



Pilot Projects

WP 4.2 Intermediate Report

City: Eindhoven

Region: The Netherlands

Organisation: City Council of Eindhoven

Pilot Buildings:

1. Swimming Pool 'ir. Ottenbad'
2. Indoor Sport Centre
3. Gymnasiums in general
4. Sport Parks in general



Nearly Zero-Energy Sports Facilities

Executive Summary

This pilot preparation is meant for the swimming pool in Ottenbad, the sports hall Indoor Sport Centre, nine gymnasiums and a number of sport parks. For each of the four pilots, measurements are taken to reduce the energy use or even switch to sustainable energy.

The measurements for the in Ottenbad are pool covering, frequency control on pump, a building automation system and solar panels. The total costs are around €460.000,-. The yearly saving shall be around at least 25%, but that has to be researched yet.

The measurement of the Indoor Sport Centre will be LED-lights. This will cost around €30.000. The yearly saving shall be around 20%.

The measurement for the sport halls will be isolation. This will cost around €10.000. The yearly saving has to be researched yet.

The measurement for the sport parks will be an Energy-saving-game between outdoor sport parks. This will cost around €10.000. The yearly saving has to be researched yet.

The starts of these projects are planned for the first quarter of 2016, but that will depend on the Sport Vision. The reason for that is the uncertainty that all the accommodations are kept being owned from the council, like the Indoor Sports Centre.

1. Pilot buildings

1. Ottenbad

The Ottenbad is a family swimming pool facility with indoor and outdoor swimming facilities. Opening hours are from Monday till Friday from 10 am until about 9.00 pm. On Saturday and Sunday from 10.00 am till 5.00 pm.

Function:

Public swimming pool

Size:

2600 m²

Year of construction:

1969

Reconstruction in 1980

Current energy saving measures:

- Wood burning bio-energy plant. It can give up to 850 kW of heat.
- 2 CHP's
- 2 Gas boilers
- Recharge point for electrical bikes
- High efficiency Air Treatment Units
- LED-lights

Renewable energy sources:

- Wood. 4-12 tonnes per day when in use.
- Solar energy

Annual energy consumption:

For 2014

Gas: 452.587 m³

Electricity (bought in): 930.054 kWh

Wood: 1134 tonnes

Reason for the pilot:

This is one of the sport accommodations with the biggest opportunities for energy saving.



2. Indoor Sport Centre

The Indoor Sport Centre is one of the biggest indoor sportcentres in the Netherlands. It offers sporters, audience and press high quality functions during sporting events. It includes a fitness area too.



Size:
4000 m²
(50 by 80 meter)

Year of construction:
1993

Current energy saving measures:

- Detection system for the lights
- Building Management System to reduce the required energy for heating the building
- Isolated pipelines for the heating water and the normal water.
- LED-lights outside
- Water-saving showers
- Roof-isolation

Reason for the pilot:

This is one of the sport accommodations with the biggest opportunities for energy saving.

3. The 9 gymnasiums of Eindhoven

- 1) Barrierweg
- 2) Bordeauxlaan
- 3) Grebbeberglaan
- 4) Heideveldstraat
- 5) Hendrik Staetslaan
- 6) Klipperstraat
- 7) Piuslaan
- 8) Vlokhovenseweg

Function:

Gymnasiums for hire.

Size:

The size of each hall is 242 m² (11*22 meter), but the sizes of the whole buildings are unknown.

Year of construction:

Differs for each gymnasium. The exact years are unknown.

Current energy saving measures:

Table 3: Current energy saving measures of the gymnasiums

	Barrierweg	Bordeauxlaan	Grebbeberglaan	Heideveldstraat	Hendrik Staetslaan	Klipperstraat	Piuslaan	Vlokhovenseweg
Detection to turn on the lights							X	
High Efficiency-Boilers	X	X	X	X	X	X	X	X
Building Management Systems for reducing energy for heating the building	X	X	X	X	X	X	X	X
Isolated Pipelines	X	X	X	X	X	X	X	X
Energy saving lights (outdoor)			X				X	
Energy saving Showers	X	X	X	X	X	X	X	X
Roof windows of double glass	X						X	X
Roof isolation			X		X			
Emergency LED-lights			X			X		

Reason for the pilot:

These are the sport accommodations with the biggest opportunities for energy saving.

4. The Sportparks in Eindhoven

- Amstelstraat
- Anconalaan
- Charles Roelslaan
- Elburglaan
- Fernhoutstraat
- Grasbaan
- J C Dirkxpad
- Locatellistraat
- Strijpsebaan 0
- Oude Bossche Baan
- Quinten Matsyslaan
- Partituurlaan
- Rijstenweg
- Roostenlaan
- Velddoornweg

These aren't their official names, but these are the street names based on the connections of the electricity net.

Function:

Different parks each with their own applying sports like football, hockey, athletics, tennis, etc.

Size:

Different for each sport park, but not relevant for this pilot. (Focus lies on behaviour, not the technical part).

Year of construction:

Different for each sport parks, but not relevant for this pilot. (Focus lies on behaviour, not the technical part).

Current energy saving measures:

Different for each sport parks, but not relevant for this pilot. (Focus lies on behaviour, not the technical part).

Reason for the pilot:

These are the sport accommodations with the biggest opportunities for energy saving by looking at the behaviour of the visitors.

2. Existing Monitoring system

Existing Monitoring system Ottenbad

The metering of the systems is done by the use of a Building Management System (BMS). The monthly utility bills are built out of three components: The energy supplier, the network administrator and the tax authorities. The council has full access and control over these bills by using the energy monitoring program. This program makes an overview about the expected costs of the energy use.

By using smart meters and the BMS, the council can measure the base line consumption.

Gas

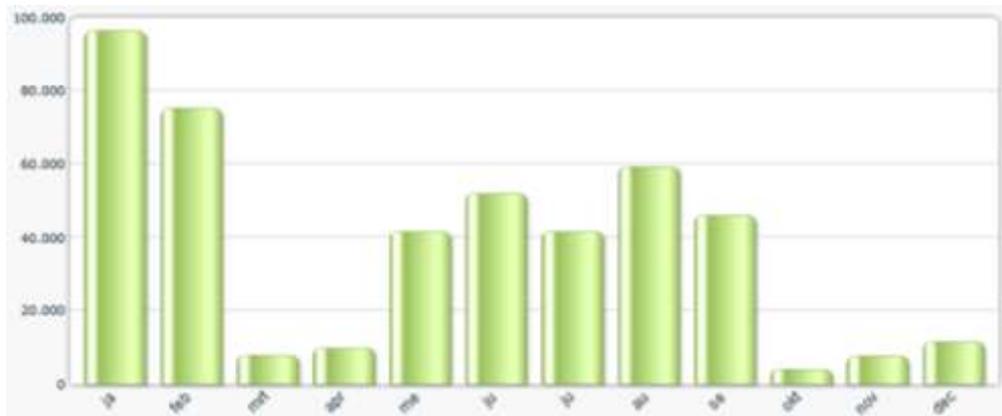


Figure 1: Gas use of 2014 (m³)

Electricity

Please note: Light green is the off peak measuring and dark green is the peak measuring.



Figure 2: Electric use of 2014(kWh)

Wood

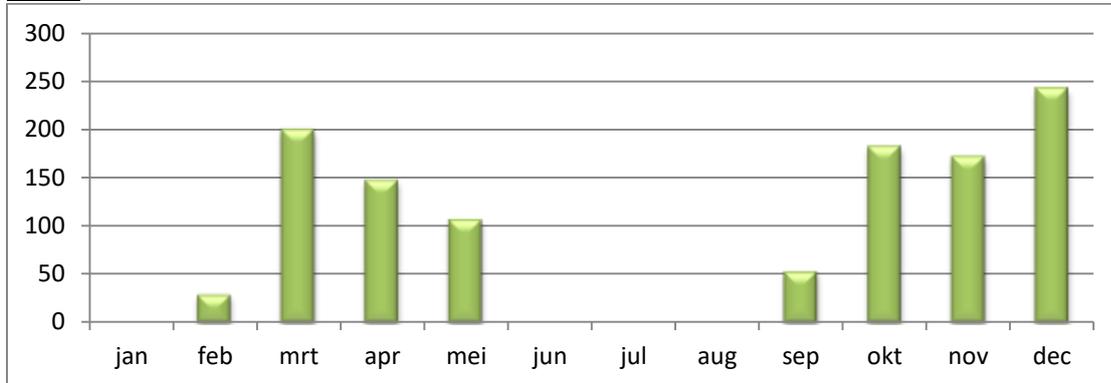


Figure 3: Wood use (Tonnes)

Existing Monitoring system Indoor Sport Centre

The metering of the systems is done by the use of a Building Management System (BMS). The monthly utility bills are built out of three components: The energy supplier, the network administrator and the tax authorities. The council has full access and control over these bills by using the energy monitoring program. This program makes an overview about the expected costs of the energy use.

By using smart meters and the BMS, the council can measure the base line consumption.

Gas

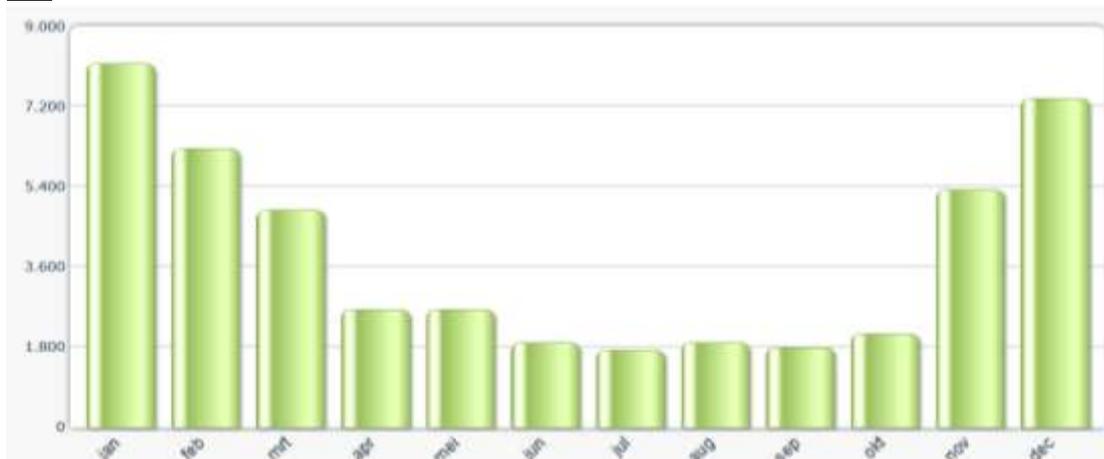


Figure 4: Gas use of 2014 (m³)

Electricity

Please note: Light green is the off peak measuring and dark green is the peak measuring.

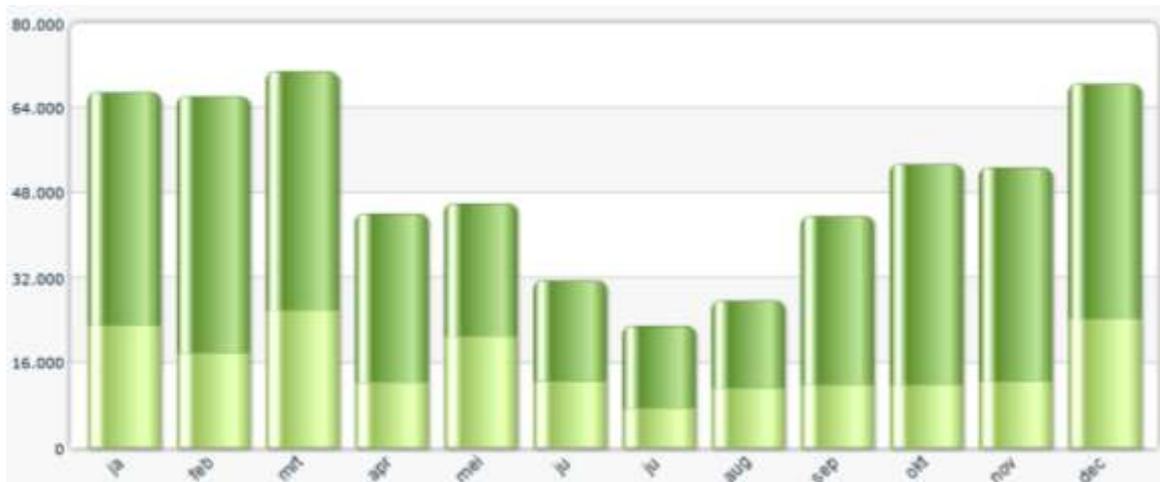


Figure 5: Electricity use of 2014 (kWh)

Existing Monitoring system Gymnasiums

The metering of the systems for each gymnasium is done by the use of a Building Management System (BMS) and smart meters. The monthly utility bills are built out of three components: The energy supplier, the network administrator and the tax authorities. The council has full access and control over these bills by using the energy monitoring program. This program makes an overview about the expected costs of the energy use.

By using smart meters and the BMS, the council can measure the base line consumption. Gymnasium Barrierweg is shown as example in Figure 6 and Figure 7.

Gas

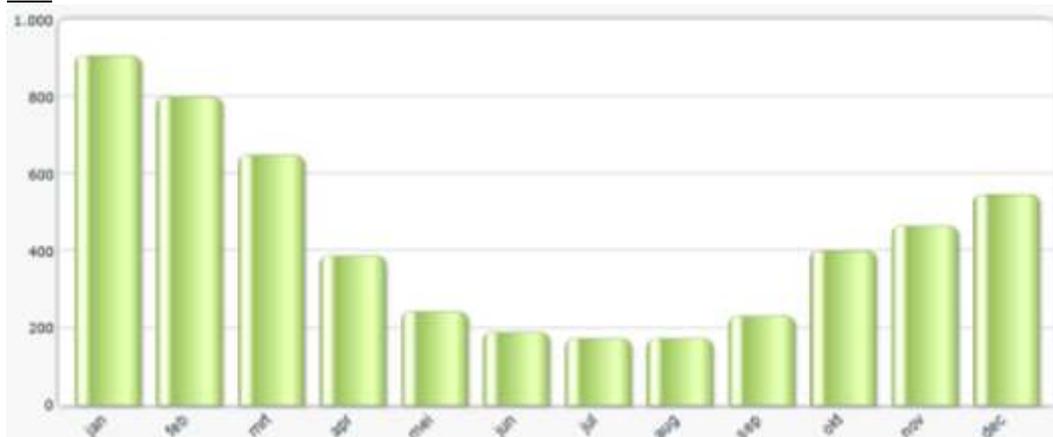


Figure 6: Gas use of 2015 of Bordeauxlaan (m³)

Electricity

Please note: Light green is the off peak measuring and dark green is the peak measuring.



Figure 7: Electricity use of 2015 of Bordeauxlaan (kWh)

Existing Monitoring system Sport Parks

The metering of the systems for each sport park is done by the use of Smart Meters. Each sport club of the sport park has access to their own Smart Meters for their own use. The monthly utility bills are built out of three components: The energy supplier, the network administrator and the tax authorities. The council has full access and control over these bills by using the energy monitoring program. This program makes an overview about the expected costs of the energy use.

By using smart meters, the council can measure the base line consumption. Sport park Acht at the Amstelstraat is shown as example in Figure 8 and Figure 9.

Gas

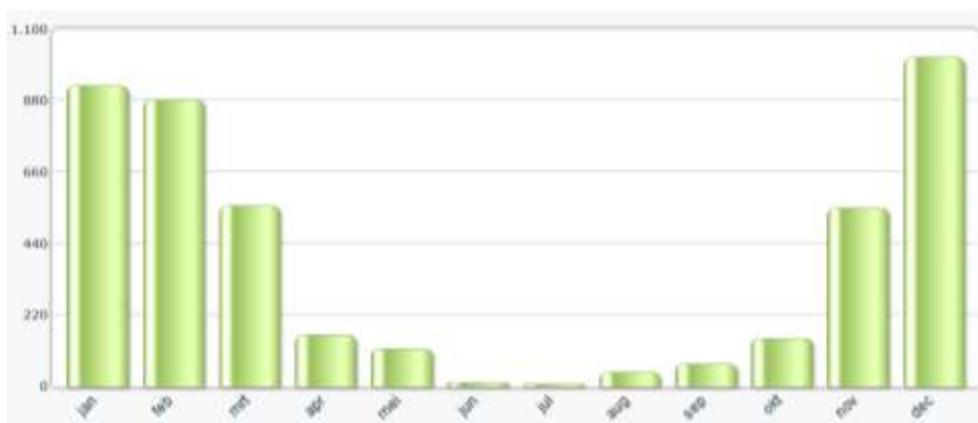


Figure 8: Gas use of 2014 of Amstelstraat (m³)

Nearly Zero-Energy Sports Facilities

Electricity

Please note: Light green is the off peak measuring and dark green is the peak measuring.

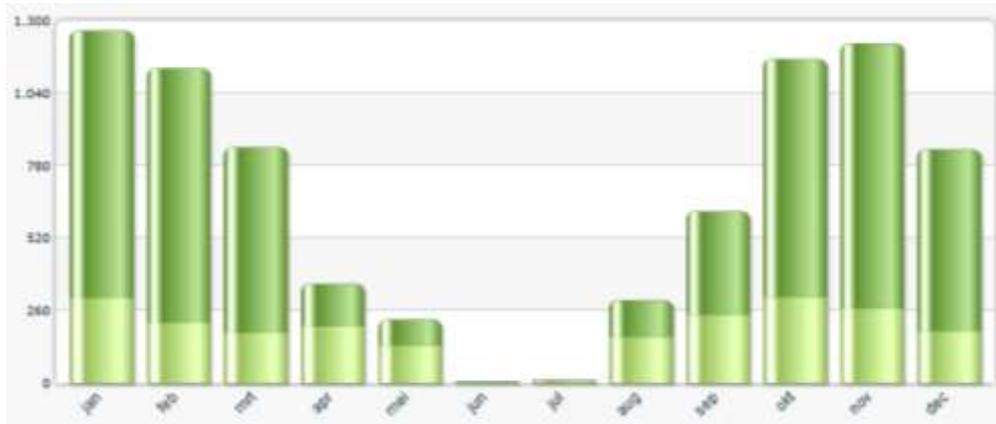


Figure 9: Electric use of 2014 of Amstelstraat (kWh)

3. Energy Audit

Energy audit Ottenbad

The City Council of Eindhoven has an Energy Workgroup especially for sport accommodations, consisting out of six people from the departments Technic, Economics and Energy Coordination. The main goal of this workgroup is to work out the possible solutions about energy saving. This means that they're rather focused on the practices and less on analysis and administration. Once per six weeks, the Energy Workgroup comes together to discuss and show reports about the current energy use in the sport accommodations of Eindhoven. Based on own knowledge, external reports and information of external companies, the Energy Workgroup makes plans to reduce the energy use. These plans are mostly focused on which solutions gave the quickest energy saving results.

The analysis of ir. Ottenbad has been done. Two interns of the Technical University of Eindhoven have made a complete analysis and gave us some very interesting suggestions. As a result of this analysis –and in fact as a real spin off of the EU-project!! - we are now preparing to install a huge buffer reservoir which enables us to use the BIO-installation a lot more efficiently. Investment: approximately € 100.000;- Paybacktime: approximately 5 years.

Energy audit Indoor Sport Centre

The City Council of Eindhoven has an Energy Workgroup especially for sport accommodations, consisting out of six people from the departments Technic, Economics and Energy Coordination. The main goal of this workgroup is to work out the possible solutions about energy saving. This means that they're rather focused on the practices and less on analysis and administration. Once per six weeks, the Energy Workgroup comes together to discuss and show reports about the current energy use in the sport accommodations of Eindhoven. Based on own knowledge, external reports and information of external companies, the Energy Workgroup makes plans to reduce the energy use. These plans are mostly focused on which solutions gave the quickest energy saving results.

Appendix 1 includes the audit of the Indoor Sport Centre. The accommodation has some good plans, already, but they need to improve on the pumps, the lights inside the building and the isolation of the windows.

Energy audit Gymnasiums

The City Council of Eindhoven has an Energy Workgroup especially for sport accommodations, consisting out of six people from the departments Technic, Economics and Energy Coordination. The main goal of this workgroup is to work out the possible solutions about energy saving. This means that they're rather focused on the practices and less on analysis and administration. Once per six weeks, the Energy Workgroup comes together to discuss and show reports about the current energy use in the sport accommodations of Eindhoven. Based on own knowledge, external reports and information of external companies, the Energy Workgroup makes plans to reduce the energy use. These plans are mostly focused on which solutions gave the quickest energy saving results.

Appendix 2 includes the checklists of the audits of the gymnasiums. The audits themselves were done as the Indoor Sport Centre in appendix 1.



Nearly Zero-Energy Sports Facilities

Energy audit Sport Parks

The City Council of Eindhoven has an Energy Workgroup especially for sport accommodations, consisting out of six people from the departments Technic, Economics and Energy Coordination. The main goal of this workgroup is to work out the possible solutions about energy saving. This means that they're rather focused on the practices and less on analysis and administration. Once per six weeks, the Energy Workgroup comes together to discuss and show reports about the current energy use in the sport accommodations of Eindhoven. Based on own knowledge, external reports and information of external companies, the Energy Workgroup makes plans to reduce the energy use. These plans are mostly focused on which solutions gave the quickest energy saving results.

4. Proposed Measures

Proposed Measures Ottenbad

For the Ottenbad, the plans are to:

- Cover the outside pool. This includes an app for mobile phone for visitors on which they can see when the outside pool is open depending on the weather forecast.
- Use of frequency control on the heating pumps.
- Create energy management by commissioning and monitoring a Building Automation System.
- Place Solar panels on the roofs.

The plans would reduce the use of gas and electricity by 10-20%. Exact numbers will be known after applying them.

Proposed Measures Indoor Sport Centre

The Indoor Sport Centre shall be provided with LED-lights. This should save around 20% of the electricity use. Exact numbers will be known after applying them.

Proposed Measures Gymnasiums

Table 4: Proposed Measures of the gymnasiums

	Barrierweg	Bordeauxlaan	Grebbeberglaan	Heideveldstraat	Hendrik Staetslaan	Klipperstraat	Piuslaan	Vlokhovenseweg
Detection for turning on the lights	X	X	X	X	X	X		X
Replacing pumps with a higher efficiency	X	X			X			X
Isolating appendages	X	X	X	X	X	X	X	X
LED-lights in the halls	X	X	X	X	X	X	X	X
Windows with HR++-isolation	X	X	X	X	X	X	X	X
Wall isolation		X	X	X	X	X	X	X
AHU with double cross exchanger			X					

Proposed Measures Sport Parks

Effective behavioural actions can save approximately 5% of the building energy consumption and is generally regarded as soft measures which cost very little to implement. However, behavioural action are probably the most difficult to implement, because they requires a change in the way people approach and do their job on a daily basis and people are always resistant to change. Therefore, a competition will be organised between all the sports parks to stimulate energy reduction.

The council believes that there's more chance in saving energy on the behavioural aspect, so no further investigation will be done for the installations of the sports parks.



Nearly Zero-Energy Sports Facilities

5. Stakeholders

Stakeholders Ottenbad

The stakeholders are the City Council of Eindhoven, the owner of the ir. Ottenbad and an internal selected organisation. Communication and data sharing goes by E-Mail with appendices.

Stakeholders Indoor Sport Centre

The stakeholders are the City Council of Eindhoven, the owner of the Indoor Sport Centre and an internal selected organisation. Communication and data sharing goes by E-Mail with appendices.

Stakeholders Gymnasiums

The stakeholders are the City Council of Eindhoven, the owners of gymnasiums and an internal selected organisation. Communication and data sharing goes by E-Mail with appendices.

Stakeholders Sport Parks

The stakeholders are the City Council of Eindhoven, the sport clubs on the sport parks and an internal selected organisation. Communication and data sharing goes by E-Mail with appendices.



Nearly Zero-Energy Sports Facilities

6. Funding Methods

Funding Methods Ottenbad

The funding is by the City Council itself. The SDE of the national Government might also help funding it. Since there no external investors, no economic benefit is really involved.

Funding Methods Indoor Sport Centre

The funding is by the City Council itself. The SDE of the national Government might also help funding it. Since there no external investors, no economic benefit is really involved.

Funding Methods Gymnasiums

The funding is by the City Council itself. The SDE of the national Government might also help funding it. Since there no external investors, no economic benefit is really involved.

Funding Methods Sport Parks

The funding is by the City Council itself. The SDE of the national Government might also help funding it. Since there no external investors, no economic benefit is really involved.

7. Business Case Analysis

Business Case Analysis Ottenbad

Table 1: Measurements for Ir. Ottenbad

Measure	Cost	Saving (yearly)	Unit (kwh/m2)	Payback (years)	CO ₂	Sources of data
Pool covering	Approximately €50.000,-	Approximately 25%	To be studied.	Approximately 5 years	To be studied	Infomil
	The heat supply for the outside pool is not separately measured. Only figures for the whole swimming pool are available.					
Use of Frequency control on pumps	Approximately €10.000,-	Subject of research	To be studied.	To be studied	To be studied	Grundfoss!
	The turnout of this plan is highly dependent of the size of the pump. There is a study to see if it is possible to introduce the pumps at the same time of major maintenance, because this has influence on the payback time.					
Building Automation System	Approximately €100.000,-	Subject of research	To be studied	To be studied	To be studied	-
	Data such as electricity and gas are available for 2012, 2013 and 2014. The focus on the project is to research the effect on energy consumption after Building Automation System is installed.					
Solar Panels	Approximately €300.000,-	Point of research	Not relevant	16-17 years	To be studied	Supplier
	Instead of reducing energy, 'green energy' will be produced. How much it will be have to be investigated yet.					

Business Case Analysis Indoor Sport Centre

Table 2: Measurement analysis of Indoor Sport Centre

Measure	Cost	Saving (yearly)	Unit (kwh/m2)	Payback (years)	CO ₂	Sources of data
Use of LED-lighting	Approximately €30.000,-	20%	To be studied	To be studied	To be studied	Infomil
	The electricity consumption for the lighting is not separately measured. Only figures for the whole accommodation are available. We are now investigating the lights used to estimate the electricity consumption. We are studying if it is possible to introduce the LED light at the same time of major maintenance. That influences the payback time.					

Business Case Analysis Gymnasiums

Table 5: Measurement analysis of the gymnasiums and sport halls

Measure	Cost	Saving (yearly)	Unit (kwh/m2)	Payback (years)	CO ₂	Sources of data
Isolation of sport halls	Approximately €10.000,-	Subject of research	To be studied	To be studied	To be studied	Infomil
An inventory of all sporting halls is in the make. Every sporting hall has its different situation (isolation, age, time of major maintenance etcetera). The target of this plan is to make a good selection method for deciding which sporting hall is the best to start with.						

Business Case Analysis Sport Parks

Table 6: Measurement analysis of the sport parks

Measure	Cost	Saving (yearly)	Unit (kwh/m2)	Payback (years)	CO ₂	Sources of data
Energy-saving-game between outdoor sport parks	Approximately €10.000,-	Subject of research	To be studied	To be studied	To be studied	-
The possible results are unknown, because the amount of behavioural change differs from every individual.						

8. Implementation Plan

Review of Energy Monitoring Systems Ottenbad

There's no review available, because of the limited time for the Pilot Preparation.

Proposed Monitoring System Ottenbad

The data of Ir. Ottenbad is filled-in on an online tool called the 'Milieubarometer'. With this tool, the carbon footprint of Ir. Ottenbad is compared with other swimming pools. The data, including utility bills, will be monthly collected and registered.

Implementation Plan Ottenbad

The start of this project will be in the first quarter of 2016. The exact date will depend on the Sport Vision. The reason for that is the uncertainty that all the accommodations are keep being owned from the council.

As a matter of fact we did install the Solar-panels, and the Building Automation System.

The cover of the outside pool is planned for this year if payback time is all right. We will not install the app for mobile phone for visitors on which they can see when the outside pool is open depending on the weather forecast. We think about a simpler idea

- Use of frequency control on the heating pumps is cancelled. The pay back time is much too long.

Review of Energy Monitoring Systems Indoor Sport Centre

There's no review available, because of the limited time for the Pilot Preparation.

Proposed Monitoring System Indoor Sport Centre

The data of the Indoor Sport Centre will be monthly electronic collected and registered. The utility bills will be received monthly as well.

Implementation Plan Indoor Sport Centre

The start of this project is still not clear The exact date still depends on the Sport Vision. The reason for that is the uncertainty that all the accommodations are keep being owned from the council like the Indoor Sport Centre. During political reasons (leaving an Elderly with Sport in her task), there has not yet been a decision on the Sport Vision by the City Council.

Payback time is good. That is not the question. We are only waiting for a go.

Review of Energy Monitoring Systems Gymnasiums

There's no review available, because of the limited time for the Pilot Preparation.

Proposed Monitoring System Gymnasiums

The data of the sports accommodations will be monthly electronic collected and registered. The utility bills will be received monthly as well.



Nearly Zero-Energy Sports Facilities

Implementation Plan Gymnasiums

As expecting the start of this project will be in the last quarter of 2016. The exact date will depend on the Sport Vision. The reason for that is the uncertainty that all the accommodations are kept being owned from the council.

Review of Energy Monitoring Systems Sport Parks

There's no review available, because of the limited time for the Pilot Preparation.

Proposed Monitoring System Sport Parks

The data of the sports accommodations will be monthly electronically collected and registered. The utility bills will be received monthly as well.

Implementation Plan Sport Parks

The Energy-saving game between outdoor sportclubs on the sport parks **has been started in October 2015. The end of the game is at the end of October 2016. First results are difficult to express in figures. But the awareness of sportclub on saving energy has been improved. Especially some leaders were interested. It is a long term story to improve behaviour in energysaving. Our strategy is that the leaders stimulates the middle of the group of sportclubs. Some easy measures saved a lot of energy: such as a holiday position of the boiler. That means some sportclubs do sport indoor in winter or do not sport in summer at all. At that time they do not use the outdoor facilities and the boiler has been put on 'holiday position'; that means that the water is not heated up. It is a simple measure but very effective.**

9. Conclusion

The following tables contain the measurements for energy efficiency.

Table 7: Measurements for ir. Ottenbad

Measure	Cost	Saving (yearly)	Unit (kwh/m2)	Payback (years)	CO ₂	Sources of data
Pool covering	Approximately €50.000,-	Approximately 25%	To be studied.	Approximately 5 years	To be studied	Infomil
	The heat supply for the outside pool is not separately measured. Only figures for the whole swimming pool are available.					
Use of Frequency control on pumps	Approximately €10.000,-	Subject of research	To be studied.	To be studied	To be studied	Grundfossl
	The turnout of this plan is highly dependent of the size of the pump. There is a study to see if it is possible to introduce the pumps at the same time of major maintenance, because this has influence on the payback time.					
Building Automation System	Approximately €100.000,-	Subject of research	To be studied	To be studied	To be studied	-
	Data such as electricity and gas are available for 2012, 2013 and 2014. The focus on the project is to research the effect on energy consumption after Building Automation System is installed.					
Solar Panels	Approximately €300.000,-	Point of research	Not relevant	16-17 years	To be studied	Supplier
	Instead of reducing energy, 'green energy' will be produced. How much it will be have to be investigated yet.					

Table 8: Measurement for the Indoor Sport Centre

Measure	Cost	Saving (yearly)	Unit (kwh/m2)	Payback (years)	CO ₂	Sources of data
Use of LED-lighting	Approximately €30.000,-	20%	To be studied	To be studied	To be studied	Infomil
	The electricity consumption for the lighting is not separately measured. Only figures for the whole accommodation are available. We are now investigating the lights used to estimate the electricity consumption. We are studying if it is possible to introduce the LED light at the same time of major maintenance. That influences the payback time.					

Table 9: Measurement for the gymnasiums

Measure	Cost	Saving (yearly)	Unit (kwh/m2)	Payback (years)	CO ₂	Sources of data
Isolation of sport halls	Approximately €10.000,-	Subject of research	To be studied	To be studied	To be studied	Infomil
An inventory of all sporting halls is in the make. Every sporting hall has its different situation (isolation, age, time of major maintenance etcetera). The target of this plan is to make a good selection method for deciding which sporting hall is the best to start with.						

Table 10: Measurement for the sport parks

Measure	Cost	Saving (yearly)	Unit (kwh/m2)	Payback (years)	CO ₂	Sources of data
Energy-saving-game between outdoor sport parks	Approximately €10.000,-	Subject of research	To be studied	To be studied	To be studied	-
The possible results are unknown, because the amount of behavioural change differs from every individual.						

These measurements are meant to start in the first quarter of 2016, but this will depend on the Sport Vision. The reason for that is the uncertainty that all the accommodations are keep being owned by the biggest stakeholder, the City Council of Eindhoven.