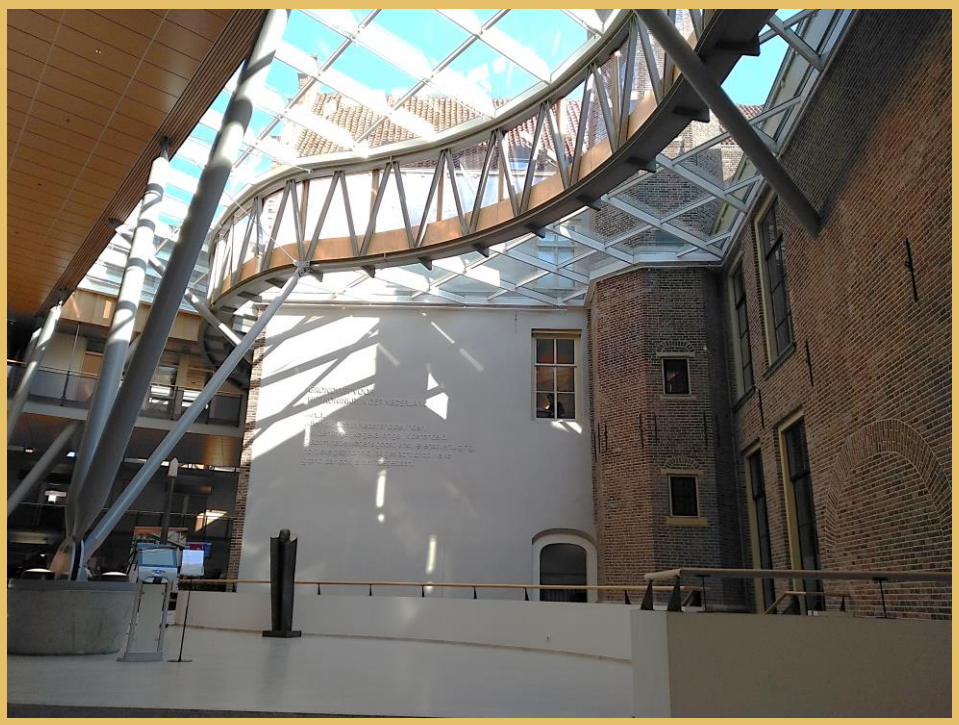

How public real estate sets the stage towards a sustainable future

A research into the facts, possibilities, and challenges of sustainable real estate strategies for municipalities in the Netherlands

Colophon

Graduation master thesis

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Preface

This report is the translation of my graduation work for my master track Management in the Built Environment at the Technical University of Delft. The last nine months were dedicated to my research, where I looked at the facts, possibilities, and challenges municipalities face when making sustainable real estate strategies.

Looking back on the process, it was a long journey where you had the feeling that you could dive into one subject and could fully explore your field of interest. At times graduating can be challenging. However, I hope that this thesis shows some light in the world of municipal real estate management. I also hope that the message came across to be more sustainable, not only for municipal real estate management but in the whole real estate sector. Furthermore, this thesis shows that being sustainable is not only a revenue model to add value for businesses, but that it truly matters for users, society, and further generations.

There are several people I would like to thank for guidance and mentoring. My first thanks go out to my supervisors form the TU Delft, Alexandra den Heijer and Laure Itard. I want to thank Alexandra for her positive approach and in-depth conversations about the importance of public real estate. It kept me motivated through my graduation process. Secondly, Laure, you helped me grasp the complicated world of sustainability, from giving feedback to help frame sustainability into my research.

I also would like to thank my colleagues at Twynstra Gudde, who made me feel welcome and where I could experience the world after graduation. With special thanks to Wicher Schönau, you gave me this opportunity, for which I am grateful.

Lastly, on a personal note, I would like to thank my friends, roommates, and family that gave me feedback and at times and could help me distract me from the routine that graduation can entail. Thank you all!

Nienke Hakenberg

Delft, July 10th, 2019

Executive Summary

Introduction and research question

When looking at cities and countries, most people value and explain cities through their public buildings. When recently the Notre-Dame partly burnt down, it became once more evident what impact such buildings have for society. Therefore, it is also a touchy subject because the community feels connected with these buildings. So, public entities have to implement the right public goals to create meaningful and sustainable public environments. A professional approach toward PRE is vital to be able to comply with the regulation to become CO_2 neutral in 2050 and set an example for the rest of the country.

Municipalities are aware that professionalizing their real estate management is necessary to become CO_2 neutral before 2050 and that it even can create cost reduction and can add value in the long term. Many municipalities are now working on a specified portfolio identification while maintaining this portfolio. Some municipalities are ready to think about how to change their portfolio into one that is almost CO_2 neutral. However, there are also municipalities that are struggling due to the lack of (energy) information of their portfolio and choosing the appropriate tools to help them achieve their goals. Some municipalities do work on the sustainability goal as seen at the benchmark of 2017, but here is also evident that around 25% of the public building stock is still categorized at label G, the worst label.

So, the Dutch government, national and local, are setting goals to be CO_2 neutral in 2050 conform the Paris agreement, but the implementations of these goals are not precise and seen in municipal real estate management.

This thesis will identify what the barriers are for this problem and how municipalities best can decide to implement a particular sustainable strategy tool. This strategy can be made based on the added value that MREM can create namely: **user satisfaction, financial policies and political goals** that later can be specified in the DAS Framework with categories such as the typologies in the portfolio, current energy consumption, finance and other factors of the buildings and its management.

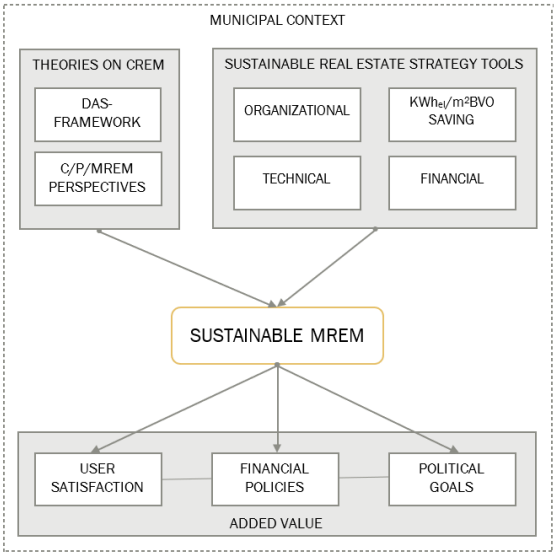
Based on the literature review and the societal and scientific relevance, the aim of this thesis can be condensed to the following:

> ***The aim of the research is:***
> To provide insight into the facts, processes, possibilities, and challenges of sustainable strategies for municipalities to create an energy neutral real estate portfolio and given this national goal, provide a road map for municipalities.

Through this aim, the input of the road map is the main research question that needs to be answered will be:

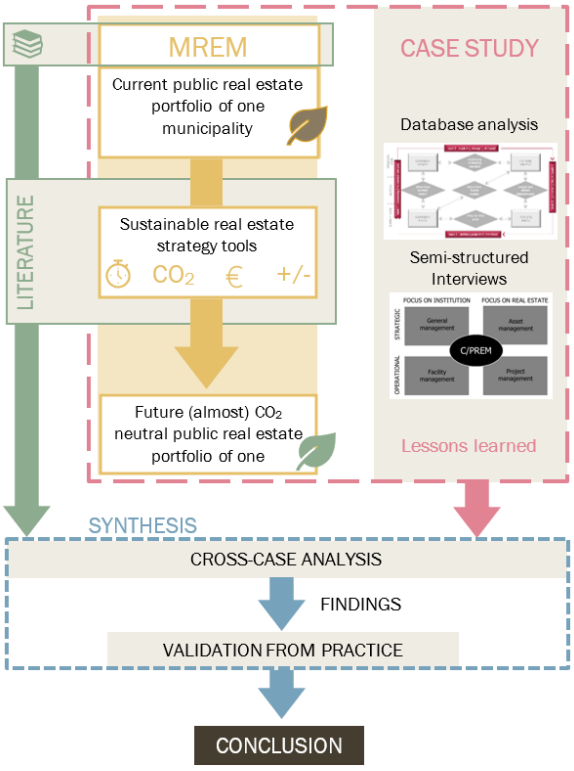
> ***Main research question:***
> What sustainable real estate management strategy tools are available at a municipal level, and how do municipalities need to apply these strategy tools to create a public real estate portfolio that is energy neutral in 2050?

The main research question can be displayed in a conceptual model. The conceptual model shows the input that municipal real estate management can use in the municipal context to create the added value. In this thesis, the added value is to have an energy neutral municipal real estate portfolio in combination with the financial policies and user satisfaction. The sustainable real estate strategy tools are being measured in the four indicators. These are the timeline with interventions in terms of governance and technical measurements, with its savings and financial structure.



Conceptual model

Methods



Research design

The research design seen on the left derives from the conceptual model. The basis of this research is to indicate that in the input (public real estate), with an added throughput (sustainable real estate strategy tools) can create an added value to the portfolio. The focus for this research is the added value in terms of political goals and how this is balanced with the financial and user goals. This framework will be used to structure the literature study as well as the case study.

The literature study will focus on the context of municipal real estate management and the sustainable municipal real estate tools to help with the strategy. The case study will also do this with the addition to structure the data in the DAS Framework and use the C/P/MREM perspective to see the organizational dynamic. Both conclusions will be synthesized in the cross-case analysis with the same indicators. After this, the findings can be drawn that further will be strengthened with examples from practice.

The end conclusion will answer the main question and sub-questions. The recommendation of this thesis will be a roadmap for other municipalities to guide them when making a sustainable real estate strategy.

Theoretical Framework

Municipalities operate in a dynamic environment, and municipalities are diverse in terms of real estate, but also size, location, and political preferences. Therefore, governance is a fascinating factor in making municipal real estate energy neutral. As seen in the literature, the public sector is more working with new public governance to optimize the performance output. In the real estate department, the same trend is seen to professionalize the department.

Municipalities can use current theories for MREM. This can be the C/PREM model to structure perspectives and can give an overview of the added value for the organization and its real estate. The DAS-Framework structures the strategy a municipality can take. This can be used to make a structured plan when making a sustainable strategy. Lastly, the Joroff ladder can place the municipality in a level of competency. This shows the global steps a real estate department needs

to take to become a strategist. Therefore, it can solve the questions like creating an energy neutral building portfolio.

Looking at the sustainable strategy tools, it came evident that about 50% of the municipalities use a type of DMOP. This strategy is quite general and widely applicable for a lot of municipal buildings. It includes aspects of energy, finance, and maintenance, and many other decision-making factors municipalities need to consider becoming energy neutral. In a DMOP, other strategy tools can be combined. A different strategy direction is using contracts like energy performance contracts with ESCos or general performance-based contracts with maintenance companies. These contracts are particularly interesting when the municipality has a clear goal that they can specify in KPIs and when there is not enough in-house experience on the subject. However, setting up such contracts, enough expertise should be available. When using ESCos or performance-based contracts, municipalities can keep the desired control and risk over the portfolio. However, these contracts can also be inflexible due to the duration of the contract type. There is also the option to outsource the making and implementing of a sustainable strategy. When choosing this path, municipalities do not have to provide any input.

There are a lot of available tools for municipalities to measure and control the sustainability and energy consumption. Municipalities can use performance-based contracts to ensure the specific performance of a portfolio or building. However, the most common in-house tools that are used by municipalities are GPR gebouw and VastgoedMaps, about 50% of the surveyed municipalities use these tools. VastgoedMaps can be measured in BREEAM_NL In-Use, GPR gebouw, and EPA-Maatwerkadvies. In those cases, the municipality can execute the strategy themselves with the technical staff or use sustainable tendering to select the right external party.

The cases

For this thesis, the type collective/multiple case study is used where there is a focus on municipalities that are working on making their real estate sustainable. It was previously founded that bigger municipalities are more likely to have a more professionalized real estate department than smaller municipalities. Therefore, purposeful sampling was used to create variation between the population's size of the municipalities This difference can give more insight into the position a municipality can be in when making and executing a sustainable real estate strategy.

Data collection

The sustainable strategy tools that have been emerged in the theoretical framework are being tested with the selected cases. This includes analysing the case study database and conducting semi-structured interviews. The DAS-Framework will be the structure in the semi-structured interviews and database research. The themes of the interview derive from the four steps in the DAS-Framework, namely: Assessment of the current portfolio, exploring the changing demand, generating future models, and the definition of projects to transform. By doing so, the process can be tracked and observed why and how the sustainable strategy tools were used.

Findings

The cross-case analysis compares the literature on the added value with the two cases. The findings showed that the base of the literature and the cases are similar. Both cases made it clear that having the right information about the current portfolio is crucial to make a suited strategy. Secondly, the cases also know the changing demand. This was made clear through coalition agreements, trends, and upcoming national and European regulations. However, this municipal context can also sow the process down for the real estate department. The generated models are a process that one case still was working on, and the other had made a global calculation to see the impact of becoming energy neutral by 2040. Both cases did show that they do not work with one strategy but have options to adapt to the ambition or course of the strategy

when needed. This consideration is mainly based upon the financial consideration and the amount of support of the council.

Lastly, defining the projects to transform is seen to be difficult in literature as well as in the cases. Every building needs its own plan, the sustainable tools founded in the literature can be used for this step by step plan. The scheme below goes more in-depth on the step between the DAS-Framework and the case study.

	DAS-Framework	Case study
Task 1: Assessing the current portfolio	When assessing the current portfolio, it is important to identify the problems of various stakeholders; these can be specified from the CREM perspective (paragraph 2.1.3). Therefore, it needs an inventory of the current space, and the use of the space, the quality and quantity of the building portfolio.	As seen from the cases, creating and maintaining the portfolio information is for the cases, the first step in making a real estate strategy. This is in correlation with literature such as Joroff et al. (1993) and the DAS-Framework. This information is, for example, the technical state of the building according to the NEN 2767 systematics, knowing if it is core, non-core or strategic property, the energy consumption, energy labels, present smart meters, rent levels and having information about the maintenance plan.
Task 2: Exploring the changing demand	For a business, it is hard to steer on the future because the future is unknown. Dealing with this can be done by selecting a generic strategy based on uncertainty levels. One can look at how much flexibility they want, or one can try to identify the future demand to create a more fitted strategy.	Both municipalities have strong statements in coalition agreements what they want to achieve. For both municipalities, the goal is to be energy neutral before 2050. Enschede indicated this as being zero on the meter, Zutphen wants this too, but they are still exploring the concept of being energy neutral. Both municipalities were experimenting on a smaller scale with sustainability tools to experience if they want to apply this on a larger scale. Zutphen indicates that it made future scenarios that are based on the upcoming policies that are being set by the national government. Enschede also had influences based on the political environment. The real estate department strategy was also based on the political consideration to make solar panel fields or not. Enschede integrated the changing demand such as European and national energy policies in the performance-based contract. This means that the executing party is responsible for keeping the client updated about the current regulations.
Task 3: Generating future models	Combining task one and task two, one can look at a possible solution. When doing this, the mismatch should be resolved. During this process, the stakeholder's perspective needs to be kept in mind.	Both cases showed that the council members eventually make the selection when choosing the strategy. Zutphen indicates that they made future scenarios based on a low, middle, and high ambition. Eventually, their choice directly correlates to the financial possibilities they have. Both cases indicate that the investments to go to an energy neutral building portfolio will probably have an unprofitable top. Also, both cases are looking when making investments in terms of the total cost of ownership.
Task 4: Defining projects to transform	The last task is to make a step by step plan. It describes the adaptation of the current supply in the future supply. A financial plan and a schedule accompany this plan. The DAS-Framework use the six scenarios of Vijverberg to indicate what can happen to a building. This is consolidation, expansion, conversion, redeployment, sale, and demolition.	Both cases have not a structured step by step plan for their whole portfolio to become energy neutral. Enschede decides for their maintenance to have a performance-based contract with also KPIs for energy reduction. When comparing the overall strategy to Vijverbergs scenarios, both cases first focus on selling non-core buildings, then they look at the maintenance plans of the buildings. From this perspective, they consolidate or convert what can be done in natural interventions points in time.

Validation

The two cases from the case study where cross cased analyzed with the subjects of the theoretical framework. From these findings, the motives and reasoning for the chosen tools where found. It also showcased the obstacles and enablers municipalities face when making a sustainable real estate strategy for their portfolio. To validate the findings even more, the two main cases are compared with experiences from practice that used the same tools that were identified from theory.

Conclusion

We can conclude from literature and case studies that there are special contracts, approaches, and guidelines municipalities can use to make their building portfolio energy neutral. However, there is not one uniform tool that can entirely transform the total building portfolio. So, the strategy tools need to be used for the right buildings at the right time with the right expertise and information. This approach needs to be in balance with the three added values of MREM, namely: political goals, financial policies, and user satisfaction. The considerations to set the pace of the energy transition is predominately based upon the financial possibilities, the amount of support of the council, the physical context, and the professionalization of the real estate department. The DAS-Framework and four C/P/MREM perspectives, used in the approach of the case studies, can help municipalities to structure and balance the values of the organization when making a sustainable strategy.

Recommendation

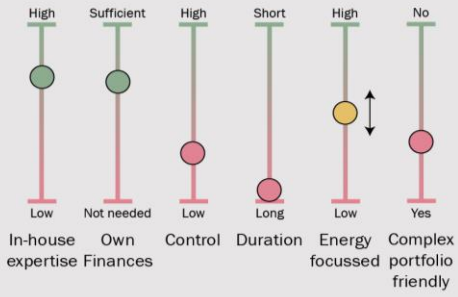
The scheme below shows the baseline the real estate department must have and a guideline to make their personal sustainable strategy. These steps can be seen as a recommendation for other municipalities to consider when making their strategy. This road map made use of the DAS-Framework. Each box indicates the reader were to think of and what to do for each added value in the four tasks of the DAS-Framework. Lastly, the sustainable strategy tools are positioned in a small assessment model to give a global direction to the tool that can be suited for a municipality.

The baseline for the roadmap

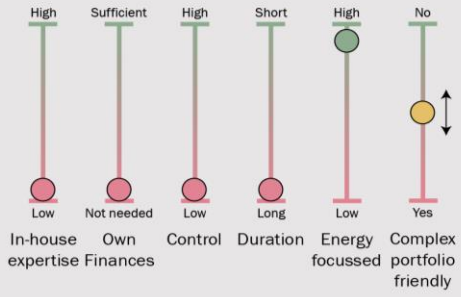
The professionalized real estate department	Energy information up to date	Decide what are core/non-core and strategic objects	Comply (if necessary*) to the activiteiten besluit wet millieubeheer	Comply (if necessary*) to the EED audit	Have internal support for making real estate energy neutral
Yes →	Yes →	Yes →	Yes →	Yes →	Yes? Go to the road map
NO? Consider if this is necessary for future demand. If so, make a start with the points made in this baseline and start a department with or without consultation of an external party.	NO? Install smart meters (when you have ≈75 or more buildings) Moreover, make an inventory of energy consumption.	NO? Look in policy documents what will be necessary for the coming years and consider the status of the building. This can be measured, for example, in NEN2767.	NO? Make a plan, with or without the help of external parties before the first of July 2019. *For municipalities that consume 50.000 kWh or 25.000 m^3 gas a year.	NO? Make every four years an Energy-audit report to comply with the regulations. *For municipalities with more than 250 FTE's or have yearly revenue of 50 million with assets more than 43 million.	NO? Try to convince other departments, with support of the Aldermen, why this is necessary. Be transparent about the interventions you want to do and let other stakeholders think along to create synergy.

DAS-Framework	Political goals	Financial policies	Enablers	Pay attention to
Task 1 Assessing the current portfolio	Comply with the current regulations and have up to date building information, also know what your core and non-core buildings are.	Create support in the municipal organization and know the current energy expenses of the building portfolio.	Have a professionalized real estate department that is operating as strategist.	Buildings such as swimming pools and monumental buildings can be challenging.
Task 2 Exploring the changing demand	Think in trends and upcoming regulation. Envision the future of the organization. Define how you want to be energy neutral.	Know what financial instruments you have at your disposal, such as subsidies and revolving funds.	Explore what can be a possible innovation for your building portfolio.	The political debate can slow the process. As a real estate department, take control of your route in becoming energy neutral.
Task 3 Generating future models	Think in phases, TCO, KPI's and ambitions levels to optimize the portfolio. Test the strategy on a smaller case if needed.	Balance the political goals with the budget and make financial scenario with the right split incentives and subsidies.	Think if the municipality can create synergy with the surrounding.	Be aware of the different stakeholders when weighing and selecting the right projects.
Task 4 Defining projects to transform	Decide what sustainable tool(s) fits best in the portfolio to become energy neutral.	Think in payback time and create a clear overview of the long term expenses.	Have experienced parties to execute the interventions for the buildings.	Try to find the positive in the transition and think in opportunities instead of seeing it as a liability.

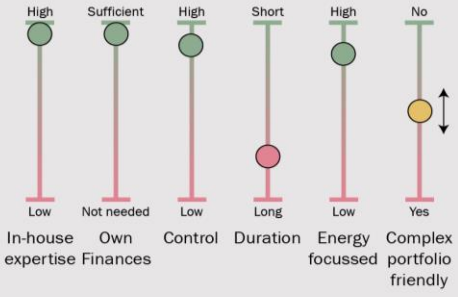
THE FIVE SUSTAINABLE STRATEGY TOOLS



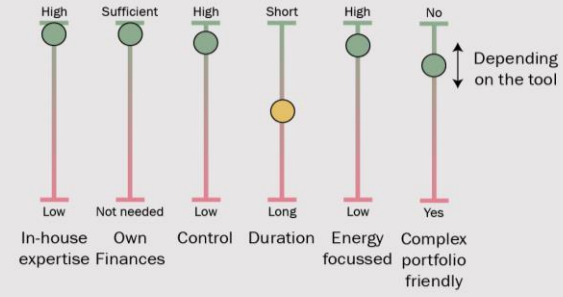
Performance-based contracting



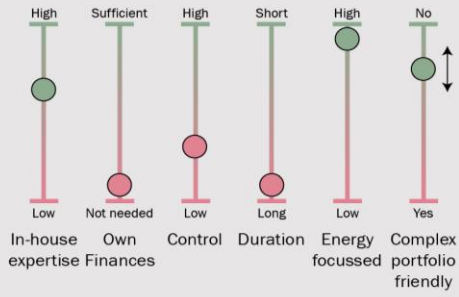
Total outsourcing



DMOP (sustainable multi-year maintenance plan)



In-house (Using software tools) with sustainable tendering



ESCos (With energy performance contracts)

Table of content

Abbreviations

CREM = Corporate Real Estate Management

MREM = Municipal Real Estate Management

PRE = Public Real Estate

PREM = Public Real Estate Management

RE = Real Estate

RVB = Rijksvastgoedbedrijf (government real estate company)

1 Introduction, research question, and methodology

1.1 Reasons for this research

Public real estate is diverse and unknowingly holds a deep place in people's lives. In public buildings, people could have been born, have met their other half, explored their interests in school, gained knowledge, made friends etcetera. Managing these buildings are not the primary task of the institutions that use them, but doing right, they can add much value to an organization. When done wrong, the public's opinion is easily made. For example, when there is exceeding costs as seen in Rijksmuseum in Amsterdam (fig. 1) or when it lacks quality seen in the Polak-building of the University of Rotterdam where the floors were unsafe (fig. 2).

So, public entities have to set an example to themselves and society. Therefore, it needs to take responsibility to implement public goals that can result in meaningful and sustainable public built environments (Den Heijer, 2018).

Figure 1: Rijksmuseum in Amsterdam

Figure 2: Polak-building in Rotterdam

Nowadays the need for a professional approach towards PRE is once more vital to react to the political policy that is set by the Netherlands to reduce the excess CO_2 emission in 2050 by 95% compared by the reference year 1990 (VVD, CDA, D66, & Christenunie, 2017). This reduction is conforming to the Paris agreement, but it also complies to the wishes of the users and other political goals. More recently, this agreement was debated in six climate tables. It eventually changed into a climate agreement and a bill that has recently been passed by the States-General (Klimaatakkoord, 2018; NOS, 2018; Nu.nl, 2019).

1.2 Problem area

The focus in this research will be about Public Real Estate (PRE) and managing it towards a sustainable future. Before doing this, there needs to be a look at the facts, current state, and the challenges for municipalities to see where the problem lies.

1.2.1 What is public real estate (PRE) and public real estate management (PREM)?

PRE is real estate that is owned by the government. CBS (2018) indicates government as *"The whole of the State, the provinces, the municipalities, the partnerships under the Joint Regulations Act, the water boards, the public-law business organizations and institutions that are controlled and mainly financed by organizations as mentioned earlier."* These governmental bodies use real estate by themselves or rent it out to social institutions to help to facilitate their social goals.

Van Leent (2012) makes a distinction between public real estate and social real estate. In the Netherlands, social rental dwellings are created by housing associations with a social purpose to ensure accommodating everybody in homes, but these associations do not directly work with public money. Social rental residences, as well as jails, will not be categorized as public real estate because not everybody can enter these buildings freely. Therefore they are not seen as public even though they get (financial) support from the government.

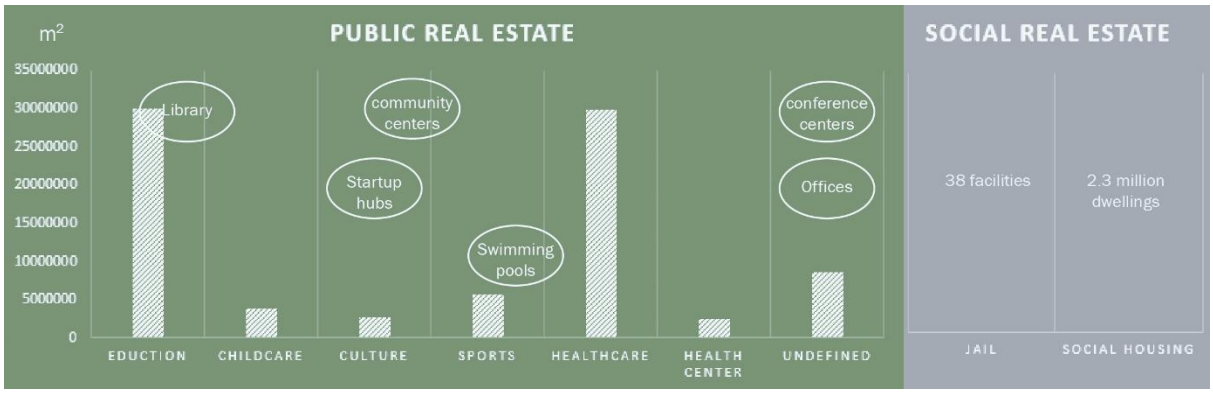


Figure 3: Public real estate with examples, social real estate in square meters. Own image, adapted from (Bouwstenen voor Sociaal, 2011; CBS, 2018b; van Leent, 2012)

In the Netherlands, the estimated amount of public square meters was indicated to be 40–47 million twelve years ago (Teuben & Waldmann, 2007). In 2011 it was already estimated to be 83,4 million square meters and accompanied by housing costs of 14.3 million euros a year (Bouwstenen voor Sociaal, 2011) (fig. 3). If we look at the estimated value of public real estate of the government, this was expected to be 89.917 million euros in 2010 (Veuger & van den Beemt-Tjeerdsma, 2017).

So, looking at these statistics, PRE is investigated, but current and exact numbers are missing. What is evident is the large number of square meters that PRE holds. Comparing the square meters of PRE, PRE is larger than the whole office market and retail market in the Netherlands combined (Bouwstenen voor Sociaal, 2011).

There is a shift made in managing the public real estate, also known as Public Real Estate Management (PREM). In this thesis, the definition of Public Real Estate Management of Van der Schaaf (2002) will be used:

"Public Real Estate Management is the management of a government's real estate portfolio by aligning the portfolio and services to (1) the needs of the users, (2) the financial policy set by the Treasury and (3) the political goals that governments want to achieve."

In this thesis, the focus will be on the local government, so municipalities. Therefore, PREM will be named as Municipal Real Estate Management (MREM).

PREM and MREM are the public counterparts of Corporate Real Estate Management (CREM). In the private sector, the need to manage real estate effectively is to produce the best support for the core business. Therefore, it enlarges productivity and can reduce costs. Dewulf, Krumm, & Jonge (2001) defines CREM as management of corporate accommodation to obtain the maximum added value for the business. As seen in the definition of Van der Schaaf (2002), PREM defines added value in terms of **user satisfaction, financial policies,** and **political goals.**

The government on state-level implements manly regulations and laws, but on a municipal level, municipalities are turning this into real actions and deeds. In this thesis, an analysis will be made for the municipal public real estate, because the municipalities have a direct approach, and they are prominent stakeholders in public real estate.

Therefore, when making this distinction buildings of the government real estate company (RVB) are not municipal real estate. The section education is a particular case because the municipalities are not the legal owners, that is the school board, but they do have a claim right on the buildings. This means that municipalities and school boards need to work together to adapt the school buildings (VNG, 2019). Private parties mostly own hospitals. However, there are some examples where municipalities are part owners of healthcare facilities because some municipalities consider this to be important to secure their social goals (Binnenlands bestuur, 2016).

1.2.2 Public real estate on a municipal level

When going in-depth on the public real estate on a municipal level, some details need to be clarified. As seen before, in figure three, there is a broad division in PRE. When looking at municipality Rotterdam as an example, they state in there policy documents that they economically own schools (claim right), they own marina's, parking garages, cultural and health real estate, but also offices and dwellings, gas station, sports facilities, and many more building typologies. (Gemeente Rotterdam cluster Stadsontwikkeling, 2018).

So as from 2009, this municipality made a choice, along with other municipalities, to only keep and maintain only the so-called core portfolio in which the municipality can uphold and create the social goals and programs. Therefore, they also stated that having real estate is not a goal on itself, but it facilitates the social goals of the municipality (EY Montesquieu, 2019).

Next, to this, they charge cost-covering rent for tenants of the public real estate. Lastly, Rotterdam stated that their real estate needs to maintain a minimum quality level based on the NEN 2767 system. This system measures the condition of buildings and is also commonly used at other municipalities (Rekenkamer Utrecht, 2018; Vastgoedbedrijf Enschede, 2011).

In 2016 Rotterdam still had a lot of commercial real estate (1289 objects) versus public real estate (1539 objects). So, their real estate is still not at core portfolio, but there is the tendency that more and more municipalities are being critical on their portfolio to be more productive and diminish financial risk (Twynstra Gudde, 2013). So, to conclude, divestment of real estate is not an uncommon process in municipalities. Municipalities tendency goes more and more towards only using real estate that is needed to execute their municipal goals.

1.2.3 MREM: the current situation

Municipalities are not wholly aware what is in their real estate portfolio (Rekenkamer Utrecht, 2018; Smits, 2014; Teuben & Waldmann, 2007; Twynstra Gudde, 2013). However, these reports also indicate that municipalities are working to have more insight into their real estate portfolio. According to Joroff, Lambert, & Louargand (1993), placing CREM on a ladder can indicate the phase in which it operates (fig. 4). When looking at reports of Republiq & TIAS (2017), Tjeerdsma, Veuger, & Frics, (2017) and Twynstra Gudde (2013), many municipalities can be placed on phase three of the ladder. It means that the municipalities are making inventories on the state and condition of the municipal real estate and how to act with it in the next phase, phase four. Only when the real estate management department of the municipality finalizes this phase, it can look at their portfolio on a strategic level.

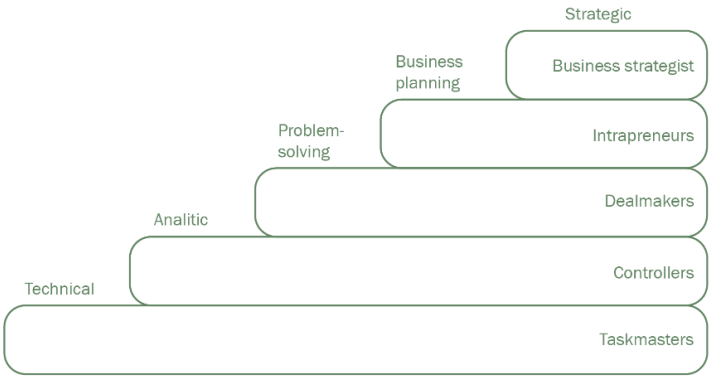


Figure 4: Corporate real estate competency shifts. Own figure based on Joroff et al. (1993)

As mentioned before, there is a diverse portfolio when it comes to PRE. Due to this reason, management can be complex. Next, to this, municipalities are having lots of primary tasks they need to fulfill and, therefore, MREM is not their core job and focus. This conclusion is also seen back in FTE's (Veuger & van den Beemt-Tjeerdsma, 2017). This results in MREM being slower in adapting than CREM in terms of innovation and knowledge (Kaganova, 1999; Smits, 2014; van der Schaaf, 2002).

1.2.4 Sustainability and PRE: The current situation

The Netherlands, along with 195 other countries, signed in 2015 the Paris agreement with the consensus to limit global warming by two degrees Celsius. The Dutch government created a national strategy to gradually reduce the CO_2 emission in the different sectors by 2030 (fig. 5). Eventually, in 2050, the added CO_2 emission needs to be reduced by 95% compared to the reference year of 1990 (VVD et al., 2017).

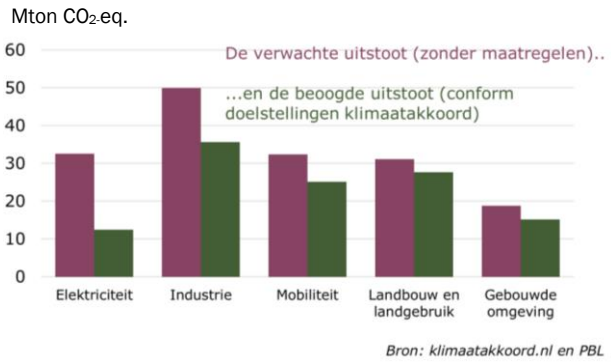


Figure 5: Climate goals per sector in 2030, expected and with goals conform the climate agreement (Financiën, 2019)

If we look at the documentation of the Dutch government, they stated that there is a considerable energy saving of 450 million euros of energy costs possible in public real estate (Agentschap NL, 2013a).

Agentschap NL (2013a) also indicates that municipalities do not know where to start and how to incorporate sustainability into their MREM. More recently, in the annual Social Real Estate Barometers of Beemt-Tjeerdsma and Veuger of 2017, it was mentioned that 31% of the municipalities that responded on the questionnaire only 21 % are working on a public real estate sustainability policy.

As of January first, 2019, new regulations in The Netherlands made it already compulsory for new government buildings to be almost energy neutral when applying for an environmental permit. For other residential and non-residential buildings, but also self-regulating public buildings like schools and hospitals, this is compulsory as of January 2020 (Rijksdienst voor Ondernemend Nederland, 2019a). However, what about the existing stock? Most of the buildings that we will use in 2050 are already build. The shift from these buildings towards energy neutral buildings will be the challenge for public real estate portfolio and other non-public buildings. There are not many regulations set in stone yet. However, there is one regulation that is set for 2023, namely, as of 2023 private and public offices of 100 m^2 and more need to be at least energy label C (Agentschap NL, 2013b). Another legislation is to be as circular as possible when publishing public tenders (Twynstra Gudde, 2019) (Fig. 6).

So, on the municipal level, there is a trend to look at sustainability. However, there first needs to be a more professional approach to public real estate management to manage the real estate towards this goal (Smits, 2014; Twynstra Gudde, 2013).

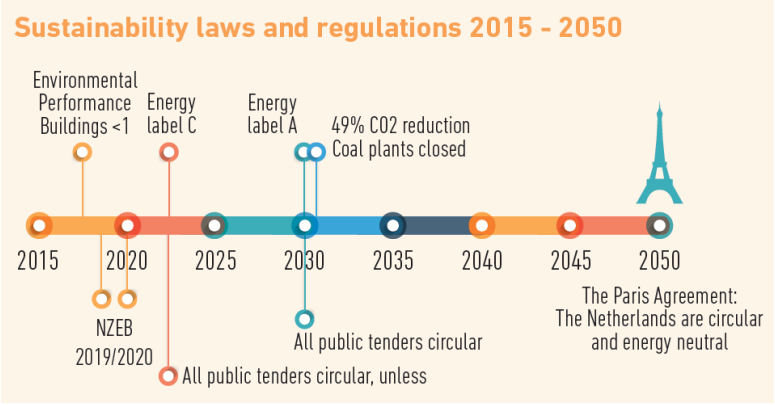


Figure 6: Timeline sustainable legislation, in red are the fixed legislation and in blue upcoming legislation (Twynstra Gudde, 2019)

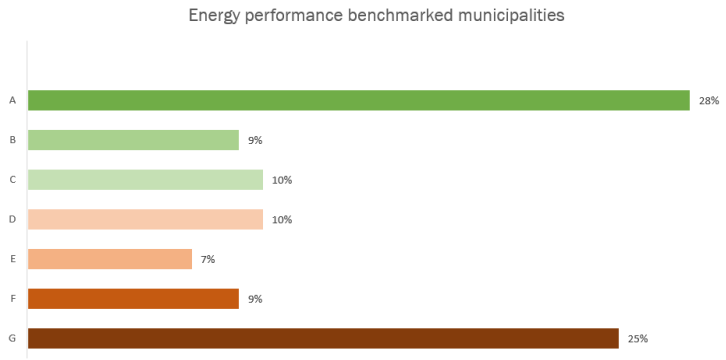


Figure 7: Energy labels of benchmarked municipal buildings (Republiq & TIAS, 2017)

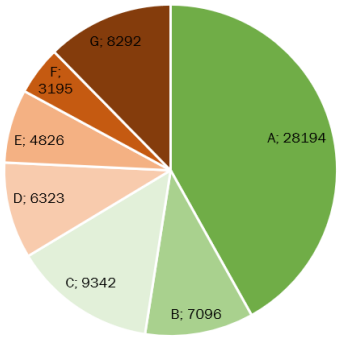


Figure 8: Nominal numbers on energy labels utility buildings (Rijkswaterstaat, 2018)

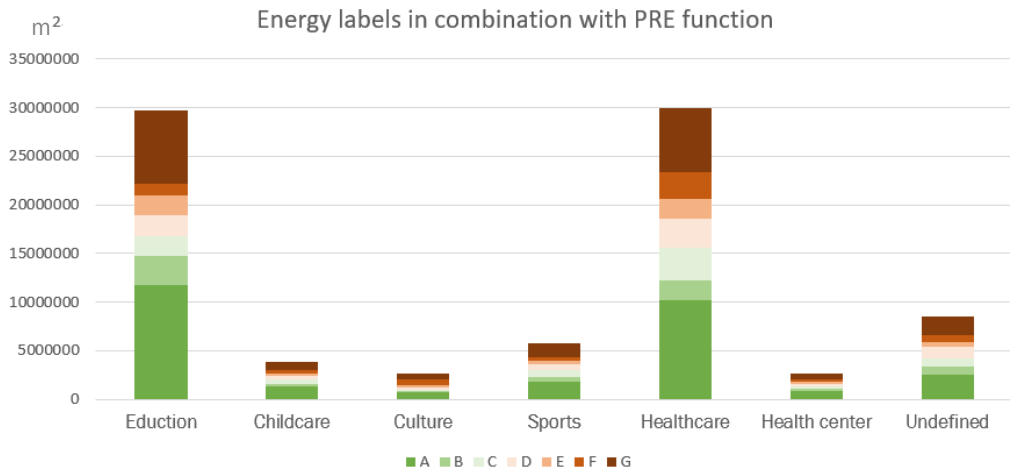


Figure 9: Square meters per function combined with energy labels. Own image based on combining the numbers of Bouwstenen voor Sociaal (2011) and Republiq & TIAS (2017*). This figure is an rough indication when we take the newer information of the benchmarked municipalities as a starting point to indicate the overall functions.*

The benchmark of Republic and TIAS of public real estate of 2017, with twenty municipalities of the Netherlands, indicates that an accurate picture of the current energy performance of the municipal real estate portfolio is lacking. Along with a good understanding of the required investment required for an energy-neutral building stock (Republiq & TIAS, 2017). The report also shows the energy labels of the real estate of the participating municipalities (fig. 7). These number are further specialized by function (Appendix A). Figure 9 is made to show the square meters per function to the energy label, with a side note that not the same function descriptions were used and that there is a general comparison made for childcare, health center and undefined. This information indicates that while 28% of the overall real estate is label A, this is counted by 25% that has label G. The numbers of Rijkswaterstaat (2018) are showing different numbers(fig. 8). Here the label G is less frequent than in the benchmarked municipalities.

However, it still indicates that there is a significant portion the real estate not in the more yet towards a label A. The square meters that have the most impact can best be found in the healthcare and education sector. However, these sectors are often not managed by municipalities.

Rekenkamer Utrecht (2018) indicated that there are goals in their municipality to reduce the energy of their real estate. However, these goals are not well formulated. Therefore, there are no clear indicators to measure the sustainability performance of the real estate. There is not yet a baseline being set on which this sustainability goal can be measured to and how the municipality wants to indicate the energy of the buildings. This same image is seen back in other municipalities (Van Den Beemt-Tjeerdsma & Veuger, 2017)

1.3 Problem statement

While municipalities are aware that they need to work on the sustainability question that impacts their public real estate, the information, and knowledge that can enable this is often not complete at municipalities. More municipalities are aware that professionalizing their real estate management is necessary to become CO_2 neutral before 2050 and that it even can create cost reduction and can add value in the long term.

Many municipalities are now working on a specified portfolio identification while maintaining this portfolio. Some municipalities are ready to think about how to change their portfolio into one that is almost CO_2 neutral. However, there are also municipalities that are struggling due to the lack of (energy) information of their portfolio and choosing the appropriate tools to help them achieve their goals. Some municipalities do work on the sustainability goal as seen at the benchmark of 2017, but here is also evident that around 25% of the public building stock is categorized at label G, the worst label.

So, the Dutch government, national and local, are setting goals to be CO_2 neutral in 2050 conform the Paris agreement, but the implementations of these goals are not precise and seen in municipal real estate management.

This thesis will identify what the barriers are for this problem and how municipalities best can decide to implement a particular sustainable strategy tool. This strategy can be made based on the added value that MREM can create namely: **user satisfaction, financial policies** and **political goals** that later can be specified in the DAS Framework with categories such as the typologies in the portfolio, current energy consumption, finance and other factors of the buildings and its management.

1.4 Societal and scientific relevance

Based on the previous market analysis and literature review, we see a mismatch between national and local sustainable intentions and the implementation of those policies into the public real estate. By identifying strategy tools and looking at the performances of these strategy tools, the energy expenses of the government can be reduced. Therefore, it helps to reduce the electricity and gas consumption primarily and thus contributes to the climate goals to not exceed the global warming of two degrees Celsius.

It provides an example for society showing that renovation towards energy neutrality is possible. Therefore, it can be an incentive for other private building owners to start transforming their homes and change their energy consumption. Besides this, having energy neutral public real estate is also beneficial for the people that use them. In many cases, energy neutral will also be accomplished through a renovation that creates better-isolated buildings, a better indoor climate. Therefore, it increases the comfort level of the people that uses them.

Scientifically, there will be new research and insight into the change in the decision-making process at municipalities. This can be extended to have more knowledge about management in public real estate on a municipal level with emerged strategies now in 2019 and beyond. By using a case study method in this thesis, the sustainable strategy tools for municipalities can be researched in real life cases to deepen the knowledge about these sustainable strategy tools.

1.5 Research questions

Based on the literature review and the societal and scientific relevance, the aim of this thesis can be condensed to the following:

> ***The aim of the research is:***
> To provide insight into the facts, processes, possibilities, and challenges of sustainable strategies for municipalities to create an energy neutral real estate portfolio and given this national goal, provide a road map for municipalities.

Through this aim, the input of the road map is the main research question that needs to be answered and is formulated as:

> ***Main research question:***
> What sustainable real estate management strategy tools are available at a municipal level, and how do municipalities need to apply these strategy tools to create a public real estate portfolio that is energy neutral in 2050?

To determine how, what, and when to use sustainable strategy tools, the following sub-questions need to be answered trough explorative and qualitative research.

1.5.1 Research sub-questions

1. *What current theories are used to make strategies for municipalities to manage Public Real Estate Management?*
2. *What current sustainable strategy tools are already available and used by municipalities?*
3. *Are there sustainability strategies tools for different building typologies?*
4. *Are there sustainable strategies where outsourcing is used?*
5. *How do financial investments affect the decision-making process?*
6. *What are the obstacles and enablers of a sustainable MREM strategy in terms of added value?*

1.5.2 Conceptual model

The main research question can be displayed in a conceptual model (fig. 10). This model is an adaptation of the input, throughput, and output model of Den Heijer (2011) for the basis of real estate management and adding value to the performance. The conceptual model shows the input that municipal real estate management can use in the municipal context to create the added value, in this thesis the added value is to have an energy neutral municipal real estate portfolio that is balanced with the financial policies and user satisfaction. The sustainable real estate strategy tools are being measured in the four indicators: These are the timeline with interventions in terms of governance and technical measurements, with its savings and financial structure.

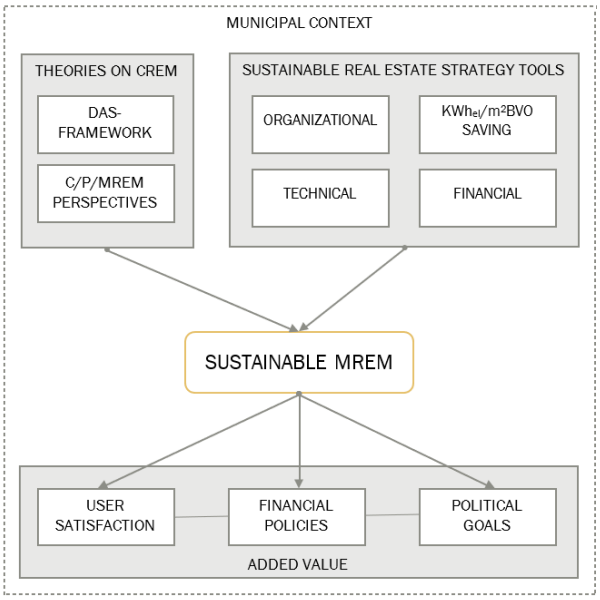


Figure 10: Conceptual model (own image)

1.6 Research method

1.6.1 Type of study

The type of study that will be used in this thesis to answer the main question and sub-questions will consist of explorative, cross-sectional, qualitative research. Qualitative research is appropriate when there has not been much research conducted in the past, or due to a lack of scientific body (Bryman, 2015). The reason for this type of research is because only some studies were conducted on municipal real estate management with a combination of sustainability, so this field of research is fairly new. Therefore, the literature research will be explorative of nature. The reason for cross-sectional research derives from the time limit of this thesis. Ideally, measuring the strategy in the coming years at municipalities would be ideal. However, due to time limitation, this study is cross-sectional to research and compare the two case studies with the literature.

1.6.2 Research design

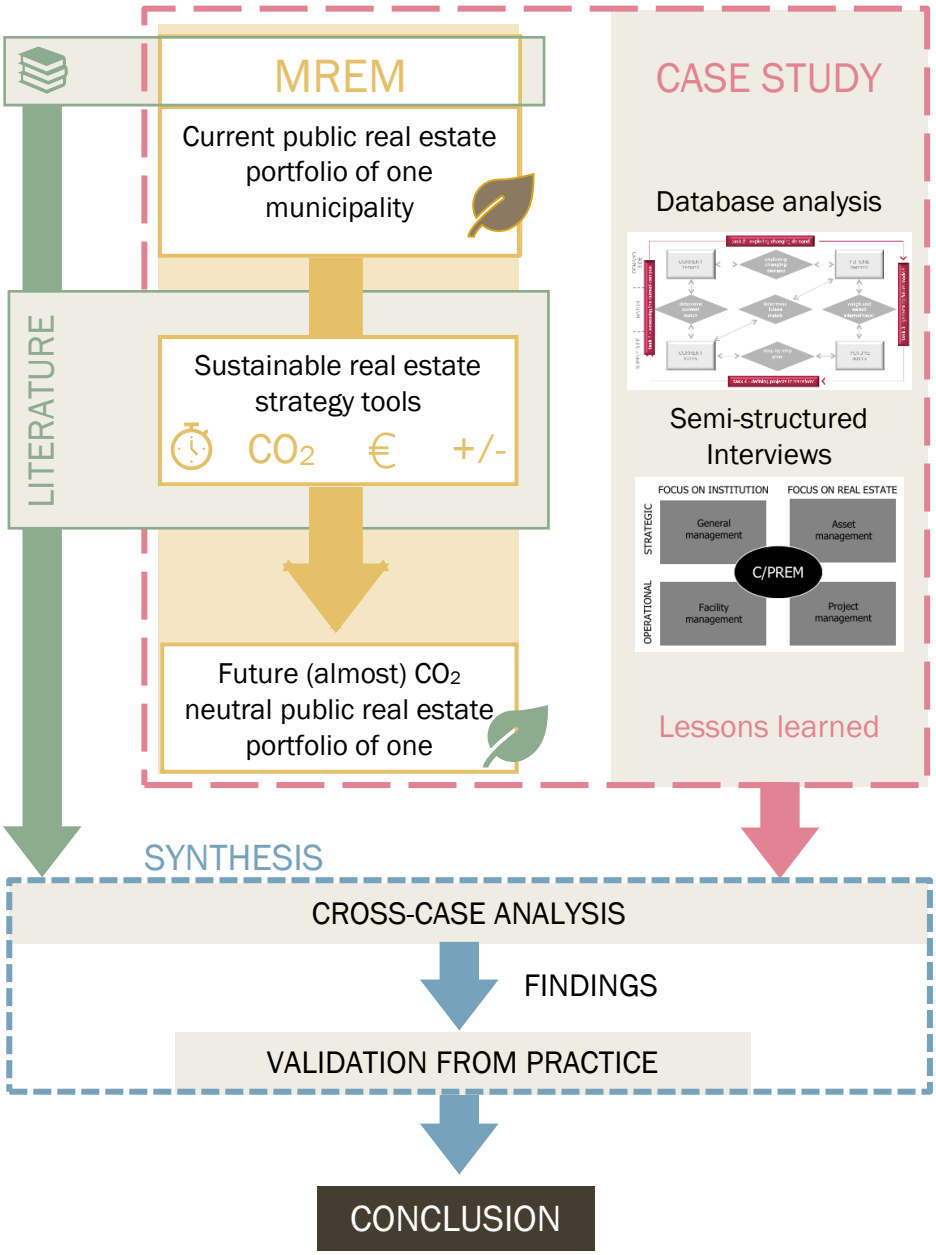


Figure 11: Research design (own image)

The research design seen in figure 11 derives from on the conceptual model (1.5.2). The basis of this research is to indicate that in the input (real estate), with an added throughput (sustainable real estate strategy tools) can add value to the building portfolio. The focus for this research is the added value in terms of political goals and how this is balanced with the financial and user goals. This framework will be used to structure the literature study as well as the case study.

The literature study will focus on the context of municipal real estate management and the sustainable municipal real estate tools to help with the strategy.

The case study will also do this with the addition to structure the data in the DAS Framework and use the C/P/MREM perspective to see the organizational dynamic. Both conclusions will be evaluated in the cross-case analysis with the same indicators. After this, the findings can be drawn that further will be strengthened with examples from practice.

The end conclusion will answer the main question and sub-questions. The recommendation of this thesis will be a roadmap for other municipalities to guide them when making a sustainable real estate strategy.

1.6.3 Literature study

The research needs information that will be investigated through a theoretical framework. This step will determine the baseline of the study in terms of the context in MREM and the strategy tools. The throughput will be defined as the sustainable strategy tools that make the added value according to the literature. So, these strategy tools identify what municipalities can use to make the building portfolio sustainable and towards the energy neutral goal. After this, the output can be specified that indicates the performance level for each studied sustainable strategy. This will then later be used as input for the case study and along with the DAS framework (1.6.6.) to create a cross-case analysis. So, the added value for public real estate is user satisfaction, financial policies, and political goals, this is translated into measurable indicators as seen below (table 1).

Icons	Indicator	Technical	Organizational
	Timeline with interventions, in terms of governance and technical measurements	✓	✓
CO_2	Energy reduction in kWh_{el}/m^2bvo (translatable to CO_2 reduction)	✓	
€	Costs/m^2	✓	
+/-	Obstacles and enablers for the added value	✓	✓

Table 1: Indicators to identify the performance level of the sustainable strategy tool based on the added value of PRE

1.6.4 Case study

Case studies are frequently used for qualitative research methodologies and are useful to look at organizational and managerial processes (Yin, 2013). In this thesis, case studies are used to test if the used sustainable strategy tools that emerged from the theoretical framework will contribute to the CO_2 neutral goal. For this thesis, the type collective/multiple case study is used where there is a focus on municipalities that are working on making their real estate sustainable. The case studies will predominately consist of semi-structured interviews and researching the case studies' database. This case study is than cross-case analysed to make the findings. The findings will be tested through experiences from practice to form an integral conclusion.

1.6.5 Case study selection (sampling)

The Netherlands counts 355 municipalities. Through purposeful sampling from a list from Agentschap NL (2013b) that had listed municipalities that are known to have a sustainable strategy and where willing to do interviews (Appendix B), a selection could be made. During this

purposeful sampling, there was also a selection made between the size of the municipality that is used for case studies. Therefore, this thesis looked at maximum variation because bigger municipalities are often more professionalized than smaller municipalities in terms of real estate. Therefore, it can get more information and perspectives out of the case studies.

The general information of the municipalities that are used for the case study are mostly public knowledge and is found on the internet. More detailed information needs to be gathered from the municipalities database on the real estate portfolio, results of the strategy, policy documents, and the municipal budgets. Lastly, the information about the experiences with the strategy will be collected mostly from the interviews. Contacting the municipalities will be done through Twynstra Gudde because they have contacts within the municipalities Enschede and Zutphen.

1.6.6 Data collection method

First, the theoretical framework will identify the context in which MREM is taking place and what sustainable real estate strategies are available for municipalities. It will give insight to the current information available for energy neutral strategies and under which circumstances these can be used. However, there is not one theory that captures this phenomenon. Therefore, this research will be more inductive than deductive.

Secondly, the information about the case study needs to be collected. This information will consist of multiple sources of data to create triangularity (Yin, 2013). Therefore, the case study database will be used, and semi-structured interviews will be held. The data will be defined in the DAS Framework with the same indicators as in the literature study (1.6.3) to make it possible to cross-compare the strategies in a later stage.

1.6.7 Data analysis method

Part 1: Within-case analysis: Database & Interviews

The sustainable strategy tools that have been emerged in the theoretical framework are being tested with case studies. This includes analysing the case study database and conducting semi-structured interviews. The semi-structured interviews with being held with experts that have worked with the overall strategy from the different perspectives of the CREM scheme (fig. 12). These will be:

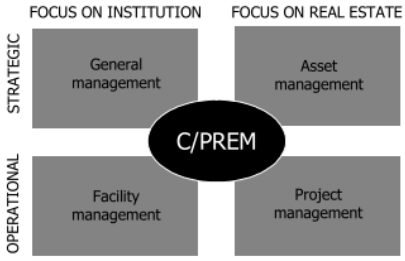


Figure 12: CREM scheme (Dewulf et al., 2001)

- Policymaker (responsible alderman)
- Portfolio manager
- Facility manager
- Project leader technical management
- Sustainability advisor (when applicable)

The DAS-Framework will be the structure in the semi-structured interviews. The themes of the interview derive from the four steps in the DAS-Framework, namely: assessment of the current portfolio, exploring the changing demand, generating future models, and the definition of projects to transform. The answers of the interview will be coded with the program Atlas.ti. In Appendix C and D, the used interview protocols are displayed.

DAS Framework

The designing an accommodation strategy (DAS) frame by De Jonge et al. (2008) is a combination of multiple concepts from diverse authors to get a complete framework to create an accommodation strategy. It is a scheme that divides four tasks (fig. 13). The first task is to describe the current status of a portfolio. This is the current demand and the current supply. After this, the current match is determined. The next task, task two, is to explore the changing demand to look at the current demand and future demand. After this, the models can be generated to make the future supply according to future demand. Lastly, the current supply needs to be

transformed into the future supply by defining the projects that can make this transformation; this is the last task, task four. The approach per step is explained below.

Task 1: Assessing the current portfolio

When assessing the current portfolio, it is vital to identify the problems of various stakeholders; these can be specified from the CREM perspective (paragraph 2.1.3). Therefore, it needs an inventory of the current space, and the use of the space, the quality and quantity of the building portfolio.

Task 2: Exploring the changing demand

For a business, it is hard to steer on the future because the future is unknown. Dealing with this can be done by selecting a generic strategy based on uncertainty levels. One can look at how much flexibility they want, or one can try to identify the future demand to create a more proper strategy.

Task 3: Generating future models

Combining task one and task two, one can look at a possible solution. When doing this, the mismatch should be identified. During this process, the stakeholder's perspective needs to be kept in mind.

Task 4: Defining projects to transform

The last task is to make a step by step plan. It describes the adaptation of the current supply in the future supply. A financial plan and a schedule accompany this plan. The DAS-Framework use the six scenarios of Vijverberg to indicate what can happen to a building. This is consolidation, expansion, conversion, redeployment, sale, and demolition.

The case study will be structured through these tasks to see the change in current and future supply and demand to see the managerial processes that are being made through time. Using the DAS-Framework, the process of the indicators can be seen through time.

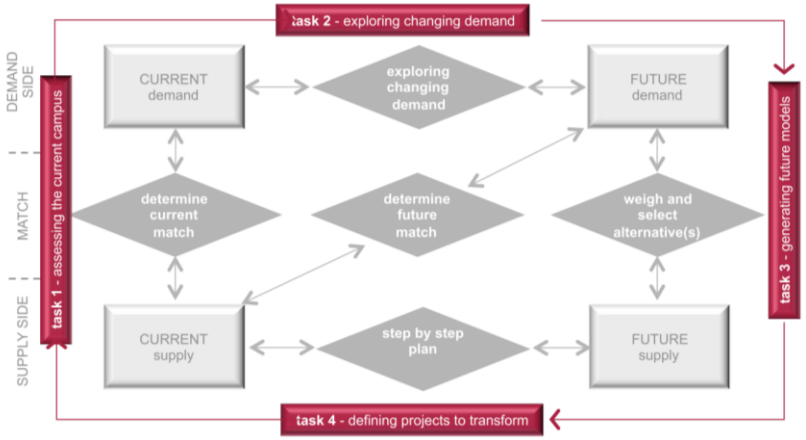


Figure 13: DAS Framework (Den Heijer, 2011a)

Part 2: Cross-Case Analysis & Validation through more experiences from practice

After analysing the two cases, the cases can be cross-analyzed. By doing this, new information can emerge to find differences between the two chose cases and the literature. The next step is to make preliminary conclusions from this analysis. This will be strengthened and deepened with experiences from a workshop event. The conclusion is made from the cross-case analysis and validations from the experiences of the mini cases, and by doing this, creating a recommendation for other municipalities shaped like a road map.

1.6.8 Reading guide

The reading guide (fig. 14) displays how the research design explained in chapter 1.6.2 will be structured in this thesis.

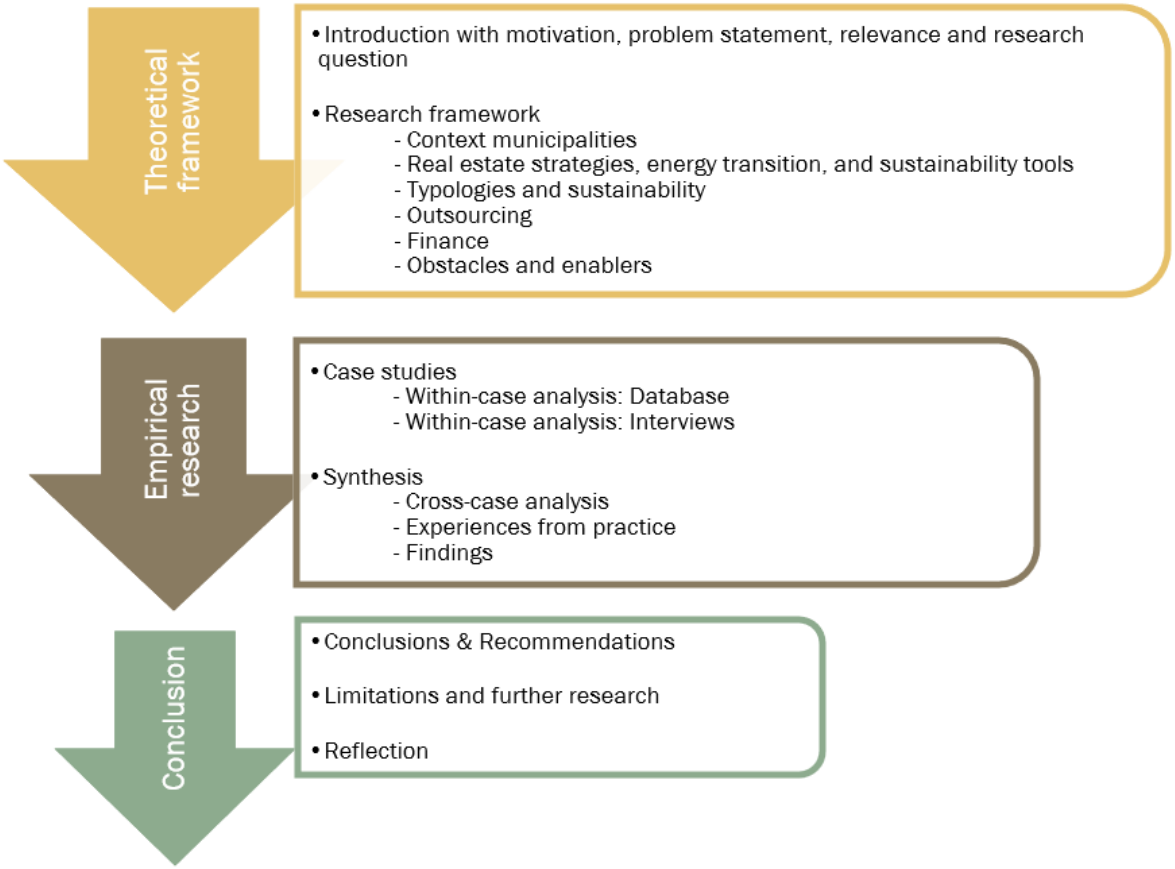


Figure 14: Reading guide (own image)

2. Theoretical framework

2.1 Context

2.1.1 Municipalities as an organization

Municipalities are in the Netherlands a part of the government. In this system, the Dutch citizens can choose a representative for the House of Representatives on a national level that controls the government policy and can submit new bills. Dutch citizens can also choose representatives for the local government; this happens every four years. Apart from the water management, all other tasks, like for example urban development, traffic and transport, education, social affairs, and implementation of the law, are regulated by the local government.

In the last ten years, the national government transfer more tasks. Therefore, the municipalities and Provincial states gained more power. On a municipal level, these tasks are the responsibilities of the college of mayor and council members. The king directly chooses the mayor on the nomination of the minister of Home Affairs and Kingdom Relations that on their turn get a recommendation from the city council of the municipality in question. The people indirectly choose council members through the local council.

So, municipalities are changing under the influences of more responsibility. They are working to professionalize their organization and facing more complicated political goals as well as professionalizing and aligning their business goals. (Smits, 2014).

2.1.2 Real estate department at municipalities

While there already was the tendency to professionalize public real estate, real progress was made in 2014 when the Dutch municipalities association (VGN) pleaded for an alderman in every municipality that will take PRE under its wings (Smits, 2014). Because of this and increasing efficiency, effectiveness, and alignment municipalities centralized the managing of the real estate portfolio. During the economic crisis, a lot of municipal land departments took many risks in development projects, but also other speculation and vacant real estate during that time made municipalities think about managing public real estate better (Planbureau voor de leefomgeving, 2014)

When looking at municipal real estate nowadays, about 70% of the municipalities are centralizing their real estate organization in their municipalities (Veuger, 2018). This centralization is often under the portfolio of one or more council members, depending on the size of the municipality.

In the real estate management triangle (fig. 15), there are three divisions made in tasks and exploitation. These levels all look and manage the same real estate, but in a different way. On an operational level, there is, for example, administrative service, on a tactical level the property will be examined on performance to look if it needs to be renovated or for instance needs to be sold. On a strategic level, the whole portfolio is being considered, and a strategic plan is formed that derives from organizational goals (Vermeulen & Wieman, 2010).

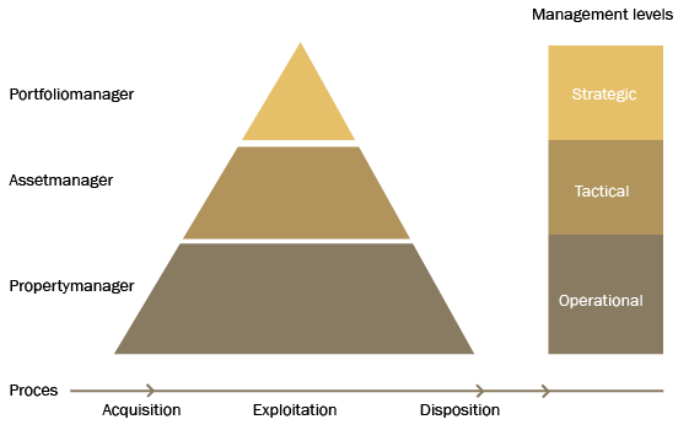


Figure 15: Real estate management triangle. Own image based on Vermeulen & Wieman (2010)

New public governance is a term that has emerged into the public sector. This type of governance is taken lessons from the

private sector in terms of output control, performance management, and entrepreneurial leadership (Osborne, 2006). Starting after World War II, there are more dynamics within the governmental organizations. As from that time, the government looked more into creating flexibility in their portfolio. This increased as from 1970, from that time on more and more buildings, mainly non-core buildings were rented from a private party. (Evers, van der Schaaf, & Dewulf, 2002).

To conclude, municipalities, so, local governments, are facing more responsibility in their tasks and are freer to implement national regulations into their policies. They are often a professionalized organization that, just like a private party, want to set goals and achieve these goals. Often the real estate tasks are centralized in the civil service. This creates more optimization and insight into this part of the municipal structure. However, the formation of a municipality can change after elections. Political aspirations and goals can change, which makes long term thinking about real estate more challenging.

2.1.3 Theories on PREM & MREM

The relation between real estate and performance is the foundations for real estate management theories (Den Heijer, 2011b). When managing real estate, the goal is to optimize the primary processes in the building and adding value to the business and focussing on demand and supply.

C/PREM perspectives

A link is seen between real estate interventions and the possible effects on organizational performance (Vries, Jonge, & Van Der Voordt, 2008). The C/PREM perspective can help to attune to organizational performance optimally. This perspective is divided into the institution and real estate focus. Furthermore, there is a division in the strategic and operational focus. De Jonge et al., (2008) stated that C/PREM could be seen from four perspectives for observation (fig. 16). It can be used for the function, the development stages, the added value, and, stakeholders. Therefore, it can be a tool to structure the interests and tasks of employers and other stakeholders of an organization.

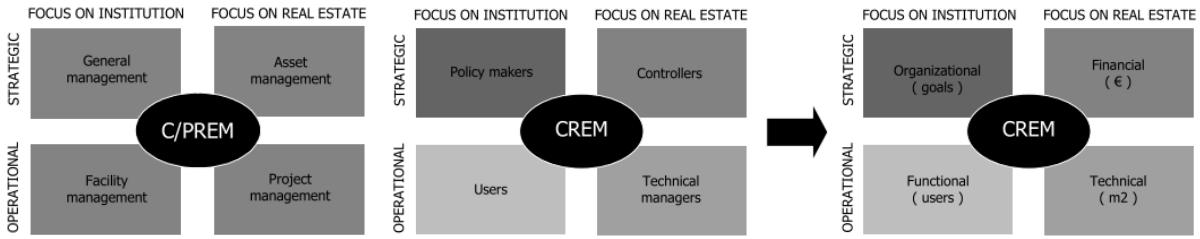


Figure 16: four domains of CREM and the various stakeholders and variables De Jonge et al., (2008)

An adaptation of Lindholm, Gibler, & Leväinen, (2006) CREM scheme can be seen in fig. 17. In this scheme, the balance between the MREM bubble and the effect on added value and the business strategy. In this case, a municipal strategy is visualized. Lindholm et al., (2006) further underlined the base principal of multiple writers that CREM can play a role in enhancing business performance. When making the real estate strategy, the DAS-Framework (paragraph 1.6.7) can be used to create a step by step plan that shapes the future supply.

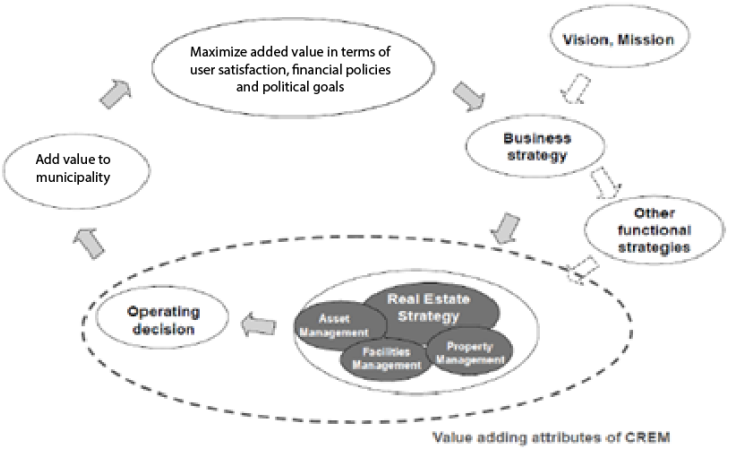


Figure 17: MREM as a Part of the organization Strategic Framework, adapted from Lindholm, Gibler, & Leväinen, (2006)

To conclude, there are several theories that municipalities can consult to structure the real estate department, structure perspectives, tasks, and can add value to the business real estate. However, these theories are more focused on corporates and are less researched in governmental bodies.

2.1.4 Legislations

Tendering

Municipalities are obliged to engage in European tender procedure when the works are over €5.000.000 and services over €200.000 (Chao-Duivis, Koning, & Ubink, 2013). These rules also apply for renovations of public buildings. Agreements between national and local governments caused that as of 2010, 75 percent of all products and services are selected with a sustainability criterion (Het Parool, 2009). This needed to grow to 100 percent in 2015. So, depending on the size of the project, some projects required to be tendered. Municipalities can also choose to tender with lower works or services. This is not uncommon to ensure that the municipalities have fairness and transparency in their choosing. From 2023 the government not only wants to tender sustainable but also circular. This legislation is currently being made.

Energy label

The law "Besluit energieprestatie gebouwen" that is valid as of 2016, made it compulsory to have a visible energy label for utility and public buildings that are bigger than 250 m². and is being often publicly visited.

Activity decision laws of environmental Conservation (activiteiten besluit wet millieubeheer)

If municipalities are consuming 50.000 kWh or 25.000 m³ gas a year, they need to make energy reduction measures with a payback time of five years. This needs to be reported before 1 July 2019 (Rijksdienst voor Ondernemend Nederland, 2019b).

Energy-audit EED

The municipality needs to make every four years an Energy-audit report when the organization has more than 250 FTE's or have yearly revenue of 50 million with assets more than 43 million. This report needs to be updated every four years (Rijksdienst voor Ondernemend Nederland, 2019d).

Offices label C

As of 2023 office building with 100 m² or more need to have an energy index (EI) of 1,8 or less, which is compatible with a label C building (Rijksdienst voor Ondernemend Nederland, 2019c), this is also seen in the overview below (fig. 18).

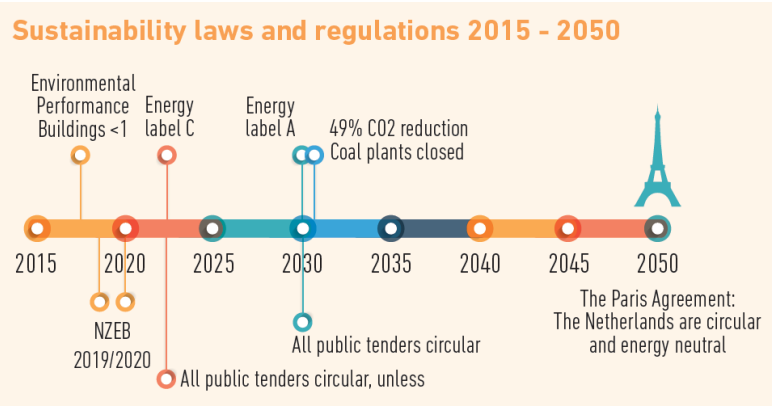


Figure 18: Timeline sustainable legislation, in red are the fixed legislation and in blue upcoming legislation (Twynstra Gudde, 2019)

2.1.5 Context conclusion

To conclude, the context of this thesis lies within the political environment. The municipalities are gaining tasks and responsibilities in a municipal environment that changes over time due to elections. About 70% have a centralized real estate organization. This can be grouped into three

management levels, strategic, tactical, and operational. This thesis will primarily investigate how this strategy works and operates in this MREM triangle. The four C/P/MREM perspectives and the DAS-Framework can organize and indicate the current supply and demand, the future supply and demand along with the needed processes between these steps.

It is seen that not many municipalities choose for total outsourcing, but sometimes they outsource parts of the management. When looking at strategies for renovating public buildings, the context of tendering need to be considered. Municipalities operate openly and transparently way, and selecting products and services are more and more heavily selected on sustainability. Next to this, there are many other energy-related regulations they need to take into consideration.

2.2 Sustainable real estate strategy tools and energy transition

According to Mintzberg (1989), general strategy-making is a fascinating process that enquires someone that understands the business and can craft a strategy. It defines the plans of the future but also sees the patterns of the past. The patterns form the past can be indicated as a realized strategy.

Mintzberg (1987) also indicated that a strategy always will be adapted through time. The intended strategy will result in a deliberated strategy but will finally, together with the emergent strategies result in one realized strategy. To compare this with the sustainable strategies of the municipalities, some did already have some sustainable strategy, but the change in context in which this intended strategy operates needed emergent strategies to set a suitable course to reach the goal that the municipality has set (fig. 19).

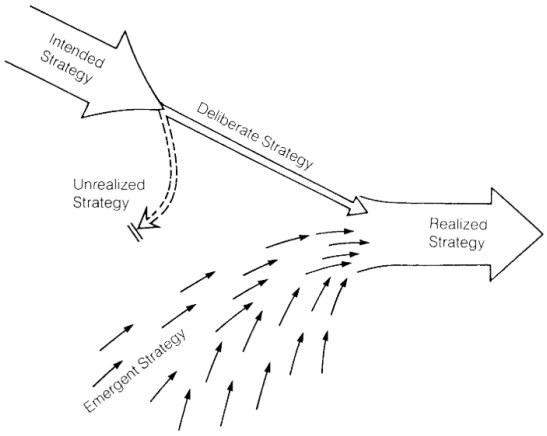


Figure 19: Intended and Emergent strategies (Mintzberg, 1987)

The effects of change, technological, economic, demographic, and environmental developments are having an impact on real estate (Dewulf et al., 2001). When managing this, there need to be making decisions on a strategic level. As explained previously, the ladder of Joroff shows the corporate real estate competency shifts. Masalskyte, Andelin, & Sarasoja (2014) made a maturity model that can assess the sustainability of CREM in a company. As seen in figure 20, a sustainability strategy only works on a tactical and strategic level. This strategy needs to incorporate resources, process, commitment, communication, finance, and strategy into one overall strategy according to (Masalskyte et al., 2014). The following paragraphs will investigate the strategy tools that municipalities theoretically have access to.

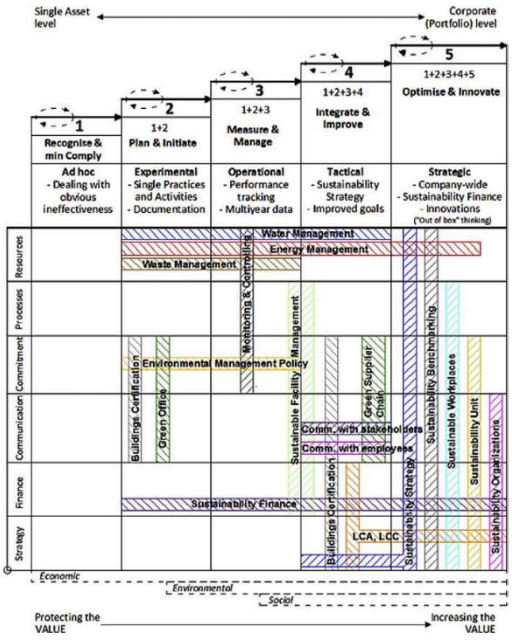


Figure 20: Initial sustainability maturity model for CREM (Masalskyte et al., 2014)

2.2.1 Energy neutral

The Netherlands has plenty of reports with sub-goals that state how to react to the 2050 goals. Solutions in the energy agenda of Ministerie van Economische Zaken (2016) stated that electricity would be sustainably generated, buildings will be heated with mainly geothermal heat

and electricity. There will be no gas used for cooking, and the Dutch government will primarily focus on the regulations that reduce the emission of CO_2 to tackle the climate goals.

As from 2019, all new build buildings of the government are almost energy neutral. Therefore, it complies with the national norm BENG. The government real estate company (Rijksvastgoedbedrijf), has a timeline of how it will comply with the federal regulations. In 2020 they want 14% of all energy of the central government real estate to be green. Three years later this is 16%, and all buildings will be at least label C. In 2030 there will 50% reduced in primary resources and the whole portfolio will be label A. In 2050 the entire building stock will be energy neutral as well the government's portfolio (Rijksvastgoedbedrijf, 2018).

However, municipalities are free to compose their strategy. They only need to comply with the 2050 rule, the BENG regulations for newly build buildings and the overall energy reduction that municipalities agreed upon of 1,5% a year (Rijksdienst voor Ondernemend Nederland, 2018). As seen in the report of Agentschap NL (2013b) and Bouwstenen voor Sociaal (2019) it is stated that many municipalities do have policy documents with ambitious plans to be energy neutral in ten, twenty or thirty years.

However, it is hard to find a suited measure. There are no standard recipes for the technical, organizational, and financial challenges to make a sustainable portfolio. Besides this, municipalities need to choose if they, or which parts, municipalities can outsource (Agentschap NL, 2013b).

The next paragraphs will be looking at the general strategy to become CO_2 neutral. Then the three most used sustainable strategies will be explained that are used by municipalities. Lastly, procedures for different typology will be clarified.

2.2.2 Three-step strategy

When looking at energy, there is more to it than the energy production and consumption. There are three steps on how to reduce energy. This also is called the trias energetica strategy (fig. 21). First, the goal of trias energetica is to reduce the energy demand of the building. In the Netherlands, 52% of energy for the public service sector goes into heating in the building (van Bueren, van Bohemen, Itard, & Visscher, 2012), isolating structures can, for example, be used to reduce the energy demand. The second step is to let the remaining energy for the building come from a sustainable source. This can, for example, be reached with a heat pump, solar panels, wind energy, and biomass. Lastly, the third step of trias energetica explains that if you must use fossil fuels, use it in the most efficiently and cleanly possible. An example of this step can be to do not use a gas boiler for the building, but you use the gas indirectly for the enabler for the turbine that generates grey electricity. In that way, you still use gas, but this gas is more efficiently used (Rijksdienst voor Ondernemend Nederland, 2015; van Bueren et al., 2012).

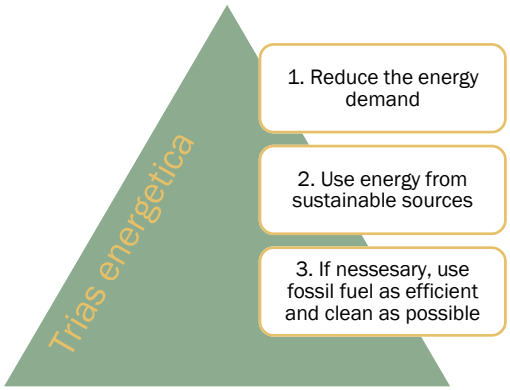


Figure 21: Trias Energetica, own image based on (Rijksdienst voor Ondernemend Nederland, 2015).

2.2.3 DMOP

As seen in Van Den Beemt-Tjeerdsma & Veuger (2017), 81% of the benchmarked municipalities have some maintenance policy. Most municipalities have a multi-year maintenance plan (MOP). Agentschap NL (2012) has created a sustainable version of this multi-year maintenance plan, a DMOP. First, they also identify that the real estate organization needs to be at a level that it is professional enough, and there needs to be enough support in the municipality itself to create a DMOP. The new barometer of Veuger (2018) shows that 50% of the respondents (75 municipalities) has a DMOP.

In the initiative phase, it needs to be determined for which municipal buildings the sustainability of the MOP could be an added value. Buildings that are used and heated, have an energy label of C or lower and are kept for at least five years are allegeable. Critical factors of making a DMOP work is to have sufficient administrative and political support, have energy and building information, and have a portfolio that is managed in one department that has enough expertise.

Also, a project team needs to be created to take the lead in making PRE sustainable. They need to identify what can work on their portfolio and which stakeholders could be involved in the DMOP.

In the exploration phase, municipalities need to look at what they want to define as sustainable, and how ambitious they want to be and which tools they want to use for this. Half of the municipalities in the Netherlands use the GPR-gebouw tool (Rijksdienst voor Ondernemend Nederland, 2018) Some towns, for example Den Haag, already implemented more sustainable goals to be the first CO_2 neutral municipality (Agentschap NL, 2013b).

Getting from a DMOP towards energy neutrally only works when the goals are properly formulated. Therefore, municipalities need to figure out how much to reduce over time and how to comply with the maximum green kWh/m^2 that a building finally needs to meet. They also have to investigate how to benchmark the energy performance. To reach this goal, municipalities need to think about finance, and if they achieve this with their own money or finance it with an Energy Service Company (ESCo) (see 2.2.4) for example. The final steps include making decisions based on the finalized DMOP strategy and start planning the renovations that follow the needed energy savings. These renovations can be tendered (see 2.1.4) to find the right private party that can execute this. When the measures are implemented, regular monitoring is needed to see if the building complies with the CO_2 neutral regulations.

2.2.4 Using Energy Service Companies (ESCos)

Using the definition of ESCo from Bertoldi, Rezessy, & Vine (2006), “ESCo guarantee the energy savings (as reflected in the contract), (2) they can finance, or via energy savings guarantee assist in arranging financing for, the operation of an energy system, and (3) their remuneration is directly tied to the energy savings achieved”. There is more than one municipal document made where ESCos are used to start to work on sustainability. An ESCo can execute a variety of activities, such as energy analysis and audits, energy management, maintaining, operating, monitoring and evaluation energy consumption and can be used for equipment supply (Bertoldi et al., 2006). Therefore, the client can be ensured with specific energy use and energy saving, this is arranged through an Energy Performance Contract (EPC), this performance risk can be a split risk or only a risk for the ESCo. An ESCo can be used in different parts of a renovation, and, in most cases, finances the operation. The benefit for the client is that financial monitoring is not a responsibility for the client. ESCos maintain the installations they made in the building. Therefore, ESCos helps to think in Total Cost of Ownership and looks at buildings over its lifetime (Agentschap NL, 2013b).

2.2.5 Performance-based contracts

Generally speaking, performance contracts are contracts that ensure a certain level of technical, astatic, and environmental performance for building elements (Straub, 2002). An ESCo can use energy performance-based contracts, but general performance-based contracts are possible to use in every step of a building process. The reason to make a performance contract is to ensure that you have a specific performance that is delivered to the building, this could be a long-term maintenance contract, but this could also be a large Design & Build contract. In those contracts, the client does not specify every detail in the building, as you would in a traditional contract, but only determines the quality it needs to have to simplify the process, with so-called key performance indicators (KPIs). However, this process only works if there is trust between the client and supplier (Fries, 1997).

2.2.6 Total outsourcing

Nowadays, the central government has the RVB that manages the federal real estate, and municipalities manage their own real estate. However, there are also cases where a municipality does not want to carry the responsibility for their public real estate; in that case, total outsourcing to a marked party can be considered. This trend of total outsourcing, for the strategic, asset, and property parts of real estate management is not common yet under municipalities (Drenth, 2018; Twynstra Gudde, 2013).

However, there are initiatives from the market that sees potential in renovating public real estate. Recently there was a fund made where schools can borrow money with a low-interest rate to install solar panels (Ekker & Hofs, 2018). There are also companies that specialize in the process to make a building or buildings of municipalities energy neutral. “Bewust investeren” is an example of such a company. They see that municipalities want to comply with the new regulations but do not have the money, time, and knowledge to fur fill this need. Then such a company will own these buildings for 15 till 30 years and will make them energy neutral. The municipality will have ground lease on the building. This means they can do whatever they want with the building in terms of function and usage. They only pay a canon, and when the ground lease period ends, the building(s) are becoming the property of the municipality again (Bewust investeren, 2019)

2.2.7 In-house available sustainability software tools

Rijksdienst voor Ondernemend Nederland (2018b) has made a list of sustainable software tools that can be used for municipalities (fig. 22). They indicate two tools that are most commonly used, namely GPR gebouw and VastgoedMaps. All these tools work with other input and output measures. Some only make energy inventories, some make an overview of the energy performances and energy or material CO_2 emission, and some use BREEAM-NL In-Use criteria.

Figure 22: Sustainability tools for municipalities to use. Own image based on Rijksdienst voor Ondernemend Nederland (2018b)

To conclude, there are multiple options to choose from as a municipality with different price tags and goals. All tools will give an insight into the sustainability of a building or a whole building portfolio. There is a difference when looking at CO_2 emission and energy performance. These tools also do not guarantee a better energy performance, the information can be used to help make the buildings sustainable, but when doing nothing with the information, it also will not help.

2.3 Energy certificates

BREEAM-in use

BREEAM-NL In-Use is a certificate that can be used to score buildings. The score has three components. It measured the sustainability of the building, this is called the “asset” part. Then there is the “maintenance” part that measures the sustainability of the maintenance and lastly, the “use” part that examines how sustainable the building is being used (Dutch Green Building Council, 2016). The BREEAM certificate system creates awareness and stimulus for the client to maximize the score for the building. However, it is not for free, the certificate costs are between 1575 and 2100 euro’s, and there are more costs such as re-submit assessment-reports and a

license fee (Dutch Green Building Council, 2019b). The benefits of doing this assessment are the option to use subsidies for co-financing the building and that the sustainability can be benchmarked with other buildings and an create value.

LEED

Leadership in energy and environmental design (LEED) is also a green building certification program that promotes better buildings. This certificate also contains several fees to become a LEED building. They do not have a renovation certificate program, but when doing a significant renovation, this certificate can also be used (USGBC, 2019). This certificate can also be used to apply for an MIA subsidy.

2.4 Building typologies

A rough distinction can be made between monumental and non-monumental buildings. Renovating monumental buildings create extra challenges. These buildings have fewer opportunities to change the first rule of trias energetica, namely diminishing energy consumption. Based on the touchability category of the monument considerations need to be made concerning the façade. DuMo is a model that can look at the monumental value and based on the touchability category A, B, C. This is a derivation from the GreenCalc+ method (Nibe, 2019).

Other non-monumental buildings can be mainly be arranged on construction year or energy label, with exceptions to a swimming pool and sports facilities. These two functions often have different characteristics concerning energy and water consumption. Also, the air quality has unique needs for these functions.

2.5 Costs and subsidies

Costs

Renovating municipal buildings can be divided into the buildings of their organization and the buildings they rent out. With rented out buildings cost-recovering rent system for social organizations is often used. Approximately between the 5% and 20% of the municipal budget is reserved for municipal real estate (De moel, Bot, & de Bruijn, 2017). Costs to renovate or improve buildings lies with the owners of the buildings. However, the benefits are for the tenant, this could be the own organization, but could also a tenant. When it is the last, a principal-agent problem arises. This means that there is an asymmetry between the costs and benefits (Bueren, 2009). So, municipalities need to think about creating the right split incentive.

Subsidies

There are five subsidies to stimulate sustainable buildings. These can be used to compensate for a part of the investment. However, this only applies when parts of the municipality also pay corporation tax. The subsidies are called SDE+ (receiving money per generated kWh), ISDE (subsidies on energy systems such as heat pumps and biomass installations) EIA (fiscal benefits) and lastly, MIA (along with BREEAM/GPR-gebouw or other certificates to get a subsidy with a max of 6,75% of the investment).

2.6 Obstacles and enablers

Below there is an overview of the strategy tools that came out of the theoretical framework that was the most relevant and used among municipalities. Based on this, the theoretical opportunities and barriers can be determined. Case studies will deepen into these strategy tools, opportunities and barriers.

	Political goals	Financial policies	User satisfaction	
Strategy tools	*Energy (KWh_{el}/m^2)*	*Costs (€)*	*Obstacles (-)*	*Enablers (+)*
DMOP	Can be specified by the municipality	Unknown	Results can only be made on buildings with label C or worse. The real estate department needs to have enough expertise to make a DMOP.	Buildings with already a MOP can more easily be adapted to a DMOP
ESCOs	Can be demanded by the municipality. For example, kWh or % total energy reduction a year.	Varies depending on the contract, could be external and internal	The contracts are long, and there is often little flexibility in the contracts. The financial transaction cost, when financing with and ESCo, need to be considered.	Energy systems and types of equipment can become challenging; an ESCO takes care of this and its maintenance It helps to think about Total Cost of Ownership The financing can be handed over if this is desirable.
Performance-based contracts	Can be demanded by the municipality. Can be accompanied with a no-claims bonus system.	Varies from lump-sum to variable contracts. Depends on the size of the maintenanc e project.	According to Straub (2002), there is a fear disturbance of price competition and loss of knowledge about their properties. Therefore, the main issues are: Starting point, performance criteria and requirements, control on agreed performances, contract period, and financial risk and payment	According to Straub (2002): Minor needs for specialist knowledge, reducing of financial risks at the longer term, significant cost savings, improvement of performance and service, stimulants for innovations, steering processes on main points and reducing of paperwork
In-house (Using software tools)	There are often % savings the tools can guarantee	Varies between e.g. €2.50/m^2 GFA €6.750 for a municipally with a population of 100.000 alternatively , €1.406 per building.	Hard to choose the right tool. Some tools are more expensive than organize the building information yourself. In-house expertise is required.	Can give a clear overview of the portfolio Can be nifty for special buildings like swimming pools with different energy consumptions. Municipalities can benchmark easily with other municipalities.
Total outsourcing	This can be demanded by a municipality	Unknown	Less control over the building More costly than in-house	The municipality can focus on the core business. No need for an in-house specialist.

Table 2: Opportunities and barriers of sustainable options. (Own figure)

2.7 Theoretical framework conclusion

As seen in the theoretical framework, municipalities operate in a dynamic environment. Municipalities are diverse in terms of real estate, but also size, location, and political preferences. Therefore, governance is a fascinating factor in making municipal real estate energy neutral. As seen in the literature, the public sector is more working with new public governance to optimize the performance output. In the real estate department, it is also seen that the trend is to professionalize the department.

Municipalities can use current theories for MREM. This can be the C/PREM model to structure perspectives and can give an overview of the added value for the organization and its real estate. The DAS-Framework structures the strategy a municipality can take. This can be used to make a structured plan when building a sustainable strategy. Lastly, the Joroff ladder can place the municipality in a level of competency. This shows the global steps a real estate department needs to take to become a strategist and can, therefore, solve the questions like creating an energy neutral building portfolio.

The information and what tools to use when needs to be precise when making municipal real estate energy neutral. The Dutch Green Building Council (2019) made a criterium that functions need to comply with. However, this is not yet set in stone. This criterium is determined in green energy kWh per m^2. There is not one formula to make the municipal real estate comply with these standards. There is the standard perception of trias energetica that gives us a three-step strategy that every strategy indirectly uses.

When looking at the sustainable strategy tools, it came evident that about 50% of the municipalities use a type of DMOP. This strategy is general and widely applicable for a lot of municipal buildings. It includes aspects of energy, finance, and maintenance, and many other decision-making factors municipalities need to consider becoming energy neutral.

One other strategy is using contracts like energy performance contracts with ESCos or general performance-based contracts with maintenance companies. This is particularly interesting when the municipality has a clear goal and can specify them in KPIs and have not enough in-house experience on the subject themselves. There is also the option to outsource the making and implementing a sustainable strategy. When choosing this path, municipalities do not have to provide any input. Using ESCos or performance-based contracts, there is more flexibility in what the municipality wants to use it for and keep control over the portfolio themselves. However, these contracts are often long, which can create less flexibility in the future.

There are a lot of available tools for municipalities to measure and control the sustainability and energy consumption. Municipalities can use performance-based contracts to ensure the specific performance of a portfolio or building. However, the most common software in-house tools that are used by municipalities are GPR-gebouw and VastgoedMaps. About 50% of the surveyed municipalities use these tools. VastgoedMaps can be measured in BREEAM_NL In-Use, GPR-gebouw, and EPA-Maatwerkadvies. In those cases, the municipality can execute the strategy themselves with the technical staff or use sustainable tendering to select the right external party.

There are special considerations to take when the building is a monumental building. Paragraph 2.6 shows us the capability to have a specified kWh per square meter, the costs, the main opportunities and barriers of the most common strategies and tools. These sub-conclusions will further be investigated through case studies.

2.7.1 Theoretical framework conclusion in the DAS-Framework

The figure below, in short, concludes the findings of the theoretical framework into the das-framework. This framework will be used to compare the case studies with the theoretical framework.

<table>
<tr>
<td rowspan="3">Task 1: The current supply is often roughly identified as a portfolio with core, non-core and strategic buildings. There is a possibility that the portfolio and building information is not always up to date. Some municipalities use in-house tools to measure energy performance.</td>
<td>Task 2: The goal is clear, being energy neutral in 2050 and often earlier. However, there is a difficulty at the definition of energy neutral and legislation, this is not set in stone. The context of a municipality influences the future demand.</td>
<td rowspan="3">Task 3: The weigh and selection of the strategy can be determined through the context (typology of the building, year, monumental status, function, core/non-core, etc), Financial policies (financial options), Political goals (ambitions municipality), KPIs, smart meters (kWh), certificate scores</td>
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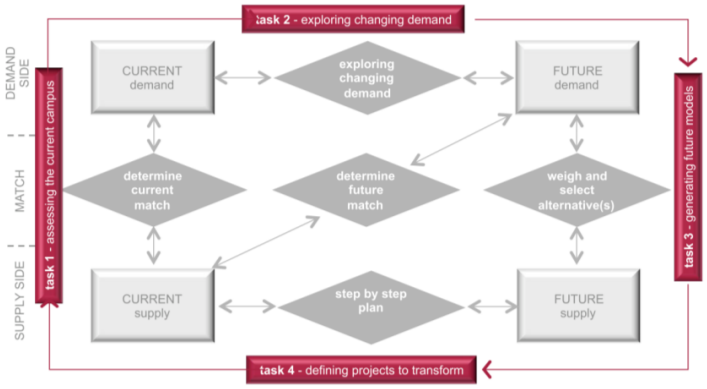
<td> 
</td>
</tr>
<tr>
<td>Task 4: The projects are not explicitly defined in the literature, due to the diversity of building portfolios. Strategy tools that are used often at municipalities are: DMOP's, ESCos, performance-based contracts and In-house software tools combined with sustainable tendering of external parties.</td>
</tr>
</table>

Figure 23: DAS-Frame with theoretical framework conclusions, own image adapted from (Den Heijer, 2011a)

3. Empirical research

This chapter entails the empirical research of this thesis. First, the case of Zutphen will be described and analysed, then the case of Enschede will be described and analysed.

3.1 Case study: Zutphen

3.1.1 General case information

The municipality of Zutphen is located in the province of Gelderland. The municipality counts 47.605 inhabitants ending 2018 (CBS, 2019). Therefore it can be considered as a middle size municipality in The Netherlands.

The municipality of Zutphen has a lot of monumental buildings because it was a former trading city because the IJssel crosses Zutphen.

Nowadays, Zutphen wants to consume 25 percent less energy by 2023 and wants to be energy neutral in 2030, 20 years sooner than officially is needed (fig. 24).

In this coalition agreement, that consist of parties of the political leftfield, the statement is to “fully make the municipal real estate sustainable in a couple of years.”

Gemeenteraadszetels				
Partij	**2005**	**2010**	**2014**	**2018**
GroenLinks	3	3	3	5
SP	3	1	5	4
PvdA	8	6	3	4
Burgerbelang	-	2	5	4
D66	2	3	4	3
VVD	4	4	3	3
CDA	4	2	2	2
Stadspartij Zutphen-Warnsveld[2]	4	4	3	2
ChristenUnie	1	1	1	1
Bewust Zutphen	-	-	0	1
Totaal	**29**	**29**	**29**	**29**

Figure 24: Infographic Zutphen, own image based on Gemeente Zutphen (2018b) and Wikipedia (2019)

3.1.2 Within-case analysis: Database

Task 1: Assessing the current portfolio

As seen from the data that was delivered, there are in total 17 of the 64 buildings that Zutphen identified as buildings reserved for their municipal organisation. Other buildings that are owned and used by the municipality are the towers and city walls, swimming pool and (school)gyms. These are in total 18 objects that are all considered to be core portfolio (this is an indication, and not yet determined administratively). The portfolio of the municipalities owned and rented out buildings contains a high percentage of monumental buildings. For the own organization buildings, 7 out of 17 buildings are monuments, and one is being defined as a representative building for the city. Looking at all municipal buildings rented out and own buildings, 23 out of 64 buildings have some identification as being a monumental building.

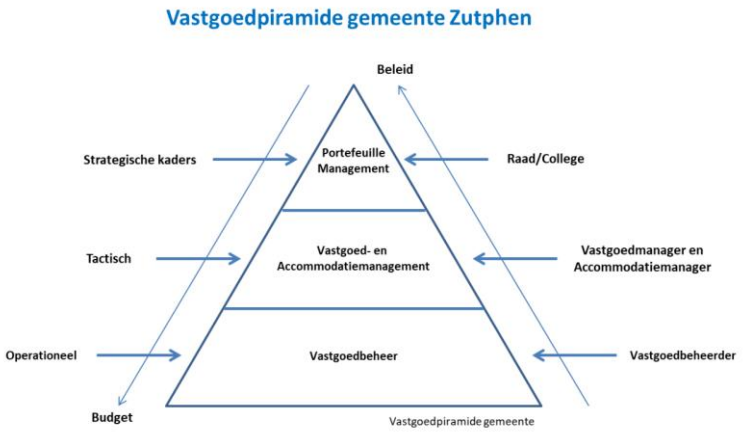


Figure 25: Real Estate Department scheme (Gemeente Zutphen, 2017)

From the analysis it is seen that 10 of the 64 buildings are being considered as a strategic object, 36 as core and 18 indicated to be sold.

School buildings have a different approach because the school boards are juristically owners of the buildings. Therefore, they need to organize their sustainability measurements. However, Zutphen did invest 10,000 per school, with 26 schools in total, to help with the energy transition (De Stentor, 2019).

Managing the municipal real estate in Zutphen is based on the real estate management triangle (fig. 25). Therefore, there is a similar division in strategic management, tactical management, and operational management, as seen in the literature (par. 2.1.2). The municipality has an Alderman for sustainability and a program manager that is now working on a masterplan to make Zutphen energy neutral before 2030.

Task 2: Exploring the changing demand

The municipality Zutphen sees the energy transition as an opportunity for the municipality to create a sustainable future and a chance to let the economy grow (Gemeente Zutphen, 2018b). When doing this, the municipality also aligns with the climate law and national goals. Besides this, they work in the changing demand to only keep the core portfolio to have better risk management. Their real estate is to accommodate social functions primarily and to execute policy (Adviesbureau Thorbecke & Cobalt Consult, 2017).

Task 3: Generating future models

In Zuthpens policy "Beleidsplan Energy neutral in 2047" (Gemeente Zutphen, 2010), there are scenarios made to make the municipal buildings' energy neutral. Here there are four points to improve the buildings, having after-isolation in the buildings, create heat recovery, replace gas boilers, and have energy efficient lighting. In this document, there is also a project approach to do this. First, they choose on with roofs solar panels can be placed, then make a study about this, create a plan and financial substantiation, make a college decision, and then realize it. One other aspect is making a business model for the energy measures, investigate collaborating with other municipalities, and lastly investigate outsourcing.

Seen in the Program budget of 2019 -2022, Zutphen is part of the clean tech region that among other things, work toward the energy transition (Gemeente Zutphen, 2018c). From their ethical and ideal starting point, they tender with criteria to buy more sustainable products and services.

Energy (political goals)

All municipal buildings need to be energetically screened for 2019; this did not happen yet. In a broader sense (whole energy transitions), they look at new ways and types of investment options (Adviesbureau Thorbecke & Cobalt Consult, 2017)

Zutphen is obligated to make a European Energy-Efficiency (EED) audit. By doing this, it is viable where the organization can create efficient measures concerting energy reduction. In 2013 they wanted green electricity, but they still had a grey energy obligation until 2018. Moreover, in the documents, there is an indication that they use the program GPR-gebouw.

Costs (financial policies)

The costs for the energy transition (making a sustainable multiyear maintenance plan and policy making) of the municipal real estate needs to come from the real estate program and budget. In new policy of the municipality in 2018 will be a submission for a financial reservation for the EED Audits to finance the obliged measures conform the Climate Act. Moreover, by doing this, they want to take measures with less than five years (10 years as aspiration), there will be a proposal to the college and council (Gemeente Zutphen, 2018a). This is not included in the plan "bestuursopdracht." As from 2020, these municipal real estate investments will be linked to decision-making on the implementation program (Gemeente Zutphen, 2018a). Therefore, credit for the EED audits will be applied under "New Policy 2018".

The municipality also wants to create buffers for making energy measures for municipal buildings. The municipality also looks for subsidies (SDE +) for the ESCos of the gym "Hanzehal:

Task 4: Defining projects to transform

The current plan builds on multiple ambitions, addendums, a manifest and notes from the municipality from the RE department, vison policy as well as coalition agreement of the college. A broad overview of missions and accompanied measures from multiple documents can be found in table 3. The red bars indicate that the measures did not happen, orange indicates that an adapted version of the measure was executed, and green indicates that the measure has been taken.

Years	Mission statement	Measures to take	Executed?
2010	Beleidsplan Zutphen Energieneutraal 2047 - Een nieuwe uitdaging vraagt om een nieuw antwoord – (Policy from 2010 till 2013)	Finding stakeholders to realize 73.000 m² solar panels	?
		Energy scan for three buildings	
		Creating solar panels on municipal building roofs (€346.000) min. 700 m²	Five roofs (110 MWh/y)
		Smart meters (€50.000)	?
		Take energy measures for maintenance if payback time is in the technical lifespan of the product	
		Buying 100% green electricity	With a delay
		Using Trias energetica as a roadmap	?
		Buying energy shares NUON?	?
		Hiring an energy coordinator	
2013	Zutphen energieneutraal! Evaluatie beleid 2013 (Evaluation 2010-2013)	ESCO Hanzehal expanding with solar panels Moreover, one other gym (75 MWh/year)	?
		V-liners in 5 municipal buildings	
		Making an energy scan for “a couple” municipal buildings	With delay
		Investigating more municipal buildings for solar panels	?
2017	Vastgoedbestendig Zutphen	Before 2019 all buildings energy scan	
		Implementing climate law (<5 payback time measure needs to be taken)	
		Split-incentive energy reduction/subsidy	?
2017	Inkoop- en aanbestedingsbeleid van de gemeente Zutphen 2017	For purchasing services and goods, the municipality uses socially responsible purchasing addendum. This strengthens the awareness to buy responsibly socially, as well as sustainable (using PIANOO guidelines in the tender).	
		Monitoring the SROI in tenders and execution	
		Reporting of the sustainability in annual purchasing report	
2018	Met elkaar kleuren we Zutphen en Warnsveld (Coalition agreement)	Zutphen energy neutral 2030	?
		Their municipal organization buildings are within a couple of years sustainable, to set an example	In progress
2018	Zutphen energieneutraal 2030 Stand van zaken	There needs to be a sustainable plan being made in this year for all MRE	One-year delay
		Two buildings were renovated, one from G-A	
2018 / 2019	Bestuursopdracht Zutphen Energieneutraal 2030 werkzaamheden 2018/2019 (To do’s)	Making EED-Audits on municipal real estate	14 buildings
		Executing energy measures with a payback time of less than five years	?
		Making all offices of municipality label c before 2023	In progress
		Have insight into the energy consumption of the MRE	In progress
		The need to have taken measures with payback time less than five years, using the right split-incentives	In progress
		Making a roadmap for the whole city to become energy neutral	In progress

Table 3: Overview of missions and measures in documents of the municipality Zutphen.

Documentation of experiences with the strategy (User satisfaction)

In 2010 the municipality of Zutphen identified the budget for the measures they wanted to take as a possible pitfall. This involved the investments for replacement and maintenance that were energy reducing (Gemeente Zutphen, 2010).

There was a previous plan, "program Zutphen Energy neutral 2013-2017", but the municipality concludes that in the current day there are new and better insight, technics, and developments concerning this subject. Therefore, where was the need for a new road map to be an energy neutral municipality in 2030 (Gemeente Zutphen, 2018a).

3.1.3 Within-case analysis: Interviews

During the interviews, the four perspectives of the C/PREM model where being interviewed, the sustainability program manager can in the four views be seen as the operational part of the organization. The semi-structured interviews were loosely structured around the DAS-Framework to see the strategy placed in time combining with the themes: political goals, financial policies, user satisfaction, municipal context, and portfolio segmentation. Some citations were given to illustrate the topics.

Interviewee	**Strategy (in time)**
Alderman	Wants to comply with the coalition agreement. So, in a couple of years have set the example to have energy neutral municipal buildings. The Alderman has not seen a structured sustainability strategy in the municipality in the past *"We hebben een voorbeeldfunctie. We hebben het coalitieakkoord staan dat we met het gemeentelijk vastgoed aan de gang willen … De praktijk, dat is een heel ander verhaal, dat betekent dat je dus inzicht moet krijgen in wat betekent dat eigenlijk?"*
Portfolio manager	The portfolio manager has asked external parties to make a scenario into categories (low, middle, and high ambitions) to make a proposition for the council to choose from and combine this with the financial policies. So, he only has an advisory role. *"We hebben een soort uitvraag opgesteld van: Dit is onze portefeuille, breng ons in kaart de wettelijke verplichting, … de EED, de informatieplicht voor energiebesparing met de bekende maatregelen lijst etc. Om die overzichtelijk te maken met de doorkijk van laag hangend fruit en voor vergaande verduurzaming. Met een vertaling voor MJOP's, de splitsing mop map, investeringen en onderhoud en hoe gaan we het financieel inzetten? Via reguliere vastgoed begroting, dus een vijf of tien jaren door de raad goed gekeurd budget voor investeringen en onderhoud of gaan we een revolverend fonds inzetten?"*
Project leader technical management	Zutphen was working with and has learning points about ESCOs. Maybe there will be an ESCo light in the future. Outsourcing their strategy-making was used to gain expertise and have a benchmark. *"Zo ben je dingen in kaart aan het brengen en dus de beginsituatie. Wat ga ik zo meteen monitoren, welke gegevens komen eruit en ga ik bereiken wat we met z'n allen uit gaan zetten."* *"Als ik voor mijzelf mag spreken hebben we liever panden in eigendom. We hebben dat ook met de ESCo van de Hanzehal gezien daar kom je ook een beetje op terug. Qua financiering heb je als gemeente een andere manier en die zou beter zijn met een ESCo light. Dus ik zou dat de volgend keer anders doen ….. in de toekomst zou het dan meer een prestatiecontract worden."*

Sustainability program manager	Want's one integrated system. Favorable on a neighborhood level and with one budget. Identified that Zutphen was working with sustainability, but it had not been bragging with this. *"We hebben bepaalde mogelijkheden om, zoals rondom het stadhuis hebben wij allerlei vastgoed, daar kunnen wij een energiesysteem voor realiseren wat weer iets betekenen voor andere mensen in de omgeving. Het is daarom belangrijk dingen samen op te zoeken om dingen efficiënter te realiseren."*

Table 4: Strategy from CREM perspective

Interviewee	Energy (KWh)
Alderman	Favorable to one precise measurement tool, preferably Zero on the meter for all municipal buildings. *"Ten eerste moet je de definities hebben dus. Energieneutraal, nul op de meter, BENG wat gaan we doen? Waar kiezen we voor?"*
Portfolio manager	Keep the balance between energy reduction and costs. These need to weigh up. A tool would be favorable to make scenarios for separate buildings quickly. Doing the EED and implementing measures that have a payback time of five years needs to happen. The aspiration is to do actions with a payback time of 10 years, to eliminate the change to re-renovate in the future. *"We willen de doorkijk geven naar de verduurzaming van je hele portefeuille en dan eigenlijk gericht op drie scenario's, drie ambitieniveaus. Dit is het ambitieniveau van het college en dat het inzichtelijk maken, wat zijn de maatregelen, wat is het effect op energielabel, wat is het effect op CO_2 uitstoot en wat kost het? Om die drie dingen met elkaar af te wegen."*
Project leader technical management	The energy monitoring is hard to see. Clearly, there are many documents, to make a clear overview of one building on paper. Smart meters can help with a portfolio above 50/60 buildings. Going gasless is hard for this portfolio because of the many monumental buildings. *"Ik denk dat voor ons in eerste instantie op energieverbruik gekeken wordt, maar ik kan me ook voor stellen dat de relatie naar CO_2 gelegd wordt."* *"Je moet meer kijken dan naar energie verbruik alleen. Ja hoor WKO en zonneparken is iets wat je mee moet nemen, maar ik ben van mening dat zeker naar het gebouw zelf moet kijken en te kijken waar je dingen kan inbouwen om zo de energievraag te reduceren".*
Sustainability program manager	Agrees with the alderman, but also wants to experiment with other and newer sorts of energy systems such as smart grids or hydrogen instead of gas.

Table 5: Energy from CREM perspective

Interviewee	Costs (€)
Alderman	He understands there needs to be a significant investment into the building portfolio and that is likely that the investment cannot be fully a payback in energy savings. However, the goal is clear and there is the aspiration to meet this goal "Als je het maar goed aanpakt en de subsidie goed weet te vinden. Dat zal voor het gemeentelijk vastgoed ingewikkelde zijn maar je kunt het best heel goed kijken naar voor financiering en terugverdientijd. Misschien hou je dan een onrendabele top over, maar dan praten even over de duim echt niet over tientallen miljoenen euro's. ..... het levert nog wat op, namelijk een lagere energierekening. Dus je kunt dat voor een deel ook weer kapitaliseren en dat pand wat je verduurzaamd wordt ook meer waard op de markt. Nou allemaal iets wat een rol moet spelen bij het uitzoeken en analyseren van wat gaan we nu allemaal doen en wanneer gaan we dat nu doen. En dus qua timing wat is nu het goeie. Nou dat is eigenlijk waar we nu voor staan, dat goed uitzoeken."
Portfolio manager	The municipality is not a municipality that is the wealthiest. So, maybe the high ambition will perhaps become a strategy with a middle aim due to finances, but there is an aspiration to do more than is needed. The portfolio manager also thinks it is good that there is one place where the sustainability budget lies to integrate the process.
Project leader technical management	When using ESCos in the future, do it with its municipal finance system. This is better because the municipality can have loans with a lower interest.
Sustainability program manager	The finances need to be more apparent from a national point of view, a toolbox could help, only incidental subsidies are not favorable, but this is now merely an option to do.

Table 6: Costs from CREM perspective

Interviewee	Obstacles (-)
Alderman	The pace of doing the energy transition. There still in the preface, where they want to move faster.
Portfolio manager	There are many compliances for municipalities that make it more complicated. There are also many monuments what makes the strategy even more difficult
Project leader technical management	The documents are tricky, and gasless is almost impossible for some buildings to be feasible.
Sustainability program manager	The finance system is not yet clear, so there are a lot of loose projects with separate subsidies, and the energy transition is still a dynamic work field. *"We zitten nog heel erg in een voorfase. Ja ik zie zoveel initiatief ontstaan. En wat ik merk is dat one size fit's all niet werkt in de energietransitie. Daar komen we sterk achter in deze gemeente."*

Table 7: Obstacles seen from CREM perspective

Interviewee	Enablers (+)
Alderman	Opportunity to the whole city. Socially and economically can be a boost for Zutphen.
Portfolio manager	Getting the right people together helps because the systems become more and more complex. Having a sustainability department causes that finance can be centralized and be more harmonized into one efficient plan.
Project leader technical management	They have a positive result for creating energy reduction when using ESCos. A tip to other municipalities is to have smart meters. *"Het mooiste zou zijn als je slimme meters hebt, als je een gemeente bent die boven de 50/60 panden bezit. Want dan zijn die energiecontracten zo complex om tot het goede inzicht en om tot de exacte energie afrekening te komen. Daar kan monitoring goed voor zijn."*
Sustainability program manager	District heating be an enabler for the monumental center.

Table 8: Enablers seen from CREM perspective

3.1.4 Lessons learned

Strategy in time

The main findings from the document are that the perceptions and actions for sustainable real estate made various adaptations from 2010 till the present day. This is mainly due to the change in policy and the financial position of the municipality. Till 2018 there were ideas to make the real estate sustainable, but only some of the suggested measures were being executed. These measures were first based on a plan that would make Zuthpen energy neutral in 2047. Here the energy measures for the municipal real estate were quite clear, after this policy document, some measure was being executed, and new measures were being introduced. Sustainability was less visible in the execution of the municipal real estate. Mainly the energy scans were shifted to the future. This phenomenon is seen until 2018. The new document with the activities of 2018/2019 is promising to have a baseline in which the municipal real estate can become sustainable.

Task 1: Assessing the current portfolio

Two external parties are being asked to make label identifications for all buildings and make custom advice for all buildings of the portfolio. The base for the strategy to indicate the core and non-core portfolio. So, they are working to assess the current municipal portfolio.

Task 2: Exploring the changing demand

Zutphen is clear on paper what they think the future demand is. Energy neutral in a couple of year for their municipal real estate. However, the definition is not yet clear. Will it be zero on the meter or BENG? It needs to be clear when they get the report back from the external parties. They are going to many masterclasses and have investigated an experienced with some strategy tools such as ESCos and renovation during natural moments. So, they are also still exploring the demand.

Task 3: Generating future models

The municipality is currently quite busy with making sustainable strategy. However, it was fragmented before, this is also seen back in the documentation and extracted from the interviews. The new strategy will be made according to three scenarios from a low to high ambition level. This way of approaching it is similar to the scenario planning from Dewulf, Den Heijer, De Puy, & van der Schaaf (1999) that is incorporated in the DAS-Framework.

Task 4: Defining projects to transform

To define the strategy per building, the real estate department hopes the external parties comes back with a kind of tool to make it easy to make a specified plan per building in the portfolio. Lastly, there is some step by step plan in the pipeline, and some nonintegrated projects are being done through subsidies, this is not yet on portfolio level.

To conclude, the municipality is feeling the pressure to now actively work with the sustainability goals and upcoming regulations while the municipality was already making reports in 2010. Some actions that already were considered back in 2010, currently being investigated actively. Examples for this are the smart meters, energy scans, and taking measures with payback time with less than five years.

Energy (political goals)

The energy measurement and reduction still need to be defined in a clear concept. Preferably zero on the meter. There are ideas for a heating district because there are a lot of (municipal) monumental buildings in the city center. The real estate department has experience with a WKO (heat and cooling reserve in the ground) that they have good experiences with this. They are also positive about ESCos energy-wise. However, in the future this needs to be financed through the municipality, a so-called ESCo light. The real estate department has currently not yet a clear indication of what their energy consumption is, this later needs to be implemented into the strategies that the external parties make. By doing this, they can work from an accurate baseline.

Costs (financial policy)

The costs of making energy neutral municipal real estate are not yet precise. There are some indications that the investment does not have a full financial payback of a hundred percent. However, there are also financial struggles in the municipality that takes pressure on this plan. This same pitfall was already mentioned in 2010. There is also not yet a “toolbox” for the sustainable program manager to have a good and financial system for the whole built environment. Now there is much work getting the right subsidy, and this is not their favorite way of doing it. It will be less integrated when doing this way and they prefer a better national program. These subsidies are not yet used with certificates like BREEAM or LEED. The reason is that they are not yet ready to determine to use this, and they also indicate that the certificates are also costing extra money.

Obstacles on added value (user satisfaction)

Having monuments creates extra obstacles because the municipality is thinking in trias energetica, and this is harder for monuments. Another obstacle that was found is the lack in overview concerning the current portfolio and energy information. Because of this, there is a higher pressure to organize this first before the sustainability strategy can be made.

The case clearly showed an obstacle to find the right balance between finding the suited measures to take and balancing it with the costs. There is friction between the financial policy and the political goals (which in in this case the sustainability goals).

Enablers on added value (user satisfaction)

Zutphen identified that they think that keeping control of your properties and choose the right people can be an enabler. Work with experts is preferable because sustainability measures become more and more complex. It could also be an enabler when there is a wider neighborhood approach to create synergy. Lastly, the energy transition can be an enabler for creating more local labor. Therefore, it creates more economic growth and can create a social boost.

3.2 Case study: Enschede

3.2.1 General case information

The municipality Enschede is situated in Overijssel near the border of Germany. Enschede counts 158.961 inhabitants. Therefore, it is the 13th biggest municipality of the Netherlands in terms of inhabitants (CBS, 2019). Enschede is the main city of Twente, a subregion of The Netherlands (fig 26). The ambitions are to have a climate neutral city by 2050. For their real estate portfolio, they want to make it energy neutral before the year 2040.

NEN 2767 systematics

Inspection of the technical state of the building and installations. Measured with conditions scores to set up a multiyear maintenance plan.

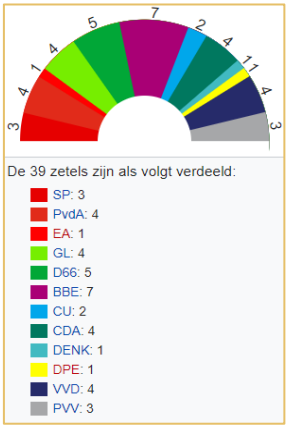


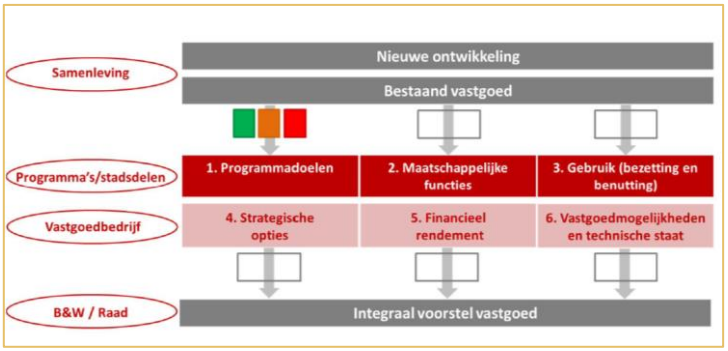
Figure 26: Overview of Enschede as a municipality (own image)

3.2.2 Within-case analysis: Database

Task 1: Assessing the current portfolio

In 2001, the real estate department was initiated to professionalize its real estate. As of 2005, there was a first real estate nota, and this was further revised in 2011. As of 2012, Enschede is working together in a "Twents Vastgoed Platform" (TVP) to collaborate with surrounding municipal real estate departments. As an organization, they have up to date information about their portfolio in terms of energy use and labels and have made a risk scan to identify what to sell and what to keep (fig. 27).

The real estate department is a "closed system" in the municipality. This means that they have to break even from their income and expenses with an accompanied buffer (Gemeente Enschede, 2019). In 2017 their real estate value was to be estimated at 126 million euros with a rent of thirteen million a year.



Real estate portfolio Municipality of Enschede (01-01-2017):

17 Culture facilities - 45.645 m²

32 Offices/business premises - 84.447 m²

7 (former) Education facilities - 7.908 m²

56 Sport facilities - 54.385 m²

20 Health facilities - 13.691 m²

10 Dwellings - 2.846 m²

69 Managed grounds - 264.000 m²

Kerncijfers 2018

Segment	Aantal panden
Ambtelijk	8
Maatschappelijk	94
Nader uit te werken	13
Verkoop	21
Totaal	**136**

Figure 27: Figures from policy documents concerning the real estate department, own image adapted from documents of the municipality of Enschede

Task 2: Exploring the changing demand

Enschede made a lot of sustainability aspirations in Vastgoednota 2.0 (2011), and they are signatories of the Manifesto Socially Responsible Purchasing (Ministerie van Infrastructuur en Waterstaat, 2017). Enschede's focus is to be climate neutral in 2020. This was the aspiration of the council at the time. While they identified that the general focus lies on the newly build

buildings, they also determined that they need to adapt their current portfolio. Therefore, they will invest as of 2011 in sustainable adjustments in the current portfolio concerning energy reduction and obligated energy measures in combination with the maintenance plan with a separate sustainable investment plan agenda for schools. As indicated in the budget of the municipality of 2019-2022, they identify the future demand to have an energy neutral portfolio by 2040. To do this, they want to make a plan that is resilient for five years with an accommodating budget identification (task 3). (Gemeente Enschede, 2019). Simultaneously the real estate department also looks at other trends like New Ways of Working, shrinkage of the municipal organization and the need for more care buildings in the municipality (Gemeente Enschede, 2017).

Task 3: Generating future models

The municipality wants to take the lead and have a strategy that looks at monumentality, the technical state of the properties, and the business constraints (Gemeente Enschede, 2018). Before they make a strategy, they investigated the need for solar panels on the roofs of municipal buildings, connecting to a heat network, having experimented with thermostatic valves with presence detection and foil on glazing as insulation or generation (Gemeente Enschede, 2019). In the document, they also explain the what sustainability means for the RE department (fig. 28).

For yearly maintenance, they have long term energy performance contracts. By doing this, more knowledge is taken from the market to come up with innovative solutions that are commercially acceptable (Municipality of Enschede, 2017). When having an energy performance contract, the contractor makes project propositions to ensures a 3% energy reduction a year.

Energy (political goals)

The target of the RE department is to have more insight into their energy consumption. They already have an energy reduction of 30% and want a further CO_2 reduction by 2020 of 30%. The goal is also to create awareness with employers about their energy consumption.

When the municipality tenders for goods or services, there is an extra substantial selection criterion for sustainability. By doing this, the municipality is buying socially responsible. Enschede wants to challenge also other partners and subsided organizations to help with the energy transition (Gemeente Enschede, 2018).

Enschede has energy labels and placed smart meters for their buildings. This indicates where to take sustainability measures. There is also the knowledge of how much energy is green to make this going from 2,2% to 30% by 2030. Currently, the rest of the energy that is not self-generated will be compensate it with purchasing 100% sustainable energy.

Figure 28: Example in defining sustainability in municipal documents (Vastgoedbedrijf Enschede, 2011)

Costs (financial policies)

The maintenance contract is made for a hundred buildings and costs €400.000 a year (Rijksdienst voor Ondernemend Nederland, 2019e). The second phase, the renovating budget arises from the maintenance budget, potential subsidies, and if needed, a raise in the cost covering rent (Gemeente Enschede, 2019). Next to this, when performing maintenance work, sustainable solutions are chosen as much as possible. When this results in a lower energy bill, the tenant pays a part. This can be a higher rent or lower subsidies given to the social tenant (if applicable).

For the future, there is made a reserve for sustainability. However, this is unclear if this reserve is only for real estate or also for other aspects of the municipal organization (Gemeente Enschede, 2019). It is also seen in the budget of 2019-2022 that the sports clubs can apply for sustainable

loans from the municipality. When the municipality themselves can use general subsidies, they will be used. However, this can still result in an unprofitable investment.

Task 4: Defining projects to transform

Enschede has made the trend to reduce the energy and gas consumption as of 2013 with 14% and 10%. They did this by making: seven white energy efficient roof covering, energy efficient air treatment installations (BaOpt), energy efficient lighting (high frequent lightning), sustainable energy generation (solar panels) and creating awareness by participating with nations awareness days (Nacht van de Nacht, Warme Truiendag) (Gemeente Enschede, n.d.)

Documentation of experiences with the strategy

Enschede indicates that what making its own real estate sustainable is going well. They indicate that the communication of the successes could be better as well as making sustainability even better into the assessment framework when making a decision (Gemeente Enschede, 2015).

They have ten tips when municipalities want to use also performance-based contracting in their maintenance operations:

- Think in functionally driven real estate policy, primary processes of the users are leading.
- Allow for at least one year that the maintenance party needs to adapt and get used to the buildings.
- Pull investments forward and think from the total cost of ownership (TCO).
- Map all the risks, and make sure that you can always terminate the contract.
- Prepare your organization in time - at least one year before the outsourcing takes effect – make them ready for the director's role and inform them transparently about the consequences for your organization.
- Make a long term commitment to each other
- Approach the building integrally, make sure that various aspects of management and maintenance are combined.
- Make sure that you create opportunities for local parties.
- Involve the purchasing department as early as possible in the process.
- Ensure that energy savings achieved lead to a future investment budget. Let the user continues to pay the energy bill because it affects consumption.
  (Rijksdienst voor Ondernemend Nederland, 2019e)

3.2.3 Within-case analysis: Interviews

During the interviews, not all four perspectives of the C/PREM model where being interviewed. The semi-structured interviews were loosely structured around the DAS-Framework to see the strategy placed in time combining with the themes: political goals, financial policies, user satisfaction, municipal context, and portfolio segmentation.

Interviewee	Strategy (in time)
Portfolio manager	The portfolio manager sees that professionalizing the RE department helped to integrate sustainability in the RE strategy earlier. Stated that the expertise was in the market. Therefore, they choose to use performance-based contracts. Not only for energy reduction but also to reduce malfunction to optimize the primary process. The contract type was first tested with one big cultural building and is now one year implemented, with little adaptation from the original contract, for their whole core portfolio that contains 100 buildings. This was tendered for two market parties that each maintains and monitors 50 buildings. *"De marktpartij wordt uitgedaagd om de energiestromen te analyseren, we hebben overal slimme meters. Dus dat is technisch ook mogelijk. En als je die energiestromen analyseert dan weet je beter of je moet investeren of dat je gewoon in gesprek met de gebruiker moet omdat die dingen doet die niet logisch zijn of anders of beter kunnen. En zo hebben we toch al behoorlijke stappen gezet. En ik denk ook dat voor heel veel gebouwen in gebruik zal gelden dat het niet altijd met investeringen gepaard gaan. Uiteindelijk als je naar energie neutraliteit wil dan moet je ook een keer investeren. D'r is best nog wel heel veel winst te halen in het gebruik en dus het beïnvloeden van het energieverbruik."*
Project leader technical management	Working continuously on the sustainable strategy, this is integrated into the RE strategy that has been there for almost ten years. The motive comes from being an energy neutral city by 2040. By screening the energy consumption, the setup could be made for energy performance contracts. Looking at the energy is the primary tasks we are doing now as well as looking at the future demand of the organization. Therefore, the strategy has for now only to do with the maintenance and use phase of the buildings. There is also a new, but long-term focus to look at natural moment for renovating the buildings using a DMOP.

Table 9: Strategy seen from CREM (solely real estate focus) perspective

Interviewee	Energy (KWh)
Portfolio manager	The portfolio manager sees heat district as an option to use for monumental buildings in the city, but this enquires much talking to multiple stakeholders. Furthermore, there is a set energy reduction plan of 3% a year in the performance-based contract. They also are now working with the portfolio for schools, and do not want to renovate multiple times, if they renovate, it needs to done right immediately. So, 100% energy neutral. *"Het plan zou betekenen dat wij twaalf hectare aan zonnepanelen moeten aanleggen op één of meerdere velden. Want de daken van onze gebouwen zijn maar in zeer beperkte mate geschikt om zonnepanelen op te leggen. Of de constructie voldoet niet …. of omdat alle installaties op het dak staan of qua bezonning. We hebben dit beeld min of meer geschetst zoals ik nu vertel aan de verantwoordelijke portefeuillehouders. Dan blijkt dat wij tegen een politiek bestuurlijke discussie aan lopen want het aanleggen van zonneparken dat is een hot politiek item en er zijn partijen die het absoluut niet willen. Dus wij hebben tot nog toe eigenlijk de opdracht gekregen van om dat nog niet grootscheeps uit te rollen. Wij gaan in elk geval de TRIAS-energetica toepassen en op natuurlijke vervanging momenten dit doen. Maar die grote slag die gaan wij op dit moment nog even niet maken. Die discussie komt gegarandeerd op de wagen natuurlijk. Maar daarvoor is het nu nog even een te grote stap om in één keer naar de raad gaan dat je zegt van nou vastgoed gaat even een parkje van twaalf hectare aanleggen."*
Project leader technical management	There is a minimal energy reduction of 3% a year shaped in an energy performance contract. The municipality is also looking at using the heating district.

Table 10: Energy seen from CREM (solely real estate focus) perspective

Interviewee	Costs (€)
Portfolio manager	Is positive surprised about the investments that have now roughly have been calculated they need to make in the future to become energy neutral. The investments that the performance contracting party now yearly suggest will be done if it is economically feasible. To finance this, they use the cheap loan system municipalities can use. They also used subsidies (SDE) in the past to co-finance solar panels. *"We hebben gekeken als we het energie verbruik naar all-electric zouden doen wat hebben we dan aan zonnepanelen nodig omdat optrekken dus dan gaan ook de cv-ketels eruit, dan gaan we dus all-electric gaan om een gevoel te krijgen met wat is de order groter van investering die nodig is. En toen bleek iets wat ons eigenlijk nog wel een beetje verrast heeft. Daar kwam een getal uit als wij dat de komende 20 jaar wegzetten. Dan is dat investeringsbedrag is behapbaar en is zelfs te dekken."*
Project leader technical management	He has calculated that the costs to be energy neutral for the portfolio will lie around 40 million euros. This funding first needs to be granted by the council. The split incentive problem will be resolved by incorporating the energy saving in the rental price. When possible, subsidies are used. *"We hebben weliswaar de aanname genomen dat onze huurder bereid is om dat geld aan ons te geven die krijgt 0-op-de-meter. En we hebben gekeken van wat blijft er dan nog een onrendabele top over en zouden we dat kunnen behappen? En warempel zou dat kunnen behappen."*

Table 11: Costs seen from CREM (solely real estate focus) perspective

Interviewee	Obstacles (-)
Portfolio manager	The political environment can slow down processes to set sustainability in motion *"In het vastgoed zijn wij geneigd om te denken in cijfers, vierkante meters, euro's, in alles kunnen we vastgoed zo ongeveer berekenen. Maar die beleidskant is een stuk lastiger. Dit heeft ook te maken met de politieke cyclus van vier jaar."*
Project leader technical management	He has not specified an obstacle. Looking back at how the smart meters are used now, creates an insight that it could be better used before the performance contracts were enabled.

Table 12: Obstacles are seen from CREM (solely real estate focus) perspective

Interviewee	Enablers (+)
Portfolio manager	The energy transition has made a turning point, it used to be perceived as a burden, but this has changed to a positive and creative point when looking at real estate.
Project leader technical management	Having the information on the real estate up front helped us to plan a strategy over the whole portfolio. While this is not yet a hundred percent set in stone, the plan is clear, and there were aware where the focus points would lay.

Table 13: Enablers saw from CREM (solely real estate focus) perspective

3.2.4 Lessons learned

Strategy in time

The main findings from the documents are that there are clear policies when it comes to their real estate. Enschede have worked on testing multiple applications to make real estate more sustainable. They are aware of what their energy consumption is, and they can monitor it well, this is also seen back in percentages energy savings. The current strategy for the municipality is clear because they sourced this out to a contracted party. These parties must look at all energy-related policies and analyze smart meter. Based on this, the external parties give actively suggestions to diminish energy consumption. This transition resulted that the municipality went form an active party to a passive party. They do not make the suggestions themselves, but only

need to demand the performances indicators they think where vital when the contract was made. The municipality is overall pleased with this strategy they implemented. Next to this, they are looking and calculating the future demand where deeper renovations are needed. Here they identify that they could have an unprofitable top, but they identify this as an acceptable unprofitable top.

Task 1: Assessing the current portfolio

The assessment of the current portfolio is a continuous process that has been going on for a long time at the municipality, and they have a clear routine for this. They specify the portfolio in core and non-core buildings. Next to this, the contracted maintenance parties monitor the buildings with smart meters. These parties need to introduce every year an energy reduction of three percent. They have a clear overview of what they can do financially and where potential risks are.

Task 2: Exploring the changing demand

They made global calculations to create an added strategy upon their performance-based maintenance contract. Their reasoning was to have a portfolio that is zero on the meter in 2040. Therefore, it would be energy neutral. They calculated the number of solar panels they would have to install to compensate the energy consumption. They not only look at energy but also other scenario's that can adapt their real estate demand such as New Ways of Working and the shrinkage of the municipal organization.

During this contract phase, the contracted parties monitor the obliged regulations they must comply to in the future. And by doing this, the contracted party consults the municipality how to react to these changes in regulations.

Task 3: Generating future models

The council do weight and select the strategy. They also experimented with pilots to see if some techniques could work for them. The real estate department delivers options for the council to choose. As seen for the strategy to place solar field, it was put on hold because it made to much political heat. Therefore, the department needed to create alternatives to adapt to the current portfolio. They currently let it takes its course and only modify installations or parts in the building in natural moments. By doing this, they look at monumentality, the technical state of the properties and business contains.

Task 4: Defining projects to transform

They did not yet specify a clear and structured plan to become energy neutral fully. They think in projects such as connecting monumental buildings to the district heating and, as seen before, trying to slowly adapt the portfolio by having contracted parties make plans to reduce the energy demand by three percent a year. Natural interventions such as the replacement of the roof are immediately done right by using white or green roofs and replacing climate systems with, for example, efficient are treatment installations (BaOpt). Here the more DMOP strategy can be seen.

Energy (political goals)

The municipality does know what their energy consumption is and the way they want to diminish this. This diminishing is done with the performance contract where the contracted parties need to propose solutions for a three percent energy reduction a year. On the operating side, they are creating awareness and implement sustainability in the whole organization, and by doing this, making it a natural process. Now they are also thinking to integrate and optimize this with a sustainability coordinator that looks at the whole organization. When having to renovate, they want to go all-electric and generate local green energy. They are also in conversation to think about the possibilities of enlarging and connect with the district heating.

Costs (financial policy)

For the maintenance of the portfolio, there is a yearly contract of €400.000. For the long-term renovations, they are aware of the rent that is coming in, and they know what the cost reductions are when going all-electric. They think in payback times to see if an investment is economically feasible. The RE department did not indicate that finance could be a problem when looking at making the municipal real estate energy neutral. However, they do estimate that they have an

unprofitable top, but this is an acceptable amount for them. They do not believe that energy certificates like BREEAM will weigh up for the costs that they give.

Obstacles on added value (user satisfaction)

The transition of the real estate is a slow and long-term process and being in a municipal environment, with elections every four years, makes it a less rational decision sometimes. So, the future is more uncertain than in other organizations. The municipal context can be challenging for long term thinking, such as making a real estate strategy. They also pointed out that they are gaining tasks such as the new legislation for school buildings and that there is no extra funding to make the renovations for these buildings.

Enablers on added value (user satisfaction)

Being higher on the Joroff ladder helped them to adapt sooner. It helped having the documents and information of the municipal buildings ready, allong with smart meters, and a clear real estate vision. Think in TCO and use private parties can help with optimizing and using new innovative ideas.

They used to see sustainability as a burden, and now they look more from opportunities, creativity, and possibilities. This way of thinking is an enabler to create sustainable measures and to get all heads in the same direction.

4 Synthesis

4.1 Cross-Case Analysis

The cross-case analysis compares the literature on the added value with the two cases. In the five themes, multiple sub-themes will be addressed where similarities or contradictions are found. Appendix F is an extended table of the synthesis of this chapter.

4.1.1 Strategy

Information identification

Both cases indicated that identifying their energy consumption is crucial when making a sustainable real estate strategy. The literature specified that there are regulations to create awareness for organizations to do this. However, there was a difference seen between the two cases. The case that already had a strategy had the energy labels and information about energy consumption. The other case was working on this and comprehended that this is a first step in the identification. Therefore, information identification is a first step municipalities need to make when making a sustainable strategy. Furthermore, both cases categorized their portfolio in core and non-core portfolio, where both cases indicated that they only want to use the sustainable strategy on the core portfolio.

Joroff ladder

Both cases identified that there are steps that one must need to make to become a strategist. And by doing this, become energy neutral. Enschede identified that they completed the Joroff ladder around 2010 and could, from then on, work on the real estate portfolio strategically. Zutphen indicates that the department is now shifting from operational, thinking tactical and strategically. The importance of making steps in the Joroff ladder is also seen in the theoretical framework.

Trias energetica

Trias energetica is in both cases and in the literature indicated as necessary steps for a building to diminish its energy consumption. Both cases explicitly used the thermology, without mentioning it as an interviewer. Therefore, it was observed that the focus of the cases lies with energy consumption and that they use these general steps in their way of thinking.

DMOP

Having a DMOP is seen back in both cases. However, the cases not used it for renovation, like literature mostly mentioned when using this strategy. The cases mostly use it for considering smaller replacement solutions. Both cases indicated that you must look in the total cost of ownership and using natural moments in the MOP to replace mainly heat and ventilation systems. Looking at deep renovations both municipalities did not yet have a detailed plan, but both agreed that when you renovate, that it is better to do more than is needed to be ahead of stricter regulations of the future.

ESCos

Zupthen used an ESCo and did learn a lot about this strategy. They were positive about their energy saving. However, Zutphen would in the future use an ESCo light, which means that they want to finance it themselves. The other case has a performance-based contract since they not only wanted to solely focus on energy reduction but also want to tackle the whole maintenance operation of their building portfolio. Looking at the literature, more expertise is necessary on the contract itself than about sustainability. However, there thus still need to be enough expertise to make the KPIs.

Performance-based contracts

Both cases see the usefulness of performance-based contracts. One case is in the short future entirely depending on this contract to provide an energy reduction of 3% a year. The benefits, seen in literature as well as in the case study, is that it can use the expertise of the market.

Furthermore, for a client, it can take some responsibility out of their hands. The risk of such contracts lies in the flexibility it gives. One must look at defining the performance correctly according to KPIs. This can be a tricky part. There also needs to be an incentive for the contracted party to ensure the energy reduction is interesting for both parties.

Outsourcing

For the sustainable strategy, the cases do not show interest to outsource the portfolio fully. However, looking at some tasks, like maintenance or investigating options to become more sustainable, both cases did use external parties to execute this. A brought-up reason to not fully outsource was to keep control of the buildings you own.

In-house software tools

Literature indicated that about 50% of the municipalities use GPR-Gebouw, one case did work with GPR-Gebouw but stopped because a tool can use more energy and money. Instead this money could be used for the buildings itself. The other case did not use a software in-house tool; the reason for this is unclear.

Building typologies

Both cases did specify that monuments can create a different approach and that this can be quite challenging. It was also seen that the sports facilities are going towards a sports company, for one example this could also be used to tackle the problems with a swimming pool. The other case also has a sports company, but this was not done for sustainability reasons.

4.1.2 Energy

Certificates

In literature certificates like BREEAM and LEED were indicated as a method municipality could use. The cases suggest that it is not a favorable choice to use, due to the costs. When used, they will not do it officially but can use the guidelines to measure their buildings unofficially.

Measuring

Both cases indicated that they use smart meters. One case used it for the whole portfolio, another only in some buildings. Zutphen stated that it is hard to figure out the building energy consumption. From literature, only some indications could be given how the TCO reduction of sustainability tools are. Measuring it in kWh_{el}/m^2 was not seen back. In the cases, this was also not specified. However, Enschede does demand a reduction of 3% a year. So here it can be seen that they relatively measure the reduction.

4.1.3. Costs

Costs

Similarities can be seen that the real estate department needs to fund most of the investments themselves and need to think about how to think in the total cost of ownership efficiently. Both indicate that there is most likely an unprofitable top when need to renovate to energy neutral, but both accept this given. When looking at the literature, it was not clearly stated that the investments are not fully able to pay themselves back.

Subsidies

The literature indicates that municipalities can use multiple subsidies. The cases also do have experiences with subsidies. However, they do not combine this with energy labels, so they do not use EIA or MIA subsidies. The SDE+ subsidy was used in one case for receiving money from the installed solar panels.

Split incentive

When measures create energy benefits or other benefits, the principal-agent problem can arise. Both cases indicate that they need to think about how to solve this. How to get money in return for the investment that was made in the building. One municipality thinks about lowering subsidies on the other side. This means when the tenant in a cultural institution, they may get less subsidy of the municipality in the cultural domain. The other case assumed that when the

tenant does not have to pay the energy company the tenant will give the money to the municipality, this was the municipality gains capital to fund the investments that created the energy reduction.

4.1.4 Obstacles

Municipal context

Both cases, as well as the literature, indicates that the municipal setting is unique. This makes it exciting, but also sometimes a longer process than needed. Making real estate decisions is talking in decades, square meter, costs, and other technical terms. In the political world, this is harder to sell because there is a short election cycle of four years. There is also a difference seen between what is said on the political side and the actions that are needed to achieve this. This is consistent with the maturity model of Masalskyte et al., (2014) that saw communication and commitment as factors to make good sustainable CREM.

4.1.5 Enablers

Innovation

Both municipalities are waiting for significant innovations. Therefore, the big renovations in the portfolio are planned later. They see innovation and new techniques as something that needs to carry the wagon. They currently see the impact for only their own real estate, but ultimately, they are also looking at technics for the whole city. When this is done, they need prospective innovation. Otherwise, it will be hard to accomplish their targets. This aspect was not seen back in the theoretical framework. However going through the literature, Hufen & De Bruijn (2016) stated that one of the obstacles for energy conservation in the building sector is the prospective innovations that make it attractive to wait and see. Looking at the cases, this behavior is similar.

Right parties

The literature does not specify that having the right parties to execute the work is critical. This was an enabler for both cases. Zutphen indicated that taking sustainability measures is becoming increasingly complicated and indicated that the right party could help with this. Enschede suggested that the experience of one of the contracted parties helped them with creating better performance compared to the party that was newly working with their performance-based contract.

4.2 Cross-case analysis findings

The table on the next page (table 14) compares the DAS-Framework with the case study. The process of the cases is compared and evaluated. The findings showed that in the foundation, the literature and the cases are fairly similar. Both cases made it clear that having useful information about the current portfolio is crucial to make a suited strategy. Secondly, the cases know the changing demand; this information was made through coalition agreements, trends, and upcoming national and European regulations. The generated models are a process that Zutphen was still was working on and were Enschede made a global calculation to see the impact of becoming energy neutral by 2040. This showed that Zutphen is still working on solving problems they have with the information of their real estate and that the other case, Enschede, is already working strategically (fig. 29).

Both cases did show that they do not work with one strategy but have options to adapt to the ambition or course of the strategy when needed. This consideration is mainly based upon the financial review and the amount of support of the council. Lastly, defining the projects to

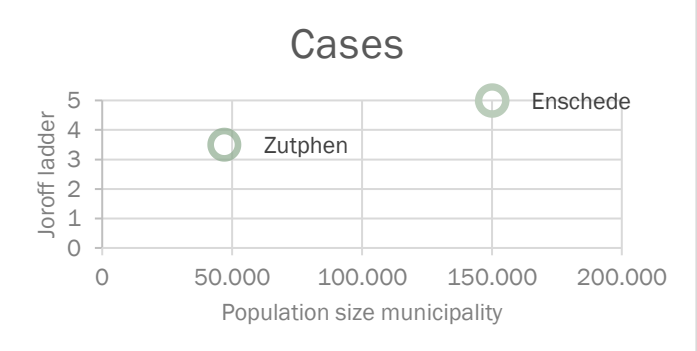


Figure 29: Position of the cases (own image)

transform is seen to be difficult in literature as well as in the cases. Every building needs its own plan, the sustainable tools founded in the literature can be used for these step by step plans.

	DAS-Framework	Case study
Task 1: Assessing the current portfolio	When assessing the current portfolio, it is important to identify the problems of various stakeholders; these can be specified from the CREM perspective (paragraph 2.1.3). Therefore, it needs an inventory of the current space, and the use of the space, the quality and quantity of the building portfolio.	As seen from the cases, creating and maintaining the portfolio information is for the cases the first step in making a real estate strategy. This is in correlation with literature such as Joroff et al. (1993) and the DAS-Framework. This information is, for example, the technical state of the building according to the NEN 2767 systematics, knowing if it is core, non-core or strategic property, the energy consumption, energy labels, present smart meters, rent levels and having information about the maintenance plan.
Task 2: Exploring the changing demand	For a business, it is hard to steer on the future because the future is unknown. Dealing with this can be done by selecting a generic strategy based on uncertainty levels. One can look at how much flexibility they want, or one can try to identify the future demand to create a more fitted strategy.	Both municipalities have strong statements in coalition agreements what they want to achieve. For both municipalities, the goal is to be energy neutral before 2050. Enschede indicated this as being zero on the meter, Zutphen wants this too, but they are still exploring the concept of being energy neutral. Both municipalities were experimenting on a smaller scale with sustainability tools to experience if they want to apply this on a larger scale. Zutphen indicates that it made future scenarios that are based on the upcoming policies that are being set by the national government. Enschede also had influences based on the political environment. The real estate department strategy was also based on political consideration to make solar panel fields or not. Enschede integrated the changing demand for European and national energy policies in the performance-based contract. This means that the executing party is responsible for keeping the client updated about the current regulations.
Task 3: Generating future models	Combining task one and task two, one can look at a possible solution. When doing this, the mismatch should be resolved. During this process, the stakeholder's perspective needs to be kept in mind.	Both cases showed that the council members eventually make the selection of choosing the strategy. Zutphen indicates that they made future scenarios based on a low, middle, and high ambition. Eventually, their choice directly correlates to the financial possibilities they have. Both cases indicate that the investments to go to an energy neutral building portfolio will probably have an unprofitable top. Also, both cases are looking when making investments in terms of the total cost of ownership.
Task 4: Defining projects to transform	The last task is to make a step by step plan. It describes the adaptation of the current supply in the future supply. A financial plan and a schedule accompany this plan. The DAS-Framework use the six scenarios of Vijverberg to indicate what can happen to a building. This is consolidation, expansion, conversion, redeployment, sale, and demolition.	Both cases have not a structured step by step plan for their whole portfolio to become energy neutral. Enschede decides for their maintenance to have a performance-based contract with also KPIs for energy reduction. When comparing the overall strategy to Vijverbergs scenarios, both cases first focus on selling non-core buildings, then they look at the maintenance plans of the buildings. From this perspective, they consolidate or convert what can be done in natural interventions points in time.

Table 14: Cross-Case comparison from a DAS-Framework perspective

4.3 Validation of the findings

The two cases from the case study where cross cased analyzed with the subjects of the theoretical framework. From these findings, the motives and reasoning for the chosen tools where found. It also showcased the obstacles and enablers municipalities face when making a sustainable real estate strategy for their portfolio. To validate the findings, even more, the cases are compared with experiences from practice that used the same tools identified from theory. The "mini cases" were collected from a gathering of "Bouwstenen voor sociaal." This is a network with mainly portfolio managers, facility managers, and technical managers of public buildings and organizations. So, during this day, multiple examples were showcased for other portfolio managers, facility managers, and technical managers to think about sustainable approaches and strategies.

4.3.1 Context and experiences from practice

The introduction of this day started with Maarten van Egmond, he is the team leader and real estate manager at RVS, this is an advisor and engineering company. His recommendation for this day to the attended people was to:

1. Go from sectoral to integral
2. Make it less complicated
3. Have better management information
4. Make more money available

In order to do so, he also advised aligning the real estate department, to become more professional. The organization needs to ask themselves where the challenges are and how to find the right technical solutions. Because he indicated that the solutions are already accessible.

He further identified that there is synergy to get from the organization and the market. Further, he stated that there is a division between sustainable advisors in the organization that wants to realize the ambitions and the technical management that wants to keep the status quo and only maintain their buildings.

Some quotes he got from the audience where:

"We are just getting started with getting our information up to date for the reporting obligation of the fist of July, we are just getting budget for this."

"We are behind when it comes to sustainability, this is mainly because we have little time and money."

After this, the audience of about 40 people needed to place themselves into the frontrunner's role, doing what is necessary and laggards. About 20% feel there where frontrunners, 60% were doing what is necessary, and 20% still needed to speed up soon. One person that was lagging claimed that this has to do with the collaboration within the municipal organization.

Municipality of Rotterdam (ESCo)

First, the municipality had the overview what their portfolio was and what they see as core and non-core object. However, they not yet have all energy labels known. In 2008 there was already the idea to do measures with a payback time less than 15 years, but in the end, there was no money reserved for making this happen. The municipality had set up a sustainability department. This made the real estate department less active when it comes to sustainability. Now they understand that this needed to be done integral. When they now look at their buildings, they are combining it as much with the transformation per neighborhood. They identified that due to the diversified portfolio, not one strategy works. In 2008 they started an ESCo for ten swimming pools. One reason for this was that this type of contract was subsidized.

They learned that ESCos take much work to set up and that it requires people that can make those type of contracts. They at the time initiated it because they had no own expertise on

sustainability, it has a clear target, there is competition, and you do not have to use their own capital. The downside they experienced was the lack of control and that it only works with a stable portfolio because it is a long-term contract (Gemeente Rotterdam, 2019).

Municipality of Tilburg (Performance-based maintenance contracts)

When the municipality was starting to think about their sustainable ambitions, the maintenance contract was going to be tendered. For them, the logic follow-up was to combine this moment to incorporate a sustainable "roadmap" into their maintenance contract. As a result, they now have a partnership with a contracted maintenance party. A reason for this type of contracting was to gain expertise from the market parties. They let the contracted party make sustainable propositions to take. This way, it will be as much integrated within the regular maintenance plan (MOP). These propositions are done through the Fastlane method.

However, in this method they take the monumental buildings out of the contract. They want to do easy buildings first, before working on the monuments.

The municipality of Tilburg learned from this performance-based maintenance contract that they need perseverance. They currently see that every sustainable measure is explained through payback times and that there still is an unprofitable top. However, this is not their future of the way to approach things. When making the contract they experienced much interference. They are content that the real estate department is keeping control in their own choice of maintenance, and this knowledge of their portfolio is slowly being transferred to their maintenance party. Therefore, they identified that working integral is the key to success (Gemeente Tilburg, 2019).

ROC Gilde (using outsourcing and KPIs)

Since this school got ownership of their buildings, there was a need to set up regulations and policies. Their ambition in 2014 was to be sustainable, but only when this was economically responsible. Experienced showed that a WKO was not in favour when having a school. In the summer heat the school is closed and do not need that much energy, they want to work in the future with heat pumps. The goal of ROC Gilde is now to have sustainability integrated into their day to day maintenance.

In the end, they needed to transform two school buildings and insist to only do this in the holiday periods. They used an external party to gain expertise to renovate circular. Moreover, a condition they had to start the project was to have a reliable and committed partner, have lean planning, and have the engineering done by a market party.

This contracting was done with KPIs and an insurance that suppliers will take back the compartments they placed after there are depreciated (ROC Gilde, 2019).

Municipality of Amsterdam (DMOP/In-house)

This presentation was done by a project leader and team manager of the real estate department. Their goal is to become climate neutral in 2030. Moreover, they also want to have a gas-free municipal real estate portfolio. This means that they must transform 120 buildings towards label A before 2022. They also stated that they are placing solar panels on every municipal roof. They identified that in their organization where was a lack of support to make their ambitions happen. They had struggled with the decision-making process, the financial support, and how to cope with monuments. During this transformation, the department had struggled to combine the European, local and intern policies.

Their solution was to make a work program that combined the MOP with DMOP measures. This was done internally with its own capacity. The reason to not incorporate external parties was that they are convinced that they have the best knowledge about their policies, regulations, MOPs and that they know the measures that they can take with the accompanying budget and capacity. However, the budget was a point of discussion within politics, and because of this, they are currently borrowing money from themselves to eventually pay back in the next political term.

To detach buildings from the gas network, they are investigating if they can connect to district heating. Furthermore, measures with a payback time of 10 years are executed in the DMOP.

They identified the key to success to quantify the results, create internal support and insist on collaborations, prioritize the measures per building. Upon this take integral measures and when works need to be tendered circular. (Gemeente Amsterdam, 2019).

3.3.2 Lessons learned

Strategy in time

What can be learned from these mini cases are that every case made their decision based on the information that they had in that moment. In the experiences, many critical points came back as seen in the theoretical framework and in the cases of Zutphen and Enschede.

The municipality of Rotterdam indicated that also the context for their decision was important. They saw financial benefits when choosing this strategy. They also identified that ESCos only could be done when the municipality is confident that the buildings are long term objects in the portfolio. Internally they saw that sustainability needed to be an integral objective within the real estate department and not something a separate sustainability department could do for them. To compare this with the experiences of Zutphen, it became clear that they had less problem with the financial side of an ESCo but had more problems in term of flexibility.

Seen from the experiences form the municipalities of Tilburg, their reason for their approach was that it came at a right moment in time. They had enough in-house experience to set up a performance-based contract. They did find it hard to take monumental buildings in this contract. This can be indicated as an obstacle to the strategy. Comparing this to the findings of the performance-based contract of Enschede, both municipalities had useful in-house information and experience when implementing this strategy. Therefore, it can be concluded that this strategy can work when the parties are a strategist and can work with external parties to create optimal solutions.

At the strategy of ROC Gilde, it could be seen that some technical solutions may work for some building typologies, but for others, it will not work. So, here the context of the organization and building typologies are also a factor that needed to be taken into consideration when making a strategy. Also, the market was used to gain expertise when making this circular renovation plan possible.

Lastly, the municipality of Amsterdam showed us that incorporating sustainable strategies into their day to day technical maintenance helped them to improve the portfolio. It does not yet steer on being total energy neutral but does think about going gasless. Here it also showed us the political influence on the strategy by making abnormal financial structures.

Energy (political goals)

Some municipalities do have information about their consumption, but some also do not yet have a clear overview of their energy consumption. They work with multiple indicators such as labels, KPIs, and benchmarking the energy consumption. The municipality of Rotterdam indicated that they had used BREEAM certificates. So, this is in contradiction to the two main cases.

Costs (financial policy)

The financial policy is seen as an interesting factor. Cases worked with payback times and indicated that this is not the way to do it for the future, but that it is now working to make financial considerations and explanations to the council. A special structure was made at one municipality to keep the spending in another political term. Here the political context is a factor that changed the financial policies. As mentioned before, some strategies were also taken because of the available subsidies.

Obstacles on added value (user satisfaction)

The clear indicated obstacles were the monuments and the lack of internal expertise. Also, the changing portfolio can make it more challenging, for example, with a strategy tool like ESCo. The lack of finance can also be a delaying factor when looking at the mini cases. The municipal context can also be placed here. This was more indirectly implied with the remark that stakeholders could be challenging.

Enablers on added value (user satisfaction)

When having good in-house expertise, this can become an asset when making a strategy. This is seen at the municipality of Amsterdam and Tilburg. Using expertise from the market can also be seen as a factor that can help municipalities to gain knowledge and help them achieve their goals.

4.4 Conclusion synthesis

When looking at the findings and the validation of the findings, many similarities could be found. Through comparing the two cases, the main findings were on the experiences of the tools and the decision-making process. There it became evident that the two cases are on a different level in the energy transition process. Form both cases, lessons could be learned. The sustainable strategy tools themselves were more compared with the theoretical framework and could, to a lesser extent, be compared with each other. The mini case where used to not only have a theoretical comparison for the used tools but have some validation through other experiences with the used tools.

The conclusions from the next chapter will incorporate the main findings from this chapter into the main question and various sub-questions.

5 Conclusions & Recommendations

This chapter discusses the main findings of this research and the answer to the main and sub-questions. The second part of the section proposes a road map as a recommendation for municipalities to use when making a sustainable building portfolio strategy.

5.1 Conclusions

5.1.1 Main question

What sustainable real estate management strategy tools are available at a municipal level, and how do municipalities need to apply these strategy tools to create a public real estate portfolio that is energy neutral in 2050?

We can conclude from literature and case studies that there are special contracts, approaches, and guidelines municipalities can use to make their building portfolio energy neutral. However, there is not one uniform tool that can entirely transform the total building portfolio. So, the strategy tools need to be used for the right buildings at the right time with the right expertise and information. This approach needs to be in balance with the three added values of MREM, namely: political goals, financial policies, and user satisfaction. The considerations to set the pace of the energy transition is predominately based upon the financial possibilities, the amount of support of the council, the physical context, and the professionalization of the real estate department. The DAS-Framework and four C/P/MREM perspectives, used in the approach of the case studies, can help municipalities to structure and balance the values of the organization when making a sustainable strategy.

5.1.2 Sub-questions

1. What current theories are used to make strategies for municipalities to manage Public Real Estate Management?

There is not one correct or straightforward way to manage PREM/MREM, as is always depends on the context, but there are online guidelines, employers' experiences and academic logic that a real estate department uses to manage their real estate. There is a division made in the real estate department to structure the tasks into operational, tactical, and strategical tasks. This is done according to the real estate management triangle. This triangle is discussed in literature like Vermeulen & Wieman (2010) and also used in the case studies of the empirical research. The origin of strategy making comes from Mintzberg (1989), where they saw that organizations created strategies from two sources, namely the intended strategy, that becomes a deliberated strategy combing it with the so-called emergent strategies. Joroff et al. (1993) made a ladder where the competence shift of real estate can be seen of an organization. The C/PREM model of de Jonge et al., (2008) can structure the perspectives on the real estate of organizations. Therefore, it defines the decision-making process. It can also connect the strategic goals with the financial goals, physical goals, and functional goals, as seen in Den Heijer (2011). Therefore, the DAS-Framework can be used to make an accommodation strategy. It primarily focusses on the iterative process to analyze and synthesize the current and future demand and supply. By doing so, a transformation in a portfolio can be made to add value to the portfolio, and therefore, create the future supply. So, there is academic literature available that discusses real estate management. However, the foundation of literature about public or municipal real estate management is inadequate and can be broadened.

1. What current sustainability strategy tools are already available and used by municipalities?

As seen in the literature, many computer in-house tools can help municipalities to have contracts and tender procedures that enable sustainability. There are also software tools, like GPR gebouw and Vastgoedmaps. These software tools can give an overview of the energy demand of the portfolio to build strategies upon this information. Some strategies outsource the tasks by using

ESCos, performance-based contracts, or hire other parties to unburden the municipality with the real estate and its sustainability demand.

However, there is not one uniform tool a municipality can use to ensure an almost energy neutral portfolio that contributes to the CO_2 reduction of 95% in 2050. There is always a balance needed in the political goal, financial policy, and user satisfaction in the municipal context. It is the tasks for municipalities to create this balance in the coming thirty years.

The case studies provided the possibility to elaborate on the processes that were used in combination with a sustainable strategy tool. It became evident that the approach municipalities take is in line with the DAS-Framework. One municipality already went through a cycle by setting up a performance-based contract. Enschede was positive about this strategy. First, they experimented with the strategy on a smaller scale to learn from each other. After the feedback loop, an improved version of the contract was implemented for the whole building portfolio.

Analysing the case of Zutphen, it showed that they are unknowingly going through the process of the DAS-Framework. This case was not yet able to make a step by step plan because they were currently working on determining the current supply. Also, they are generating future models to evaluate future demand, together with an eternal party. They think making the strategy with the foundation of trias energetica and testing it on a smaller scale with the help of external parties that have the expertise can help strengthen the strategy.

2. Are there sustainability strategy tools for different building typologies?

Yes, we see different software tools and approaches, for example, with sports facilities and swimming pools and monumental buildings. Some arise from the context of a building like having district heating or being a non-core building for the municipality. The case study once more identified that a uniform strategy for a whole portfolio in a strategical, tactical, and operational way is not possible. Every building has its own demand and life cycle, accompanied by its personalized strategy. The focus for a municipality is to determine if the building is a core, non-core, or a strategic object. This determines the best way to approach the buildings in terms of sustainability. Municipalities do not want to make disinvestments. However, this approach is also strange because, in the end, every building in the municipality needs to become energy neutral. Here it is seen that there is an underlining business approach and that municipalities choose wisely which buildings they want to put investments in.

3. Are there sustainable strategies where outsourcing is used?

As seen in the literature as well as in the cases, municipalities prefer external parties to help them with organizing the energy transition. Theoretically, we saw the tools ESCo, Performance-based contracts, and total outsourcing as optional tools to outsource. The utility of the usage of ESCos and performance-based contracts was seen back in the cases. The complete outsourcing strategy is not common yet. One case study did show that some parts of the strategy-making were outsourced; this was to organize the information that is needed for upcoming regulations. In this specific case, but also more in general terms, research showed the importance for municipalities to incorporate and use the market in the strategy. The case studies brought, for example, the external parties in the process sooner to make use of the expertise of the market.

The used contract types in the cases are often long term. Therefore, municipalities need to build some flexibility into the contract. They need to create an incentive for the market party to ensure they are equally willing to make the buildings sustainable.

4. How do financial investments affect the decision-making process?

There is a direct link between the political goals (for the building portfolio specified as being energy neutral) and the financial policy. This connection is in a lesser extent seen back between the political goals and the user satisfaction and financial policy and user satisfaction.

The theoretical framework did not directly show a link between the financial decision-making process and the researched tools. In practice, we saw that the energy certificates would be used when there is a financial benefit option to it, like the possibility to apply for subsidies.

The financial decision-making process was seen back in the case studies. Here, it became evident that political aspirations, laid down in coalition agreements, are depended on the budget that is given. Both cases indicate that the split-incentive needs to be considered for tenants of municipal buildings. While municipalities are aware of payback times and possible energy reduction, a starting fund is required to initiate the transition process.

5. *What are the obstacles and enablers of a sustainable MREM strategy in terms of added value?*

Innovation can be seen as an obstacle as well as an enabler for the political goal to have an energy neutral building portfolio. It currently restrains municipalities from reacting adequately to sustainable innovations. There is not yet an adequate guideline available, nor are there fully working examples of municipalities that function with an energy neutral building portfolio. Due to fast innovations in sustainable techniques being the first can be less favourable because there could be something better in the future.

Secondly, the municipal context can be seen as an obstacle in the energy transition process. This in terms of physical context as well as the organization. The physical context can enable specific options like using district heating; it can also be an obstacle when there are lots of monumental building. One mini case even showed that they incorporated every building into the strategy except for the monuments, due to the challenging character. Organizationally wise, it is essential that all departments of the municipalities agree to the finances that need to go to the building portfolio. Policymakers cannot say that they want to have an energy neutral building portfolio within a couple of years without wanting to put more energy and finances in the buildings. When making sustainable measurements, the cases showed that not all expenses could be justified when looking at payback times. So, there needs to be a realistic approach from policymakers as a constructive (or realistic) way to find and combine strategies with the city to find synergy.

5.2 Road map

First, this paragraph shows a baseline the real estate department must have when making a sustainable real estate strategy. Then a roadmap, shaped globally in the DAS-Framework, is made for municipalities to make a personal sustainable strategy (fig. 30). These steps can be seen as a recommendation to consider when making a strategy. Each box indicates were to think of and what to do for each added value in the four tasks of the DAS-Framework. Lastly, the sustainable strategy tools are positioned in a small assessment model to give a global direction to the tools that can be suited for a municipality. Further examples of experiences from every tool, except for In-house with tools, can be found in chapter 4.3.1.

The baseline for the roadmap

The professionalized real estate department	Energy information up to date	Decide what are core/non-core and strategic objects	Comply (if necessary*) to the activiteiten besluit wet millieubeheer	Comply (if necessary*) to the EED audit	Have internal support for making real estate energy neutral
Yes →	Yes →	Yes →	Yes →	Yes →	Yes? Go to the road map
NO? Consider if this is necessary for future demand. If so, make a start with the points made in this baseline and start a department with or without consultation of an external party.	NO? Install smart meters (when you have ≈75 or more buildings) Moreover, make an inventory of energy consumption.	NO? Look in policy documents what will be necessary for the coming years and consider the status of the building. This can be measured, for example, in NEN2767.	NO? Make a plan, with or without the help of external parties before the first of July 2019. *For municipalities that consume 50.000 kWh or 25.000 m^3 gas a year.	NO? Make every four years an Energy-audit report to comply with the regulations. *For municipalities with more than 250 FTE's or have yearly revenue of 50 million with assets more than 43 million.	NO? Try to convince other departments, with support of the Aldermen, why this is necessary. Be transparent about the interventions you want to do and let other stakeholders think along to create synergy.

Table 15: Baseline for the roadmap

DAS-Framework	Political goals	Financial policies	Enablers	Pay attention to
Task 1 Assessing the current portfolio	Comply with the current regulations and have up to date building information, also know what your core and non-core buildings are.	Create support in the municipal organization and know the current energy expenses of the building portfolio.	Have a professionalized real estate department that is operating as strategist.	Buildings such as swimming pools and monumental buildings can be challenging.
Task 2 Exploring the changing demand	Think in trends and upcoming regulation. Envision the future of the organization. Define how you want to be energy neutral.	Know what financial instruments you have at your disposal, such as subsidies and revolving funds.	Explore what can be a possible innovation for your building portfolio.	The political debate can slow the process. As a real estate department, take control of your route in becoming energy neutral.
Task 3 Generating future models	Think in phases, TCO, KPI's and ambitions levels to optimize the portfolio. Test the strategy on a smaller case if needed.	Balance the political goals with the budget and make financial scenario with the right split incentives and subsidies.	Think if the municipality can create synergy with the surrounding.	Be aware of the different stakeholders when weighing and selecting the right projects.
Task 4 Defining projects to transform	Decide what sustainable tool(s) fits best in the portfolio to become energy neutral.	Think in payback time and create a clear overview of the long term expenses.	Have experienced parties to execute the interventions for the buildings.	Try to find the positive in the transition and think in opportunities instead of seeing it as a liability.

THE FIVE SUSTAINABLE STRATEGY TOOLS

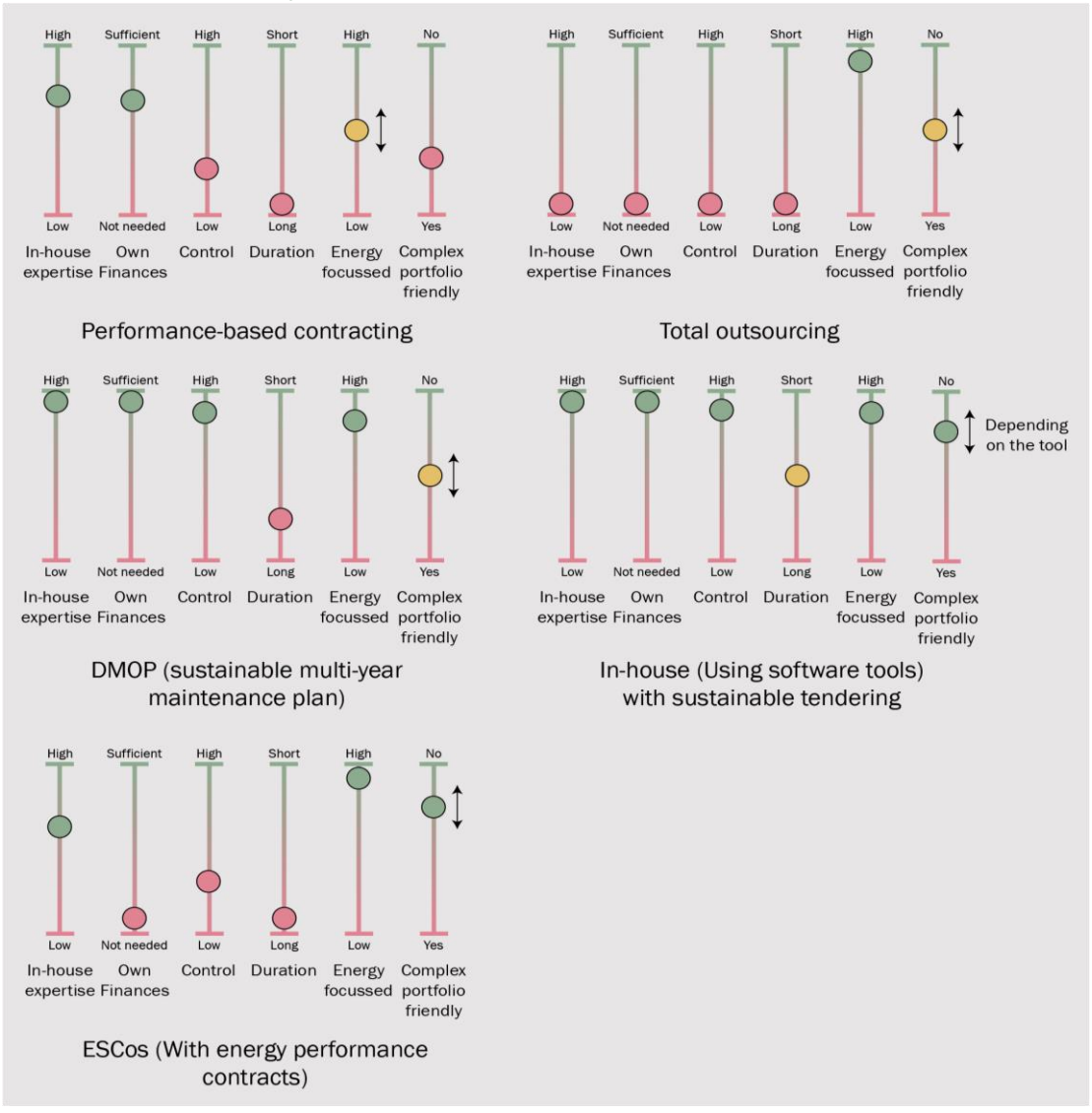


Figure 30: Road map (own image)

6 Limitations & further research

In this chapter, the limitations of the study will be discussed. The chapter ends with recommendations for new research concerning the field of research.

6.1 Discussion methodology

6.1.1 Validity

In terms of validity, there is internal and external validity. Internally there needs to be a correspondence between the observations in the case study and what is developed in the theoretical framework (Bryman, 2015). When we looked at the synthesis and compared the literature with the cases, mostly similarities were found, this can also be seen in the appendix F. The strategy tools that were used by municipalities were found back in the theoretical framework. The case studies did indicate where the focus lies for municipalities. Innovation and the municipal context proved to be more important than the literature showed. Going in the case studies, I did find many projects where the municipality worked with ESCos. However, the case showed that it should be noted that it does not always have to be the right solution when looking at the financial policies of a municipality.

Externally wise, the findings need to be in some degree be generalized across social settings. Due to the nature of case studies, this is harder to do because of the sample size. Therefore, this aspect could be seen as a limitation in this thesis. The mini cases did help to find more in-depth knowledge for the other sustainable strategy tools that came up in the theoretical framework.

6.1.2 Reliability

Bryman (2015) also identifies external reliability and internal reliability in qualitative research. External reliability looks at the degree in which the study can be replicated. The context is never the same when doing case studies. This makes the study interesting and complex. To exactly replicate a case study is impossible. However, the approaches by using the CREM-model and DAS-Framework in the case study can be copied in other studies. This thesis could be replicated with the same conceptual model and being conducted at other municipalities in different provinces and with different populations size. This is also a recommendation for further research.

Internally, there is not a person that can verify the observations and findings I, the researcher, has made. The term triangulation can also be placed here. Triangulating your data and find multiple sources can strengthen the findings. This is done in this thesis with the literature, database of the case study, making a cross-case analysis and, evaluating the findings with examples in practice. However, this is done only through one person, me. Therefore, to have a better and stronger thesis, a second person preferably need to check the data and the findings I have made through the data collection.

6.1.3 Limitations of this study

First, looking at the literature, there are many sources used from the non-academic field. This was inevitable, due to the practical research question, but also because MREM is a relatively new academic field. This thesis did build on general management literature, such as Mintzberg to make the research connect more with the academic field. It also used research and tools developed from the TU Delft. This study has due to its nature less focus on other countries. It would be interesting too, in the future, do cross-national research to see if the problem statement also is seen back in other settings and other countries.

Secondly, the case study selection was challenging to determine whenever to do one case study or multiple cases and, with that question in mind, how many in total. This is because the depth for each case will decrease when increasing the number of cases in this fairly short period. Therefore, the sample size of this thesis is not extremely large by using two cases. However, as

mentioned before, this is done to create depth in both studies. If the study had extra time, it would have been favourable to have a third case. A municipality would be selected that did not have yet a professionalized real estate department. Therefore it needed to be on level one or two of the Joroff (1993) ladder. It would be interesting to see if municipalities will outsource sooner or would collaborate more with other municipalities.

Due to literature, an indication was made where some obstacles and enables where. This subconsciousness thought could create biases while executing the case studies. Even though this was my interest and subject of matter of the last nine months, some knowledge could be missing and could have created misunderstanding or could have let to misconception. This is not only applicable to me, but this could also be the case for the interviewees. For the interviewees, the subject could be a bit sensitive to be fully able to share experiences. They might not want to be too explicit, talking about the things that might went wrong during the process. Therefore, the data could be missing some interesting points.

Lastly, there was a generalisation made between a CO_2 reduction of 95% in 2050 and conforming this into measurable indicators for the built environment. As seen in literature and case study, many people think in energy and energy reduction. For the built environment, it is the most accessible measuring tool to see if energy goals are being reached and after this, converting it back into CO_2 emission. However, in the future, one must look at CO_2 and being circular and not solely look at reducing energy consumption. When thinking about renovation, you then also need to consider the materials and possible need to make Life Cycle Analysis (LCA's) when making building interventions.

6.2 Discussion findings and conclusion

6.2.1 Cross-case analysis

The cross-case analysis was compared with the five themes and eventually also with the DAS-Framework. As mentioned before, I could not precisely compare the tools with each other because of both cases wherein a different period in the decision-making process. Also, fully converting the findings into the conclusion was a bit harder because the sub-questions mainly focused on the theoretical framework and exploring the strategy tools. Therefore, some minor alterations in the sub-questions were made to let the findings better connect with the sub conclusions.

6.2.2 Validation of the findings

During the "Bouwstenen voor sociaal" day, I did not find many new findings, but it more verified the conclusions I have made through the cross-case analysis. What did come to my attention was the clear different perception of the technical and portfolio managers of the municipality. In the case of Enschede, I found that these perceptions were more in line with each other, but after the mini cases, I identified that some municipalities have more struggle to unify the technical managers and portfolio managers during the energy transition of the buildings. This was a new insight in the conclusions I had made from the cross-case analysis.

6.2.3 Conclusions and road map

The conclusions are a combination of the founded information from literature and case studies. The conclusions, together with the road map, should form a foundation where municipalities need to think about when making a sustainable real estate strategy. I wished it was even more detailed than I have put down in words. However, this is in line with my conclusion that municipalities are so diverse, and that there is not one uniform solution. The experiences of the cases should help in what directions a municipality wants to go and what factors can cause bumps on the road. Before going in depth in the strategies, I was under the assumption that the strategy could be categorised in energy saving per m^2 and that there was clear cost indication such as euro/m^2. After the literature study and case studies, I realised that strategy tools cannot exactly be calculated and that exact numbers are missing and that there is no simple yes or no

indication to choose a strategy. Therefore, the conclusion was more based on how to finance the strategy and how the energy savings could be measured, and which options are available.

6.3 Recommendations for further research

6.3.1 Organizational structure

The findings indicated that there is an influence on the decision-making process when looking at the organizational structure. However, the structure was coarsely discussed. More research can be conducted to see relations between the structure and the decision-making process. It can be possible that smaller municipalities have shorter lines in the decision-making process. Therefore, it can be quicker in making decisions. However, literature also showed that smaller municipalities sometimes do not have a real estate department. Research can be done looking at such organizational structures, will those municipalities collaborate sooner with other municipalities, or will each department take measures into their own used buildings?

There was also a tension field visible between the council and the real estate department. This is understandable because the words of the politicians need to be brought into action. This means adaptions and money. It was also seen in the cases that sometimes the persons do not “speak the same language.” This was elaborated in one case that the real estate department talks in m^2 and other technical terms and that the policy side talks in goals and possibilities.

The cases also discussed the positive and negative sides of having a sustainable coordinator. Here some contradictions can be seen. So, the influence and impact of a sustainable coordinator on organizational real estate can be a topic for further research. This can also be extended to have a sustainable department that works on a city scale.

6.3.2 DMOP

As seen in literature and case studies, the most used tool is to make sustainable alterations in the natural maintenance process. Research can be done to see how far municipalities can come only applying these measures and if they can reach their goals when solely using this strategy. The document of Agentschap NL (2012) indicated that it only influences buildings with a label C or less. However, since 2012, technics and regulations have changed. It could be possible that updated information and literature about this subject is needed. So, research into this process is no unwanted matter.

6.3.3 Relation market and municipalities

In conversations, the subject of the market expertise often arises. Municipalities sometimes feel that they do not have enough expertise in-house and that the market can help with innovation and efficiency. However, they also know that the market party needs to want something in return. Research can be done by looking at these interactions and relations to see how an efficient and balanced relationship can be made. This can predominately be interesting in the long-term contracts such as ESCos and Performance-based contracts. I can also be interesting to see it from the other side and see what the motives of the private companies are to work or not work with the public sector.

6.3.4 Finance

After finalizing the theoretical framework, some information was found on how municipalities could finance their real estate renovations and interventions. When conducting empirical research, it was evident that the financial system of municipalities is a bit different than for private organizations. In-depth analysis can be done into the financial system, and the considerations municipalities need to make to want to finance it with or without a private party.

6.3.5 Developments in the Climate act

When doing this thesis, the development of climate laws and other political decisions were adapting quickly. This is also an uncertain field when working in a political context. Further

research in this field needs to be up to date with the changing national and international regulations. Research can also look further into the impact the national and international regulations has on the policies that municipalities can make.

6.3.6 Public real estate

As seen in the problem statement, most public square meters can be found in education and the health sector. I found out that my interest, also due to the statement of Veuger (2018) became municipal real estate management. But this is not where the most square meters are. So, further research in those public buildings can also help to speed up the knowledge and pace of the energy transition.

7 Reflection

7.1 Topic of research

We, as a society, are not perfect, nor is the municipality. However, there is a growing need for sustainable measurements. Whether you like it or not, an energy transition needs to be made, and this is how my thesis topic came to mind. The Barometer of Veuger & van den Beemt-Tjeerdsma (2017) indicated that there is a lack of sustainability measurements taken into the municipal building portfolio and that municipalities are getting behind. New policies that were being made during the time of this thesis created more needed actions at municipalities in the short term. As mentioned before, REM is not the core responsibility for a municipality, but the new regulations made the municipalities almost feel obliged to set the example for society. Therefore, I chose to focus this thesis on sustainability in municipal real estate.

7.1.1 Graduation topic in relation to MSc AUBS, MBE, and REM

Looking at this graduation topic, it is quite in line with (public) real estate management (REM). The combination of aligning business goals (public goals) with the accommodating real estate is the core job of a portfolio manager. Therefore, this thesis is also looking at one portfolio and researched how sustainable measures were implemented in this portfolio strategy. When looking at the master track Management in the Built Environment (MBE) sustainability and portfolio management are integrated into the master program. The study MBE makes you look at the big picture. Looking at the whole master program (MSc AUBS), the sustainability part of this thesis is almost always a topic that is part of a design or research in all master tracks of AUBS.

7.2 Research process

7.2.1 Exploration

Starting with my graduation, I had looked at the main topics before the summer holiday break. I always knew I wanted to do something with popular subjects that play an essential role in today's life. I had in mind to look at the impact of the Dutch housing market when Brexit was announced. I knew that my interest was more into the macroeconomics and not solely on building level. In the end, I chose a popular subject somewhere in the middle grounds, namely on a portfolio level. I found in public real estate the part of REM what I liked, looking a building from more a process way and not having to define the added value in terms of money and m^2, but also look at real estate in terms of current public and societal goals like sustainability.

7.2.2 Moving to P2

Working towards the P2 had some up and downs, looking at the process, there was not a continuity because there were more courses that needed to be completed simultaneously. This also had my interest because I wanted to finish these courses as efficient as possible. In the meantime, the graduation topic was going more towards sustainability and looking at PREM on a municipal level.

7.2.3 Moving to P3

After the P2 I reflected where I was and where I wanted to go. From this point, I incorporated the feedback I got in my report. This was mainly about the way some topics were discussed and trying to create nuances in my story. I also started my internship at Twynstra Gudde. I think this was a good move to keep pace in my graduation. Besides this, I became more familiar to life after graduation and what it is like to be in a work environment. Twynstra Gudde also helped me a lot to get in touch with my case studies. However, it took a bit longer to set out the case study than expected. Municipalities are, what I can see, busy with managing what they need to do. Therefore it took longer to plan the interviews with the needed persons.

7.2.4 Moving to P4

From this point on, I had good rhythm and structure where I wanted to go with my research conclusions. However, making the conclusions was the most challenging task of this phase. The feedback I got helped me to structure the report more in the DAS-Framework. Making the cross-case analysis was more difficult because the theoretical framework was more explorative of nature. Here the DAS-Framework was also used to structure this aspect. Also, small alterations were made to the sub-questions because my feeling was that the conclusions where stronger. Therefore, it became a bit more an iterative process.

7.2.5 Moving to P5

After the P4, the last part of the research is conducted. This is an addition to the work. At a workshop event, portfolio managers and technical managers will come and listen to examples regarding sustainability and maintenance of public buildings. Here the findings of my thesis are tested, strengthened, and deepened. Most information was not new information. However, it did give more perspective on some strategies that where not used in the two big cases. Therefore, in contradiction to the feedback I had gotten in P4 I still placed this data moment as not new data in chapter three, but more as validation and as a reflection moment of the findings I had made in chapter four. The data was not big enough to make new cross case analysis from with the other two bigger cases. After this, the roadmap was strengthened. The first map that was made, didn't explained the choices that well, but when I wanted to be more detailed, the focus and overview disappeared. Therefore, in the P5 period my main purpose was to strengthen this picture more.

7.3 Research methods

This part of the reflection elaborates on the research method and approach about the graduation studio methodical line of inquiry, reflecting thereby upon the scientific relevance of the work.

7.3.1 Choice of methods

The choice of literature research combined with a case study and small validation moment arises from the level of my expertise. The basis of the thesis came from reading and finding information in the literature and the internet, building this knowledge was needed to create the research theme and the research question. So, doing literature research came as first nature when starting with the thesis.

Secondly, the choice of qualitative research emerged because when looking at the sustainability question at municipalities, it identified for me as a technical and organizational problem. The choice of conducting case studies arises from this fundamental aspect.

Favorable, the case study would be a longitude case study. However, due to the nature of a thesis, this is not possible. Therefore, my recommendation for further research would consequently also be to deepen this thesis with more longitudinal case studies to fully grasp the strategies and strategy making in time.

7.3.2 Literature research

During the literature research, the desktop application Mendeley is used to organize and analyse the literature and other sources of interest. Most documentation was found online when searching for relevant keywords. However, the university library, and to a lesser extent, google scholar, was also handy for the more scientific literature.

7.3.3 Case study and interviews

The basis of the case study and interview protocol came from the course "Case study methods" from the TU Delft. Another source of setting up the case study was Bryman (2015). The analysis of the data was done through Atlas.ti

7.3.4 Ethical dilemmas

When looking at the ethical considerations, the data that will be used will not be used for other purposes than educational purpose. Data that is private will be made anonymous if the user of the data wishes this. I have experienced that municipalities were enthusiastic about the research, but that they were less willing to share than expected. One data collection moment was cancelled due to unknown reasons. Because of this, I made clear that if the municipalities do not want to be mentioned by name, I could make them anonymous. This was later communicated, now, with a retro perspective on this item, I should have made this known upfront with the municipalities because they probably were more willing to share.

7.4 Dissemination

This paragraph elaborates on the relationship between this thesis and the broader social, professional, and scientific framework where we touch upon the transferability of the project results.

7.4.1 Research position

Identifying strategies and looking at the performances of these strategies can benefit, in the long term, the energy expenses of the government. It provides an example for society showing that renovation towards being energy neutral is possible and can be an incentive for other private building owners to start transforming their homes and change their energy consumption. Besides this, having energy neutral public real estate is also beneficial for the people that use them. In many cases, energy neutral will also be accomplished through a renovation that creates better-isolated buildings, a better indoor climate. Therefore, it increases the comfort level of the people that use them.

Scientifically, there will be new research and insight into the change in the decision-making process of municipalities. This can be extended to have more knowledge about the decision-making processes for public real estate on a municipal level with emerged strategies. However, this research is in its current paradigm. The future can entail a paradigm shift where the energy transition can be seen in a different context.

7.4.2 Transferability

The data is analysed according to parts of the fair guiding principles of Wilkinson (2016). Using the guiding principles is done to ensure people that the data can easily be accessed. To make the generated (meta)data findable, accessible, interoperable, and reusable, researchers can contact me to access the coded transcriptions. The coding is done through the steps from the DAS-Framework to connect with previous work in this field of research and to give the possibility to reuse the interview protocols.

7.4.3 Dissemination and audience

The thesis will be publicly published in the Delft university repository. People that have an affinity in the topic sustainability and public real estate, so municipalities and other public organizations, can be an audience for this thesis. It can also help a future researcher in topics that involve MREM and sustainability strategies.

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8.2 Figures

Frontpage retrieved 03-01-2019 from:

https://www.tweesnoekenarchitectuur.nl/projecten/gemeentehuis-cranendonck-budel/

Figure 1: retrieved 10-01-2019 from:

https://www.hak-installatieservice.nl/project-rijksmuseum-amsterdam/

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Parts of Figure 24 and 26: retrieved 10-03-2019 from:

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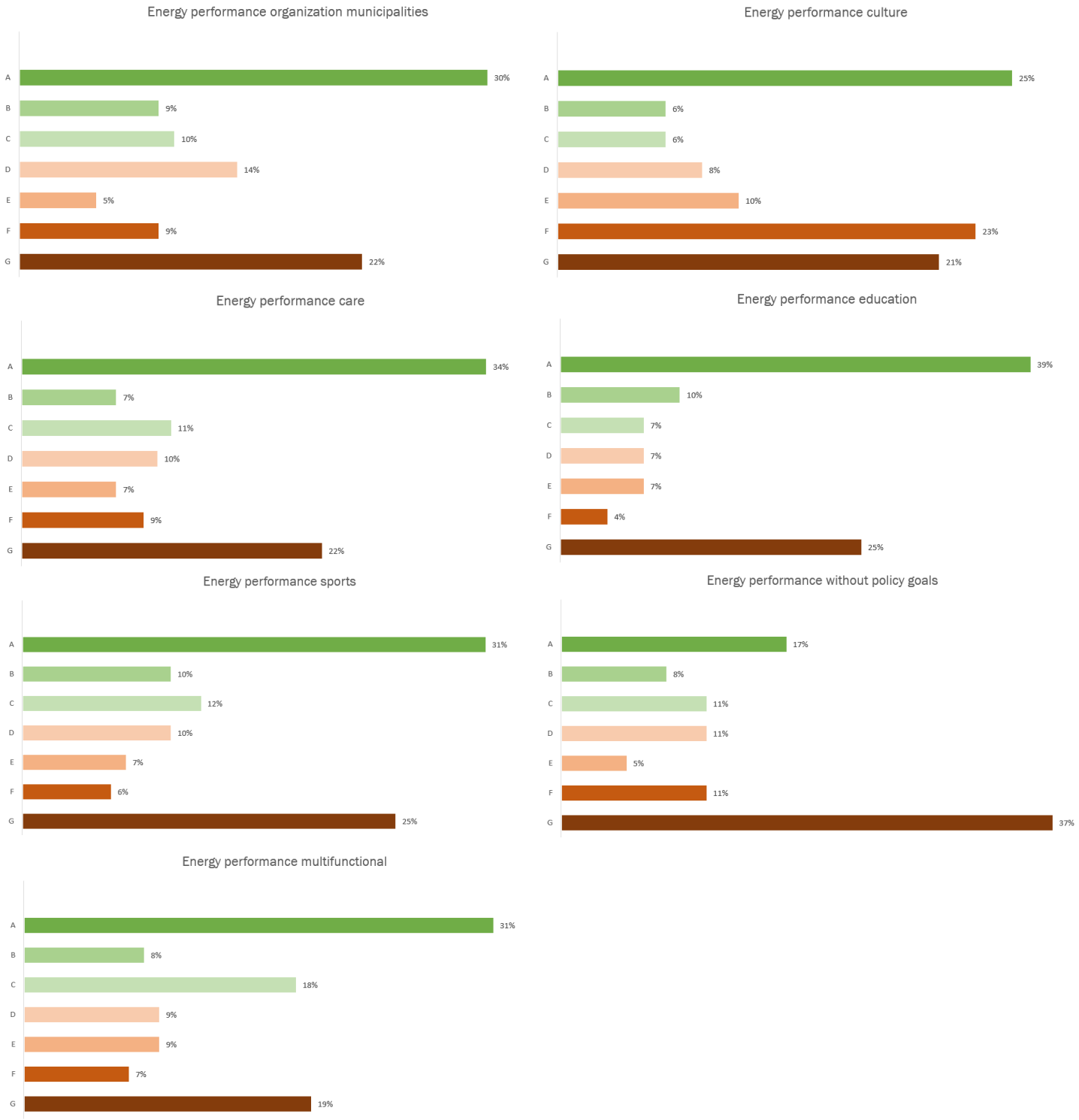
A: Energy labels benchmarked municipalities

Energy labels of the benchmarked municipalities based on function (Republiq & TIAS, 2017)



B: Municipalities that conducted interviews

Municipalities that have conducted an interview about ESCOs by Agentschap NL (2013b) and that can be approached for the case study

Gemeente Almere, Anko Kuyt (projectleider vastgoedbedrijf)

Gemeente Eindhoven, René Bartels (projectmanager)

Gemeente Enschede, Erwin van Proosdij (hoofd vastgoed)

Gemeente ’s-Hertogenbosch, Leendert Odijk (team coördinator Bouw en Onderhoud Gemeentelijk vastgoed)

Gemeente Lochem, Thijs de la Court (wethouder duurzaamheid)

Gemeente Nijmegen, Erik Cobussen (bouwmanager)

Gemeente Veldhoven, Leoniek van der Hoorn – Ravenhorst (beleidsmedewerker milieuzaken) en Thamar Dirkx-deGreef (senior vastgoedbeheer)

Gemeente Vlaardingen, Frank van Zelst (programmamanager duurzaamheid)

Gemeente Zutphen, Marnix van Os (medewerker afdeling Strategie en Beleid)

C: Interview protocol

Geïnterviewde: _____
Gemeente: _____
Onderwerp: Duurzame strategie m.b.t. gemeentelijk vastgoed
Interviewer: Nienke Hakenberg – Master student TU Delft

Introductie

Beste x bedankt dat u mij wil ontvangen voor dit interview. Ik ben Nienke Hakenberg en ik studeer aan de faculteit Bouwkunde in Delft. Op het moment ben ik bezig met afstuderen aan mijn master Management of the Built Environment. Ten eerste wil ik u vragen of ik dit gesprek mag opnemen? Ik zal beginnen met wat algemene vragen om een beeld te krijgen wie u bent en wat uw betrekkingen is met de verduurzaming van het gemeentelijk vastgoed
De inhoud van dit interview zal gaan over duurzame vastgoed strategie, de voortgang van de strategie tot uw organisatiedoel en uw mening over de strategie.

Context

- Kunt u mij vertellen wat uw huidige positie is bij de gemeente x en hoelang u dit al doet?

- Hoelang bent u betrokken met de verduurzamingsstrategie van het gemeentelijk vastgoed?

Strategie

Task 1: Assessing the current portfolio

- Hoe zag de vastgoedstrategie eruit voordat het verduurzamingsaspect werd meegenomen?

- Hoe zag het proces eruit om tot een duurzaamheidsstrategie te komen?
    - Energieverbruik doorgelicht?
    - Stakeholders?

- Is er hulp ingeschakeld vanuit instantie/documenten/adviseurs?

Task 2: Exploring the changing demand

- Wat zijn de doelstellingen vanuit uw perspectief met betrekking tot duurzaamheid?

Task 3: Generating future models

- Hoe ziet de vastgoedportefeuillestrategie er nu uit wanneer duurzaamheid is meegenomen?
    - Gebruik van KPI? (Hoe meten jullie, CO2, kWh besparing?)
    - Gebruik van Energieprestatie contracten bij onderhoud/renovatie?
    - Wet milieubeheer?

- Hoe merk je het verschil nu? Kunt u voorbeelden geven?
    - Verschillende aanpak voor gebouw typologie?
        - Gekeken naar leeftijd gebouw, m.b.t. afstoten of sloop nieuwbouw?
        - Scholen & Zorg, kostendekkende huur?
        -Monumentaal? DuMo of Greencalc+ toegepast?
    - Per niveau organisatie?
    - Welke aspect van de gebouwcyclus?
    - Transformatie/ Afstoten?
    - Financiering van de strategie?

Task 4: Defining projects to transform

- Kunt u de strategie beschrijven met een voorbeeldproject vanuit het ontwerp tot realisatie?

Obstakels en instaat stellers

- Hoe vindt u dat de strategie gaat tot nu toe? Is de gemeente goed bezig?
- Wat zou u anders doen mocht u dit opnieuw doen? Kunt u voorbeelden geven?

Afsluiting

Dit was het interview. Ik wil u bedanken voor uw tijd.
Heeft u nog vragen voor mij? Is er nog iets dat u wilt verduidelijken?

D: More elaborated interview protocol

Geïnterviewde: _____
Gemeente: _____
Onderwerp: Duurzame strategie m.b.t. gemeentelijk vastgoed
Interviewer: Nienke Hakenberg – Master student TU Delft

Introductie

Beste meneer/mevrouw, bedankt dat u mij wilt ontvangen voor dit interview. Ik ben Nienke Hakenberg en ik studeer aan de faculteit Bouwkunde in Delft. Op het moment ben ik bezig met afstuderen aan mijn master Management of the Built Environment. Ten eerste wil ik u vragen of ik dit gesprek mag opnemen? Ik zal beginnen met wat algemene vragen om een beeld te krijgen wie u bent en wat uw bijdrage is/was op de verduurzaming van het gemeentelijk vastgoed beleid.

De inhoud van dit interview zal gaan over de duurzame vastgoed strategie (met betrekking tot proces, de manier van energiebesparing en de kosten), de voortgang van de strategie en uw mening over de strategie.

Context (Task 1: Assessing the current portfolio)

1. Wat is uw huidige positie/functie bij de gemeente en hoelang bekleed u al deze positie/functie?

2. Hoe zijn de vastgoedtaken bij uw gemeente georganiseerd? (Organisatiestructuur van de vastgoedafdeling)

3. Hoelang bent u betrokken met de verduurzamingsstrategie van het gemeentelijk vastgoed?

4. Hoe zag de vastgoedstrategie eruit voordat het verduurzamingsaspect werd meegenomen?

Doelstellingen (Task 2: Exploring the changing demand)

1. Wat zijn de doelstellingen vanuit uw perspectief met betrekking tot duurzaamheid?

Strategie & energie (Task 3: Generating future models)

1. Hoe zag het proces eruit om tot een duurzaamheidsstrategie te komen?

    1.1 Wat was de aanleiding?

    1.2 Was het energieverbruik doorgelicht?

    1.3 Was de wet milieubeheer (of andere wetgeving) een aanleiding?

    1.4 Welke stakeholders waren bij het proces betrokken?

    1.5 Is er gekeken naar uitbesteden?

2. Is er hulp ingeschakeld vanuit externe instanties/documenten/adviseurs?

3. Hoe ziet de vastgoedportefeuillestrategie er nu uit wanneer duurzaamheid is meegenomen?

3.1 Hoe ziet de verduurzamingsstrategie eruit per niveau van de organisatie

(Operationeel, tactisch, strategisch)?

3.2 Welke onderdelen van de gebouwcyclus heeft de duurzame vastgoedstrategie betrekking? (Initiatief, ontwerp, bouw, onderhoud, gebruik fases

3.3 Is er gebruik gemaakt van Key preformance indicators (KPI) in een onderdeel van de strategie zoals de besparing van het energie gebruik? Kunt u voorbeelden geven?

3.4 Hebben jullie het meerjaren onderhoudsplan (MJOP) gebruikt als leidraad van je strategie van de verduurzaming (DMJOP van gemaakt)? Zo ja, kunt u voorbeelden geven? Zo nee, waarom niet?

3.5 Is er gebruik gemaakt van energieprestatie contracten bij aanbesteding voor renovatie of onderhoud?

3.6 Was er een verschillende aanpak per gebouw typologie opgesteld?

3.7 Is er gekeken naar leeftijd gebouw, m.b.t. afstoten, transformeren of sloop/nieuwbouw?

3.8 Hoe wordt er omgegaan met monumentale panden m.b.t. verduurzaming?

Is er bijvoorbeeld DuMo of Greencalc+ toegepast?

Kosten

1. Hoe wordt de verduurzaming van het vastgoed gefinancierd?

1.2 Hoe verwerken jullie de energiebesparing in de kostendekkende huur?

1.3 Maken jullie gebruik van subsidies, zo ja, hoe? Zo nee, waarom niet?

Uitvoering strategie (Task 4: Defining project to transform)

1. Kunt u de strategie beschrijven met een voorbeeldproject vanuit het ontwerp tot realisatie?

Obstakels en instaat stellers

1. Hoe merkt uw het verschil in de vastgoed strategie nu? Wordt er anders naar het vastgoed gekeken? Kunt u voorbeelden geven?

2. Hoe vindt u dat de strategie gaat tot nu toe? Is de gemeente goed bezig?

3. Wat zou u anders doen mocht u dit opnieuw moeten aanpakken? Kunt u voorbeelden geven?

4. Waar zitten de verbeterpunten momenteel?

5. Wat gaat er goed met betrekking tot de duurzame vastgoedstrategie?

6. Welke lering kan uit uw duurzame strategie getrokken worden?

Afsluiting

Dit was het interview. Ik wil u bedanken voor uw tijd en moeite.

1. Heeft u nog vragen voor mij?

2. Is er nog iets wat u wilt verduidelijken of wilt u nog iets delen wat nog niet aan de orde is gekomen?

E: Max green kWh in 2050 according to DGBC

Maximum green kWh to use in 2050 to be energy neutral according to Dutch Green Building Council (2019) based on future supply green energy and consumption per function.

Offices: 50 kWh per m^2

Retail

Store with cooling, e.g., supermarket: 150 kWh per m^2

Store without cooling: 80 kWh per m^2

Education

Primary: 60 kWh per m^2

Secondary: 60 kWh per m^2

University and University of applied sciences: 70 kWh per m^2

Care sector

Hospital: 100 kWh per m^2

Reception with overnight stay: 80 kWh per m^2 centrum

Reception without overnight stay: 90 kWh per m^2

Medical health center: 80 kWh per m^2

Logistics/Warehouses

Warehouse with cooling: 80 kWh per m^2

Warehouse without cooling: 50 kWh per m^2

F: Cross-case analysis detailed table

Themes	Sub-themes	Literature	Zutphen	Enschede	Similarities?
Strategy Timeline with interventions, in terms of governance and technical measurements	Energy identification	Is obliged by law if the building is bigger than 250 m^2 and is public assessable	Working to collect all energy labels	Have an energy label for all buildings.	
	Joroff ladder	Being on the highest level can look at real estate from a strategic point of view, something necessary when making an energy neutral portfolio	Is taking steps to go from operational to tactical and strategical and identified that this is important.	Made these steps sooner but indicate professionalizing the real estate department as a crucial part to think in RE strategies.	
	Trias energetica	Indicated Trias energetica as a base concept to make a strategy	Used this to explain the basic steps they want to take	Used this to explain the basic steps they want to take	
	DMOP	Identify the general steps municipalities need to take, there is however a focus for renovating buildings that are label C or lower	Is in the preface to work with DMOPs and integrate them with the no regrets measures. They want to look at natural maintenance moments	Looks at natural maintenance moments to think per building what is best in a particular situation.	
	ESCos	Sees a positive strategy tool when there is little finance	Has used them but will not be used in the same format for the future, due to finance that could be done by themselves	Do not use them	
	Performance-based contracts	Can be used for each step in the building process. For renovation process or maintenance to ensure a certain quality	EPC or general performance contracts could be seen as an option for the future	Are used for the core portfolio. With the reasoning that the market has the expertise.	
	Outsourcing	Is an option to fully take responsibilities out of hands.	Partly, the current investigation and guiding are outsourced. In the future, it is unknown if they will outsource or not.	They outsource maintenance. Their motivations were not only sustainability, however, it is integrated into the contract	
	In-house software tools	Many options to monitor and set up the right	Does not use this	Has used it in the past but feels that it is more valuable to	

		information for the portfolio		not pay money to the tool but direct to the building.	
	Building typologies	Identified that buildings need different approaches. Monumental vs. non-monumental and function	Is aware that there needs to be a different approach for monumental buildings.	Is aware that there needs to be a different approach for monumental buildings.	
Energy reduction in kWh_{el}/m^2 **(Policy goals)**	Certificates	Sees added value to have a system and option for subsidies	Could be an option, but this is not likely	Do not want to spend money on this.	
Costs per m^2 **(Financial policy)**	Costs	The cost of a strategy is dependent on many factors, from literature, only the costs of tools could be extracted. The general cost lies between 5 till 20 percent of the municipal budget.	Do not know yet the financial consequences. There are thinking about revolved funding; they think they will have an unprofitable top for the big renovation investment.	€400.000 a year for 100 buildings and an acceptable unprofitable top for the big renovation investment	
	Subsidies	Can be a good tool to gain additional money	When possible, they use it but would have preferred a better system from central government	When possible, they use it.	
	Split incentive	Principal-agent problem.	Indicates this as an element they need to solve	Have thought about how to solve this.	
Obstacles on added strategy (-)	Municipal context	There are more responsibilities and municipalities are professionalizing their real estate department this process is going slow for some municipalities	Indicated that it sometimes could be a "treacly" process	Indicates that it is harder to accomplish things in a municipal context due to the political environment and cycle of four years	
Enablers on added strategy (+)	Innovation	Did not stated or found information clearly that innovation could play an important role.	Wants to experiment with this, but sees it also it as a process that sustainability in the built environment needs to go through and is, therefore, more	Enschede also sees that innovation is happening. Therefore, they first focus on the maintenance and reducing if with 3% a year and when the significant renovations	

			hesitant to act now	need to come, most possible where are new techniques they want to use.	
	Right parties	Did not stated or found information clearly that having the right parties could play an important role.	Stated that it is essential in sustainability measures that you have the right parties	Indicates that one party of the maintenance contract is doing better than the other because they have earlier experience with the contract. It takes time to get used to each other and the portfolio.	

Tabel 15: Green indicates similarity, yellow indicates that there is partly a similarity and red indicates that there is hardly similarity found between the cases and literature.