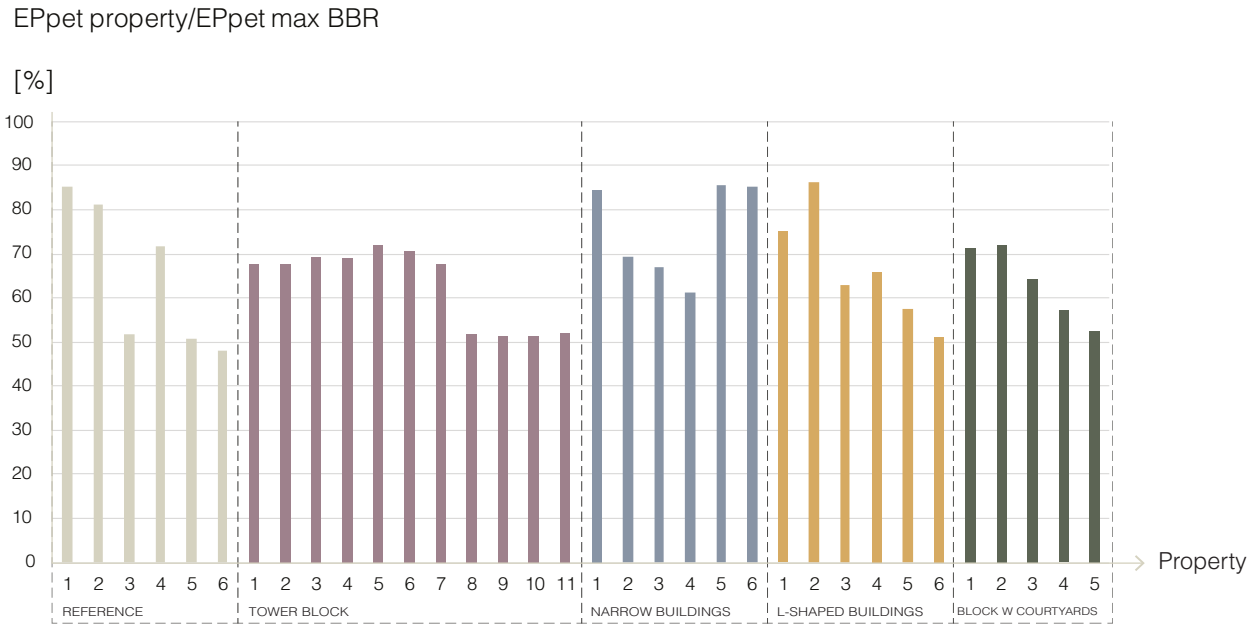



figure 78. *The EPpet weighed towards BBR demands*

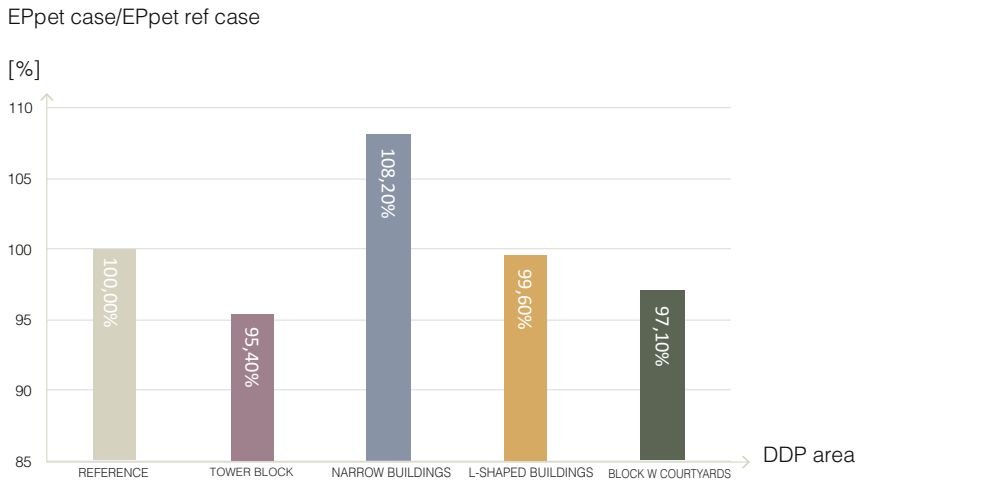



figure 79. *EPpet each case / EPpet reference case*

The comparison of EPpet between the iterations (figure 77-xx) shows how the tool can be used to compare various properties and various iterations to each other. In this case study the comparison has been made to develop and improve iteration 0, therefore the data is shown in comparison to this iteration in figure 79. Read from this diagram the whole iteration areas EPpet in iteration 1-4 is calculated to be able to read which area gives the best result while validating from the energy perspective. Figure 77 & 78, which is presented earlier, can thereafter be used to localize where the building geometry can be improved. For instance, if the thermal losses are high this could be further developed in the iteration model.

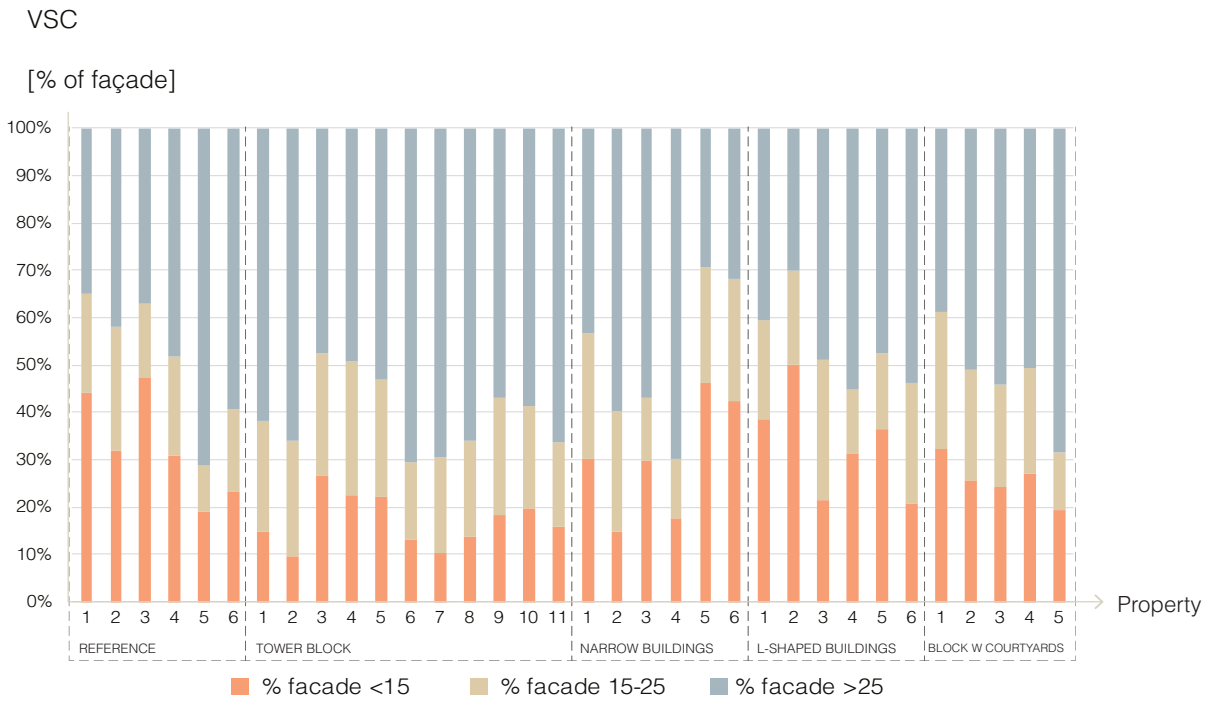



figure 80. *The percentage of different VSC values per property*

The VSC comparison between the iterations is mainly done by the model-visualizations, which can be found in appendix 2. This because they are easier to translate into which specific areas in the iteration that have the worst VSC. However, the diagram above (figure 80) creates a schematic overview over the different iterations. This helps mostly while using the tool as an examination tool but can also be used for identifying certain properties to merge into a combined iteration suggestion.

## Reflection on the case study

*The perks of an implemented 3D perspective*
The DDP plan is presented through a 2D plan and for most of the process this is also the main planning tool. All process parts cannot be normalized and described since they are individual for each process. Therefore, this thesis does not propose that 3D forums are not used today but adding a tool like BeDOT to the DDP process forces a deeper understanding of the 3D perspective of the plan. This gives the responsible planner a clearer image on parameters that might not be as defined by a 2D format (e.g. height).

As is mentioned earlier in the thesis, height affects the building performance in several ways and not only the specific building but also the surroundings. Due to this, an understanding for the full impact of this is of high relevance to create sustainable buildings, and a tool working in a 3D format might be a good addition for creating that understanding early.

*The incentive for creating new solutions*
While working with the parameters, energy and daylight, the need for creating a good outcome for both grew throughout the iterations. This is a perspective, that I as an architect, am new to and it was fun to connect the dots between what might be the solution to gain a better result.

The method proposed builds upon several iterations, which as of today, the tool might not be optimally built for. However, the outcomes highlighted and found during the thesis are aspects that through the case study showed to have impact on performance of the building. Moreover, this also highlights the need to establish awareness of these parameters in the earlier stages of the process.

By creating awareness, the change of perspective also leads to finding new solutions. This results new innovations. The new solutions might not be revolutionary in itself but supports the ultimate goal: more sustainable buildings.

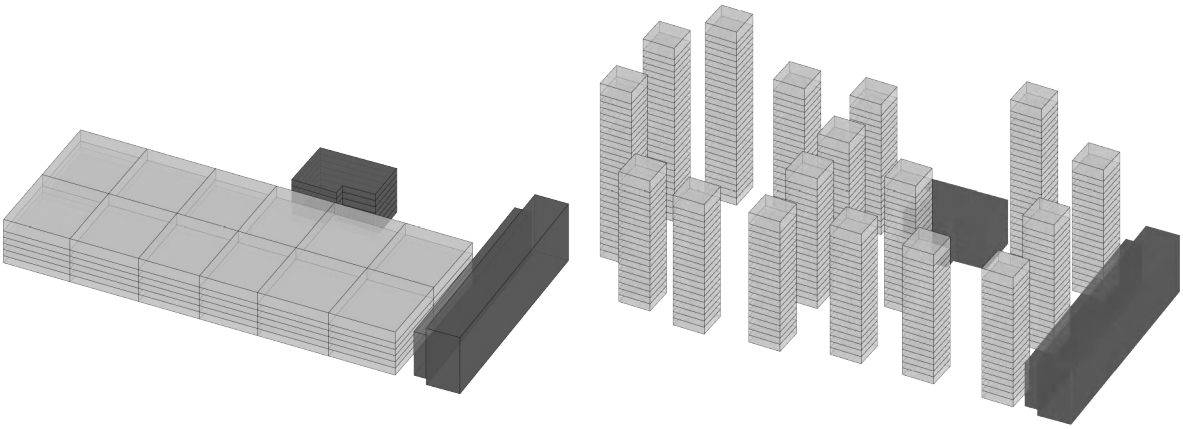


figure 81. *Illustration over "dream" scenarios in regard to energy & daylight*

*The goal: not optimization (?)*

This heading might sound contradictory to what is mentioned as an objective for this thesis. But, during the iterations and literature review the focus on a holistic process is one of the main takings. The holistic perspective is a great balance act of different parameters and to identify what weighs more is a difficult task. In the end, optimizing based on one or two parameters does not make an entire building. As a quick illustration of this we made two cases were the first had a proposed energy optimization and the second is based on daylight optimization (figure 81). These are just examples, but the result is two quite boring areas.

The aspect of optimization is always important to keep in mind when working with quantifiable parameters. It can always be discussed and argued to reach as good values as possible, but what will the result from this be?

This is also one of the most illustrative results for me as an architect. The parameters design and aesthetics are subjective and based on the individual. Thus, the result can be both beautiful and ugly depending on the eyes of the beholder. But to create a durable and sustainable environment when we create new buildings and environments, we need to be able to broaden the focus on buildings to both humanistic and artistic parameters. This is something that the architects possess the competence of. Therefore, there is a great advantage in being more aware of BPP in the earlier stages but also being able to have the architect perform the analyses together with an engineer. This may/will create a more holistic project and an understanding for each disciplines contribution to the end result.

# 6.

*Discussion*

# DISCUSSION

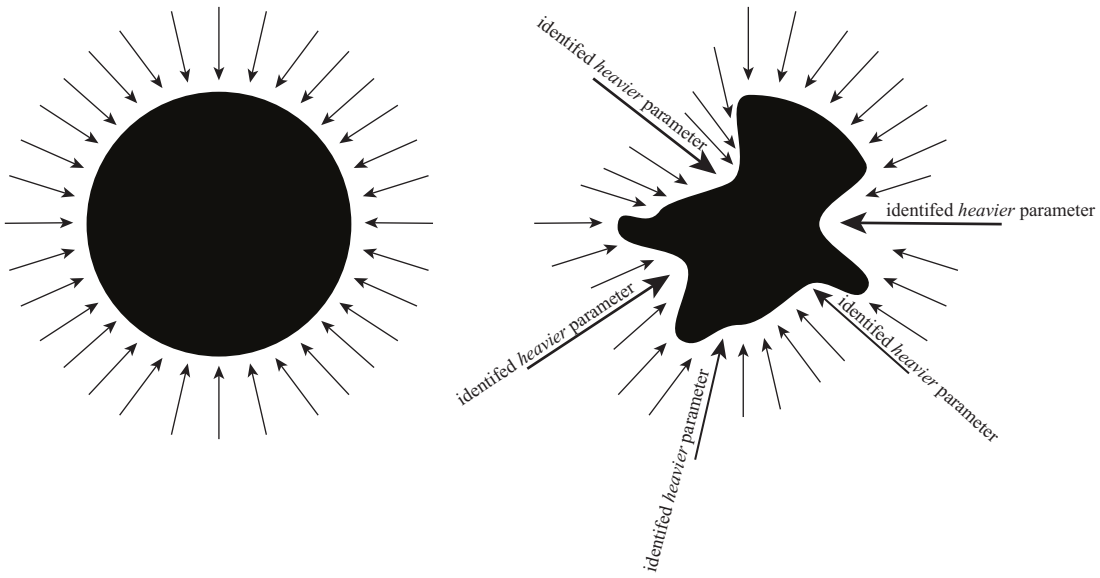
I do propose implementing energy and daylight analyzes in the DDP process. Especially in its function as a change of perspective. When investigating the effect on the design process I noticed that the implementation of BPP in the DDP process creates a more specific massing modelling at an earlier stage of the building planning process. This creates a sort of merging of the specific building design and the area planning.

The addition of BPP are not revolutionary and new in its own. These are indicators used already today and needs to be set further or later in the process. To change the time for implementation does not change the fact that they are necessary. Changing the order however gives an information-based decision method when designing a new DDP. This also opens up for a communication of the Parameters earlier which can insinuate more development in the field in a prolonged perspective.

Upon this, sustainability becomes a strong factor. The BPP discussed in this thesis have a strong connection to sustainability, which is a vital part of the development of our cities. By implementing them in an earlier stage of the process and therefore giving a more awareness to them cannot be diminished. My understanding is that there is a possibility to take gain in the DDP process today since there are actors involved which have the competence in BPP today. There is also a great strength with the municipality's role in the entire process. This creates a specific actor throughout the process which can help the implementation of the new tool in several aspects. Both for their own examination but also as a possible track keeper in the beginning of the implementation. However, to actually success with the implementation of BeDOT in the process a new actor should be considered to strengthen the governance more.

The question that will remain is when you should think on BPPs such as daylight and energy before other parameters. When interviewing some of the actors in the DDP process today they mentioned that there is no existing method to decide which analyzes that should be done or weigh more. Thus, a directive for deciding what parameters that are of interest is yet to be created. Here it is important to remember earlier theses about BeDOT, they exemplify the possibility to use BPP analyzes in other stages of the building planning process. Arguably this shows how parametric design can be made in different stages, but there is a need of prioritizing what and when. Another model to remember while discussing which parameter to further analyze is the one from Negendahl (2016) which lifts the discussion about weighing the parameters. However, he lifts it with the aspect of the outside pressures. I would like to propose a change in that model, to highlight the aspect of identifying which aspects that weighs more (figure 82).

Lastly, I would like to add that the concept of design thinking was something that I found to be of great importance during the development of the DDP process and while translating the implementation of the tool into a design method. To clarify, there is still a need to explore and design further to gain better results. This is important for both the thesis research questions, to keep the knowledge as a framework for new innovations.




*Holistic view with same weight on all parameters*

*Holistic view where the identified heavier parameters is chosen. Thus, given the opportunity to impact more.*

figure 82. *Adapted from Negendal's (2016) 'holistic view' with own additions*

*references*

# REFERENCES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*Appendices*

# Intervju 1
# Detaljplaneprocessen

## Allmänt

- Är det vanligt i er kommun att ni själva påbörjar en detaljplan utan att en byggherre ansökt om planbesked?
  Svar: Nej

  Om ja:
  - Hur ser processen ut i det fallet (med fokus på energi- och dagsljusfrågor)?
    Svar: Det sker sällan. I de fall då privat aktör inte sökt planbesked så är det oftast en kommunal aktör som söker planbesked i for av kommunal byggherre. I somliga fall ansöker fastighetskontoret om planbesked och plan för mark som senare säljs med tillhörande planerad byggrätt.

- Vilken/vilka är de största skillnaderna mellan när en byggherre ansöker om planbesked och när kommunen själva väljer att upprätta en detaljplan (avseende dagsljus och energi)?
  Svar: Planbeskedsansökan hanterar inte frågan om dagsljus eller energi specifikt. Frågor som hanteras vid planbesked/ansökan om planbesked är mer generella om lämplighet att genomföra plan för ansökt område/fastigheter.

- Vilka handlingar skickar byggherren in när denne ansöker om planbesked (när det rör dagsljus och energi)?
  Svar: Vet ej.

- Hur detaljerad är den information som byggherren ansöker om planbesked med (preliminära energi- och dagsljusberäkningar, byggnadshöjd, tilltänkt användning av byggnader etc.)?
  Svar: Vet ej.

- Vilka faktorer skulle du säga har störst betydelse vid bedömningen av en byggnads tillåtna placering, höjd etc. (ljud, luftföroreningar osv.)?
  Svar: Ett flertal faktorer samspelar för planering av bebyggelse, placering och volym.
  Läge i staden – vilken typ av område och omgivande bebyggelse finns. I ett villaområde kan det vara opassande med större bebyggelse, vid större kommunikationsknutpunkter är det mer lämpligt att planera för större och mer yteffektiv bebyggelse. I kvartersstaden kan det vara mer lämpligt att fortsätta med

kvartersbebyggelse till exempel.
Läge, stråk, noder, platser avgör mycket av lämplig typ av exploatering.
Gatumiljö, Gårdsmiljö och parkmiljöer i närhet av bebyggelse spelar in på volym som är lämplig.
Innehåll i planerad bebyggelse spelar stor roll. Är det bostäder, handel, kontor, skola, förskola, industri eller lager eller nåt annat som planeras är av avgörande betydelse.

Luft, buller, risk, översvämningsrisk, dagvattenhantering, kulturmiljö är andra avgörande faktorer som spelar in på en byggnads möjliga utformning.

- Anser du att detaljplaneprocessen har förändrats de senaste åren / håller på att förändras? Om ja, hur?
  Svar: Den har och håller på att förändras. Min erfarenhet av planeringsprocessen är inte så lång (5 år). Men vi är i en förändringsprocess vad gäller vilka frågor och hur man utreder och avväger specifika frågor inom processen. En mer holistisk och sammanvägd stadsplanering efterfrågas samtidigt som det finns politiska och ekonomiska påtryckningar att effektivisera och minska handläggningstiderna för planläggning.
- Förändringar som skett de senaste åren är till exempel att riktvärden för buller ändrats så att man tillåter bebyggelse i mer bullerutsatta miljöer. Frågan om riksintressens inverkan på planeringen utreds i dagsläget. Dagsljus är en aktuell fråga där riktlinjer och riktvärden säkerligen kommer att specificeras och revideras de närmaste åren.
- En annan tydlig förändring är synlig genom miljöcertifieringarna och deras implementering i byggprocessen. De har uppmärksammat många aspekter som bestäms redan i planskedet.

## Program

- När är det av betydelse att ha ett program som komplement till detaljplanen?
  Svar: Program (enligt Plan och bygglagen(PBL)) är av betydelse för att utreda större områdens möjliga utveckling. Program är ett betydelsefullt verktyg då avvägningar av mer strategisk natur för ett delområde bedöms behövas. Program kan hantera större frågor för ett större område än vad som är lämpligt och rimligt att utreda i en detaljplan.
  OBS! Viktigt at inte banda ihop program för byggnad och program enligt PBL.
  Program för en byggnad beskriver vilket innehåll som byggnaden skall innehålla och tas fram av fastighetsutvecklare/fastighetsägare.

- Vilka fördelar finns med att ha ett program(PBL)?
  Svar: Kan svara på mer komplexa och övergripande frågeställningar än vad som kan hanteras inom en detaljplan.

- Vilka nackdelar finns med att ha ett program(PBL)?
  Svar: Det tar lång tid att fastställa och livslängden för de beslut som tas inom ett

program har en tendens att inte vara aktuella för längre tid. I den komplexa natur som stadsutvecklingen sker är övergripande beslut en färskvara och beroende av politik och många förutsättningar som snabbt an förändras.

- Vilken nivå av detaljstyrning kan tillämpas i ett program (t.ex. fasadmaterial, kulör etc. som kan tänkas påverka dagsljus och energi)?
  Svar: detaljnivån för program enligt PBL bör vara på en övergripande nivå. Om område för programmet är av specifik karaktär kan övergripande inriktning för fasadgestaltning, kulör, fönstersättning, volym, detaljer på bebyggelse hanteras. Detta bör ske på en övergripande detaljnivå och inte styra i detalj. En annan handling som är vanlig att ta fram men som inte har någon juridisk tyngd vid senare bygglovsgivning är så kallade kvalitetsprogram eller gestaltningsprogram. Dessa dokument brukar tas fram och hantera detaljer som rör gestaltningen eller kvalitetsaspekter av bebyggelse, mark och område för detaljplan. Då dessa dokument inte stöds eller hanteras under Plan och bygglagen så är det inte möjliga att följa upp vid en bygglovsgranskning.
  Ett intressant exempel på när detta hände är bebyggelsen Studio 01 vid Stora torp. Gestaltningsprogrammet som togs fram dikterade att det bebyggelsen skulle uppföras i ljusa fasadmaterial liknande omgivande bebyggelse. Studio 01(som senare vann Kaspar Salin-priset) gestaltades i ”svart” tegel, i rak motsatts till gestaltningsprogrammet. Så det finns en juridisk svårighet att hantera om man väljer att ta fram gestaltningsprogram.

### Nyckeltal

- Vilka nyckeltal/faktorer är främst av betydelse när detaljplanen utvecklas?
  Svar: Antal bostäder, Total BTA, uppdelning kvartersmark, gataumark, parkmark, övrig allmän plats.
  Det finns en rad olika nyckeltal som används inom ett planprojekt i olika faser. Göteborgs stad arbetar i dagsläget med en ny riktljnije på stategisk nivå kring vilka indikatorer/nyckeltal och måltal som vi skall arbeta mot. En förlaga till det arbetet är Spacescapes mäta stad.
  http://www.spacescape.se/project/indikatorer-for-stadskvalitet/

- Finns det standardnyckeltal som används i utformningen av byggrätt (storlekar på utrymmen som styr utfallet på byggnadens djup etc.)?
  Svar: vet ej

## Studier

- Vilka studier genomförs i detaljplaneskedet (som kan påverka energi och dagsljus)?
  Svar: Det varierar på vilken typ av detaljplan och bedömningen av omfattningen av detaljplanen. Det finns generella krav på bedömningar och underlag som skall hanteras för alla detaljplaner. Det varierar med andra ord.
  Se gärna de planer som pågår just nu och de utredningar som de tar fram på:
  https://goteborg.se/wps/portal/start/byggande--lantmateri-och-planarbete/kommunens-planarbete/plan--och-byggprojekt/

Men generellt så är det en problematik i att man som exploatör gärna maximerar den givna BTA i detaljplanen.

Miljökonsekvenser av förslag i detaljplan redovisas inom detaljplanen och en rad avvägandes skall göras i förhållande till miljöaspekter. Man gör en så kallad lämplighetsprövning enligt 2 kap. Plan- och bygglagen samt en avvägning enligt 3 och 4 kap. Miljöbalken.

I detaljplanen bedöms och beskrivs hur detaljplanen medverkar eller påverka möjligheten till att uppfylla stadens miljömål.

- Anser du att dessa är av betydelse? Varför/varför inte?
  Svar: Jag anser att många av de utredningar som tas fram har stor betydelse för detaljplanernas utformning och förslag som presenteras och bedöms. En svårighet inom arbetet med att ta fram en detaljplan är att de flesta utredningar görs parallellt och bedömer ofta ett förslag, vilket innebär att utredningarnas resultat och förslag till förnedring kan stå i konflikt med varandra. Detta innebär att en iterativ process är svår att hantera. Inte minst rent upphandlingstekniskt.

- Anser du att det saknas någon studie? i så fall vilken och varför?
  Svar: Det är svårt att säga.

- Vem är ansvarig för de olika studierna?
  Svar: Vissa studier upphandlas av och hanteras av stadsbyggnadskontoret eller annan kommunal förvaltning (tex kretslopp och vatten som hanterar dagvattenutredningar), andra kräver vi(sbk) att exploatören tar fram.

- Enligt din vetskap; involveras energi på något sätt i detaljplaneskedet?
  Nej
  Om ja:
    - Hur?
      Svar:

- Anser du att energi är en viktig parameter att ta hänsyn till redan i detaljplaneskedet?
  Nej, eller kanske.
  Om ja:
    - Varför?
      Svar:

    - Hur borde energi tas hänsyn till?
      Svar:

  Om nej:
    - Varför inte?
      Svar: Detaljplaner reglerar markanvändning, var, vad och hur mycket av respektive användning som kan utvecklas inom ett område. Att reglera detaljer kring byggnadsutformning, materialval eller specifika energisystem är att från ett myndighetsperspektiv att låsa detaljer över en lång tid med ett verktyg(detaljplanen) som är konstruerat för att vara

enbart nödvändigt begränsande. Jag tror att detaljplanen är fel verktyg för att reglera energi i förhållande till byggnadsutformning.

- Enligt din vetskap; involveras dagsljus på något sätt i detaljplaneskedet?
  Om ja:
  - Hur?
    Svar: Det är en superintressant fråga. Dagsljus kommer in i detaljplaneskedet mer och mer nu. Min uppfattning är att det är en fråga som tidigare inte varit så avgörande i planeringen. Men nu med dagens förtätningsideal och allmänna önskan efter större exploateringar i och av tätbyggda områden så blir den högaktuell.
    Vi strävar efter och det efterfrågas av oss generella detaljplaner som kan utvecklas över tid med bland annat olika innehåll. Inom detaljplaneskedet så är då dagsljusfrågan viktig men också enormt svår. Riktlinjerna är vaga kring vilka ytor som kräver god tillgång till dagsljus vilket är en fråga som kan bedömas fullt ut först vid en mer detaljerad utformning av byggnadsvolymer och invändiga lokaler och användning. För detaljplanen krävs att den inte är omöjlig att genomföra, vilket då kräver att man kan hantera utbyggnad i förhållande till användning och dagsljus.
    För djupa byggrätter skapar stora mörka kärnor utan god tillgång på dagsljus. I de fall får man bedöma hur lämpligt och troligt utnyttjande och användning av de ytor som skapas utan god tillgång på dagsljus kan bli. Hur många toaletter och skrivarrum kan en byggnad behöva? Är mötesrum vistelseytor som kräver dagsljus?

- Anser du att dagsljus är en viktig parameter att ta hänsyn till redan i detaljplaneskedet?
  Om ja: Ja
  - Varför?
    Svar: Övergripande kontroll av dagsljus och att utreda möjligheterna/problemen med planerade byggnadsvolymer ger möjligheter tidigt att reglera den bebyggda miljön så att god tillgång på dagsljus kan tillgodoses bättre.
  - Hur borde dagsljus tas hänsyn till?
    Svar: Genom utredning av dagsljusförhållanden givet planerade volymer och de problem som volymgestaltningen kan innebära med avseende på dagsljus.

  Om nej:
  - Varför inte?
    Svar:

## Detaljnivå

- Vilken detaljnivå rörande byggnadens design kan regleras i detaljplaneskedet?
  Svar: Övergripande nivå kan regleras. I särskilda fall, så som vid kulturmiljöintressanta områden kan mer specifik detaljnivå vara lämplig.

- Vilken detaljnivå rörande byggnadens design tycker du är önskvärd att regleras i detaljplaneskedet? Varför?
  Svar:

- Vilka fördelar/nackdelar ser du med att detaljstyra design i detaljplanen (t.ex. maximal eller minimal andel fönsterarea)?
  Svar:

# Building performance simulation (BPS)

- Har du kommit i kontakt med BPS i ditt arbete?
  NEJ
  Om ja:
    - På vilket sätt har du kommit i kontakt med BPS?
      Svar:
    - Vilka parametrar har du kommit i kontakt med (dagsljus etc.)?
      Svar:

- Anser du att BPS är av betydelse i detaljplaneskedet?
  Kanske, Jag är för dåligt insatt i vilka möjligheter som BPS ger som kan vara aktuella för detaljplaneskedet.
  Om ja:
    - Varför?
      Svar:
    - Hur anser du att BPS ska implementeras i detaljplaneskedet?
      Svar:
    - Vilken detaljnivå är av relevans i detaljplaneskedet?
      Svar:

  Om nej:
    - Varför inte?
      Svar: Kan inte svara då jag inte vet vilka möjligheter som finns.
      Men det är även här ett dilemma mellan att i en detaljplan studera och reglar något detaljerat samtidigt som ett mål är att hålla detaljplanerna generella och hållbara över tid.
    -

# Verktyg för detaljplaneskedet

- Om det fanns ett webbaserat verktyg för BPS (fokus på dagsljus och energi) speciellt anpassat till detaljplaneskedet, anser du att det vore av värde?
  JA
  Om ja:
    - Varför?
      Svar: Ett enkelt verktyg som kan visa detaljplanens föreslagna volymers

relation till dagsljus och energi skulle underlätta i bedömning och avvägning för bästa markanvändning.

- Vem skulle använda detta?
  Svar: Planhandläggare/projektledare och exploatör.
- Vad anser du är de viktigaste egenskaperna ett sådant verktyg bör ha?
  Svar: Enkelt gränssnitt, lättarbetat, Enkelt att visualisera och hantera resultat/bilder.
- Vilka nyckeltal är viktig för dig som användare?
  Svar: Vet ej.
- Hur lång tid tycker du att det är acceptabelt att en beräkning får ta?
  Svar:5 min
- Hur föredrar du att resultatet illustreras?
  Svar: Bild och tabell
- Hur skulle du föredra att byggnadsgeometrin hanteras (okej med ett antal färdiga byggnadsformer att välja mellan, rita själv etc.)?
  Svar: rita själv, eller importera i enkelt format,
- Vilken detaljnivå på geometrin anser du är viktig för att göra verktyget användbart (exempelvis inkludera balkonger, loftgångar osv.)?
  Svar: vet ej.

Om nej:

- Varför inte?
  Svar:

# Intervju 2
# Detaljplaneprocessen

- Är det vanligt i er kommun att ni själva påbörjar en detaljplan utan att en byggherre ansökt om planbesked?
  Om ja:
  - Hur ser processen ut i det fallet (med fokus på energi- och dagsljusfrågor)?
    Svar: JA det händer. Dagsljus är en aspekt, det är dock på senare år man har börjat uppmärksamma att det är svårt att hantera dagljus. Det finns ett tydligt samband mellan en ökad explaotering och svårigheter att hantera dagsljus. Energi kollar man väldigt sällan på.
  - I dagsläget är mycket på initiativ av byggherre/exploatör

- Vilken/vilka är de största skillnaderna mellan när en byggherre ansöker om planbesked och när kommunen själva väljer att upprätta en detaljplan (avseende dagsljus och energi)?
  Svar: Ingen skillnad. Ofta vill byggherrarna exploatera något mer än kommunen. En högre exploatering leder ofta till att man måste studera dagsljus mer.
  - En byggherre har oftast en idé om byggnadsutformning och har redan i tidigt skede tänkt på lägenhetsindelning och utformning. Det gör att det blir svårare att göra förändringar i förslaget. Oftast ligger det ett ekonomiskt intresse i botten och ändras förslaget så ändras lönsamheten vilket påverkar genomförbarheten i projektet.
  - Håller kommunen själv i utformningen är det större chans att man tittar på förutsättningarna innan man tittar på gestaltningen vilket medför att det är enklare att göra ett förslag som uppfyller de krav som finns.

- Vilka handlingar skickar byggherren in när denne ansöker om planbesked (när det rör dagsljus och energi)?
  Svar:
  - Ibland dagsljus om kontoret ber om det, aldrig energi.
  - Vi har krav på dagsljus först när det kommer till bygglov och det tillhörande startbeskedet. Vi börjar bli bättre på att efterfråga dagsljusstudier när det kommer till planarbete och planbesked men det är inte i alla fall detta utreds så tidigt. Energi kommer också sent.

- Hur detaljerad är den information som byggherren ansöker om planbesked med (preliminära energi- och dagsljusberäkningar, byggnadshöjd, tilltänkt användning av byggnader etc.)?
  Svar:
  - Användning och höjd är preciserade. Dock så är detaljplaneprocessen en prövning. Ett positivt planbesked innebär inte att det detaljplanen kommer medge samma förslag. I detaljplanen prövas förslaget mot lagar, diskuteras med allmänhet, diskuteras med andra förvaltningen och studeras utifrån ett stadsbyggnadsperspektiv. Energi är aldrig preciserat.

    - Det som brukar redovisas är volymer, situationsplan, sektioner och en beskrivning av den tänkta byggnaden. Det är få fall där man lämnar in beräkningar på dagsljus om vi inte efterfrågar det, samma gäller energi.
    - Däremot brukar exploatörerna vara duktiga på att redovisa klimatsmarta lösningar som solpaneler eller gröna tak i sina tidiga skisser.

- Vilka faktorer skulle du säga har störst betydelse vid bedömningen av en byggnads tillåtna placering, höjd etc. (ljud, luftföroreningar osv.)?
  Svar:
    - Närhet till omkringliggande bebyggelse och påverkan från omgivningen (buller m.m.)
    - Det är en samlad bedömning. Går inte att säga något som har störst betydelse. Förslaget måste klara acceptabla ljudnivåer inte överskrida luftkvalitetsnormerna, inte medför betydande påverkan på riksintressen etc.

- Anser du att detaljplaneprocessen har förändrats de senaste åren / håller på att förändras? Om ja, hur?
  Svar:
    - Mer aspekter att ta hänsyn till.
    - Ja, det märks att det är fler och fler förutsättningar som måste tas hänsyn till i tidigt skede för att inte få det som en överraskning sen i ett senare skede. Dagsljus är en av de faktorer som det snackas mycket om nu, men även luftmiljö i den täta staden. Autonoma transporter är någonting som vi kommer höra mycket om inom några år.
    - En annan sak som märks av är miljöcertifieringarna och dess påverkan på hela processen. Ofta uppmärksammas det att detaljplaner som är satta hindrar möjligheten att uppfylla sagda certifiering.

# Program

- När är det av betydelse att ha ett program som komplement till detaljplanen?
  Svar:
    - När man behöver se frågor i ett större sammanhang.
    - Ett program tas fram för att underlätta kommande detaljplanearbeten. Det kan röra sig om att det finns komplexa frågor som måste lösas, stora motstående intressen eller många sakägare.

- Vilka fördelar finns med att ha ett program?
  Svar:
    - Man kan ta ett helhetsgrepp på ett bättre sätt.
    - Ett program ger en vägledning och skapar samsyn kring frågor som annars kunde ältats länge under detaljplanearbetet.

- Vilka nackdelar finns med att ha ett program?
  Svar:
    - Behövs det inte så är det bara tids- och resurskrävande.

    - Det är resurskrävande och det finns oftast svårigheter med den ekonomiska värderingen av ett program. Alltså, är det värt det?

- Vilken nivå av detaljstyrning kan tillämpas i ett program (t.ex. fasadmaterial, kulör etc. som kan tänkas påverka dagsljus och energi)?
  Svar:
    - Det beror mycket på i vilket område som programmet tas fram. Detaljeringsgraden är högre t.ex. inom vallgraven än vad den är på norra Hisingen.

### Nyckeltal

- Vilka nyckeltal/faktorer är främst av betydelse när detaljplanen utvecklas?
  Svar:
    - antalet bostäder/småhus, p-tal, kostnader

- Finns det standardnyckeltal som används i utformningen av byggrätt (storlekar på utrymmen som styr utfallet på byggnadens djup etc.)?
  Svar:
    - Det finns, men de används sparsamt.

## Studier

- Vilka studier genomförs i detaljplaneskedet (som kan påverka energi och dagsljus)?
  Svar:
    - Exploatering, utformning av förslaget
    - Buller, solstudie och dagsljusutredning, luftmiljöutredning.

- Anser du att dessa är av betydelse? Varför/varför inte?
  Svar:
    - Alla studier som görs är för att få fram ett bra förslag.
    - Ja absolut! De ger ju förutsättningar att bedöma markens lämplighet för den specifika typen av användning.

- Anser du att det saknas någon studie? i så fall vilken och varför?
  Svar:
    - Vi har möjlighet att begära in de utredningar som vi anser krävs för att bedöma lämpligheten för den användning som är föreslagen i förslaget.
    - Men om det skulle vara något så är det de parametrar som också håller på och uppmärksammas i vårt arbete med dagsljus.

- Vem är ansvarig för de olika studierna?
  Svar:
    - Kommunen eller exploatörerna.

- Enligt din vetskap; involveras energi på något sätt i detaljplaneskedet?
  Om ja:

- Hur?
  Svar: Ja, det skulle vara hur man avser att värma upp hus. I övrigt nej, inte enligt min vetskap.

- Anser du att energi är en viktig parameter att ta hänsyn till redan i detaljplaneskedet?
  Om ja:
  - **Varför?**
    **Svar:** Ja och nej. För att bygga ett hållbart samhälle som tar hand om de resurser som vi har måste vi i ett tidigt skede tänka på hur vi kan skapa energieffektiva byggnader. Jag har svårt att se hur detta skulle implementeras i detaljplaneskedet mer än att vi möjliggör och tar höjd för olika typer av lösningar, t.ex. lågenergihus som har tjockare väggar eller trähus som generellt har ett tjockare bjälklag.
  - **Hur borde energi tas hänsyn till?**
    **Svar:** Hushållning med resurser och att bygga effektiva byggnader kommer att bli en förutsättning för vidare stadsutveckling. Att tidigt utreda om projekten blir hållbara är en god idé.

  Om nej:
  - Varför inte?
    Svar: Svar:
  - Det är en aspekt som är svår att ta in i ett tidigt skede, tror den är bättre lämpad i ett skedet där man hanterar frågor mer detaljerat.
  - Å andra sidan kan inte en detaljplan lösa allt. Det märks mer och mer att många har en övertro till det detaljplanen kan reglera. Vi kan reglera användningen av mark och vatten ändamålsenligt. Vi kan inte reglera någonting som vi inte har stöd för i lagen, vilket innebär att det måste till ändringar i PBL om vi ska kunna ställa krav redan i detaljplanen på energi. Jag vet inte om det är effektivt att lösa alla frågor så tidigt, dessutom kan en detaljplan vara aktuell i flera hundra år, vilket innebär att en lösning vad gäller energi kan vara aktuell år 1 men inte lika aktuell år 50, men man måste ändå förhålla sig till den eftersom att detaljplanen är juridiskt bindande.

- Enligt din vetskap; involveras dagsljus på något sätt i detaljplaneskedet?
  Om ja:
  - Hur?
    Svar:
  - Ja, vi gör solstudier och dagsljusutredningar i planskedet.
  - I detaljplaneskedet görs en bedömning att det finns möjligheter att i ett senare skede kunna utforma lägenheter så att de får en god dagsljustillgång.

- Anser du att dagsljus är en viktig parameter att ta hänsyn till redan i detaljplaneskedet?
  Om ja:
  - **Varför?**
    Svar: Ja, här har vi möjlighet att justera förslaget så att t.ex. en bostad får tillräckligt med dagsljus för att uppnå de krav som ställs.

- **Hur borde dagsljus tas hänsyn till?**
  **Svar:** Vi har börjat att tänka mer och mer på dagsljus och solljus, från att det var ett sätt att förhindra enkelsidiga lägenheter i norrläge till dagens forskning som visar att vi mår bättre om vi har tillgång till dagsljus. Frågan har börjat få betydelse och kommer att bli en starkare faktor när vi bedömer lämpligheten i framtiden.

- Varför?
  Svar: tar man inte hänsyn till det finns stor risk att man inte kan uppföra byggnader som klarar dagsljusnivåerna. Studier har visat att det är viktgt med dagsljus bland annat för att människors psykiska hälsa, sömn, inlärningsförmåga m.m.
- Hur borde dagsljus tas hänsyn till?
  Svar:

## Detaljnivå

- Vilken detaljnivå rörande byggnadens design kan regleras i detaljplaneskedet?
  Svar:
  - Så mycket som krävs. Det är så stor skillnad från detaljplan till detaljplan. Om man bygger i närhet av kulturhistoriskt värdefull bebyggelse eller om man rullar ut en villamatta i Angered.
  - Detaljeringsgraden anpassas efter detaljplanens komplexitet och förutsättningar.
  - Beror på placering.

- Vilken detaljnivå rörande byggnadens design tycker du är önskvärd att regleras i detaljplaneskedet? Varför?
  Svar:
  - Det kan hända mycket mellan detaljplan och bygglov, ibland kan det gå flera år innan man kommer igång med byggnation, då är det viktigt att vi beslutar om hållbara regleringar i detaljplanen och inte anpassar oss efter gällande designnormer som gäller just idag. Jag skulle därför önska en flexibel reglering före en detaljerad reglering.
  - Höjd, skala, utbredning. Inte detaljstyra för mycket.

- Vilka fördelar/nackdelar ser du med att detaljstyra design i detaljplanen (t.ex. maximal eller minimal andel fönsterarea)?
  Svar:
  - Det är en balansgång. Det är dumt att måla in detaljplanen i ett hörn med bara en lösning på ett problem om den lösningen är dyr och dålig. Därför bör detaljplanen vara flexibel och hålla den detaljeringsgrad som krävs för att den tänkta användningen ska vara lämplig.
  - Bedömer det inte som lämpligt. Blir en för detalerad detaljplan. Detaljplanen ska visa att det finns ett sätt att uppföra en byggnad om det finns andra sätt som bedöms som acceptabla ska även det vara möjliga.

# Building performance simulation (BPS)

- Har du kommit i kontakt med BPS i ditt arbete?
  Om ja:
  - På vilket sätt har du kommit i kontakt med BPS?
    Svar:
  - Vilka parametrar har du kommit i kontakt med (dagsljus etc.)?
    Svar: VSC, dagsljusfaktor

- Anser du att BPS är av betydelse i detaljplaneskedet?
  Om ja:
  - Varför?
    Svar: En tidig indikation ur ett hållbarhetsperspektiv är alltid bra. Att ha en iterativ process med exploatör där vi även tar hänsyn till hållbarhetsperspektivet kan inte vara dåligt.
  - Hur anser du att BPS ska implementeras i detaljplaneskedet?
    Svar: Använd det som metod att utvärdera hållbarhet och energieffektivitet.
  - Vilken detaljnivå är av relevans i detaljplaneskedet?
    Svar: Hur väl byggnaden stämmer överens med kommunens mål om energihantering och hållbarhet samt ett förslag på hur man kan förbättra designen för att bli än mer effektiv. Hållbart över tid.

  Om nej:
  - Varför inte?
    Svar:

# Verktyg för detaljplaneskedet

- Om det fanns ett webbaserat verktyg för BPS (fokus på dagsljus och energi) speciellt anpassat till detaljplaneskedet, anser du att det vore av värde?
  Om ja:
  - Varför?
    Svar: För dagsljus. tidigt identifiera energiåtgång och hur man kan effektivisera, samt tillgång till dagsljus för att bedöma en byggnads lämplighet är positivt.
  - Vem skulle använda detta?
    Svar: Planhandläggare, exploatörer.
  - Vad anser du är de viktigaste egenskaperna ett sådant verktyg bör ha?
    Svar: VSC, dagsljus, enegieffektivitet och hushållning med resurser.
  - Vilka nyckeltal är viktig för dig som användare?
    Svar: VSC samt mängden mörk BTA.

- Hur lång tid tycker du att det är acceptabelt att en beräkning får ta?
  Svar: Så kort tid som möjligt, en timme max.
- Hur föredrar du att resultatet illustreras?
  Svar: I bild/ tabeller och illustrationer.
- Hur skulle du föredra att byggnadsgeometrin hanteras (okej med ett antal färdiga byggnadsformer att välja mellan, rita själv etc.)?
  Svar: färdiga former med möjlighet till frihandsritning.
- Vilken detaljnivå på geometrin anser du är viktig för att göra verktyget användbart (exempelvis inkludera balkonger, loftgångar osv.)?
  Svar: Balkonger loftgångar bedömer jag inte behövs. / Balkonger ska kunna inkluderas vid behov.

Om nej:

- Varför inte?
  Svar:

# Intervju 3

Q = De som frågar A: = Den som svarar. Start: 5 min ish.

Q: Alltså jättemycket aspekter som en arkitekter har, så vi kommer fokusera på det vi har utbildats till, Energi och dagsljus (?) så vi är lite smalare och så

A: Ni ska återigen verifiera bidrott (?) ni snackar generellt om…

Q: Nej alltså vi ska nog mer verifiera att det är gynnsamt att implementera building performance simulations i detaljplanskedet.

A: Då ska man väl kolla väl typ såhär vilka parametrar kan man liksom… den detaljnoggranheten som finns…

Q: Ja alltså det kommer vara form och geometri och rent teoretisk vet vi vilken typ av byggnad som ger bäst… Det vi är inne på nu är att vi måste verifiera en annan parameter också. Så vi kan inte bara köra energi annars får vi…

A: Om ni kollar på dagsljust måste ni kolla på inneklimat också. Det man tänker på när man ser på det som du ska verifiera, alla dessa man ska diskuterat och framfört länge det här med, du vet, man har exempel med att man kan jobba med formfaktor, form, volym, där man kan orientera för att optimera sol och såhär. Det här programmet kan rotera byggnader i typ alla väderstreck och varje gång man har sett den här sortens metodförklaringar går det inte göra i verkligheten. Du har en tomt här, du kan inte bara rotera den tomten när tomten är så ditt hus kommer bli så. Du kan inte ha det som en sfär här liksom.

Q: Nej men exakt, så ville vi kanske att man hade tänkt efter innan man sätter det fot…

A: Ja exakt, men det footprintet kan ju va så att det har mycket annat av det befintliga. Leder, vägar jag menar… Det finns mycket begränsningar som gör att det låser till att frihetsgraderna begränsas så mycket.

Q: Jo men vi tänkte ju mycket på det för det finns ju anledningar till kanske att man satte ett hus för att man inte vill gå iväg där, det klart att man satte ett hus där för att göra ett barriär av ljud och aa. Det är jätteklurigt

A: Ja det är såhär man sitter och rotera och sådär

Q: Det är litegrann därför vi valt att gå in i detaljplanen, litegrann att det går fortfarande till många paramterar man ska ta hänsyn till. Men du har fortfarande en större frihet i själva marken. Så du kan fortfarande orientera om byggnaden mer än vad du kan göra när du faktiskt går in i en fysisk fastighet och du har en detaljplan som är satt på det området.
För att jag vet när vi pratat med stadsbyggnadskontoret så har de sagt att det finns ju områden som är jättestora områden som de kommer göra detaljplaner på. Och där har man jättestor möjlighet för att vi snackar om stora områden och då är det ju inte rätt att anpassa sig till fem hus runt, för då har vi jättestora områden och där kanske man måste tänka innan man sätter… bestämmer hur man ska placera, hur det här ska va, så kanske man kan ha tänkt efter innan. För det man märkte nu var att det är jättemånga byggnader, på grund av täthet, som inte klarar dagsljuskraven. Då har kommunen sagt att ”ni får bygga såhär högt, och på det här området”. Och sen så vill jag ju såklart maximera det, och så gör de det och sen så skickar de bygglovshandledningar och då uppnår man inte kraven. Då har kommunen sagt att ni får bygga såhär högt och då kanske man kollat det innan.

A: Sen blir det ju mycket diskussion.

Q: Ja.

A: Men aa… Det är mycket att tänka på. Finns det någon aspekt som ni tänker på eller arbetade med hur… jag vet inte vem som gjort det egentligen, men om det är liksom vad är det för svårigheter med att… skjuta fram eller tidigarelägga de här studierna liksom till innan detalj… Det finns ju lagar som säger vad och hur mycket man får detaljstyra. Och liksom får du säga… vad finns det för problem… eller vad är det som talar emot från att göra detta? Om du säger såhär att okej, här har du ett område och vi vill att du har ett verktyg för att jobba med volymer och göra dagsljusenergi och klimat och klimatallting. Och så gör du det. Du kan kolla med LCA, klimatpåverkan… Går det? Eller finns det liksom saker... Varför gör man inte… Eller kan ni bara inte eller…?

Q: Jag tror att den största faktorn att man tidskomprimerar processen på fel håll, litegrann. Vi har pratat ganska mycket med kommunen nu och de säger ”kommer det ett verktyg som gör det här fort, så vill vi ha med den. Det är inget juridiskt mässigt som säger att du inte får detaljstyra just den här delen. Det finns ju massa olika detaljplaner och processer och hamnar du då i ett kulturhistorisk område eller så, där du ska sätta lite detaljplaner och ha mycket bebyggelse och allting sånt, så kanske kommer med… en annan approach man måste göra är en miljökonsekvensbedömning också. Om det då säger att ”ja men vi behöver bygga för de här värdena, lalala och vi vill också att ni ska bygga efter ett miljöprogram” att då faktiskt sätta sådana här... göra belägg för sådana parametrar i detaljplaneskedet, det gynnar bara.

A: Det är en sak att gynna, att det är logiskt bättre men det står också att det inte är tillåtet. Man får ju inte styra detaljutformningen och bygglovet…

Q: Nej men exakt.

A: Så det är sådana saker som bara kan gå emot som… som man behöver lösa också eller regeländring måste till också.

Q: Det som är svårt också det är… vi trodde att i alla fall kommunen hade faktiskt tagit hänsyn till dagsljus, de har ju en tanke om det, men det verkar inte vara så med de vi prata med. Vi har kontakt med en dagsljusgrupp som har satt igång ett projekt i stadsbyggnadskontoret och de har ju dels satt ihop för att de har problem. Det har uppdagats de senaste fem åren och de märker att folk inte kan bygga det de vill bygga för att de inte följer… Men ja det finns jättemånga aspekter som är ett problem som du säger.

A: Det är bara regelmässigt, men är det inte det så är det bra. Då är det bara att hitta rätt…

Q: Men frågan är om att det kanske kan handla om man vill ha en rekommendation ”om ni uppfyller den här miljöcertifieringen på det här området, behöver ni tänka såhär och såhär. Att det kan vara ett tips att ni bör tänka på hur ni ser över byggnaden, vilken riktning och tuntututun.” Alltså frågan är om det kommer vara så mycket som ett detaljplantilllägg att det detaljstyr, eller om det kommer vara ett programtillägg. För det vad jag har kollat mer på är att det här är mer ett verktyg för att sätta en detaljplan mer än att det kommer att säga…

A: ”den här tomtindelning med de höjderna vi har sagt…”

Q: Så ger det de bästa förutsättningar.

A: Jo men typ maxar man alla byggrätter som vi föreslagit…

Q: Så kommer ni inte klara rättviskraven…

A: Nej men det man säger är att maxarna de byggrätter som vi ger ut nu, så har man förutsättningarna för att klara dagsljus. Och det är en optimal med typ energi. Det optimala ur energiperspektiv utan att ge avkall på kvalité.

Q: Utan att bara vara en box. En annan stor… det jag har, nu när jag gått igenom en massa olika dokument som kommunen publicerat, när de gör sina analyser idag tänker de ofta väldigt mycket bara plan. 2D. Och det märks i deras analyser och i deras material också, och därför så kan ju det här, om de bara få tänka lite mer, att om vi har en 20 vånings byggnad här vad ger det omgivande?
A: Det är nog bara så att man inte vet. Man bygger ju inte så högt i Sverige. Detaljplanen ser likadan ut om det har varit 3 våningar eller om det har varit 23 våningar ser det likadant ut, förutom den där siffran. Så det här känslan man har… tumme-mot-pekfingerkänsla, som gammal planarkitekt kanske suttit på… ”det här bli bra”, för att det var en 3 våningshus. Nu är det 25 våningshus.
Q: Det är ju väldigt många nya aspekter som kommer in och sätter lite grann, framförallt förtätning utav städer, sker nästan överallt…
A: Man tar heller inte hänsyn till det befintliga i Sverige. Det är en annan aspekt när man förtätar. Att man ser till det här var hårda dagsljuskrav för det nya som byggs – det byggs ju tätt liksom. Det är jättesvårt för att man måste tricksa för att det är så tight mellan husen. Men de husen som byggdes med andra förutsättningar kommer ju absolut inte klara sig nu. Men de skiter vi i.
Q: Nej men verkligen. Det vi i alla fall känner är den största utmaningen, det är hur vi ska optimera energin då dagsljus mot en annan parameter. Och sen också att vi kanske inte har kunskapen i någon av de andra parametrar.
A: Har ni någon punktlista med frågor?
… slut 16 min ish.
… start 1:01.43 min ish
A: Ni jobbar inte med metodik på något sätt? För att jag ska bara nämna med Linda, med att hitta ett samarbetssätt mellan arkitekt och ingenjören.
Q: Du jobbar ju lite med det. -Både och. Jag hittar inte en metodik. Det jag ska försöka bevisa i slutändan är att liksom att en ändring i processen kan ge incitament för innovation för arkitektens arbete. Så jag måste fortfarande bevisa det mot arkitekten. Så jag har börjat kolla litegrann på innovationer och hur… väldigt väldigt krasst och väldigt stort, hur någonting såhär kan ge en mer undermedveten process mot innovation. Det är väldigt mycket buzzwords och det är jag medveten om, men jag försöker hitta någon sorts mätetal mot att arkitekter kan faktiskt gynnas utav det kommer den här typen av krav för att det är faktabaserat och det kommer hjälpa hela processen. Det är inte bara taget ur tunn luft att det ska komma en sådan här analysering tidigare i skedet. Men det handlar inte så mycket… -Det var det som var Lindas exjobb. Vi har lite såhär koll på… också. Men att vi gör lite olika saker, typ att vi försöker hoppa in tidigare. -Jag har spunnit i Monas rapport. Hon har ju gjort en identifiering utav parametrar och jag ska göra det och hålla på med det, men det har blivit litegrann det att jag har varit tvungen att identifiera ett case som båda disciplinerna har godkänt. Nu har det blivit lite mer ”jävlaranamma”, nu när det har landat litegrann. Så förhoppningsvis så ska det landa ännu mer och bli ännu mer avgränsat. Bara det att det är avgränsat till svenska detaljplaneprocessen är skitbra!

# Intervju 4
# Planbesked och bygglov

1. Vilken/vilka är de största skillnaderna mellan när ni som byggherre ansöker om planbesked och när kommunen själva väljer att upprätta en detaljplan (avseende dagsljus och energi)?
   Svar: Allmänt kan jag kommentera att när vi själva är med och utformar detaljplaner ( i jämförelse med att vi köper detaljplanelagd mark) har vi större möjlighet att se till helheten och utforma produkten optimalt utifrån bland annat ovan nämnda parametrar, även om jag får medge att fokus oftast snarare är utifrån en målgruppsanalys och ekonomiska parametrar.

2. Vilka handlingar skickas in när ni ansöker om planbesked (när det rör dagsljus och energi)?
   Svar: Jag har inte varit med och ansökt om planbesked, då jag hittills främst jobbat i ett senare skede, dock har jag svårt att tro att vi behövt skicka in specifika handlingar rörande dagsljus och energi. Vi på Skanska Nya Hem Svanenmärker dock alltid våra bostäder, vilket bland annat innebär att vi ska leverera 15% lägre energiförbrukning än BBR-kraven, samt att vi behöver uppfylla dagsljuskraven, så möjligt att vi motiverar ett planbesked med detta för att få större tyngd i ansökan.

3. Hur detaljerad är den information som ni skickar in vid ansökan om planbesked (preliminära energi- och dagsljusberäkningar, byggnadshöjd, tilltänkt användning av byggnader etc.)?
   Svar: Se svar på fråga 2

4. Anser du att processen vid ansökan om planbesked har förändrats de senaste åren / håller på att förändras (fokus på energi och dagsljus)? Om ja, hur?
   Svar: Kanske inte just i samband med planbesked, men det är större fokus generellt på dagsljus och energi, men framförallt i bygglovsprocessen.

5. Vilka handlingar skickas in när ni ansöker om bygglov (när det rör dagsljus och energi)?
   Svar: Inte alltid något utav ovan efterfrågas i samband med bygglov, utan först i samband med tekniskt samråd och fråga om startbesked. Generellt brukar dock skicka in dagsljusberäkningar och ibland energiberäkningar. Framförallt det sistnämnda efterfrågas dock oftast först i samband med tekniskt samråd.

6. Hur detaljerad är den information som ni skickar in vid ansökan om bygglov (preliminära energi- och dagsljusberäkningar, byggnadshöjd, tilltänkt användning av byggnader etc.)?
   Svar: Själva bygglovsansökan består till främsta delen utav arkitektritningar, inkl material och kulörbeskrivningar, samt yt- och lägenhetssammanställningar, så själva utformningen utav byggnaderna är detaljerad. Främst fokus på höjd, våningsantal mm (lite beroende på vad som står i detaljplanen). Vi brukar även skicka in tillgänglighetsutlåtande, samt utlåtande från akustik och brand, samt

numera i Göteborg även mobilitetsutredningar och mobilitetsavtal med Göteborgs stad. Min känsla är att det är större fokus på ovan frågor än energi- och dagsljusfrågor, även om dessa börjar uppmärksammas mer och mer. Här upplever jag dock att vi som byggherrar har hårdare fokus på frågorna via våra interna Svanenkrav, än vad staden har.

7. Anser du att processen vid ansökan om bygglov har förändrats de senaste åren / håller på att förändras (fokus på energi och dagsljus)? Om ja, hur?
   Svar: Ja känslan är att dessa frågor får allt större fokus, även om de som sagt än så länge har mindre betydelse än många andra parametrar. Man märker också att Länsstyrelsen och andra myndigheter än så länge fokuserar betydligt mer på luft, buller och trafikfrågor.

8. Vilket/vilka är de vanligaste orsakerna till avslag vid bygglovsansökan?
   Svar: Det kan vara avsteg från detaljplanen som inte beviljas. Sällan utifrån dagsljus och energi utan snarare tolkningar utifrån byggnaden storlek, antingen fotavtryck, höjd eller volym.

9. Finns det något du önskar att kommunen gjorde som ej görs idag när det rör energi/dagsljus och detaljplanen/bygglov?
   Min känsla är att kommunen fokuserar väldigt lite på dessa frågor i samband med framtagandet utav detaljplaner. Den största fokusen ligger i samband med bygglov/startbesked, vilket gör att vi som byggherrar tar en stor risk. Om man kunde medvetandegöra dessa frågor tidigare och utifrån dessa göra medvetna val i detaljplaneprocessen hade det varit bättre för oss som byggherrar. Kortfattat kan man säga att bygglovshandläggarna kan acceptera avsteg om dessa framgår utav detaljplanen, därmed hade det varit betydligt bättre för oss byggherrar om detaljplanerna var tydligare kring dessa frågorna.

# Program i detaljplaneprocessen

10. Tycker du att det är hjälpsamt med program som komplement till detaljplanen? Om ja:
    - Vid vilka tillfällen är detta hjälpsamt/ej hjälpsamt?
      Svar: Ja det är hjälpsamt. Dels för att under framtagandet utav detaljplanen veta vad som fungerar och inte fungerar, men också som ett verktyg att luta sig mot senare i processen.
    - Vilka fördelar finns med att ha ett program som komplement till detaljplanen??
      Svar: Man medvetandegör vad som fungerar och inte fungerar redan i ett tidigt skede och kan ta fram realistiska planer som går att genomföra så att vi som byggherre slipper sitta med Svarte-Petter vid en bygglovsansökan.
    - Vilka nackdelar finns med att ha ett program som komplement till detaljplanen??
      Svar: Generellt önskar vi så flexibla detaljplaner som möjligt, så det får helst inte vara alltför styrt i en detaljplan. Främst för att det är en

föränderlig marknad och en lång detaljplaneprocess kan innebära att det man projekterat för inte längre är aktuellt eller genomförbart. Då är det en fördel med flexibla planer som tillåter ett annat utförande.

11. Vilken nivå av detaljstyrning tycker du är önskvärt att tillämpa i ett program (som kan tänkas påverka dagsljus och energi)?
    Svar: Rätt nivå är att med enkla studier kunna säkerställa att aktuella krav kan uppfyllas, alternativt ge vägledning till hur de skulle kunna uppfyllas. Dock ska vi vara medveten om att det framförallt på energisidan kommer allt skarpare krav, så det kan vara farligt med en alltför snäv byggrätt.

# Studier i plan- och bygglovsprocessen

12. Vilka studier genomförs i samband med framtagande av ansökan om planbesked(som kan påverka energi och dagsljus)?
    Svar: Min känsla är att solljusstudier är vanligare än dagsljusstudier från kommunens sida. För att se hur den nya bebyggelsen påverkar den befintliga. Det är inte lika stor fokus på dagsljus för den kommande bebyggelsen. Däremot utför vi själva som regel dagsljusstudier innan vi köper någon mark för att kunna säkerställa att det vi önskar eller räknar med ska byggas i samband med en markaffär även är genomförbart i praktiken.
    När det gäller energiberäkningar mm, så efterfrågas dessa som regel inte från stadens sida. I vår interna projekteringsprocess ligger de däremot med och vi utför energiberäkningar såväli förslagshandlingsskedet, som systemhandlingsskedet (bygglov) och i bygghandlingsskedet. Det är oftast först de sistnämnda handlingarna som kommunen efterfrågar.

13. Anser du att dessa är av betydelse? Varför/varför inte?
    Svar: Ja. För att kunna säkerställa att den produkt som är tänkt till en plats även fungerar att genomföra.

14. Anser du att det saknas någon studie? i så fall vilken och varför?
    Svar: Egentligen inte, men i och med att dagsljusfrågorna får allt större fokus så finns det en önskan att man tar fram realistiska planer, så med tanke på det är det viktigt med dagsljusstudier redan i ett tidigt skede.

15. Vilka studier genomförs i samband med framtagande av bygglovshandlingar (som kan påverka energi och dagsljus)?
    Svar: Dagsljusstudier/simuleringar och energiberäkningar.

16. Anser du att dessa är av betydelse? Varför/varför inte?
    Svar: Ja, åtminstone för oss som byggherrar, så att vi vet att de byggnader vi projekterat går att genomföra och att vi håller vad vi lovar gentemot våra köpare.

17. Anser du att det saknas någon studie? i så fall vilken och varför?
    Svar: Nej

18. Anser du att studier av dagsljus kan vara ett hjälpmedel för kommunen i detaljplaneprocessen?
    Svar: Ja
    Om ja:
    - Varför?
      Svar: För att medvetandegöra för kommunen om planen är genomförbar.

    Om nej:
    - Varför inte?
      Svar:

19. Anser du att studier av energi kan vara ett hjälpmedel för kommunen i detaljplaneprocessen?
    Svar: Nja.
    Om ja:
    - Varför?
      Svar:

    Om nej:
    - Varför inte?
      Svar: Än så länge är min känsla att energin inte är den trånga sektorn. Det går oftast att lösa. Med det sagt så kommer kraven bli hårdare och hårdare, så behovet kommer att finnas inom en snar framtid.

# Design i tidiga skeden

20. Finns standardmått som hjälper till att bestämma en byggnads geometri (rumsdjup för bostäder, kontor etc.)?
    Svar: Vi på Skanska har interna hjälpmedel i form utav något som vi kallar för Skanskas bostadsplattformar. Dessa innehåller handböcker för alltifrån arkitekter, till installationer och även ett särskilt hjälpdokument kring dagsljusnyckeltal.

    I så stor utsträckning som möjligt försöker vi prefabricera våra bostäder. Det är inte så hårt styrt att vi är bundna till strikta byggnadsdjup och bredder, däremot finns det riktlinjer om våningshöjd beroende på byggmetod och planlösningar och bärande väggar är direkt kopplade till de spännvidder på elementen som aktuell byggmetod klarar av .

21. Hur påverkar den ekonomiska aspekten utformningen av en byggnad?
    Svar: Det är ekonomiskt mer fördelaktigt att bygga med så få hörn som möjligt, samt att om möjligt hellre bygga fler våningar och därmed minska utbredningen av husen. Utgångspunkten i detaljplanen ska vara en relativ enkel och rationell produkt. Det är lättare att i senare skede addera mervärden om projektekonomin så tillåter.

    Vidare gäller att inom ett projekt med flera huskroppar bör samma hustyp upprepas i möjligaste mån. Det är avsevärt mer gynnsamt att återupprepa en hustyp genom att rotera eller parallellförskjuta den, jämfört med att spegla en hustyp. En genomtänkt byggnadsutformning är en förutsättning för att åstadkomma en effektiv

produktionsprocess, robusta byggnader och låga garantikostnader. Byggnader ska därför helst utformas på sådant sätt att komplicerade geometrier som är svåra att producera med säkerställd kvalitet och ekonomi undviks. Maximering av bostadsarean måste balanseras mot eventuell merkostnad på grund av mer komplicerad byggnadsgeometri.

Rent ekonomiskt är ett loftgångshus oftast en kostnadseffektiv produkt, då man får ut större andel BOA i förhållande till BTA som byggs, i jämförelse med ett hus med invändigt trapphus. Om man inte har en köpstark målgrupp kan ett loftgångshus därför vara att föredra. Man bygger billigare BOA som därmed inte behöver säljas lika dyrt.

22. Av vem, när och hur bestäms byggnadsform, höjd och väderstreck?
    Svar: I detaljplanen sätts grunderna och det markeras var i ett område det är tillåtet att uppföra en byggnad, samt hur den får utformas. Lite beroende på detaljplanens flexibilitet är det slutligen vi byggherrar som med hjälp utav bland annat arkitekter och inom detaljplanens förutsättningar utformar den slutliga produkten.

23. Brukar man ta hänsyn till energi och dagsljus när man bestämmer byggnadsform, höjd och väderstreck?
    Svar: Ja vi som byggherrar gör så gott som alltid dessa studier. Däremot är jag inte lika säker på att man från stadens sida alltid tagit hänsyn till dessa parametrar, särskilt inte vad gäller detaljplaner som baseras på slutna kvarter.

24. Vilka faktorer skulle du säga har störst betydelse för en byggnads form? finns det faktorer som är i konflikt med varandra och hur hanterar man detta?
    Svar: Ur vår aspekt som byggherre handlar det i första hand om en marknadsanalys. Vilken målgrupp ser vi och vilken produkt efterfrågar denna målgrupp? Sedan finns det massvis med yttre faktorer som man behöver ta hänsyn till. Dagsljus och energi är två, liksom brand och buller. Sedan ska man inte heller underskatta närområdets synpunkter. Grannar som överklagar innebär utdragna processen, vilket i förlängningen försvårar arbetet. Därför försöker vi i allt större utsträckning, genom dialogarbete, även ta hänsyn till vad de kringboende tycker och tänker. I slutändan brukar det allt som oftast bli en kompromiss utav alla ovan faktorer.

    Så bra byggnad som möjligt vs. Så många bostäder som möjligt är ett konstant övervägande.

    Vad grannarna anser är definitivt en faktor som vi behöver ta hänsyn till, liksom Länsstyrelsen. Sedan finns det många andra faktorer som motverkar varandra. Dagsljus ställer exempelvis krav på fönsterytor, medan mängden fönster påverkar energin och ekonomin. På samma sätt kan slutna kvarter vara gynnsamt ur bullerperspektivet, men förödande när det kommer till dagsljus.

25. Om en byggnad skall optimeras utifrån dagsljus och energi, vilka andra faktorer anser du är viktigast att samtidigt ta hänsyn till (kvaliteér som ljus, buller, tillgång till grönytor etc.)?
    Svar: Ljus, buller, grönytefaktorer är några, liksom hållbarhet, trygghet och tillgänglighet. Jag skulle också vilja påstå att det i förlängningen blir en omöjlighet att förtäta staden om samtliga krav måste tillgodoses. Alla krav innebär också en allt dyrare produkt, vilket stänger ute en allt större andel människor från att ha råd att köpa en bostad, så människors betalningsförmåga är ytterligare en parameter att ta hänsyn till.

# Avslutande frågor

26. Finns det något övrigt du vill tillägga?
    Svar: Är det rimligt och rätt väg att gå att alla krav alltid måste uppfyllas? Hur rimmar detta med en önskan om att förtäta stadskärnorna? Är det exempelvis så att dagsljus ska vara dimensionerande, eller bör en framkomlig väg snarare vara att hitta lättnader i regelverket? Vad anser de som arbetar skift och sover på dagarna, efterfrågar de dagsljus?
    Hur är det med oss som jobbar dagtid och under den största delen utav den ”ljusa” tiden befinner oss på arbetet och inte i bostaden, är vi i behov utav mer dagsljus i våra bostäder, eller finns det andra vägar att gå? Mår vi exempelvis bättre av att gå ut i friska luften och få dagsljuset den vägen?
    Det är inga enkla frågor och människors hälsa är viktigare än allt annat, men i förlängningen handlar det mycket om att kunna förstå problematiken och göra medvetna val utifrån detta. Ju mer som går att simulera i tidigt skede, desto bättre. Ur ett ekonomiskt perspektiv är förhållandet mellan tid och åtgärd intressant. Kostnaden för åtgärd växer exponentiellt med tiden.

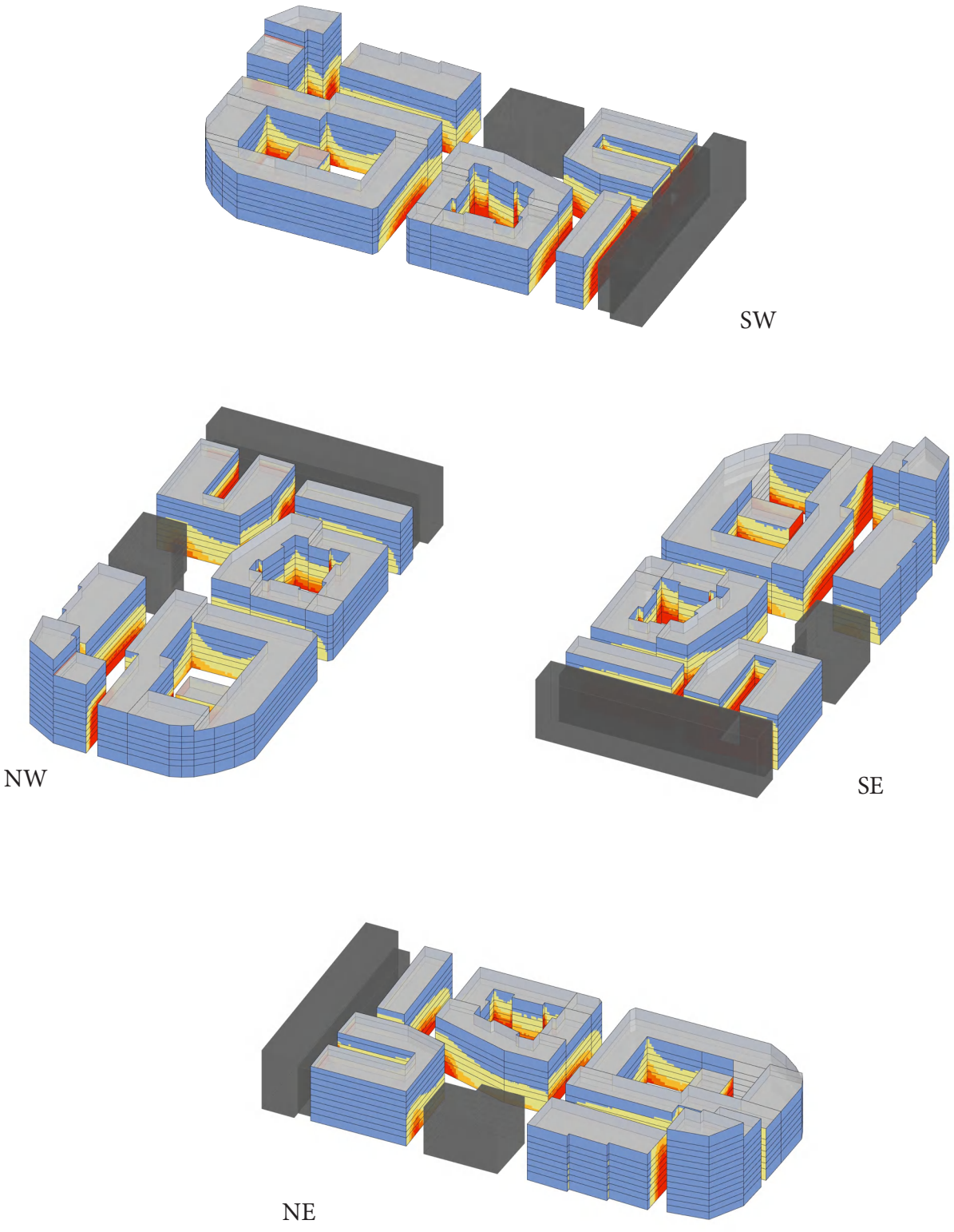
APPENDIX 2
Case study information

## \ndicators for city-qualities (adapted from: SpaceScape & Göteborg Stad, 2018)

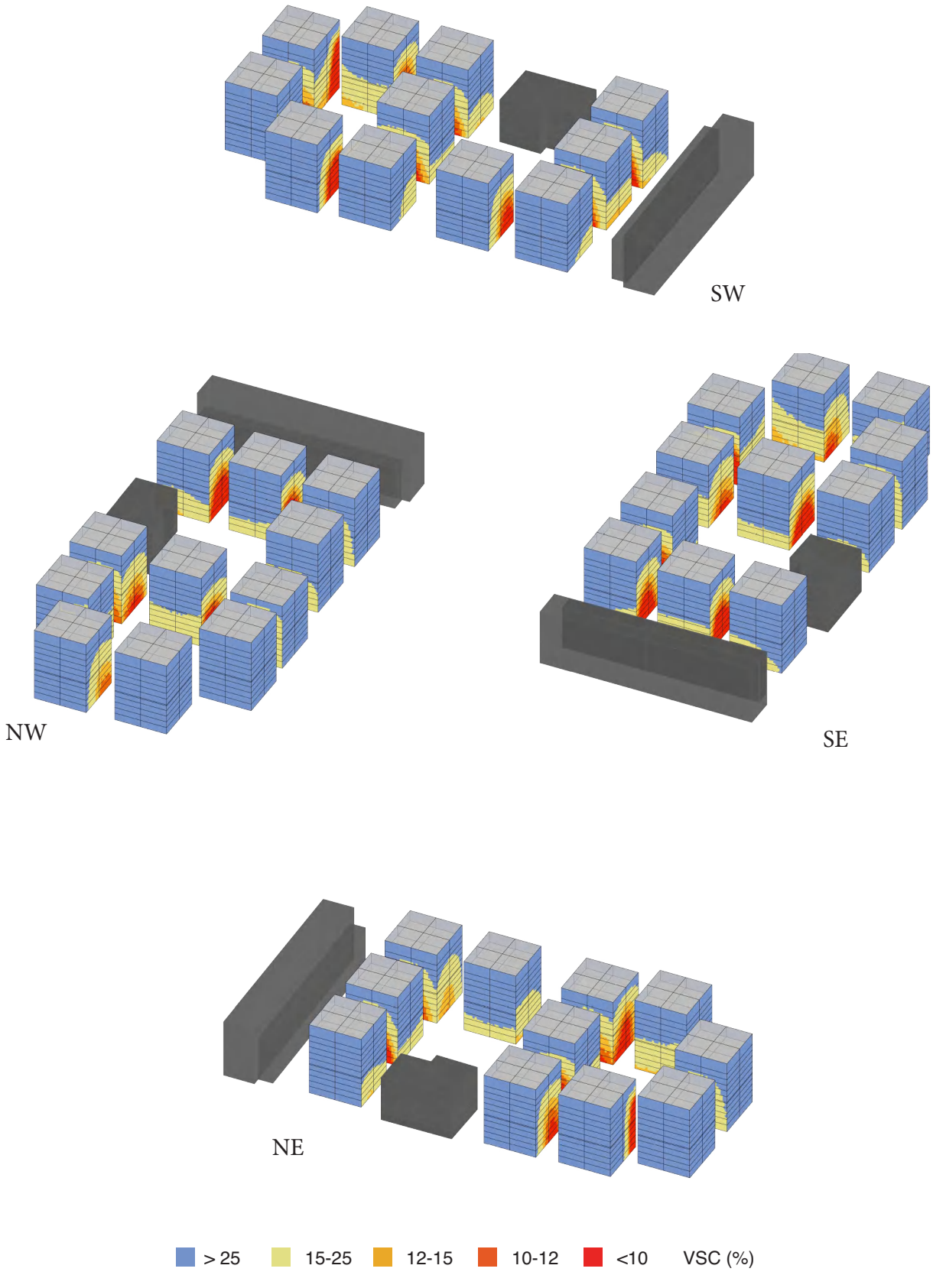
| INDICATOR | MEASUREMENT | RECOMENDATION |
|---|---|---|
| PUBLIC SPACE | % Free Public Space | > 15 % park and square area |
| GREENERY | Walking Distance To Greenery | max 200 m to areas > 0.2 ha |
| PLAYGROUND | Walking Distance To Playground | max 500 m to playgrounds > 0.1 ha |
| PARK | Walking Distance To Park | max 1 km to park > 2 ha |
| GREEN AREA | % Green Area | > 50 % vegetation area in plan area |
| CROSS ROADS | Distance Between Cross Roads | 50-150 m between cross roads |
| TRAFFIC SAFETY | % Low Speed Streets | > 50 % street under 30 km/h |
| STREET SPACE | % Car Space In Street Section | max 50 % car space |
| SPACE SYNTAX | Space Syntax | overlapping room integration |
| BUILDING EXPLOITATION | Exploitation Number | > 1.0 in plan area or > 2.0 in plots within 500 m to a public transport |
| MIX OF FUNCTION | Amount Of Residents / Bta | 30-70 % location area in plan area |
| SIZE OF ESTATE | Area Of Plot | < 2000 square meters |
| ENTRANCES | Distance Between Entrances | < 15 m  between entrances along facades |
| STREET LOCATIONS | Locations In Ground Floor Along Facades | > 75 % of ground floors along main streets |
| COURTYARDS | Area Of Courtyards | > 1500 square meters |
| GREEN AREAS | % Green Areas Per Block | > 50 % green area / block |

plan area  traffic area  block/plot area  abc  done in programme/not relevant for further work

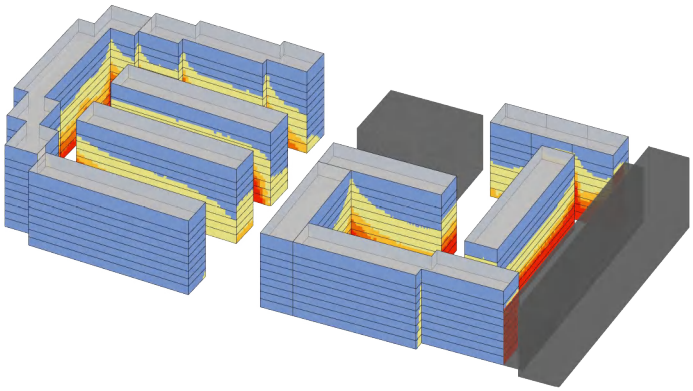
APPENDIX 2a
Iteration 0 - additional model visualization



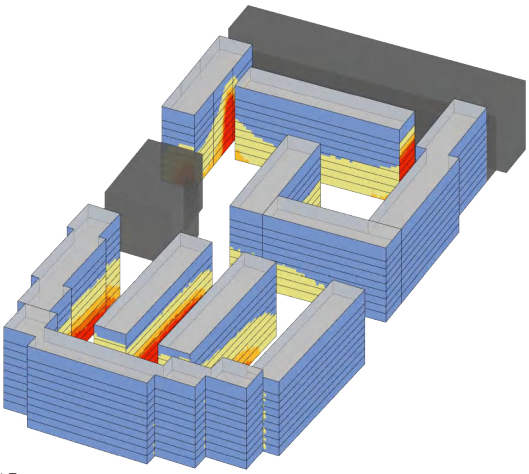
APPENDIX 2b
Iteration 1 - additional model visualization



APPENDIX 2c
Iteration 2 - additional model visualization



SW



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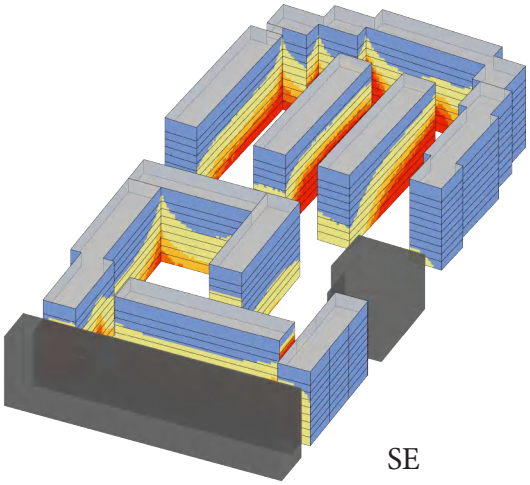
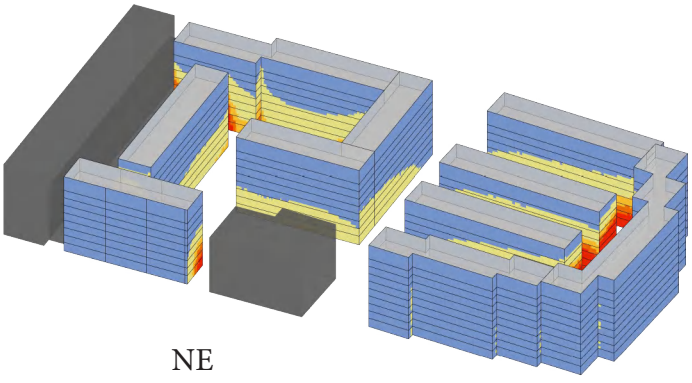
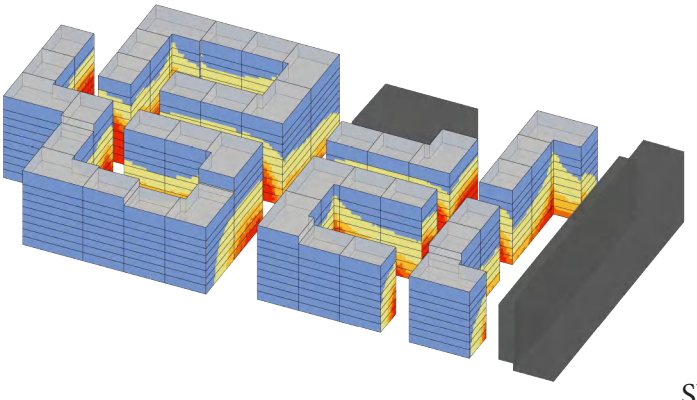


SE



NE

APPENDIX 2d
Iteration 3 - additional model visualization



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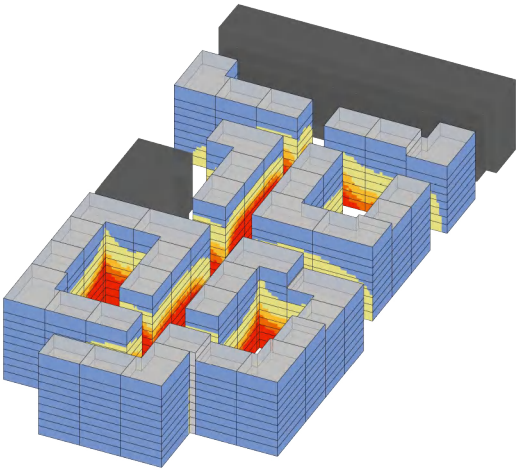

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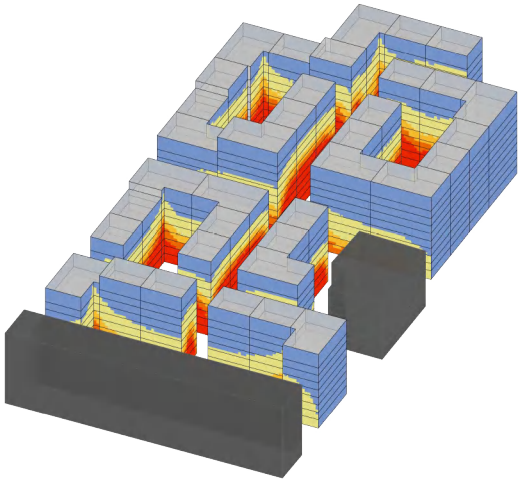

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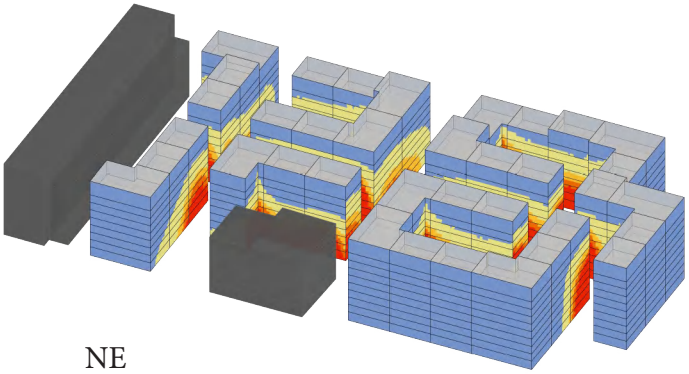
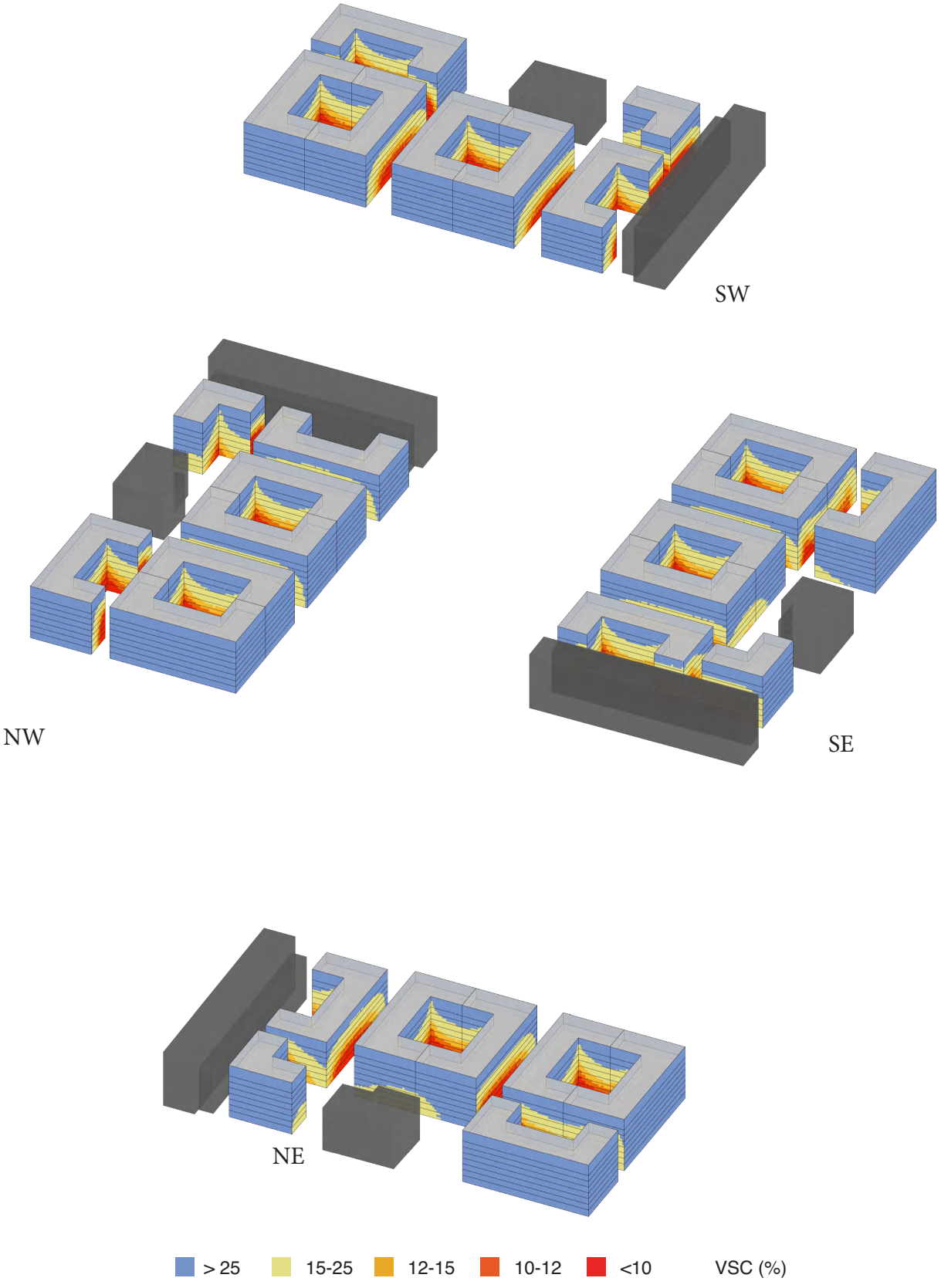


NE

APPENDIX 2e
Iteration 4 - additional model visualization

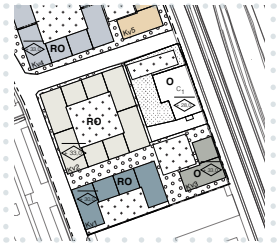


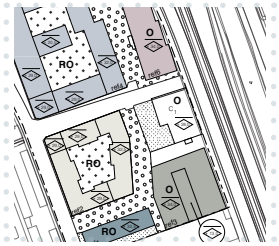
APPENDIX 3
COMPOSITIONS

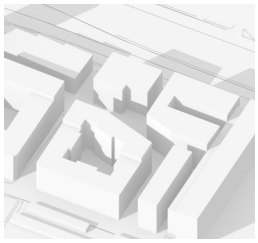
# THE INNOVATION PROCESS

VISION

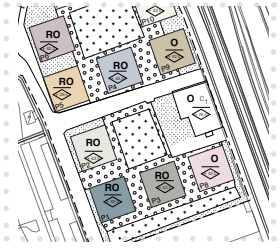




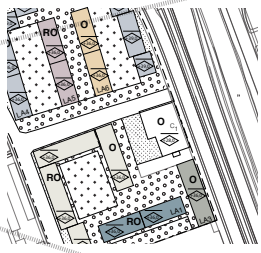




SKILLS

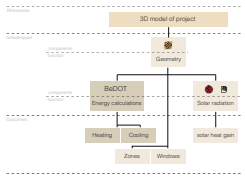


INCENTIVES

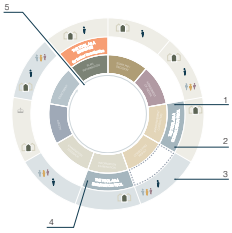




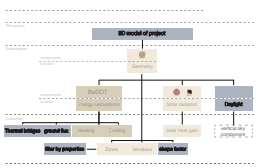


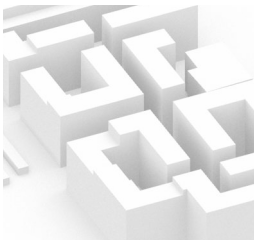


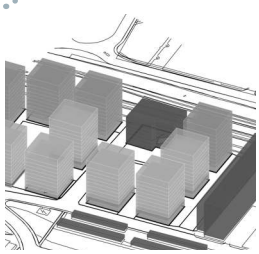

RESOURCES

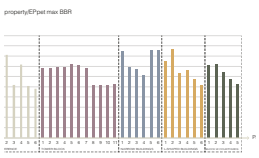


ACTION PLAN

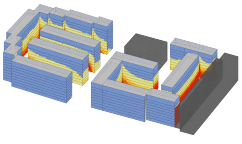


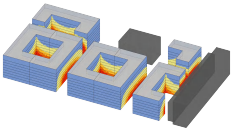






OUTCOMES





# THE DEVELOPED PROCESS