Research on the compliance of the EED

Yordi Boone
Student Number: 68218

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Management Summary

In this document the research justification of the showcase was created. The research shows to what extent Bax-shop still has to improve their buildings to obtain a certain energy building label which is a directive (the European Energy Efficiency Directive) given by the European government to all its member states and underlying companies that roughly explained, share the size of Bax-shop or are bigger. Therefore, Bax-shop has asked to find out in what way and at what costs they can comply to this directive. This research was done in relation to energy efficiency, return on investment, prime considerations and improvement costs per building. Following from these sections, four information gaps were identified as basis for the execution of the research:

1. The extent of options to increase energy efficiency and energy savings in buildings from Bax-shop.
2. The extent of best solutions in comparison to the costs that are made by executing this solution, in other words, the return on investment on each solution.
3. Whether the prime considerations for improvements are equal to every building or if there are huge variances that needs different approaches to each building.
4. The extent of the same improvements towards an individual building being of the same costs per certain unit or these unit prices differentiating due to other circumstances of each building.

To answer these questions, mostly literature research was performed but still some field research was necessary. Due to the limitations of the coronavirus a lot of research options were discontinued and had to be desk researched, some field research could be done by surveys that were given to employees in other parts of the buildings since it was not allowed to go to different departments of the buildings at the time of the outbreak. The desk research was validated by comparison with different sources and the field research were simple check lists that were filled in by people with more knowledge in the area than the average person. These checklists were colour coded and translated into a usable source of information.

Results show that Bax-shop already has an above average standard of building quality in one building and that there is still some work to do on their other property. Building "A" (Olympiastraat 2-4) has obtained in current state label "A", which means this building already has the aspired label which is needed in 2030 and would not need further improvements, but further improvements like cheap and efficient are recommended. Building "E" (Verrijn Stuartweg 18) has obtained in its current state label "E", which means that this building is quite fare below the standard (label "C" that has to be obtained in 2023. It is recommended to at least improve this building to this standard with a total investment sum of ± €22.725,99.

All recommended improvements could be implemented within a time span of a few weeks, given that everything is done at the same time and insulation takes the longest time to complete. Furthermore, it has to be installed before the year 2023 and the best timeframe to implement changes would be Q1 or Q2 of each year since the client of this research has said it to be the quietest time of the year.
Taking these recommendations into account, Bax-shop will comply with the EED and therefore reach its goal to comply with this directive before the year of 2023.

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1. PRELIMINARY RESEARCH

1.1 Company Analysis

Bax-shop which was founded in 1998, has been focusing on retailing music and DJ equipment via their online web shop. They also have 4 physical stores which customers can come to where they offer advice and the products from the webstore as well. Bax-shop exists of their web shop and 4 physical stores, these physical stores are situated in Amsterdam, Rotterdam, Antwerp, Apeldoorn and Goes. That last place is also where the office is situated and where the main storage of their stock is. During the research visits will be made to all the other locations since this is essential to the research.

The company, as its slogan states, "we support your stage", has as mission to help every customer from amateur to professional to obtain the best equipment to fit the customers' need. Bax-shop uses all their possible assets to achieve happy customers and achieving for everyone to be able to make music. The original idea from the two brothers that founded the company was to rent out their own DJ equipment to customers to do this. The values Bax-shop lives by are honesty by which is giving fair advice about the products and what someone needs in their particular situation if they were to come to a physical store or start up a chat on the web store, with other words, understanding the customer. Also trust, as the company cares for their customers to gain enjoyment from their purchased products and to be positive in their community, which would be the artist community to be positive about Bax-shop and make the company a statement in this sector, they aim to share their passion and dreams with all customers.

The vision of the company is to reach every musician, DJ or producer in Europe and helping them to create and listen to music. Help them reach their dream. Music is passion and Bax-shop wants to positively contribute to this passion through offering services, support and commitment. The long-term company goal is becoming the market leader in Europe for music and audio equipment. The short-term company goal is to become more known and expand throughout the Benelux even more. The main market that is targeted are all users of music instruments and consumer that need audio and music equipment for all ages. Therefore, the target group is varied from old to young, however focusing on artists and amateurs in the music scene.

The industry Bax is situated in is competitive, because at the end of the day everyone doesn't want to pay too much for their instruments and equipment so there is always competition on the lowest prices. It is also a growing industry, since at the end of the day, it is a web shop in music instruments and equipment. This is a sector that is still growing and very popular among consumers. Bax-shop was the first company that started selling instruments and equipment online becoming the market leader and growing rapidly. The overall trend of consumers spending more and more online still increases and so is the market share of Bax-shop. If they are going to expand cross country and to other countries, they will probably have the advantage of being a very big player and being able to offer low prices making them more attractive than competitors. The business is an LLC and the reason for choosing for such a business to research in is because they tend to have more facets to business of which the author can learn from. Meaning that there are also more people involved and more knowledge to be obtained to take with me. The LLC is started by two brothers both owning 40 percent of shares and leading the company, besides them the father in law of one of the brothers owns the other 20 percent of the shares. Under them is a normal structure with management and employees.

The key financial figures for this company are the sales figures and the purchase and overhead costs. However, if you look at the research later on, the key figures are costs of investments and return on

investments. The primary activities consist of selling purchased products from wholesalers concerning music and audio equipment and accessories. The production process is the service and expertise that is offered to the consumer to decide on the best product that fits the consumers need, in physical and online stores. Inputs in the company can be the knowledge and manhours of the employees together with the purchase of products, outputs are satisfied and well-advised customers which leave the stores with purchased products. The company is very pull oriented, since they work on consumers' orders and do not buy more to upkeep their stock, moreover stock is not always good in their situation since this also gives more costs if the particular item does not sell fast. For the company IT is very important, it is the platform by which they generate the most turnover and if not for IT they would probably be not as big as they are now. In terms of IT on the work floor, there are some regulations that restrict people from harming the company or being uncareful with sensitive information.

In total the company has four hundred people under its wing. To be able to work for Bax-shop you have to possess certain skills, however per department or job these variate as what the specific requirements are. For the finance department it will probably be possible to apply for a job if you possess a diploma concerning that field. Moreover, the finance department has been mapped out and is shown below.

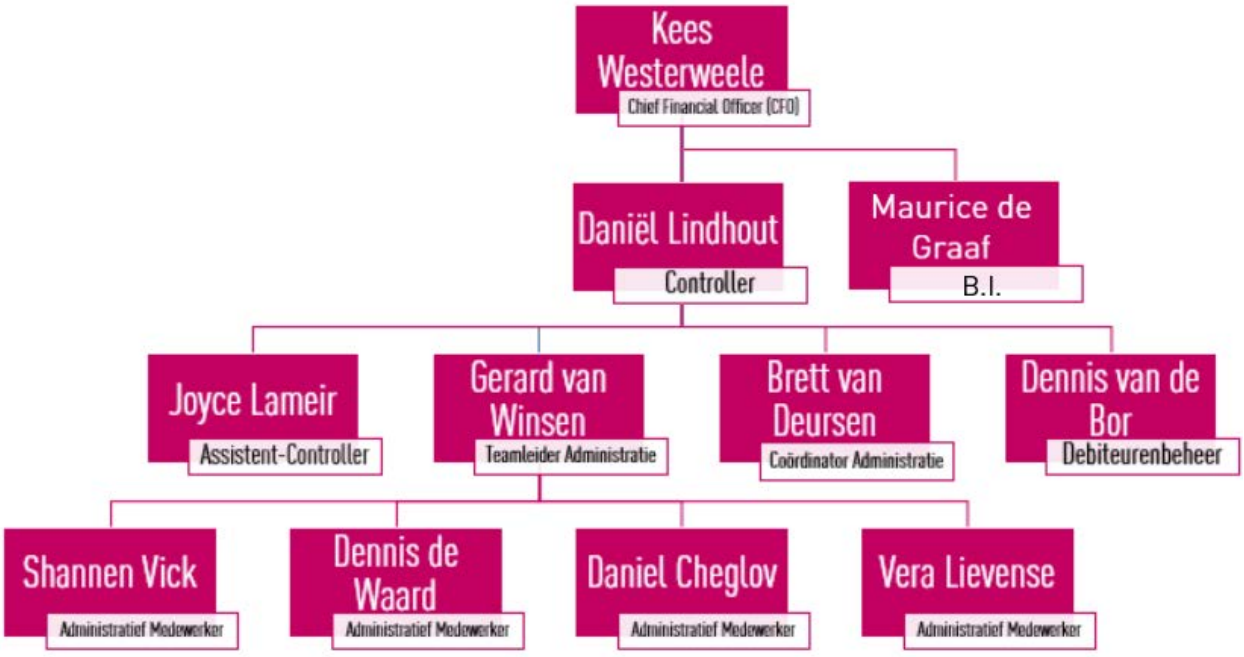

Figure 1 - Hierarchy Financial Dept.

1.2 Problem Analysis

Imagine yourself in a fully sustainable world, where every country, company and individual person consumes as much as they return to the world. A world without climate change, species going extinct and pollution of nature (DW, 2016). Unfortunately, this is a world that has yet to be created. To get to this situation, more and more countries make laws and regulations to improve current situation, more businesses are aiming to become sustainable and all individual people are becoming more aware of how to be sustainable. In other words, the world is changing and shifting towards this ideal situation, but the world isn't there yet. To get to that ideal world Bax-Shop is also, like so many others, forced by European law and regulations to become more sustainable with the focus towards energy efficiency and saving.

This should help to achieve the goal of the EU to have 20 percent improvement in energy efficiency at the end of 2020 in comparison to 2009, when this regulation was created (European Commision, 2011). Over time this goal of the EU has shifted and companies got a longer time period to adapt their buildings. Currently there is a goal set by the EU that buildings have to comply to an energy label "C" by 2023 and to a label "A" by 2030. The company will therefore have to obtain these labels before set deadlines. Bax-Shop has already done some preliminary research with regard to searching for the best solutions and attached costs and has asked to take this a step further and also look into a way to implement this. Researching what the optimal way is to implement these solutions and which of these will create better energy efficiency and return on investments will have the main focus. The implementation of this plan will be done in all buildings directly owned by Bax-Shop and the rented buildings will be forced to change through demand of Bax-Shop towards the owner. Becoming more energy efficient is something you can see like an investment. In current situation, where the company has not yet achieved an optimal efficiency on this, it loses on yearly basis a lot of money on energy loss. For example, less well insulated walls and roofs leading to loss of warmth and systems having to generate heat more often to keep the same temperature within the building. If the company indeed invests in better insulation and other measures, the initial costs will be the instalment of such. However, because the energy is better contained the amount of times that the heating system has to warm up is less. The result of this will be a savings in yearly costs which will lead to a return on investment and becoming more efficient.

The following figure shows 5 categories which are the possible causes to the defined problem.

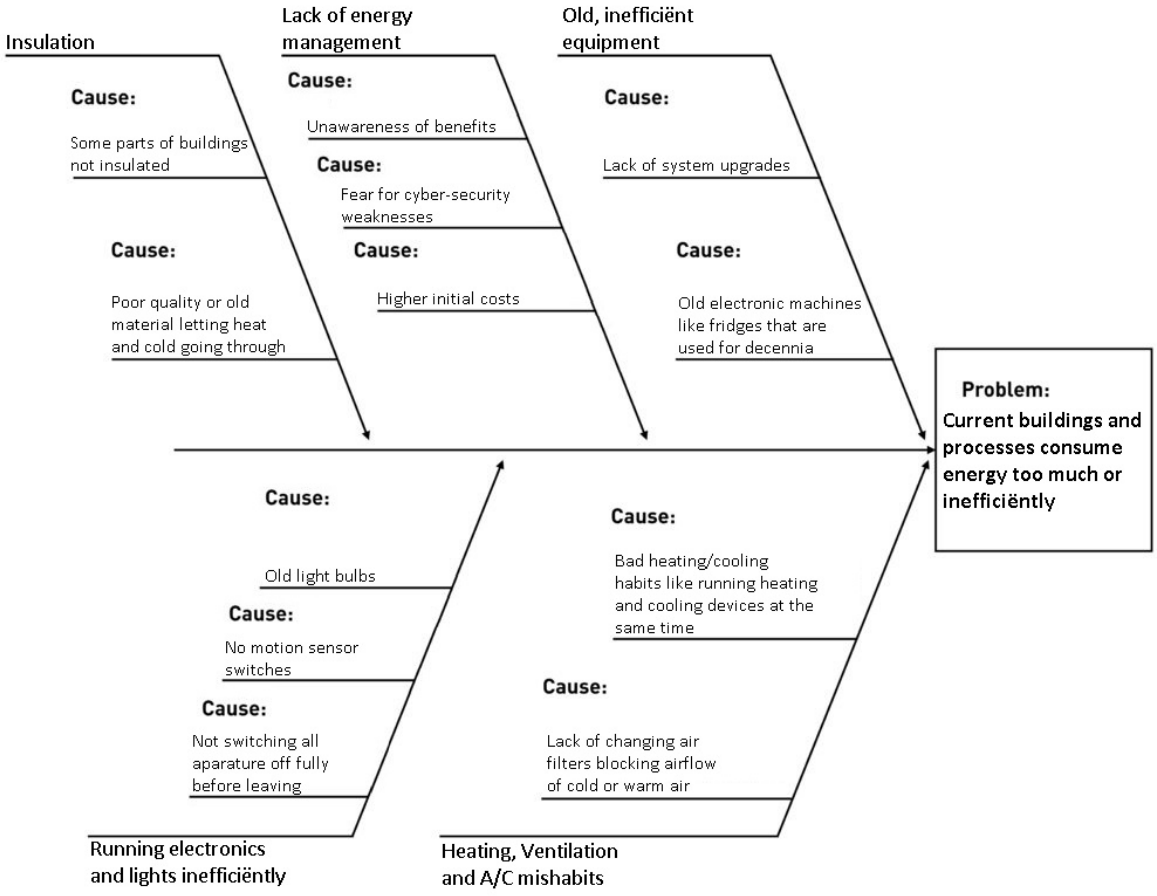

Figure 2 - Ichikawa Diagram

1.2.1 Insulation

The first cause of current buildings and processes consuming energy too much or inefficiently is insulation. This cause is driven by the fact that older buildings used to be less well isolated, since back in the day this was normal. However, nowadays most buildings that are new or recently build are well insulated. Therefore, this tends to be a bigger problem with older buildings. Moreover, insulation that has the minimal resistance lets more warm or cold air through from outside then insulation with more resistance, which leads to the climate system to kick in more often.

1.2.2 Lack of energy management systems

The second cause is a lack of energy management systems in a building. An energy management system (EMS) is a system of computer-aided tools used by operators of electric utility grids to monitor, control, and optimize the performance of the generation or emission of energy. Possible causes for this lack of energy management could be that people are scared of extra possibilities to holes in the cyber-security surrounding of the company. Another could be that the benefits of an energy management system are not completely clear or that the people that are in charge of this are poorly informed. Lastly, the cause could also be that the initial costs of equipping this system seem too high for the company.

1.2.3 Old and inefficient equipment or devices

The third cause could be old and inefficient equipment which is still used or installed throughout the building which are not maintained properly or have not received a system upgrade for a long time, this contributes to devices becoming less energy efficient. Next to this, devices or machines could also be very old. If you look at machines or devices from 20 years ago, these machines consume way more electricity than the same machines nowadays. The reason for this is the ongoing development and improvement of technology and optimization of such machines. Of course, companies are all for the less costs the better, and that is understandable, however, machines like kitchen equipment and printers and such are therefore saved on and not often replaced unless is really necessary.

1.2.4 Running electronics and lights inefficiently

The fourth cause is running electronic devices and lights inefficiently. This point goes hand in hand with the third cause, however is a different facet to the problem. The sub causes for this cause are old light bulbs equipped in buildings. This causes lights, that burn all day long in offices and such, to be very energy consuming. If old halogen lights are switched out for LED lighting which are far more energy efficient, this will surely be a huge improvement already. Furthermore, having no motion sensors in, for example toilets, will contribute to unnecessary usage of electricity. Also, when employees go home at the end of the day or on a Friday and they forget to switch off certain lights, they will burn for a long time unnecessary. Another cause is a little related but is devices that re not turned off fully which keep consuming electricity or which are in "stand-by" mode and also keep consuming a little electricity.

1.2.5 Heating, Ventilation and A/C (HVAC) mis habits

The fifth and last cause for buildings and processes consuming too much energy or energy inefficiently is heating, ventilation or A/C mis habits, or in short HVAC. What the sub causes for this is for starters running cooling and heating systems at the same time. This could be that in a building a certain employee turns the thermostat higher. In another part of that same building, the temperature rises as well. However, the employee here finds it too warm and turns on the A/C unit to cool the room a bit. This leads to double usage of energy and therefore is very unnecessary and inefficient. Another cause could be that the air filter in the system is not changed regularly, leading to blockage of the system with dust or filth

and causing the system to work harder to get the same amount of air through. Not only is this causing more electricity usage by the system but a filthy system is also bad for the air quality in the building.

1.3 SMART project aim

To improve and make energy usage more efficient within Bax-shop, the solution is probable to lay in building optimisation of the company and improving efficiency of all technology and machines. This means figuring out in what way the company can make the buildings within Bax-shop less energy consuming. Furthermore, the solution could also be to generate more renewable energy by the company themselves through solar panels and wind energy, enabling Bax-shop to use the same amount of energy but using more renewable sources and therefore in embedded in the buildings, improving the buildings carbon footprint.

The project aim of this research is to find out what the best ways are to improve energy usage within Bax-shop. Furthermore, coming up with a plan to implement this improvement and help the company comply with EU regulations. Moreover, this will be categorized under operations and supply chain management when looking at the four working and management tools. This is because the final goal is to manage and execute an operation on paper, which will later be executed by the company.

1.4 Information Gaps

In order to understand in which way and to which extent Bax-shop needs to adapt its buildings and company processes to obtain the most effective energy saving solutions there first needs to be understanding of what all the possibilities are and what each of these solutions could save on energy usage. After that checking what the most cost-effective solutions are, since this still is a commercial business. After that what the best combinations are of these options. Once found out, what each individual building should have as prime consideration to change or improve and what this is really going to cost. If everything is made clear, a plan of execution will be made which will lead to the final result.

1.5.1 Information Gaps Defined

To come further in the research all answers on the following information gaps need to be formulated:

1. What are all possible options to increase energy efficiency and energy savings in buildings from Bax-shop?
2. What are the best solutions in comparison to the costs that are made by executing this solution, in other words what is the return on investment on each solution?
3. Are the prime considerations for improvement the same for every building or are there huge variances that needs different approaches to each building?
4. Are the same improvements towards an individual building of the same costs per certain unit or do these unit prices differ due to other circumstances of each building?

1.5.2 Main Question Research

The main question for the research will be answered by combining the answers to the sub questions to come to a logical explanation. The main question will therefore be: What is the best way of implementation of energy saving solutions with regard to return on investment and gaining efficiency within Bax-shop?

2. RESEARCH APPROACH

In this part the approach on how to perform the research and gather information to fill the information gaps will be explained.

2.1 Design

In the first two weeks of preliminary research, the plan of approach has been created including a thorough problem analysis and the identification of the possible information gaps. Which is based on the knowledge retrieved from the literature research. The operationalization of the main concepts addressed in the literature research, will lead to questions which will be corresponded through mail. The research took place for about four weeks after the POA was given a "GO". Followed with the results of the desk research this research justification and hereafter professional product will be generated. The last five weeks will be spent on the solution (professional product), the implementation at the company, the presentation at the HZ and finishing up. The planning in the last section includes a more detailed planning of the whole process.

2.2 Approach Per Information Gap

Upon deciding what the exact information gaps were, there was literature research conducted to fill in the unknown information and becoming the basis of the professional product. It will only be literature research which will be elaborated on in the limitation chapter.

In total there are four information gaps, when these are answered the answer to the main question will follow. In order to "fill" these information gaps literature research was conducted and only little field research, the reason for this is that literature research can do only so much, but at the end you need to have at least some parts of field research in the form of questions to be answered by someone to proceed further. However, information gap two, three and four could be almost entirely be answered by desk research alone. Information gap one needed some answers to additional questions which were corresponded through e-mail. On desk research alone it is believed that this research would achieve the same level of reliability than a combination of desk research and field research, the reason for this is that "A desk research gives you the benefit of the hard numbers of primary research without needing to create that data in the first place, and best of all, you can learn exactly what you need to know to find what's relevant to you and your partners." (Research Optimus, 2019).

2.3 Data Collection

During the research, data will be collected through desk research and little field research. Desk research will be done on literature, articles and internal company information. Field research will come from mail correspondence on questions about the research. This basically gives me a clear view and perspective on certain matters.

2.4 Data Analysis

Due to the limitations to the research which are described in that chapter only mostly desk research was conducted, this meant that data analysis was not done by transcribing and coding interviews which is known as primary data analysis. Instead secondary data analysis was used to achieve the answers to the information gaps. "Secondary data analysis involves a researcher using the information that someone else has gathered for his or her own purposes. Researchers leverage secondary data analysis in an attempt to answer a new research question, or to examine an alternative perspective on the original question of a previous study." (Foley, 2018).

2.5 Operationalisation

Through desk research four main concepts of this research have been formed, namely energy efficiency, return on investment, prime considerations and improvement costs per building. These concepts have been converted into measurable indicators in table 1, each one of these indicators is then looked into through desk research and correspondence.

Concept	Dimension	Subdimensions	Indicators
Energy efficiency	More efficient solutions	Heating solutions	• How many heating solutions are available?
		Electrical solutions	• How many electrical solutions are available?
	Building adaptions	Isolation	• How many solutions can be obtained from isolation improvements? • Are buildings badly isolated?
		Electrical systems	• Extent of electrical systems currently installed. • Extent of systems able to improve efficiency.
Return on investment	General Costs	Most- & least expensive	• Overview of most and least expensive solutions.
		Depreciation and lifetime of investment	• Taken into account the lifespan of an investment and renewal of such later on.
	Attractiveness to Invest	Payback time	• Amount of time needed to earn back the invested sum.
		Difficulty of installation	• Extent of effort • Extent of difficulty
		Overall purchase price	• Comparison of purchase price to return on investment.
Prime considerations	Impact of investment	Change in energy usage per solution	• Extent per solution of which change in energy is seen.
		Change in waste per solution	• Extent per solution of which less energy is wasted or co^2 is emitted.
		Building quality	• Extent of building state and ware.
	Building differentiation	Difference in building scale	• Extent of differentiation in costs compared to building size.
		Amount of work	• Extent of time that needs to be calculated in before an improvement is realised. • The impact or scale of an improvement.
Improvement costs per building	Most expensive building	Amount of investments needed	• Extent of how much liquidity is needed to accomplish EU regulations.

Table 1 - Operationalisation table

2.6 Reliability & Validity

Due to the scale of the research and the global situation no interviews were taken. Instead information needed for the research is extracted from desk research. The desk research was expected to be sufficient enough and reliable enough on its own since the information comes from documents and in-company reports. To tackle any unreliable information, it is double checked. When writing research papers, make sure that you are finding sources both primary and secondary that are valid, reliable, and relevant (Mometrix Test Preparation, 2019). Therefore, before information is accepted it is double checked by correspondence through mail and overlap with other documents.

2.7 Limitations

The limitations to this research are the coronavirus, this resulted in a global pandemic at the time of conducting this research and therefore leading to a prohibition of conducting field research. This research will therefore only consist of desk research and individual mail correspondence between the researcher and the client of this research.

3. RESULTS

The research initially led to some basic theoretical findings which were put into categories and dimensions. Operationalizing these items led to more questions going deeper into the material. These questions could all be answered with the desk research done and together with additional information of the client and some back and forth communication with various employees, the results of the desk research show all the necessary information needed. Upon follow-up of this research to form an implementation plan, this information could be used and made decisions with. This plan will eventually lead to the implementation and realisation of Bax-Shop meeting the regulations of the EU.

3.1 Energy efficiency, Return on investment, Prime considerations, Improvement costs per building on building innovations of Bax-Shop

Since climate change and pollution became more and more apparent. Companies, governments and individuals started to do something about the matter. The government took multiple measures including taking on the European Energy Directive or EED in short. If a company has more the 250 employers, or an annual turnover exceeding €50 million and an annual balance sheet exceeding €43 million, this company must carry out an energy audit at least every 4 years (Mense, 2019).

Due to this, a lot of companies have to improve their buildings. New buildings are made in a sustainable way. Sustainable construction, or 'green building' has become increasingly popular over the last few years as homeowners, construction companies and other concerns attempt to make their projects and their homes more energy efficient and greener (Whitlock, 2015). Already existing buildings however are redesigned and equipped with the newest energy efficient technology. Energy efficient buildings can be defined as buildings that are designed to provide a significant reduction of the energy need for heating and cooling.

It is no secret that in the previous centuries, buildings were less well equipped and therefore wasted more energy than the newly constructed buildings. Despite recent progress, there is still room for growth. As of 2015, 17 percent of single-family homes built prior to 1980 were still reported to have 'poor insulation', and only 11 percent had received an energy audit. By comparison, a recent profile of newly constructed homes (built after 2009) showed only 1 percent of residents reporting 'poor insulation' which is an impressively low share. Moreover, nearly 90 percent of new homes come with double- or triple-pane windows. Bringing older homes up to this higher standard will require significant investments to the existing older buildings (Jeunesse, 2017).

Looking at the future of building innovations with regard to energy efficiency we can see that it is vital that new homes are built to be able to emit as low carbon as possible. For example, the UK already set a law in motion that by 2050 buildings should be carbon neutral. This means buildings that generate their own electricity, generate their own heat and contain other systems that regulate everything, leading to further improvements in technology and the way a house or office is created. Moreover, besides the future home standard there are also changes in building materials that have to be made. Products such as glass mineral wool boast impressive credentials, as they use high proportions of recycled glass. And some of the greener alternatives to concrete include straw bales, rammed earth, bamboo, recycled plastic and wood (Weatherall, 2019).

Energy efficiency

There are multiple researches that zoom in on the more efficient solutions to becoming more energy efficient. Here the Trias Energetica concept is mentioned multiple times (figure 3). This concept consists of three parts that basically present the general steps to take in a most sustainable way to save energy. However, in this research the focus is solely on step one of this concept, which is the reduction of energy demand and avoidance of wasted energy.

For starters, technologies that allow us to control the indoors climate are some of the largest consumers of energy. In 1993, space heating and air conditioning together accounted for around 58 percent of the total residential energy usage. By the year of 2011 this percentage was closer to about 48 percent, thanks to more efficient equipment. However, currently the global aim is to decrease these heating solutions energy usage or consumption to even less percentage. This is needed to achieve the zero-carbon goal which are set by most western countries.

Alongside heating solutions, you also have electrical energy efficiency. Electrical energy efficiency is understood as the reduction in power and energy demands from the electrical system without affecting the normal activities carried out in buildings, industrial plants or any other transformation process. Electrical energy efficiency seems to consist of economic and technical optimization. This means that when executed correctly there should be a reduction of technical and economic costs of operation. This can be divided into three basic points:

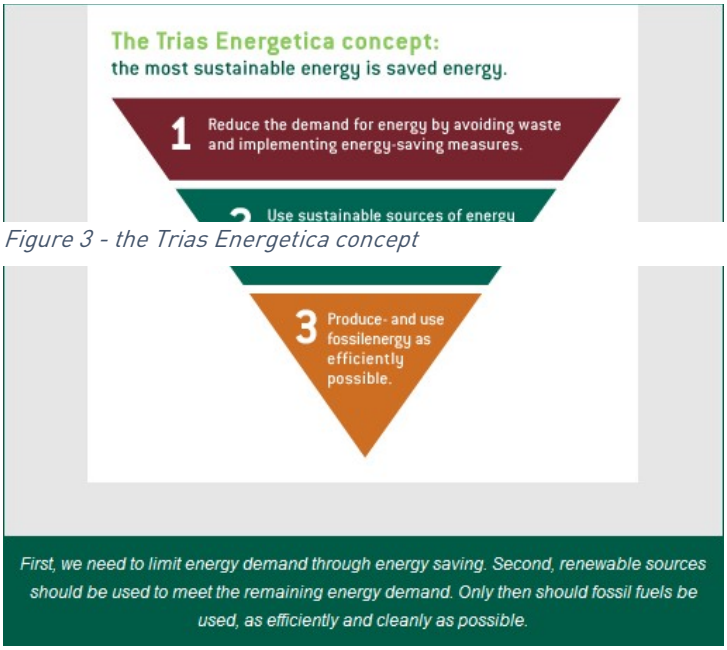

Figure 3 - the Trias Energetica concept

- Support the sustainability of the system and the environment by reducing greenhouse emissions as a result of reducing the energy demand.
- Improving of the technical management of the installations by increasing its efficiency and avoiding stoppages and breakdowns.
- Reduction of the economic cost of the energy as well as the operating costs of the installations.

Return on investment

On average the most expensive improvements turn out to be the least attractive to tackle, this is basically due to the larger sum to invest into this particular solution. In most cases the expensive investments would be insulation, this can be divided into insulating walls and roofs, and there is insulating glass which can be installed. The best current insulating glass is HR++, this stands for high-efficiency glass. It is double glazed and fitted with an HR-coating on the inside of the air cavity. Insulation glass forms the basis for a large number of multifunctional glazing, this could be solar control, being burglar proof and being sound proof. Assuming that an average house has approximately 20m² of glass, the use of HR++ glass will save approximately 400m³ of gas per year compared with single-glazing. Naturally, this depends upon the fuel behaviour and the glass surface. This is 200m³ a year more than for regular double-glazing. Assuming a gas price of 0,67 Euros per m³, HR++ glass saves 366 Euros a year compared

to single-glazing (Energysage, 2020).
The least expensive and easiest to overcome investment on average is replacement of light bulbs from halogen to LED-spots. Traditional incandescent light bulbs consume an excessive amount of electricity and must be replaced more often than their energy efficient alternatives. Halogen incandescent bulbs, compact fluorescent lights (CFL's), and light-emitting diode bulbs (LED's) use anywhere from 25-80% less electricity and last three to 25 times longer than traditional bulbs (Lester, 2015). Although energy efficient bulbs are more expensive off the shelf, their efficient energy use and longer service lives mean that they cost less in the long run and thus are the clear winners in terms of their environmental and financial benefits.
In terms of depreciation and lifetime of investments it variates a bit. The insulation is argued to have an economic lifespan of 30 years, thereafter they should be replaced or upgraded to a newer kind of glass if by then this exists. LED lights however, they are said to be having an average lifespan of 20 years, which is a bit shorter but for a light source pretty impressive if you think about how often a halogen light has to be replaced (Facilicom, 2019).
While keeping the most-and least expensive investment in mind, the time to pay back these investments variate clearly. Insulating glass is by far, more expensive than changing LED's and therefore would on average take for a household with 20m² of glass 10 years to earn back. While LED's would only take one single year to pay back the investment. Moreover, glass is in comparison way more difficult to install than LED lights, which could be installed by every individual while glass cannot.

Prime considerations

As prime considerations for improving buildings at Bax-shop a lot of variables have to be taken into account. First off not every improvement returns the same amount of efficiency or reduction of energy costs. Then the difference in building quality is an important variable. One building could simply be lacking more insulation or technology than other buildings or could be older than the other buildings. Bax-shop has, at the moment of writing this research 10 buildings under its wing that are being rented. Besides this, Bax-shop also has two main buildings that are property of Bax-shop. Within this scope the focus is mostly given to the property of Bax-shop which will later be explained in §3.4. When looking at these buildings the scale is different aswell, the property at the "Olympiastraat 2-4" consists of an extensive brick and mortar shop as well as a huge warehouse in the back. Not to forget about the office space where the main back-end tasks are being executed. Therefore, prices to adapt certain parts of this building will be massively increased in comparison to the average brick and mortar shop on its own. And in relation to the increase of costs stands the amount of work involved into completion of the improvements.
What needs to be added here is the fact that Bax-shop at the moment of writing is insecure about the fate of their buildings in the future and is slowly discussing the demolition of the "Verrijn Stuartweg 18" in order to create a bigger and better warehouse. Furthermore, the dismissal and renewal of certain rented properties is an ever-changing process since in the short duration of writing the research the decision has fallen to leave the current rented building in Amsterdam to go to a more modern facility. Therefore, for the sake of this research it is only focussed on the current owned property of Bax-shop and not the rented property.

Improvement costs per building

As a matter of fact, the exact costs for improvements will be reflected in more detail in §3.5. However, the logical reasoning behind this matter is simply that the building which has the worst label needs the most work to be up to EED standard. This means when a building achieves an energy label of D, this building will need to be improved to a label C before 2023. Thereafter it needs again improvement to achieve at

least label A before the year of 2030. If the example of a label D building has to be all the way improved this will mean that there are a lot more costs involved than with a building which is already at label B. How this is determined is simply with a checklist going through all the buildings and check what is already present and what is in poor state thus needing replacement.

3.2 Energy efficiency

In this research and within the scope of Bax-shop the decision has been made to only look at a particular amount of solutions. This involves all the regular ways of improvements and what has been left out are the extremes such as redesigning a building with other sustainable materials because these kind of solutions just would not fit the strategy. In table 2 and table 5 in the appendix the checklist can be seen of all possible improvements within this scope. The lay-out of this checklist has been retrieved from a company specialised in this field named "Facilicom" which also supported the research with certain prices and numbers to calculate more results. The improvements which are needed to get to at least a label C in 2023 and label A in 2030 and which for the rest of this research are taken into consideration are following for these tables. In these tables there are different colours, blue stands for heating solutions, green stands for electrical solutions and purple stands for insulation improvements. If something has been marked with "Ja" it means "Yes" and stands for this particular solution already being installed. Therefore, this solution will not be colour coded since the implementation is not necessary anymore. The amount of heating solutions that can still be improved turns out to be 43 electrical, 29 heating and 4 insulation related items at the building on the "Olympiastreet 2-4". In addition, there are 13 electrical, 2 heating and 2 insulation related problems at the building on the "Verrijn Stuartway 18". The buildings owned by Bax-shop which are these two earlier mentioned, also had a label inspection prior to the research, this turned out to be a label "A" for the "Olympiastreet 2-4" and label "E" for the "Verrijn Stuartway 18". Given these labels and the amount of improvements needed and found, the conclusion can already be made that the property of Bax-shop is not in too bad shape. Glancing at the list in a more positive way the conclusion can aswell be made that there are 22 electrical improvements already done, spread across the two buildings. These improvements variate in bringing more efficiency or saving energy, such as movement sensors which turn light off when there is nobody around and on only when needed. This way electricity is only used when necessary and nothing is wasted.

3.3 Return on investment

Now that an overview has been made of possible solutions to obtain a certain label in 2023, a comparison can be made what the general costs per solution are and what the amount of time is in which the ROI (return on investment) is completed. Appendix table 4 and table 7 reflect the general cost per solution after compiling the checklists to certain categories. The costs of these investments have been calculated on the base of average costs at similar jobs per unit and have been compared with other companies which have been asked to hand out their pricing to similar cases. Eventually there was an established average price per unit which is used. For each building owned by Bax-shop an overview has been made following from these calculations. In these overviews it is shown which improvement is most-and least expensive, amount of time needed to earn back the invested sum and a clear insight of the amount of change in savings and efficiency per improvement. The life span of each improvement has been left out of the figures, this is because each change would have an average lifespan of 20 till 30 years and given the calculated results, it did not need to be investigated further as this was not relevant for the research. The extent of how expensive each improvement is can also be used as a reflection of how much effort has to be put into it, moreover the level of difficulty is also a big influence. This is because changing lights can be done by almost everyone and lights on its own are fairly cheap, therefore this improvement is not costly at

all and is highly recommended to improve first. However, adding insulation to roofs or walls is very costly since the amount of work is much more and the complexity is much higher. A team of specialists or construction workers have to be hired and they have to execute the job which is far more expensive than doing something yourself. Which leads to doing such improvements as a last resort, when all else is done and there are no other options left than to tackle the more expensive options.

3.4 Prime considerations

Each solution brings its own change in energy efficiency and energy waste. Looking back at table 4 and 7 in the appendix a clear figure is given om how much money each option saves on the energy bill. However, for the Olympiastraat 2-4, the precise change in energy was calculated to be 4,7% improved when it comes to the total amount of gas used and 9,8% improved when it comes to the total amount of electricity used. The current total energy used was obtained from looking back at last year's numbers. The outcome was a total of 22.596 m^3 gas and 615.364 kWh used. If all options given in the appendix would be installed correctly the calculated energy usage would be ± 22.555 m^3 gas and ± 560.441 kWh in the new situation. At an average price for gas per m^3 of €0,22 and an average price per kWh of €0,101 the numbers shown in figure 5 would be achieved. For the Verrijn Stuartweg 18 the last year situation is a total of 11.351 m^3 gas and 109.256 kWh used. The new label "C" situation is estimated to be ± 1.301 m^3 gas and ± 65.286 kWh. Which is an improvement of 88,5% in gas and 40,2% in electricity. These results do not come as a surprise, since one building already has a label "A" and technically does not need to be further improved to comply with the EED, however the other building has a label "E" and therefore does not even reach the label "C" goal set by the EU to be a minimum in 2023. This means more work has to be done on the Verrijn Stuartweg 18 and also tells us that the building is in worse shape than the Olympiastraat 2-4. Moreover, the costs will therefore be higher than the other building even though the "E"-label building is smaller, it just needs more work to get up to standard.
As mentioned in §3.1 under the subtitle prime considerations, the focus lies mostly on the property of Bax-shop themselves. This has to do with who is responsible for what. As a party that rents a building you are only responsible for the measures that are related to the execution of an organization, which in these cases is storage or shop. This means that in worst case scenario these buildings need different lights and time switches to be installed by Bax-shop. All the other building related measures are up to the original owner of the building and have nothing to do with the responsibility of Bax-shop (Facilicom, 2019).

3.5 Improvement costs per building

The improvement costs per building is variating. First off, the owned buildings by Bax-shop have to be paid for first, since here lies the responsibility of Bax-shop. This means at least label "C" by 2023 and therefore would cost Bax-shop ± €22.725,99 this money has to be used to improve the Verrijn Stuartweg 18 location. All the other buildings are up to standard for the year 2023.
If looking at the year 2030 by which the standard is minimal label "A", the costs Bax-shop has to spend are another €27.682,80. After that the total costs on all improvements have been payed and both buildings will have the "A"-label which is desired to comply with the EED. These prices will only be justified in Q1 or Q2 of each year, this is the period when business is the quietest and no interference with work done on the buildings is created. Otherwise warehousing tasks may be slowed down or other work which causes other costs as a result.

4. CONCLUSION

Bax-shop as so many other businesses has to comply with the regulations and directives the government has given. In order to do so, the property of Bax-shop has to be adapted and improved to acquire the standard that is wanted. To research what is the best to do for Bax-shop, four information gaps were created. These were energy efficiency, return on investment, prime considerations and improvement costs per building. With the aspiration to identify and thereafter close potential information gaps between the current situation and desired situation.

Results of this research show that all possible improvements of energy efficiency and energy savings were divided in three categories, heating solutions, electrical solutions and insulations solutions. Within these three categories a checklist was made in which all possible options were taken into account. It became obvious that most solutions would come from the electrical category and therefore wields the biggest benefit for Bax-shop.

During the research it has become clear that electrical solutions were not only the most possibilities for improvement but the change in lights and adding movement sensors to the building would wield the best return on investment. Not only does it earn itself back as one of the fastest investments but it also is easier to install and has a longer lifetime than current lights. A change in lights and movement sensors would therefore be the best solution in comparison to the costs.

The prime considerations for improving the buildings are different for each building, this has not only to do with the size variation but also the current state of each building. As of now the one building as already an "A" label which is sufficient enough to even pass the 2030 standard. However, the other building has an "E" label which is far under sufficient to pass the standard even for 2023. This means that there is much more work to do than on the better-quality building. This goes together with needing more improvements, more costs, more work and time before everything is up to EED standard.

Since the minimal improvements needed at the "Olympiastraat" are none existent there are no costs required to get to the EED standard of 2023 and even 2030. If management of Bax-shop still wants to improve certain points there are more availabilities to do so.

The same improvements are different in price to each building, this because one building needs more work or another building is older and again another reason could be that the building is simply larger and the price differs for a larger number of units. Moreover, another reason that costs could be variating is that improvements take place in the wrong time of the year. What is meant by this is that execution of improvements should be timed correctly and not when business is booming like for example in December. Then the construction workers hired to do the job will be in the way of the normal business processes and these could be slowed down which costs more time for the hired workers aswell becoming more unnecessary costs.

In conclusion, it can be said that Bax-shop already has some good quality buildings. However, there are still some points that need to be improved to get to the desired energy efficiency and energy savings necessary to obtain the minimal label "C" and later on label "A" status. In addition, this can be achieved fairly easy by adding some insulation, adding movement sensors and changing lights to another kind of light. After doing all the improvements to get to the minimum "A"-label it will take Bax-shop roughly 5,5 years to break even on their investments. After which the improvements will start to earn Bax-shop more money. Moreover, these conclusions are taken under the condition that the circumstances stay around the same.

In this research, besides the limitations of the corona virus, it gives a solid insight in the field the client wanted to receive knowledge of. However, the calculations are only estimated based on historical facts and therefore offer no guarantee to the real numbers after instalment of the improvements. Besides that,

this research has been done mostly with the scope towards the property of Bax-shop. If the rented buildings were to be added to the research the total costs could be slightly higher due to replacement of lights in those buildings aswell. Moreover, this should not affect Bax-shop all too much since next to light all improvement costs are for the original owner of these buildings. The recommendations given in this report can however help the company to legally comply with regulations and therefore move the company forward in the field of energy efficiency.

5. RECOMMENDATIONS

The recommendation of this research boils down to at least improving the building at the "Verrijn Stuartweg" to the EED standard of 2023 with a total investment sum of ± €22.725,99 this includes:

- facade insulation inside ±€8.251,86
- Suction ventilation timer office ±€200,00
- TLD-lamps replaced by LED-tubes ±€1.275,30
- Glow lamps replaced by LED-lamps ±€12,30
- TL5-lamps replaced by LED-tubes ±€7.982,70
- Movement sensors lights warehouse ±€5.003,83

Even though it is likely that the building will be demolished in the future, it is as of writing uncertain at what time and year. Therefore, it is still recommended to pass label "C" since this is at least needed before 2023. All recommended improvements could be implemented within a time span of a few weeks, given that everything is done at the same time and insulation takes the longest time to complete. Furthermore, it has to be installed before the year 2023 and the best timeframe to implement changes would be Q1 or Q2 of each year since the client of this research has explained this to be the quietest time of the year.
Thereafter, when the year of 2023 is passed the other improvement package to get to label "A" has to be implemented on the condition that the demolition is hold off. It is recommended to do this in two steps. This way the investments are spread over multiple years and gives less disruption of the normal cash flow. The label "A" improvement is only one point to undertake. However, it is just as expensive as the whole former list:

- Replacement of single glass with HR++ glass ±€27.682,80

Therefore, it is suggested to do this step between the year of 2024 and 2030 and in the same quarters of the year as earlier mentioned.

However, as Bax-shop is a big company, these prices could be less problematic for management as anticipated and therefore could lead to an all-in approach. This would mean that all improvements would be installed before 2023 in one go. This would cost around the total sum of €50.409 for the location at the "Verrijn Stuartweg 18".
If management want to go even further and improve everything to its full extent this would mean that the costs for the optional improvements also should be added which is insulating the roof fully for €70.628 at the "Verrijn Stuartweg 18" and adding the sum for the "Olympiastraat 2-4" to this sum with an amount of €21.673 for all its improvements and the optional glass replacement to coated HR++ glass for around €33.274. This brings the total to €175.984, - and to spend this amount is optional but strongly not recommended. Also because of the possible demolition, it is then suggested to keep to the essentials if the deconstruction is decided on in the near future.

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APPENDIXES

Here you can find possible questionnaires/topic lists, transcribed interviews, raw data, planning's, and other viable sources.

Planning

Weeknummer	Deadline	Omschrijving
Week 1	28/01	Beginning of the Internship (27th of Januari)
Week 2	04/02	Gathering information about Bax-Shop and identifying information gaps
Week 3	11/02	Write: Plan of Approach (POA)
Week 3	14/02	**Hand-In:** Plan of Approach (POA)
Week 4	21/02	Receive Feedback on POA
Week 5	02/03	Improve POA based on Feedback
Week 5	02/03	**Hand-In:** Plan of Approach improved (POA)
Week 6	06/03	Prepare Interviews
Week 7	13/03	Conduct Interviews
Week 8	20/03	Conduct Interviews + **Hand-in:** Assessment form in-company coach I
Week 9	27/03	Code and Evaluate Interviews
Week 10	03/04	Write Research Justification
Week 11	10/04	Write Research Justification
Week 12	17/04	Write Research Justification + Professional Product
Week 13	24/04	Write Professional Product
Week 14	01/05	Write Professional Product
Week 15	08/05	Finish Research Justification and Professional Product
Week 16	15/05	Ensure conformity between justification and professional product + final check and lay-out check
Week 17	22/05	**Hand-In:** Assessment form in-company coach II
Week 18	29/05	**Hand-In:** Research Justification Report
Week 19	05/06	**Hand-In:** Professional Product and Presentation (complete Showcase + Defence)
Week 20	12/06	**Defence / Introduction professional product at Bax-Shop**
Week 21	19/06	**Defence / Introduction professional product at Bax-Shop**
Week 22	26/06	End of Internship (26th of June)

Figure 4 - Planning throughout the graduation internship

Checklists and Raw Data in Dutch - Buildings owned by Bax-shop

Olympiastraat 2-4

		Aanwezigheid		
#	Erkende maatregel	Ja	Nee	Opmerkingen
GA1b	Automatisch EBS met rapportagefunctie		X	Er is een slimme meter aanwezig, maar de verbruiksgegevens worden niet gemonitord en/of geanalyseerd.
GB1	Spouwmuurisolatie	X		Minimale isolatiedikte winkel is 70 mm
GD1	Thermostatische radiatorkranen / ruimtethermostaten	X		Ruimtethermostaat iSense aanwezig
GD2	Isolatie leidingen en appendages CV		X	Leidingen en appendages CV-ketel zijn niet geïsoleerd
GE1	Afzuiginstallatie warmteproducerende apparatuur	X		Studio's zijn voorzien van eigen ventilatie- units.
GF1	LED-verlichting vluchtwegaanduiding	X		LED vluchtwegarmaturen 2x1W
GF3a	Reclame: LED-lampen ipv gloei-/halogeen-/neonlampen	X		LED-armatuur met een vermogen van 128 watt

GF3b	Reclame: TLD-lampen vervangen door LED	X		
GF4b	PL-lampen vervangen door LED (retrofit)	X		LED-downlighters/spots aanwezig
GF5a	Halogeen- of gloeilampen vervangen door LED	X		LED-spots in studio's
GF7	Aanwezigheidsschakeling verlichting	X		Aanwezigheidsdetectie verlichting toiletten en bijbehorende hal
GF8b	Schemer- en tijdschakelaar buitenverlichting	X		Buitenverlichting geschakeld mbv schemerschakelaar en schakelklok
GF9	Schemer- en/of tijdschakelaar reclameverlichting	X		Reclameverlichting geschakeld mbv schemerschakelaar en schakelklok
FA1	Tijdschakelaar met weekschakeling verwarming	X		iSense geoptimaliseerd weersafhankelijke regeling met weekschakeling
FA2a	CR- of VR-ketel vervangen door HR107- ketel	X		HR107-ketel Remeha Quinta
FA3	Weersafhankelijke regeling CV-installatie	X		iSense geoptimaliseerd weersafhankelijke regeling met weekschakeling
FA4	Geoptimaliseerd weersafhankelijke regeling CV	X		
GA1b	Automatisch EBS met rapportagefunctie		X	Er is een slimme meter aanwezig, maar de verbruiksgegevens worden niet gemonitord en/of geanalyseerd.
GB1	Spouwmuurisolatie	X		Bouwjaar kantoor 1981
GC1	Schakelklok ventilatie		X	Onbekend op welke wijze ventilatie is geschakeld.
GC2	Cascaderegeling ventilatie	X		Standenschakelaar aanwezig
GC3	Warmteterugwinning luchtbehandeling	X		LBK met HR kruisstroomwarmtewisselaar
GC4	Energiezuinige ventilator (IE3 met toerenregling)	X		Gelijkstroomventilatoren
GC5	Geisoleerde kanalen balansventilatie	X		Kanalen zijn geïsoleerd en vallen binnen thermische schil van het gebouw.
GE5	LED-verlichting vluchtwegaanduiding	X		LED vluchtwegarmaturen 2x1W
GE6a	Halogeen- of gloeilampen vervangen door LED	X		LED-spots in toiletten
GE7a	TLD-lampen vervangen door LED (retrofit)	X		LED-panelen of TL5 inbouwarmaturen
FA2b	HR100-ketel vervangen door HR107-ketel		X	
FA3	Warm tapwater: HR gasboiler		X	Elektrische close-in boilers
FA4a	Tijdschakelaar verwarming	X		Centrale schakeling warmtepompen mbv bedieningspaneel serverruimte
FA4b	Tijdschakelaar met weekschakeling verwarming	X		Ingestelde kloktijden onbekend
FA5	Weersafhankelijke regeling CV-installatie		X	Geen CV-installatie aanwezig. Verwarming m.b.v. airco's in warmtepomp uitvoering.
FB1	Energiezuinige schakeling verlichting koel-/vriescel		X	Geen koel-/vriescel aanwezig
FB2	Ontdooiingsregeling verdamper koel-/vriescel		X	
FB3	LED-verlichting koel-/vriescel		X	
FB4	Deurschakeling ventilator koel-/vriescel		X	

FD1b	Aanwezigheidsdetectie ventilatie en verlichting lift		X	
FD2	Lift: LED-lampen i.p.v. gloei-/halogeenlampen		X	
FF1	Centrale printers en kopieermachines		X	Multifunctional printer aanwezig
FG1	Beperken aantal fysieke servers	X		
FG2a	Direct vrije luchtkoeling serverruimte		X	Opgesteld vermogen servers < 5 kW
FG2b	Verdampings-, adiabatische of hybride koelers		X	
FG2c	Hoog temperatuur zaalkoelers		X	
FG3a	Computer Room Airc Conditioner met COP 5,5		X	
FG3b	Energiezuinige koelinstallatie (COP 5,5) serverruimte		X	
FG4	Compartimenteren apparatuur serverruimte		X	
FG5	Powermanagement servers serverruimte		X	
FG6b	Verdampingskoeler via bypass datacenter		X	
FG6c	Indirecte lucht/luchtkoeling datacenter		X	
FG6d	Directe vrije luchtkoeling datacenter		X	
FG7	Hogetemperatuur koeling datacenter		X	
FG8	Blindplaten in ongebruikte racks datacenter		X	
FG9a	Toerenregeling ventilatoren zaalkoelers datacenter		X	
FG9b	Nieuwe zaalkoeler met toerenregeling datacenter		X	
FH1	Energiezuinig UPS-systeem (96%)		X	Geen UPS-systeem aanwezig
FI1	Energiezuinige motoren (4-375 kW; IE4)		X	Geen motoren > 4 kW aanwezig
GA1b	Automatisch EBS met rapportagefunctie		X	Er is een slimme meter aanwezig, maar de verbruiksgegevens worden niet gemonitord en/of geanalyseerd.
GB1	Spouwmuurisolatie	X		Bouwjaar 1980. Bovendien is kantoor in 2005 volledig verbouwd en vernieuwd.
GC1	Schakelklok ventilatie	X		Geen schakelklok, maar ventilatie is geschakeld met verlichting.
GC2	Cascaderegeling ventilatie	X		Standenschakelaar aanwezig
GC3	Warmteterugwinning luchtbehandeling	X		LBK met HR kruisstroomwarmtewisselaar
GC4	Energiezuinige ventilator (IE3 met toerenregling)	X		Gelijkstroomventilatoren
GC5	Geisoleerde kanalen balansventilatie	X		Kanalen zijn geïsoleerd en vallen binnen thermische schil van het gebouw.
GD1	Isolatie leidingen en appendages CV		X	Appendages en deel leidingen zijn niet geïsoleerd

GD2	Klokthermostaten en overwerktimers CV	X		Nefit Easyapp waarbij verwarming geregeld kan worden op aanwezigheid
GE5	LED-verlichting vluchtwegaanduiding	X		LED vluchtwegarmaturen 2x1W
GE6a	Halogeen- of gloeilampen vervangen door LED		X	Halogeenspots in vergaderruimte 1e en entree BG.
GE7a	TLD-lampen vervangen door LED (retrofit)		X	Kantoren: TLD 4x18W inbouwarmaturen
GE7b	PL-lampen vervangen door LED (retrofit)		X	Gang & toiletten: downlighters PL 18W
FA1	Geoptimaliseerd weersafhankelijke regeling CV	X		Nefit Easyapp met zelflerende CV klokprogramma
FA2a	CR- of VR-ketel vervangen door HR107- ketel	X		HR107-ketel Remeha Quinta Pro 65
FA2b	HR100-ketel vervangen door HR107-ketel	X		
FA4a	Tijdschakelaar verwarming	X		Nefit Easyapp met zelflerende CV klokprogramma
FA4b	Tijdschakelaar met weekschakeling verwarming	X		
FA5	Weersafhankelijke regeling CV-installatie	X		Nefit Easyapp is voorzien van weersafhanekelijke regeling
FB2	Ontdooiingsregeling verdamper koel-/vriescel		X	
FB3	LED-verlichting koel-/vriescel		X	
FB4	Deurschakeling ventilator koel-/vriescel		X	
FD1b	Aanwezigheidsdetectie ventilatie en verlichting lift		X	
FD2	Lift: LED-lampen i.p.v. gloei-/halogeenlampen		X	
FF1	Centrale printers en kopieermachines		X	Multifunctional printer aanwezig
FG1	Beperken aantal fysieke servers		X	Vermogen serverruimte < 5 kW
FG2a	Direct vrije luchtkoeling serverruimte		X	
FG2b	Verdampings-, adiabatische of hybride koelers		X	
FG2c	Hoog temperatuur zaalkoelers		X	
FG3a	Computer Room Airc Conditioner met COP 5,5		X	
FG3b	Energiezuinige koelinstallatie (COP 5,5) serverruimte		X	
FG4	Compartimenteren apparatuur serverruimte		X	
FG5	Powermanagement servers serverruimte		X	
FG6b	Verdampingskoeler via bypass datacenter		X	
FG6c	Indirecte lucht/luchtkoeling datacenter		X	
FG6d	Directe vrije luchtkoeling datacenter		X	
FG7	Hogetemperatuur koeling datacenter		X	

FG8	Blindplaten in ongebruikte racks datacenter		X	
FG9a	Toerenregeling ventilatoren zaalkoelers datacenter		X	
FG9b	Nieuwe zaalkoeler met toerenregeling datacenter		X	
FH1	Energiezuinig UPS-systeem (96%)		X	Geen UPS-systeem aanwezig
FI1	Energiezuinige motoren (4-375 kW; IE4)		X	Geen motoren > 4 kW aanwezig
GA1	Kantoor: Spouwmuurisolatie	X		Gevel kantoor logistiek 50 of 75 mm isolatie
GA2a	Snelsluitende en/of automatische bedrijfsdeuren		X	Deur tussen onverwarmd magazijn 7 en magazijn 2 staat gehele dag open
GA2b	Loopdeuren	X		Daar waar nodig zijn loopdeuren aanwezig
GA3a	Geïsoleerde transportdeur	X		Transportdeur met geïsoleerde panelen
GA3b	Luchtkussens	X		
GA3c	Tochtslabben	X		Tochtslabben aanwezig. Worden echter niet gebruikt.
GB1a	Tijdschakelaar met weekschakeling ventilatie		X	Ventilatie magazijn 2 en 5 wordt handmatig geschakeld.
GB1b	Aanwezigheidsschakelaar ventilatie (kleine ruimten)	X		Ventilatie toiletten en kantoor logistiek geschakeld met verlichting
GB4	Tijdschakelaar ventilatie		X	Ventilatie magazijn 2 en 5 wordt handmatig geschakeld.
GC2	Bedrijfshal: Ondersteuningsventilatoren verwarming	X		Magazijnen zijn voorzien van ondersteuningsventilatoren
GD1a	TLD-lampen vervangen door LED (retrofit)	X		TLD-armaturen met LED-tubes aanwezig
GD1b	PL-lampen vervangen door LED (retrofit)	X		Downlighters met PLC-LED
GD2b	LED opbouwarmatuur		X	Nog 2 TLD-opbouwarmaturen aanwezig in opslag logistiek
GD4	LED-verlichting vluchtwegaanduiding	X		LED vluchtwegarmaturen 2x1W
GD5a	Schemerschakelaar buitenverlichting	X		Schemerschakelaar buitenverlichting
GD7	Meerdere schakelgroepen verlichting		X	Verlichting in de magazijn en logistiek centrum was continu aan. Onduidelijk of de verlichting in onderdelen te schakelen is.
GD8a	Buiten: Halogeenverlichting vervangen door LED	X		LED-schijnwerpers aanwezig
GD12	Aanwezigheidsschakeling verlichting		X	Geen aanwezigheidsschakelingen aanwezig
FA2b	Bedrijfshal: Gasgestookte donkerstraler		X	Direct gasgestookte luchtverwarmers aanwezig
FA4b	Tijdschakelaar met weekschakeling verwarming		X	Verwarming bedrijfshallen geschakeld mbv aan/uit thermostaten
FA12	Bedrijfshal: HR luchtverhitter		X	VR luchtverhitters aanwezig
FH1	Centrale printers en kopieermachines	X		
FJ1	Energiezuinige motoren (4-375 kW; IE4)		X	Onbekend. Uitzoeken bij vervangen motoren.

FK1	Pomp met toerenregeling		X	Onbekend of pompen met > 1.400 uren aanwezig zijn
GA1b	Automatisch EBS met rapportagefunctie		X	Uitzoeken welk energieregistratie- en bewakingssysteem (EBS) met rapportagefunctie voor Bax-shop geschikt is voor het monitoren en analyseren van het energieverbruik.
GD2	Isolatie leidingen en appendages CV		X	Offerte aanvragen voor isoleren leidingen en appendages CV-installatie
GA1b	Automatisch EBS met rapportagefunctie		X	Zie opvolging GA1b Detailhandel
GC1	Schakelklok ventilatie		X	Uitzoeken op welke wijze de LBK's van de kantoren van de winkel zijn geschakeld. Indien de LBK's continu in bedrijf zijn, dienen deze mbv een schakelklok na sluitingstijd te worden uitgeschakeld.
GA1b	Automatisch EBS met rapportagefunctie		X	Zie opvolging GA1b Detailhandel
GD1	Isolatie leidingen en appendages CV		X	Offerte aanvragen voor isoleren leidingen en appendages CV-installatie
GE6a	Halogeen- of gloeilampen vervangen door LED	X		Halogeenspots vervangen door LED-spots of niet gebruikte spots verwijderen
GE7a	TLD-lampen vervangen door LED (retrofit)	X		TLD verlichting vervangen door LED-verlichting door vervangen armatuur of toepassen retrofit LED-lampen.
GE7b	PL-lampen vervangen door LED (retrofit)	X		PL-verlichting downlighters vervangen door LED-verlichting door vervangen armatuur of toepassen retrofit LED-lampen.
GA2a	Snelsluitende en/of automatische bedrijfsdeuren		X	Uitzoeken wat, al dan niet op een natuurlijk moment, de mogelijkheden zijn om de sluis naar magazijn 7 mbv een snelsluitende en/of automatische bedrijfsdeur af te sluiten.
GB1a	Tijdschakelaar met weekschakeling ventilatie		X	Afzuigventilatoren voorzien van schakelklok zodat deze na sluitingstijd wordt uitgeschakeld.
GB4	Tijdschakelaar ventilatie		X	
GD2b	LED opbouwarmatuur		X	TLD verlichting vervangen door LED- verlichting door vervangen armatuur of toepassen retrofit LED-lampen.
GD7	Meerdere schakelgroepen verlichting		X	Aanwezigheidsdetectie verlichting magazijn in gedeelten waar niet continu iemand aanwezig is.
GD12	Aanwezigheidsschakeling verlichting		X	
FA2b	Bedrijfshal: Gasgestookte donkerstraler		X	Op natuurlijk moment de huidige conventionele luchtverhitters vervangen door gasgestookte donkerstralers of HR- luchtverhitter.
FA12	Bedrijfshal: HR luchtverhitter		X	
FA4b	Tijdschakelaar met weekschakeling verwarming		X	Doordat de magazijnen slechts 12 uur per week niet in bedrijf zijn en de magazijn beperkt worden verwarmd is de toepassing van een tijdschakelaar voor de verwarming niet rendabel.
FJ1	Energiezuinige motoren (4-375 kW; IE4)		X	Bij het vervangen van motoren met een vermogen tussen de 4 en 375 kW en meer dan 4.500 bedrijfsuren per jaar dienen IE4-motoren of beter te worden toegepast.

FK1	Pomp met toerenregeling		x	Op natuurlijk moment pompen met smoorrregeling en meer dan 1400 draaiuren vervangen door pompen met toerenregeling.

Tabel 2 - Checklist Olympiastraat 2-4

Compiled list of possible measures – Olympiastraat 2-4

Possible Measures
Dubbel glas vervangen door HR++ glas
Dubbel glas vervangen door gecoat HR++ glas
Schakelklok LBK's kantoren
Schakelklok ventilatie magazijn
Aanpassen verlichting
TLD-armatuur vervangen door LED-armatuur
TLD-lampen vervangen door LED-tubes
TL5-lampen vervangen door LED-tubes
Downlighters vervangen door LED-spots
PL lampen vervangen door LED (retrofit)
Halogeenspots vervangen door LED-spots
Aanwezigheidsdetectie verlichting magazijn

Tabel 3 - Compiled list of possible measures - Olympiastraat 2-4

Estimated total investment costs – Olympiastraat 2-4

Dubbel glas vervangen door HR++ glas			**€**	**20.586,68**	
Dubbel glas, therm.	4,80 m²	172,00 €/m²	€	825,60	HR++ glas, excl. Kozijn
Dubbel glas, hout	114,89 m²	172,00 €/m²	€	1.759,60	HR++ glas, excl. Kozijn
Dubbel glas vervangen door gecoat HR++ glas			**€**	**33.273,82**	
Dubbel glas, therm.	4,80 m²	278,00 €/m²	€	1.334,40	Gecoat HR++ glas, excl. Kozijn
Dubbel glas, hout	114,89 m²	278,00 €/m²	€	31.939,42	Gecoat HR++ glas, excl. Kozijn
Schakelklok LBK's kantoren			**€**	**200,00**	
4: LBK's Kantoren winkel	2 stuks	50 €/stuk	€	100,00	Ventilatie alleen aan tijdens kantooruren
5: LBK's Helpdesk	2 stuks	50 €/stuk	€	100,00	Ventilatie alleen aan tijdens kantooruren
Bij bepaling besparing is aangenomen dat ventilatie de helft van het jaar 's nachts onnodig aan is. Besparing aardgasverbruik geschat op 1% per heater.					
Schakelklok ventilatie magazijn			**€**	**100,00**	
Magazijn 2	1 stuk	50 €/stuk	€	50,00	Ventilatie uit van zaterdag 22:00u tot zondag 10:00u

Magazijn 5	1 stuk	50 €/stuk	€	50,00	Ventilatie uit van zaterdag 22:00u tot zondag 10:00u
Bij bepaling besparing is aangenomen dat ventilatie de helft van het jaar 's nachts onnodig aan is. Besparing aardgasverbruik geschat op 1% per heater.					
Aanpassen verlichting			**€**	**21.372,61**	
TLD-lampen vervangen door LED-tubes			€	6.114,00	
TL5-lampen vervangen door LED-tubes			€	4.026,60	
PL lampen vervangen door LED (retrofit)			€	685,65	
Halogeenspots vervangen door LED-spots			€	72,00	
Aanwezigheidsdetectie verlichting magazijn			€	10.474,36	
TLD-lampen vervangen door LED-tubes		**10,00 €/stuk**	**€**	**6.114,00**	
TLD 4x18W HF, inbouw	129 stuks	36,40 €/stuk	€	4.695,60	LED-tubes 4x9W
TLD 2x36W HF, opbouw	2 stuks	20,20 €/stuk	€	40,40	LED-tubes 2x15W
TLD 2x58W HF, opbouw	2 stuks	24,00 €/stuk	€	48,00	LED-tubes 2x20W
TL5-lampen vervangen door LED-tubes			**€**	**4.026,60**	
TL5 4x14W HF, inbouw	27 stuks	48,00 €/stuk	€	1.296,00	LED-tubes 4x8W
TL5 3x54W HF, pendel	10 stuks	63,00 €/stuk	€	630,00	LED-tubes 3x26W
TL5 2x49W HF, trog	20 stuks	46,60 €/stuk	€	932,00	LED-tubes 2x26W
TL5 2x49W HF, pendel	2 stuks	46,60 €/stuk	€	93,20	LED-tubes 2x26W
TL5 1x14W HF, lichtlijn	2 stuks	24,00 €/stuk	€	48,00	LED-tube 1x8W
TL5 1x21W HF, lichtlijn	8 stuks	26,30 €/stuk	€	210,40	LED-tube 1x10W
TL5 1x28W HF, lichtlijn	18 stuks	17,80 €/stuk	€	320,40	LED-tube 1x16,5W
TL5 1x35W HF, lichtlijn	26 stuks	19,10 €/stuk	€	496,60	LED-tube 1x20W
PL lampen vervangen door LED (retrofit)		2,00 €/stuk	**€**	**685,65**	
PL lampen vervangen door LED (retrofit)			€	571,65	
PL 1x18W HF, downlighter	11 stuks	5,55 €/stuk	€	61,05	PL-C LED 6,5W
PL 2x18W HF, downlighter	46 stuks	11,10 €/stuk	€	510,60	PL-C LED 2x6,5W
Halogeenspots vervangen door LED-spots		2,00 €/stuk	**€**	**72,00**	
Halogeenspots vervangen door LED-spots			€	48,00	
Halogeenspot 50W	12 stuks	4,00 €/stuk	€	48,00	LED-spot 5W
Aanwezigheidsdetectie verlichting magazijn		0,05 €/m²	**€**	**10.474,36**	
Aanwezigheidsdetectie verlichting magazijn			€	10.071,50	
Magazijn	8.057,2 m²	1,25 €/m²	€	10.071,50	Handschakelaars vervang- en door aanwezigheidsdetectie
Recomm. Measures ROI max. 5 year			**€**	**21.672,61**	
Schakelklok LBK's kantoren			€	200,00	
Schakelklok ventilatie magazijn			€	100,00	
TLD-lampen vervangen door LED-tubes			€	6.114,00	
TL5-lampen vervangen door LED-tubes			€	4.026,00	
PL lampen vervangen door LED (retrofit)			€	685,65	

Halogeenspots vervangen door LED-spots			€	72,00	
Aanwezigheidsdetectie verlichting magazijn			€	10.474,36	

Tabel 4 - Estimated total investment costs Olympiastraat 2-4

Improvement Measures and Estimated ROI – Olympiastraat 2-4

Improvement Measures	Investment [€]	Gas [€/jaar]	Electr. [€/jaar]	Total Savings [€/jaar]	Est. ROI [jaar]
***Dubbel glas vervangen door HR++ glas*	*20.587,00*	*371,00*	*95,00*	*466,00*	*44,20*
***Dubbel glas vervangen door gecoat HR++ glas*	*33.274,00*	*227,00*	*96,00*	*323,00*	*103,00*
Schakelklok LBK's kantoren	200,00	-	78,00	78,00	2,56
Schakelklok ventilatie magazijn	100,00	9,00	36,00	45,00	2,22
TLD-lampen vervangen door LED-tubes	6.114,00	-	1.445,00	1.445,00	4,23
TL5-lampen vervangen door LED-tubes	4.027,00	-	1.017,00	1.017,00	3,96
PL lampen vervangen door LED (retrofit)	686,00	-	352,00	352,00	1,95
Halogeenspots vervangen door LED-spots	72,00	-	145,00	145,00	0,50
Aanwezigheidsdetectie verlichting magazijn	10.474,00	-	2.467,00	2.467,00	4,25
Improvement Measures ROI	21.673,00	9,00	5.540,00	5.549,00	3,91

*** Data in savings is measured by looking up the "normal" annual current usage and comparing the new situation in usage which returns the improvement in efficiency**

**** This improvement is optional and not recommended, therefore it is not added to the final calculations**

Figuur 5 - Improvement measures and estimated ROI - Olympiastraat 2-4

Verrijn Stuartweg 18

		Aanwezigheid		
#	Erkende maatregel	Ja	Nee	Opmerkingen
GB1	Spouwmuurisolatie	X		Bouwjaar kantoor 1979
GC1	Schakelklok ventilatie		X	Onbekend op welke wijze de ventilatie is geschakeld
GC2	Cascaderegeling ventilatie	X		Standenschakelaar aanwezig
GD1	Isolatie leidingen en appendages CV		X	Leidingen en appendages niet geïsoleerd.
GD2	Klokthermostaten en overwerktimers CV	X		Aanwezig, app Remeha Etwist
GE5	LED-verlichting vluchtwegaanduiding		X	Vluchtwegarmaturen met TL-verlichting
GE6a	Halogeen- of gloeilampen vervangen door LED		X	Halogeenspots in kantine en gang en gloeilamp in werkkast
GE7a	TLD-lampen vervangen door LED (retrofit)		X	TLD-armaturen verlichting kantoren, gangen en kleedkamers
GE7b	PL-lampen vervangen door LED (retrofit)		X	PL-lampen voor verlichting toiletten
FA1	Geoptimaliseerd weersafhankelijke regeling CV	X		CV-ketel geoptimaliseerd weersafhankelijk geregeld met app Remeha Etwist
FA2a	CR- of VR-ketel vervangen door HR107- ketel	X		HR107-ketel Remeha Quinta Ace 90
FA2b	HR100-ketel vervangen door HR107-ketel	X		
FA4a	Tijdschakelaar verwarming	X		Via app Remeha Etwist
FA4b	Tijdschakelaar met weekschakeling verwarming	X		Ingestelde kloktijden onbekend
FA5	Weersafhankelijke regeling CV-installatie	X		Weersafhankelijke regelaar aanwezig

FC1	Debietregeling afzuiging keuken		X	Handmatige bediening
GD4	LED-verlichting vluchtwegaanduiding		X	Vluchtwegarmaturen met TL-verlichting
GD7	Meerdere schakelgroepen verlichting		X	Verlichting in magazijnen was continu aan. Onduidelijk of de verlichting in onderdelen te schakelen is.
GD12	Aanwezigheidsschakeling verlichting		X	Geen aanwezigheidsschakelingen aanwezig
GC1	Schakelklok ventilatie		X	Schakelklok ventilatie kantoor
GD1	Isolatie leidingen en appendages CV		X	Offerte aanvragen voor isoleren leidingen en appendages CV-installatie
GE5	LED-verlichting vluchtwegaanduiding		X	Op natuurlijk moment armaturen vluchtwegaanduiding vervangen door LED-armaturen
GE6a	Halogeen- of gloeilampen vervangen door LED	X		Halogeen- en gloeilampen vervangen door LED. (bij niet gebruikte armaturen lampen verwijderen)
GE7a	TLD-lampen vervangen door LED (retrofit)	X		TLD verlichting vervangen door LED-verlichting door vervangen armatuur of toepassen retrofit LED-lampen.
GE7b	PL-lampen vervangen door LED (retrofit)	X		Indien aantal branduren per jaar > 2000 uur, PL-lampen vervangen door retrofit LED-lampen
FC1	Debietregeling afzuiging keuken		X	Indien de keuken in gebruik wordt genomen dient op natuurlijk moment de afzuiginstallatie te worden voorzien van rook en/of dampdetectie
GD4	LED-verlichting vluchtwegaanduiding		X	Op natuurlijk moment armaturen vluchtwegaanduiding vervangen door LED-armaturen
GD7	Meerdere schakelgroepen verlichting		X	Aanwezigheidsdetectie verlichting magazijn in gedeelten waar niet continu iemand aanwezig is.
GD12	Aanwezigheidsschakeling verlichting		X	

Tabel 5 - Checklist Verrijn Stuartweg 18

Compiled list of possible measures – Verrijn Stuartweg 18

Possible Measures
Gevelisolatie binnenzijde
Extra gevelisolatie binnenzijde
Isolatie hellend dak
Gevel- en dakisolatie
Enkel glas vervangen door HR++ glas
Schakelklok afzuigventilatie kantoor
Aanpassen verlichting
TLD-armatuur vervangen door LED-armatuur

TLD-lampen vervangen door LED-tubes
PL lampen vervangen door LED (retrofit)
Halogeenspots vervangen door LED-spots
Gloeilampen vervangen door LED-lampen
Aanwezigheidsdetectie verlichting
TL5-lampen vervangen door LED-tubes
Aanwezigheidsdetectie verlichting magazijn

Tabel 6 - Compiled list of possible measures – Verrijn Stuartweg 18

Estimated total investment costs - Verrijn Stuartweg 18

Gevelisolatie binnenzijde			**€**	**8.251,86**	
Gevel - magazijn	78,22 m²	83,00 €/m²	€	6.492,26	100 mm isolatie,
Tussenmuur	21,20 m²	83,00 €/m²	€	1.759,60	behangklaar
Extra gevelisolatie binnenzijde			**€**	**17.438,49**	
Metselgevel	83,69 m²	81,00 €/m²	€	6.778,89	80 mm extra isolatie,
Paneelgevel	60,76 m²	81,00 €/m²	€	4.921,56	behangklaar
Plaatgevel	55,02 m²	81,00 €/m²	€	4.456,62	
Geïsoleerde binnengevel	15,82 m²	81,00 €/m²	€	1.281,42	
Isolatie hellend dak			**€**	**40.107,88**	
Hellend dak	374,84 m²	107,00 €/m²	€	40.107,88	80 mm extra isolatie, incl. vervangen dakbedekking
Gevel- en dakisolatie			**€**	**70.627,99**	
Gevel - magazijn	110,08 m²	83,00 €/m²	€	9.136,64	100 mm isolatie,
Tussenmuur	21,20 m²	83,00 €/m²	€	1.759,60	behangklaar
Metselgevel	78,62 m²	81,00 €/m²	€	6.368,22	80 mm extra isolatie,
Paneelgevel	90,12 m²	81,00 €/m²	€	7.299,72	behangklaar
Plaatgevel	57,71 m²	81,00 €/m²	€	4.674,51	
Geïsoleerde binnengevel	15,82 m²	81,00 €/m²	€	1.281,42	
Hellend dak	374,84 m²	107,00 €/m²	€	40.107,88	80 mm extra isolatie, incl. vervangen dakbedekking
Enkel glas vervangen door HR++ glas			**€**	**27.682,80**	
Enkel glas, hout	68,46 m²	170,00 €/m²	€	11.638,20	HR++ glas, excl. Kozijn
Enkel glas & ZW, hout	14,21 m²	170,00 €/m²	€	2.415,70	
Enkel glas, hout (binnen)	80,17 m²	170,00 €/m²	€	13.628,90	
Schakelklok afzuigventilatie kantoor			**€**	**200,00**	
Weekschakeling ventilatie	1 stuks	200,00 €/stuk	€	200,00	Ventilatie alleen tijdens kantooruren
Aanpassen verlichting			**€**	**37.209,10**	
TLD-lampen vervangen door LED-tubes (ZM)			€	1.275,30	
PL lampen vervangen door LED (retrofit) (ZM)			€	78,80	
Halogeenspots vervangen door LED-spots (ZM)			€	576,20	

Gloeilampen vervangen door LED-lampen (ZM)			€	12,30	
Aanwezigheidsdetectie verlichting kantoor (ZM)			€	4.189,20	
TL5-lampen vervangen door LED-tubes (ZM)			€	7.982,70	
Aanwezigheidsdetectie verlichting magazijn (ZM)			€	23.094,60	
TLD-armatuur verv door LED-armatuur		25,00 €/stuk	**€**	**4.205,20**	
TLD-armatuur vervangen door LED-armatuur			*€*	*2.780,20*	
TLD 4x18W conv, inbouw	31 stuks	49,20 €/stuk	€	1.525,20	LED-paneel 30W
TLD 3x18W HF, inbouw	25 stuks	49,20 €/stuk	€	1.230,00	LED-paneel 30W
TLD 2x18W conv, inbouw	1 stuks	25,00 €/stuk	€	25,00	LED-paneel 24W
TLD-lampen vervangen door LED-tubes		2,00 €/stuk	**€**	**1.275,30**	
TLD-lampen vervangen door LED-tubes			*€*	*1.161,30*	
TLD 4x18W conv, inbouw	31 stuks	15,20 €/stuk	€	471,20	LED-tubes 4x8W
TLD 3x18W HF, inbouw	25 stuks	27,30 €/stuk	€	682,50	LED-tubes 3x9W
TLD 2x18W conv, inbouw	1 stuks	7,60 €/stuk	€	7,60	LED-tubes 2x8W
PL lampen vervangen door LED (retrofit)		2,00 €/stuk	**€**	**78,80**	
PL lampen vervangen door LED (retrofit)			*€*	*68,80*	
PL 1x13W conv, downlighter	2 stuks	6,95 €/stuk	€	13,90	PL-C LED 4,5W
PLS 2x9W conv, plafond	3 stuks	18,30 €/stuk	€	54,90	PL-S LED 4W
Halogeenspots vervangen door LED-spots		2,00 €/stuk	**€**	**576,20**	
Halogeenspots vervangen door LED-spots			*€*	*484,20*	
Halogeenspot 50W (QR111-12V)	25 stuks	15,84 €/stuk	€	396,00	LED-spot 11W
Steekhalogeen 20W (GY 6.35)	21 stuks	4,20 €/stuk	€	88,20	LED 1,7W
Gloeilampen vervangen door LED-lampen		2,00 €/stuk	**€**	**12,30**	
Gloeilampen vervangen door LED-lampen			*€*	*8,30*	
Gloeilamp 40W	2 stuks	4,15 €/stuk	€	8,30	LED gloeilamp 4W
Aanwezigheidsdetectie verlichting kantoor		0,30 €/m²	**€**	**4.189,20**	
Aanwezigheidsdetectie verlichting kantoor			*€*	*3.979,74*	
sector 1: Radiatoren	262,2 m²	5,70 €/m²	€	1.494,54	Handschakelaars vervang-
sector 2: Afzuiging	264,1 m²	5,70 €/m²	€	1.505,37	en door
sector 3: Airco	171,9 m²	5,70 €/m²	€	979,83	aanwezigheidsdetectie
TL5-lampen vervangen door LED-tubes		2,00 €/stuk	**€**	**7.982,70**	
TL5-lampen vervangen door LED-tubes			*€*	*7.582,70*	
TL5 2x35W HF, trog	107 stuks	38,20 €/stuk	€	4.087,40	LED-tubes 2x20W
TL5 2x35W HF, trog (uit)	90 stuks	38,20 €/stuk	€	3.438,00	LED-tubes 2x20W
TL5 1x35W HF, montagebalk	3 stuks	19,10 €/stuk	€	57,30	LED-tubes 1x20W
Aanwezigheidsdetectie verlichting magazijn		0,05 €/m²	**€**	**5.003,83**	
Aanwezigheidsdetectie verlichting magazijn			*€*	*4.811,38*	

Magazijn	3.849,1 m²	1,25 €/m²	€	4.811,38	Handschakelaars vervang-en door
Maatregelenpakket ROI max. 5 jaar			**€**	**14.474,13**	
Schakelklok afzuigventilatie kantoor	kantoor		€	200,00	
TLD-lampen vervangen door LED-tubes	LED-tubes		€	1.275,30	
Gloeilampen vervangen door LED-lampen	LED-lampen		€	12,30	
TL5-lampen vervangen door LED-tubes	LED-tubes		€	7.982,70	
Aanwezigheidsdetectie verlichting magazijn	magazijn		€	5.003,83	
Maatregelenpakket C-label			**€**	**22.725,99**	
Gevelisolatie binnenzijde	binnenzijde		€	8.251,86	
Schakelklok afzuigventilatie kantoor	kantoor		€	200,00	
TLD-lampen vervangen door LED-tubes	LED-tubes		€	1.275,30	
Gloeilampen vervangen door LED-lampen	LED-lampen		€	12,30	
TL5-lampen vervangen door LED-tubes	LED-tubes		€	7.982,70	
Aanwezigheidsdetectie verlichting magazijn	magazijn		€	5.003,83	
Maatregelenpakket A-label			**€**	**50.408,79**	
Gevelisolatie binnenzijde	binnenzijde		€	8.251,86	
Enkel glas vervangen door HR++ glas	glas		€	27.682,80	
Schakelklok afzuigventilatie kantoor	kantoor		€	200,00	
TLD-lampen vervangen door LED-tubes	LED-tubes		€	1.275,30	
Gloeilampen vervangen door LED-lampen	LED-lampen		€	12,30	
TL5-lampen vervangen door LED-tubes	LED-tubes		€	7.982,70	
Aanwezigheidsdetectie verlichting magazijn	magazijn		€	5.003,83	

Tabel 7 - Estimated total costs investments Verrijn Stuartweg 18

Improvement Measures and Estimated ROI – Verrijn Stuartweg 18

Improvement Measures	Investment [€]	Gas [€/jaar]	Electr. [€/jaar]	Total Savings [€/jaar]	Est. ROI [jaar]
Gevelisolatie binnenzijde	8.252,00	811,00	-	811,00	10,18
***Extra gevelisolatie binnenzijde*	*17.438,00*	*211,00*	*-*	*211,00*	*82,64*
***Isolatie hellend dak*	*40.108,00*	*32,00*	*-*	*32,00*	*1.253,38*
***Gevel- en dakisolatie*	*70.628,00*	*1.256,00*	*-*	*1.256,00*	*56,23*
Enkel glas vervangen door HR++ glas	27.683,00	1.711,00	-	1.711,00	16,18
Schakelklok afzuigventilatie kantoor	200,00	1.485,00	-	1.485,00	0,13
***Aanpassen verlichting*	*37.209,00*	*-*	*4.598,00*	*4.598,00*	*8,09*
***TLD-armatuur vervangen door LED-armatuur*	*4.205,00*	*-*	*314,00*	*314,00*	*13,39*
TLD-lampen vervangen door LED-tubes	1.275,00	-	325,00	325,00	3,92
***PL lampen vervangen door LED (retrofit)*	*79,00*	*-*	*6,00*	*6,00*	*13,17*
***Halogeenspots vervangen door LED-spots*	*576,00*	*-*	*100,00*	*100,00*	*5,76*
Gloeilampen vervangen door LED-lampen	12,00	-	5,00	5,00	2,40
***Aanwezigheidsdetectie verlichting*	*4.189,00*	*-*	*137,00*	*137,00*	*30,58*
TL5-lampen vervangen door LED-tubes	7.983,00	-	3.403,00	3.403,00	2,35
Aanwezigheidsdetectie verlichting magazijn	5.004,00	-	1.382,00	1.382,00	3,62
Improvement Measures C-label	22.726,00	2.296,00	5.115,00	7.411,00	3,07
Improvement Measures A-label	50.409,00	4.007,00	5.115,00	9.122,00	5,53

* Data in savings is measured by looking up the "normal" annual current usage and comparing the new situation in usage which returns the improvement in efficiency

** This improvement is optional and not recommended, therefore it is not added to the final calculations

Figuur 6 - Improvement Measures and Estimated ROI – Verrijn Stuartweg 18