Energy Policy Plan 2017-2020

Radboud Universiteit

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**Summary, goals, and instruments**

**Energy**

Radboud University is on the right track with energy conservation. However, there has also been an increase in consumption due to new activities. In order to achieve absolute energy conservation, the energy programme is being intensified. A hybrid energy grid is being created for Heyendaal Zuid and the new construction for the Faculty of Social Sciences (FSW) will be energy neutral. The approach for climate installations and lighting will be worked out further.

1. Radboud University is striving to achieve an annual 2% absolute energy conservation during the 2017-2020 policy period.
   a. Radboud University is carrying out energy conservation projects and is employing a *life-cycle* approach in the process. The criterion for energy conserving measures is related to the “life cycle” of such measures. In order to improve the application of these, a standard technical programme of requirements for the preservation of sustainability will be used.
   b. There will be an *Energietoets* (energy assessment) during each feasibility study/project proposal from the UVB. These will provide a picture of whether the project is resulting in excessive use or conservation of energy.
   c. The goal is to concentrate on facilities with longer opening hours. The logic behind this is to avoid having multiple similar facilities open at the same time, which results in unnecessary energy being consumed.
   d. The UVB is also seeking out a collaboration with the faculties and institutes for innovative technology and methods. When it is possible, we will conduct pilot projects.
   e. Radboud University is cancelling its CO₂ rights from the CO₂ emission trading system in connection with the annual energy conservation to be achieved. This is to prevent these energy savings from being consumed elsewhere as additional CO₂ emissions. With this action, we primarily want to engage in discussion about the waterbed effect of this instrument. This will be further elaborated in the energy programme.

2. Radboud University is doing as much as possible to increase the amount of sustainable energy in its total energy consumption.
   a. There will be more solar panels on campus and the Aquifer Thermal Energy Storage will be used more.
   b. The purchase of energy will be more sustainable. Together with Radboud university medical center, Radboud University will enter into a principle-based collaboration with an external party for realising sustainable energy projects. The invitations to tender for electricity will be involved in this. The intention is to invest in sustainable energy projects in which we will become co-owners of the sustainable installation. In this way, Radboud University will be demonstrably producing sustainable energy, even if the production does not take place on campus. Radboud University will determine when and to what extent collaboration will occur.

**Water and material use**

3. Radboud University will reduce its drinking water consumption by 2% each year.
   a. Through good management using the *Energy Consumptie Systeem* (energy consumption system).
   b. By modifying (hot) water systems in the Huygens building.

4. Environmental impact will play a role in decisions regarding material use for renovations and new construction.
   a. Environmental class 4 or higher according to the *Environmental Classification System from NIBE* will be avoided, unless there are significant reasons to use them.
   b. For projects with a scope of less than €1 million, the UVB will use the *shadow pricing* method to provide an idea of the environmental impact of the materials.
   c. The UVB will conduct at least one project in the field of *circular construction*.
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1 Introduction

This Energy Policy Plan describes the objective and the manner in which Radboud University will conserve energy and the direction we aim to go in the years to come. The plan involves the operational management of Radboud University and not its programme of education and research. The task of implementing the energy policy has largely been left to the Department of Property Management, but the faculties and other businesses will play a role in it as well.

The Department of Property Management will also manage the objectives for the themes of drinking water and sustainable use of materials, because these are included in the energy policy and the coordination thereof.

2 Why an energy policy?

Climate change

The energy used by Radboud University is primarily generated by fossil fuels at the moment, which release CO₂. This contributes to global warming and in turn, climate change. This is a worldwide problem and also has an impact on the operational management of Radboud University. Radboud University endorses the objectives that were agreed upon in Paris at the end of 2015: reduction of 80-95% CO₂ emissions (2050 compared to 1990) for the purposes of limiting the average global temperature increase in 2100 to 2°C or, better still, 1.5°C.

Climate ambition

At the end of 2014, Radboud University joined the Klimaatcoalitie (Climate Coalition) and pledged itself to the goal of becoming climate neutral by 2050 (at the latest). This Energy Policy Plan is related to scopes 1 and 2 of the GreenHouseGas Protocol. That means it involves the consumption of natural gas and electricity. Therefore, themes such as transportation and the purchase of goods fall outside of the energy policy and are described elsewhere (RU’s Sustainability Agenda).
This ambition can be accomplished if the rate of 2% absolute energy conservation can be continued each year and the amount of sustainable energy in the Dutch electricity industry increases by 2.5% annually. Furthermore, Radboud University can take additional steps by collaborating in sustainable energy projects. See also Chapter 7.

Energy as an expense

In addition to counteracting climate change, the energy policy is also focused on decreasing RU energy expenses.

3 What does it involve?

Energy for operational management

Energy can be considered the motor that drives education and research. Without energy, education and research are virtually impossible.

At Radboud University, energy is used for the following building functions:
- heating
- cooling
- ventilation / air conditioning / humidification
- lighting
- hot water preparation
- monitoring / security
- drinking / cleaning facilities
- office equipment (printers/copiers)
- ICT (servers, networks, PCs) and telephony
- utilities in education rooms
- utilities in laboratories

Energy is also required for:
- research (equipment)
- lighting the property, and
- special facilities (catering/hospitality).

Energy consumption

In 2016, the energy consumption consisted of 2.6 million m³ of natural gas and 36 million kWh of electricity. Electricity is 80% of the primary energy consumption at Radboud University.

Energy balance

The energy demand of various energy functions has been analysed. In the figure below, the distribution of primary energy consumption is displayed in relation to its energy carrier and function.

Natural gas consumption is primarily used for heating. The electricity consumption of devices concerns standard devices such as PCs, monitors, and beverage vending machines. It also includes research equipment such as MRI machines. The energy consumption of magnets at the HFML (High Field Magnetic Laboratory) and the associated refrigeration (roughly 13 million kWh per year or 30% additional primary energy) has not been incorporated into these figures due to agreements with the government.
4 What have we been doing?

2013-2016 Energy Policy Evaluation

The results of the implementation of the energy policy were established in the *EnergieJaarverslagen* (annual energy reports). With decentralised heating, optimisation of aquifer thermal energy storage, sustainable renovations, energy-efficient new construction, and other energy projects, a great deal of energy conservation has been achieved. This conservation was as high as 4.9% in 2016. However, consumption has increased as a result of purchasing more equipment and expanding opening hours. In 2012, the objective was an absolute energy conservation of 2% per year. Absolute conservation is the total energy conservation minus additional use. The table below shows the development of the absolute energy conservation.

<table>
<thead>
<tr>
<th>Year</th>
<th>Natural Gas (temperature corrected)</th>
<th>Electricity (temperature collected)</th>
<th>All Primary Energy (temperature collected)</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>23.3%</td>
<td>8.1%</td>
<td>19.4%</td>
<td>17.1%</td>
</tr>
<tr>
<td>2013</td>
<td>19.4%</td>
<td>11.3%</td>
<td>17.1%</td>
<td>14.8%</td>
</tr>
<tr>
<td>2014</td>
<td>17.1%</td>
<td>9.6%</td>
<td>15.3%</td>
<td>13.0%</td>
</tr>
<tr>
<td>2015</td>
<td>15.3%</td>
<td>8.1%</td>
<td>13.0%</td>
<td>11.2%</td>
</tr>
<tr>
<td>2016</td>
<td>13.0%</td>
<td>6.5%</td>
<td>10.6%</td>
<td>9.8%</td>
</tr>
</tbody>
</table>

The result has been 5.2% absolute conservation in 4 years. Therefore, the objective of 8% (2% x 4) has not been fully realised. This means that more attention must be paid to the causes of excessive use and the energy conservation programme has to be intensified.
Improvement of efficiency versus absolute conservation

The national objectives for energy conservation are related to improving efficiency. That means that these objectives aim for decreased use per product unit. This encourages innovation in the business community and does not hinder economic growth. Given the global impact of energy consumption and its effect on Radboud University's expenses, this is not sufficient for achieving the climate objective. For this reason, we opted for an absolute energy conservation objective again for the 2017-2020 period.

Choosing a relative energy conservation goal is not an option given the contribution that Radboud University wants to make to the climate objective.

5 Energy costs

Direct costs

The annual costs for energy amount to roughly €5 million. Translated into housing rates, this amounts to a share of roughly 12%. Compared to the total annual expenses of the university, this is less than 1%.

Life-cycle approach

Radboud University is employing a life-cycle approach (also called life-cycle costs or total costs of ownership). This means that all costs (including maintenance costs) must be included in considerations of whether a measure is cost effective. This approach is a strong point for energy conservation and works well at Radboud University. The criterion for energy conserving measures is related to the “life cycle” of such measures as well as the expected increase in price and inflation.

Energy conservation requires sacrifices, too. Cutbacks and a reduction of the investment budgets may make it more difficult to make energy provision more sustainable.

In order to better apply the life-cycle approach, a standard technical programme of requirements for the preservation of sustainability will be used, with conditions regarding improving the quality of building facades, ventilation, heating, cooling, and air treatment.

Environmental costs

Our insight into the true energy costs are progressively increasing. Many costs are not incorporated into market prices. Examples of this are air pollution and climate change. The expenses for these are primarily dumped on society. For this reason, these are also called externalities. According to studies by the International Monetary Fund and the European Union, these externalities are roughly 30% of what we are currently paying in the Netherlands and in turn, at Radboud University. If the consumer wants to pay the real costs, then the calculation must be increased by this percentage.

It is expected (according to organisations such as the International Energy Agency and PBL Netherlands Environmental Assessment Agency) that the price of energy will increase structurally.

This is also a global issue and has an impact on the operational management of Radboud University. Therefore, the high degree of dependence on fossil fuels constitutes a risk for our operational management in the mid to long term.

Shifting from variable to fixed costs

For the sustainability of electricity provision, we are seeing a shift towards higher capital charges. Sustainable energy systems (e.g. solar panels or wind turbines) demand higher investment per asset unit than conventional systems. In contrast to this, the costs for making sustainable power available is extremely low. This calls for a different approach to determining the energy costs as a part of the accommodation costs at Radboud University.

The depreciation component will be higher and usage component (maintenance and energy) will be lower.

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1 This does not include third parties: HFML, BV Campus, KDV, HAN in Gymnasion

Energy Policy Plan Radboud University 2017-2020
6 Energy savings

In order to reduce energy expenses and combat climate change, Radboud University is primarily focusing on energy conservation (reduction of energy demand). Radboud University employs the *Trias Energetica* for its approach to energy issues. This means that we will be working in accordance with specific steps.

<table>
<thead>
<tr>
<th>Trias Energetica</th>
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<tbody>
<tr>
<td><strong>Step 1. Limit energy demand</strong></td>
</tr>
<tr>
<td>The first step can be achieved in various ways. In principle, measures have been in place for the last several years, including architectural and technical design tactics such as building shape, degree of insulation, and natural light (window distribution and surface area). Energy demand can also be limited by installing new equipment as needed. Examples of this are not installing more artificial lighting than is necessary and using air treatment systems when needed (CO₂ regulations).</td>
</tr>
</tbody>
</table>

| **Step 2. Using sustainable energy sources** |
| Sustainable energy as a source for energy provision is the best option. Solar panels for electricity and energy from the soil are good examples. |

| **Step 3. Using finite resources efficiently** |
| After maximum energy conservation and use of sustainable energy, the next challenge is ensuring that systems work as efficiently as possible (e.g. a water heater with a high yield). |

For this approach to have sustainable results, the order of the steps is essential:
1. first, enact as many measures as possible from step 1 (these are the most important measures)
2. if that is no longer possible to do responsibly, then enact as many measures as possible from step 2
3. finally, enact measures from step 3 if there is still remaining demand.

Reduction of energy demand offers a great deal of potential at Radboud University. Furthermore, it is primarily enacted using measures that ensure it is suitable for the future. It contributes directly to independence (from autocratic regimes) and is often cheaper than measures involving energy provision.

7 Sustainable energy

**Sustainable energy on campus**

The most important sustainable source of energy at Radboud University is currently the ground (Aquifer Thermal Energy Storage or WKO). However, since the campus lies in a “drinking water protection zone”, there are limitations for expanding its capacity. Solar power (photovoltaic sun energy) is also being used. The total amount of self-generated sustainable energy is currently 5%. WKO constitutes the bulk of this.

**Solar panels on new roofs**

In addition to using WKO, Radboud University can generate more sustainable energy itself by installing additional solar panels. The technical potential for the campus is roughly 3-4% of our primary consumption. Due to the lower price of electricity for Radboud University, the energy payback time (roughly 10 years with a grant) is longer than for individual households. Solar panels last longer than 20 years. This investment would yield returns within the technical lifetime of the product. However, a condition would be that the roof on which the solar panel was placed would have to be new or not require any major renovation in the next 20 years. Such a renovation would increase the expenses during the product life cycle. The systems below are currently in use.
However, the payback time for energy saving measures is generally lower and has a higher priority in the *Trias Energetica*. For this reason, we are focusing on energy conservation first and supplementing this with sustainable energy. Solar panels are a perfect addition to an integral set of measures. This also ensures that it stays in line with the increasing sustainability standards of the new buildings at Radboud University. In this way, new buildings can be made energy neutral (such as the new FSW construction).

### More sustainable energy

Producing our own energy is preferred, but some sustainable energy options are not suitable on campus for environmental health reasons (negative impact radius). For instance, producing biomass and large-scale wind turbines. Small-scale wind turbines have yet to be developed sufficiently.

It is still not possible to set sustainability conditions on the energy purchase of gas and electricity. However, we have further increased our share of sustainable energy by purchasing renewable power\(^2\). We were able to increase our share of sustainable energy to around 20% at a relatively low cost. In doing so, we demonstrated our intention to contribute more towards sustainable energy in addition to our own production. However, renewable power (under the current circumstances) is a form of “compensation”, which means it can work against the *Trias Energetica*. We have doubts about the contribution that renewable power makes to the realisation of new, sustainable energy production. After all, renewable power comes from systems that have already been created.

### Collaboration in sustainable energy projects

It is difficult to achieve additional sustainable energy on campus. Radboud University can only be climate neutral by 2050, if national electricity provision is made more sustainable by 2.5% each year, which makes us dependent on what other parties are able to achieve (see Chapter 9).

Radboud University can collaborate in sustainable energy projects with parties who have the required knowledge and experience to realise them. The proposal is to link such a collaboration to an invitation to tender for electricity. Nothing will change in terms of purchasing the power. The price will continue to be based on the market price, which we will establish in advance according to a specific procedure. The difference will lie in the length of the contract. This will have to change from 2-5 years to 10-15 years due to the energy payback time of sustainable energy projects.

The proposal is to invest a minimum of €175,000 each year in sustainable energy projects, through which a portion of the sustainable system will become the property of Radboud University. This possibility is provided by a framework agreement, in which further completion of the sustainable energy projects is up to Radboud University. It is currently being investigated whether there are legal obstacles to this.

### Example

A project with wind turbines will provide 26 million kWh per year and cost €14 million. Now, imagine that Radboud University contributes 5%. It then yields an 11 terajoule reduction in primary energy per year, which is 3%. The expenses (distributed over this policy period) amount to €175,000 per year. This investment will typically have a financial yield of roughly 2 to 6%, so it will pay off in the long run.

With this proposal, Radboud University would make a concrete contribution to:
- breaking the automatic assumption that the electricity you purchase can only be generated by fossil fuels;
- cutting back on the energy externalities, which are not incorporated into the market price;
- the development of business models to shift from variable charges to one-time costs;
- accelerating the transition from fossil fuel driven energy production to sustainable energy production.

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\(^2\) Or purchasing and cancelling Garanties van Oorsprong (guarantees of origin)
Due to the collaboration on sustainable energy projects, Radboud University can produce more sustainable energy, although not on campus. This allows Radboud University to be less dependent on what others create and to take its own concrete steps in contributing to the university becoming more sustainable. These steps are shown in Chapter 9.

8 Energy provision

From central boiler room to heat pumps

The buildings on campus are becoming more and more energy efficient. Energy conservation is being implemented in existing buildings. Various renovations have been performed, such as in the Trigon building (with a current gas conservation of nearly 50%). There has been a shift in the provision of energy. It has moved from a central boiler room to individual boilers in each building. Heat pumps are being installed more and more frequently, even in existing buildings. In addition to the transition towards more efficient buildings, we are seeing a decrease of the flow temperature. This means buildings are becoming increasingly better suited for using Aquifer Thermal Energy Storage.

Aquifer Thermal Energy Storage

In Aquifer Thermal Energy Storage (= Seasonal storage = WKO), the cold from the winter and the heat in the summer are stored underground. The cold is used for cooling the buildings in the summer and the warmth is used for heating the buildings in the winter. This costs less energy than heating with gas boilers and cooling with cooling machines. In recent years, this system has been optimised and expanded. The figure below provides an overview of this.

This system fits well into the functions of the buildings on campus and provides additional reductions in the use of fossil fuel produced energy. In addition to a reduction in energy consumption, we are seeing a decrease of the flow temperature. For cooling, development towards a higher flow temperature is preferable because the WKO can be used more frequently. Both developments are necessary for the use of sustainable heating and cooling in the buildings.
Another benefit of the system is that it is also used to take advantage of the remaining warmth from the HFML Magnet Lab. This heat can often be used to directly heat buildings using the above ground portion of the WKO system. This film explains how it works: http://www.ru.nl/uvb/energie/energie/duurzaam/.

For the time being, we can still move forward with the capacity of the WKO, especially because we have conserved energy in the buildings that are linked to it. In 2017/2018, it will be researched whether additional sources would be necessary and where they could be placed.

**District heating?**

The development towards low temperature heating and high temperature cooling does not entirely fit in with district heating. However, at the request of the Municipality of Nijmegen, we have researched whether a link to Nijmegen’s heating grid would be feasible. Together with the Municipality of Nijmegen, Gelderland Province, and Radboud university medical center, we had a *social cost-benefit analysis* conducted for the heating grid in the area between the Central Station and the Radboud campus. The result of this https://www.ecn.nl/publicaties/ECN-E--16--005 was that energy conservation and hybrid heating pumps for the buildings along the route and energy conservation as well as additional WKO on campus would yield the highest CO$_2$ reduction and the highest social benefit.

The approach using energy conservation and WKO fits best at Radboud University, because the buildings need both heating and cooling.

**Hybrid energy grid**

A hybrid energy grid (an interconnected combination of conventional energy supply and sustainable energy sources) is being created for Heyendaal Zuid. It will involve:

- Disconnecting the last buildings on Thomas van Aquinostraat from Radboud university medical center’s hot water network, resulting in no more substantial losses through the pipes.
- The conversion of this hot water network into a low temperature heating grid, which will heat Spinoza Hoog, TvA1, and TvA8 with much better yield and eliminate the need for temporary facilities.
- Connecting the Erasmus building to the WKO sooner, resulting in more heat from the HFML and the WKO being used.
- Connecting the FSW new construction to the Erasmus building using cooling pipes, which would result in the WKO being fully used for the new construction.

For the realisation of this, an additional total investment of €492,000 must be made, which would be earned back in 2.5 years. This yields an annual savings of nearly 3% and therefore acts as a cornerstone of this Energy Policy Plan.

**Storage**

With energy provision becoming more sustainable, it has become more important to look at the selection of offerings. Solar panels only provide power during the day (when it is bright), while wind turbines only yield power when it is windy. Currently, it is not economically interesting to anticipate the offerings of sustainable electricity, but with the increase in the amount of sustainable electricity production, it is becoming more and more valuable.
more important. We will be researching how we can predict what the ever-changing selection will yield for the university in the future.

9 What are we going to do?

Approach for new construction and renovations

For new construction, the design should be as energy-efficient as possible. The goal is a building that will require a minimum of additional energy. Its features should include a compact shape, maximum use of daylight, exploitation of the sun’s heat in the winter and avoiding it in the summer, and a high degree of insulation. This means that the energy aspect is an important criterion in the selection of the architect.

The Grotius building is an extremely efficient structure that scored 45% under the EPN. With the FSW new construction, Radboud University will be taking it a step further with energy efficiency being more explicitly incorporated into the design assignment. In this building, all systems will be driven by demand and the goal is to achieve energy neutrality.

Radboud University employs the life-cycle approach. An integral set contains design measures that do not require investment, measures with very short energy payback times, and measures with long payback times. It is important that certain measures (e.g. triple glass) have a payback time of more than 10 years, but that they begin yielding returns within the technical product lifetime.

In order to better apply the life-cycle approach, a standard technical programme of requirements for the preservation of sustainability will be used, with conditions regarding improving the quality of building facades, ventilation, heating, cooling, and air treatment.

Programme for new construction/renovation/demolition

As we move towards the future, the buildings that are demolished and the new ones that replace them are important. The construction/renovation/demolition programme was translated into energy consumption based on the MIP 2016. In the figure below, the prognosis (May 2017) for energy consumption at Radboud University (excl. third parties) is shown. Including Berchmanianum in the building portfolio did not have a positive effect on energy efficiency. In contrast, the demolition of important buildings\(^3\) will have a positive effect because the new buildings replacing them are more efficient.

With a hybrid energy grid, an important foundation is being laid for the realisation of our goal, such as is shown in the figure below.

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\(^3\) In these figures, the destruction/demolition of Administration Building Hoog and Spinoza Hoog have been included, while the demolition of TvA1 and Linneaus have not.
Other important energy projects in the 2017-2020 period are insulation in Mercator 3, a connection from Mercator 3 to the energy centre of the Huygens building, and the renovation of the (hot) water system in the Huygens building. It is possible that a project for the expansion of the WKO source capacity will follow.

In the figure above, the conservation from the “smaller” projects, as described below, have not been incorporated.

**Energy conservation in existing buildings**

In addition to the typical energy projects, energy conservation can also be realised through the renovation and modification of buildings while applying conservation measures.

For many buildings at Radboud University, energy conservation studies have been conducted, which provide an idea for available energy conservation options.

In general, structural modifications are only made during renovations (a natural time to do it). Other measures suit projects like *Aanpassen klimaatinstallaties* (modification of climate systems).

Various buildings have been assessed regarding the options for replacing the lighting with LED. In the upcoming period, various lighting projects will be carried out. Roughly €300,000 per year is required for this, which we want to cover from the energy budget.

Renovation of the (hot) water system in the Huygens building will also improve energy conservation. A one-time investment of roughly €200,000 is required for this.

**Energy conservation via the building management system**

In 2015, the project *Aanpak instellingen klimaatinstallaties* (approach to climate system settings). The goal of this is to realise energy conservation through the adjustment of the control of climate systems. By means of “building profiles”, the gas and electricity consumption will be analysed first. After that, the settings can be modified in the building management system. Afterwards, the effect can be measured. This project will be completed in 2017.

The intention is to make it more structural by attracting a technical energy management employee to the UVB.

**Behaviour**

In the past policy period (2013-2016), in the context of the *Kleine Duurzaamheid* (small sustainability) project, three pilot projects were started to improve the management of individual energy use (primarily electricity), paper use, car use, catering, and waste.

The pilot only received structural attention at the Faculty of Sciences (FNWI). Scaling it up showed that these were labour-intensive projects and that it is difficult to address employees on this theme. In order to perform these projects effectively, help is required from professional parties, such as from the Department of Behavioural Sciences (from FSW).
Energy assessment

In the EnergieJaarverslagen, increasingly more attention is being paid to energy conservation. During 2016, excessive consumption was addressed more extensively because it was relatively high at the time. In the years to come, Radboud University will pay more attention to this. Decisions are often made that result in excessive energy use, even though this was not known beforehand. For this reason, the UVB will now conduct an energy assessment during each feasibility study/project proposal. These will provide a picture of whether the project is resulting in excessive use or conservation of energy. The UVB can offer its recommendations for proposals from other faculties/services. In 2017, the energy assessment was further elaborated.

Energy programme

In the Energy Programme that is created every year or two, there is a description of the projects that will be carried out during that period. This concerns the most effective use of people and tools for achieving the energy objective. The relationship with the MIP and the MJOP is also important.

Funding

In the table below, a summary has been created of the necessary funds

<table>
<thead>
<tr>
<th>Project</th>
<th>Amount</th>
<th>Frequency</th>
<th>Funding From</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid energy grid - Heyendaal Zuid</td>
<td>€492,000 (additional investment)</td>
<td>one-time</td>
<td>MIP 2018</td>
</tr>
<tr>
<td>Collaboration on sustainable energy projects</td>
<td>€175,000</td>
<td>annual</td>
<td>energy budget</td>
</tr>
<tr>
<td>Energy savings for existing buildings (incl. LED lighting)</td>
<td>€300,000</td>
<td>annual</td>
<td>energy budget</td>
</tr>
<tr>
<td>Modifying the (hot) water system in the Huygens building</td>
<td>€200,000</td>
<td>one-time</td>
<td>energy budget</td>
</tr>
</tbody>
</table>

Effect on (sustainable) energy consumption

In the figure below, the long-term effects and developments have been laid out.
The blue line shows the expected gas use and the red one shows electricity use. The total primary energy use is shown in light green. Development up until 2023 is based on the new construction/demolition/renovation programme (Chapter 5). From 2024 to 2034, no programme is known, but a shift in the provision of energy from gas to electricity is anticipated (incl. connected to the WKO). It also takes into account the 2% additional energy conservation per year. The additional solar panels that we will be installing are included as well. If this development continues, there will be a 50% reduction by 2050.

Only if we extrapolate and incorporate the intended national policy regarding sustainable energy\(^4\) can we become energy neutral (orange dotted line), but then we are dependent on what others yield. It seems like we cannot achieve the objective of becoming energy neutral by 2050 (\textit{National Klimaatconvenant} - “national climate treaty”) on our own. Breakthrough techniques may be on the way to make this realisation easier.

By collaborating on sustainable energy projects (Chapter 7), we can produce more sustainable energy, although not on campus. The dark-green line in the figure shows the steps (11 terajoules = 3%) that we can take ourselves.

10 Drinking water and material use

Drinking water conservation and the use of sustainable materials fall under the energy policy.

Drinking water

Up until 2016, substantial savings have been made in drinking water consumption, primarily due to the cooling systems approach. Drinking water consumption is also more closely monitored, so irregularities are detected sooner.

We want to maintain the downward trend and strive for 2% drinking water conservation per year. We will do this via good management using the Energy Consumption System and by modifying the water systems in the Huygens building.

We will investigate whether we can create drinking water tapping points outside of buildings (such as in the \textit{Join the pipe} project).

Sustainable use of materials

Radboud University has opted for a practical approach in determining the environmental impact of material use: the Environmental Classification system from NIBE. The method is based on life-cycle analyses (LCA). The data are available at the component level (e.g. what is a sustainable solution for roof covering on a flat roof) and provide a quick indication of environmental impact. There are 7 classes: 1 has the lowest environmental impact and 7 has the highest. In 2011, we chose to avoid class 5 or higher. This was quite successful. For this reason, we have currently chosen to avoid class 4 or higher, unless there are significant reasons to use that particular material.

This data also allows you to calculate the price of a whole building. For projects with a scope less than €1 million, we will use the \textit{shadow pricing} calculation, which is similar to the \textit{Greencalc+} method that we used previously.

Circular construction

Circular economy is rapidly on the rise. Radboud University supports this by doing things such as signing the \textit{Grondstoffenakkoord} (raw materials agreement). Circular economy offers options for making things more sustainable. To this end, different business models are often used which demand different methods of purchasing services and products than what we are used to. The UVB will research the available options. The goal is to execute one (or more) circular construction projects in the upcoming period. Another proposal will be formulated for this.

\(^4\) NEV = Nationale Energieverkenning 2016 (national energy exploration), established and intended policy, ECN
11 Organisation and communication

The implementation of the energy policy has largely been left to the Department of Property Management. All departments have their own task in this.
In 2010, Energy Management was introduced at RU. This relates to recurring activities which ensure that energy savings (and associated behavioural aspects) are implemented. See also the diagram below.

![Energy Management Diagram]

However, the faculties and other businesses will play a role in it as well. Radboud University often collaborates with Radboud university medical center in the field of energy.
It is important that staff members and students know what is going on in the domain of energy conservation and sustainable energy. For this reason, the reports, *EnergieJaarverslagen*, and other important information on energy have been provided at: www.ru.nl/energie. Various energy projects will be highlighted using news items. This can help generate support and awareness. If necessary, other means of communication will be used.
12  Relationship with sustainability policy

Environmental care

Energy care is an important component of environmental care. Energy care and environmental build on each other in regards to assessment/auditing. Radboud University has been ISO 14001 certified for this since 2010.

Sustainability Agenda

Since 2016, Radboud University has had a Sustainability Agenda. The Energy Policy at Radboud University is a part of the sustainability policy. However, because it has its own dynamic and programme, it is handled separately in this plan. Topics and themes like the non-energy portion of the CO₂ footprint, transportation, and waste are worked out in the Sustainability Agenda. Energy is discussed in the behaviour project group and the sustainable work and study environment project group.

13  Relationship with legislation

Energy policy is not free of commitment. There are legal requirements that Radboud University must meet, such as the requirement that all energy-saving measures which pay back within five years must be taken. This Energy Policy Plan provides an approach in which these legal requirements are not just met, but exceeded. Together with Radboud university medical center, we are a compulsory participant in CO₂ emission trading. This instrument has a disadvantage that is called the waterbed effect. This means that the energy conservation that Radboud University achieves may create room elsewhere for more CO₂ to be emitted. In order to combat that, we will cancel the CO₂ allowances from the CO₂ emissions trading system that concern energy conservation achieved annually⁵.

Appendix 1: List of abbreviations

CO₂ – Carbon dioxide – greenhouse gas (causes increased global warming)
EBP – Energy Policy Plan
ECS – Energy Consumption System – energy measurement system that stores data
EJV – Energie Jaarverslag = annual report on energy
EP – Energy Programme
EPN – Energie Prestatie Norm (energy performance norm)
MIP – Meerjaren Investering Prognose (multi-year investment prognosis)
MJOP – Meerjaren Onderhouds programma (multi-year maintenance programme)
UVB – Department of Property Management (RU)
WKO = Warmte Koude Opslag = Seasonal Storage = Aquifer Thermal Energy Storage

⁵ This costs between €6,000 and €16,000 per year.