WAGENINGEN UR
For quality of life

Energy Vision for 2030

Facilities and Services

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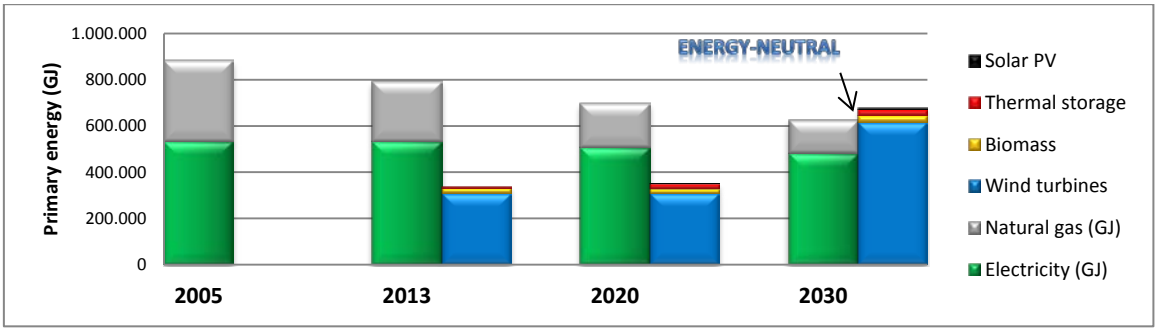
Wageningen UR (Wageningen University and various research institutes) is specialised in the domain of healthy food and living environments.

Contents

Summary of the Energy Vision for 2030

Sustainability is an explicit element of Wageningen UR's operations, teaching and research. Energy has a clear position within this element: Energy has a direct effect on Wageningen UR's continuity and accounts for a large proportion of the sustainability of the organisation's operations (CO_2 footprint). Energy is also a major cost item. Wageningen UR has made great advances in the sustainability of its operations in recent years and has turned its leader ambitions [(1)] into deeds. As a result, Wageningen UR may now refer to itself as the Netherlands' most sustainable institution of higher education [(3)] (SustainaBul 2013). This Energy Vision 2030 has been drawn up to serve as an appropriate guideline for the longer term.

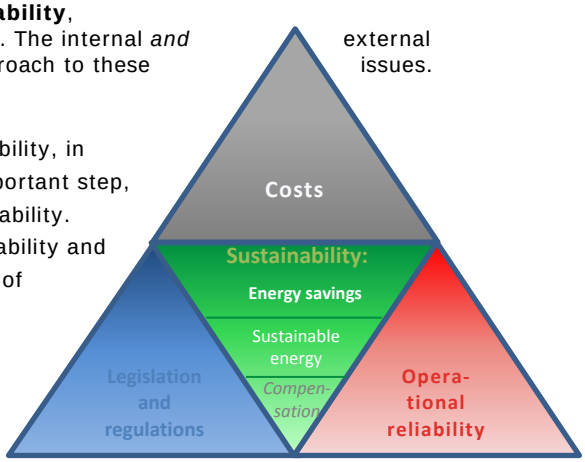
Real estate developments. The real estate developments are of great importance to the organisation's direct energy consumption. Pursuant to the organisation's policy, the concentration of activities in the core complexes will continue, the efficiency of the utilisation of the buildings will increase and their multifunctional use will be expanded. This latter objective will be achieved by further cooperation and by sharing facilities. The construction of new buildings will be completed in 2016, when the emphasis will shift to more efficient utilisation and to renovation and maintenance. The aforementioned real estate developments will result in the more rapid decline in energy consumption in the years until 2020 than in subsequent years.



Forecast movements in energy consumption and sustainable generation (wind turbine scenario)

Target for 2030: a 30% decline in direct energy consumption in comparison with

Four important issues play a role in the energy supplies: **sustainability**, **operational reliability, costs** and **legislation and regulations**. The internal *and* external stakeholders have an interest in an appropriate and balanced approach to these issues.



Sustainability

Wageningen UR has specified a preferential sequence for sustainability, in analogy with the *Trias Energetica* . *Energy savings* is the most important step, as this has a direct and beneficial effect on both costs and sustainability. Increasing the *sustainable generation of energy* increases sustainability and reduces dependency. The last option is *compensation* as a means of reducing the CO_2 footprint.

Four methods for the generation of energy are of interest to Wageningen UR:

- Wind. The wind turbines in Lelystad make by far the greatest contribution to the sustainable generation of energy at present and probably also in the future. This Energy Vision assumes that the contribution will double, which can be achieved by replacing the current 26 wind turbines with models with a higher output or by ultimately increasing the current 50% of the output allocated or used by Wageningen UR to 100%.
- Solar energy. Solar PV (photovoltaic) currently plays a modest role. Although this has become an interesting option for small-scale users, the current 15-20 year payback period is still too long for large-scale users. Developments have accelerated in recent years and if these continue solar energy could ultimately become an interesting alternative for wind energy. However, a large surface area will then need to be reserved – in particular in the form of land, as roofs alone do not offer sufficient capacity.
- Thermal storage + heat pumps. The expansion of the thermal storage system on Wageningen Campus will continue, on the basis of the thermal storage system framework plan. Connecting more buildings to the thermal storage system and using heat pumps will result in increased heating and/or cooling energy efficiencies. The total contribution can then increase to about 4% in 2030.

- Biomass. The bio-fermentation installations in Lelystad and Sterksel supply sustainable electricity and can also produce sustainable fuel or green gas. At the same time they also make a contribution to solving the manure problem, and assist in reducing the amount of waste formed as by-products from food and feed. For these reasons these installations are also of importance to the primary process. With today's low electricity prices, expansion is currently less interesting from an economic perspective.
- Compensation. The **full** in-house generation of sustainable energy is not as yet an economic proposition due to the current market conditions and the low prices of conventional energy. The procurement of green energy offers the most rapid means of fulfilling Wageningen UR's ambition to reduce its CO_2 footprint and achieve climate-neutral operations. All electricity procured from 2011 onwards will be green electricity. However, the market for green gas or CO_2 credits is still in development, the additional price is relatively high and supplies are limited. For the time being preference is not given to procurement of green natural gas.

Wageningen UR strives for energy-neutral operations (in-house generation of energy ≥ consumption) by 2030.

Operational reliability. Operational reliability and user-friendliness are important issues both now and in the future. Reliable energy supplies can be regarded as a chain in which the weakest link determines the risk of failures and the effect in terms of damage and/or loss. Consequently, an overall or comprehensive approach is required. Transformers, links (lines and cables), the building installations and the protocols for breakdowns, tests and maintenance all need to exhibit an appropriate performance. This also needs continual attention. User satisfaction with the climate in buildings is a less acute but nevertheless important issue. This is reviewed in the periodic staff-satisfaction surveys.

Costs. The annual costs incurred in the procurement of energy amount to 10 million euros, whereby the cost of the delivery component – the commodity – can vary greatly. The capital and maintenance costs incurred for the installations and infrastructure amount to a total of about 20 million euros per annum. The energy procurement strategy is based on the procurement of energy at the lowest possible price, subject to the condition of budget certainty. Energy prices are expected to increase in the future, in part due to higher transport costs and taxes.

Legislation and regulations. The need to achieve national and international CO_2 targets will result in the government's imposition of much more stringent requirements on sustainability and the energy consumption of buildings in the coming years. New buildings shall need to be 'virtually climate-neutral' from 2020 (Dutch Buildings Decree) and the proportion of energy generated from sustainable sources shall also need to be increased greatly. As Wageningen UR's building programme will be limited from 2016 onwards, climate-neutral construction will be of less relevance to the organisation. However, it is expected that renovations will also be governed by more stringent requirements. Wageningen UR, within the context of the Multi-Year Agreement 3 (MJA-3), has undertaken to achieve 20% savings in the organisation's direct energy consumption by 2020 as compared to 2005, and to achieve 10% savings via the chain.

Integration in the organisation. The targets can be achieved only when energy and sustainability are fully integrated in the organisation. Major advances have been made in this integration in recent years, as a result of which the leader ambition has been fulfilled. The energy management system is based on a responsibility allocation system which ensures that energy is integrated in the organisation. The energy management system is based on the following pillars:

- Energy Efficiency Plan (EEP). A multi-year plan of measures for the reduction of energy consumption.
- Monitoring. By means of the building management system and energy management system.
- Sustainable construction and maintenance by means of a multi-year maintenance plan.
- Sustainable procurement.
- Energy incentive. Passing on costs provides a great incentive for energy savings.
- Link with research/teaching. Major advances have been made via the 'acceleration of the sustainable operations' project. It is now necessary to jointly remain in the lead.
- Communication. Wageningen UR's sustainability achievements are relatively unknown, both inside and outside the organisation. A number of policy and advisory reports have revealed that more communication is needed: 'Show it'. Several steps have been taken in recent years, in particular in the form of the attention given to the issue in annual reports and the formation of the Wageningen Green Office.

1 Background

The mission of Wageningen University and Research Centre (Wageningen UR) is 'to explore the potential of nature to improve the quality of life'. Our staff of 6500 and 8000 students from over 100 countries are active in the healthy food & environment domain all over the world, both for governments and the business communities [(5)].

Sustainability is an explicit element of Wageningen UR's teaching and research. Wageningen UR's operations support the organisation's teaching and research. Energy has a clear position within the operations: energy is a major cost item, has a direct effect on the organisation's continuity and accounts for a large proportion of Wageningen UR's CO_2 footprint and sustainability.

Wageningen UR has made great advances in the sustainability of its operations in recent years and has turned its leader ambitions [(1)] into deeds. The organisation's insight into its energy consumption, focus on energy savings, use of sustainable energy and CO_2 compensation pursuant to the *Trias Energetica* [(2)] have all contributed to Wageningen UR's ability to refer to itself as the Netherlands' most sustainable institution of higher education (SustainaBul 2013) [(3)]. Moreover, according to the Transparency Benchmark [(6)], Wageningen UR is the Netherlands' most transparent university in terms of CSR and sustainability.

Wageningen UR's future approach to the organisation's energy supplies is laid down in this Energy Vision for 2030. The Energy Strategy, which is adopted at periodic intervals, lays down the specific plans and activities for the coming period. The Energy Strategy for 2013-2016 is enclosed with this Energy Vision.

1.1 Stakeholders

Wageningen UR's Energy Vision is based on the needs and requirements of its stakeholders. Wageningen UR's stakeholders are [(7)]:

- Clients and partners in the government, business community, non-governmental organisations and research institutes both in the Netherlands and abroad
- Government
- Issuers of grants
- Suppliers
- The public and media
- Staff and students
- Alumni and donors

The various stakeholders have different needs and requirements for Wageningen UR's energy supplies (see Figure 1).

The following elements determine the needs and wishes of the various stakeholders to a greater or lesser extent:

- costs
- operational reliability, incl. user satisfaction
- legislation and regulations
- sustainability

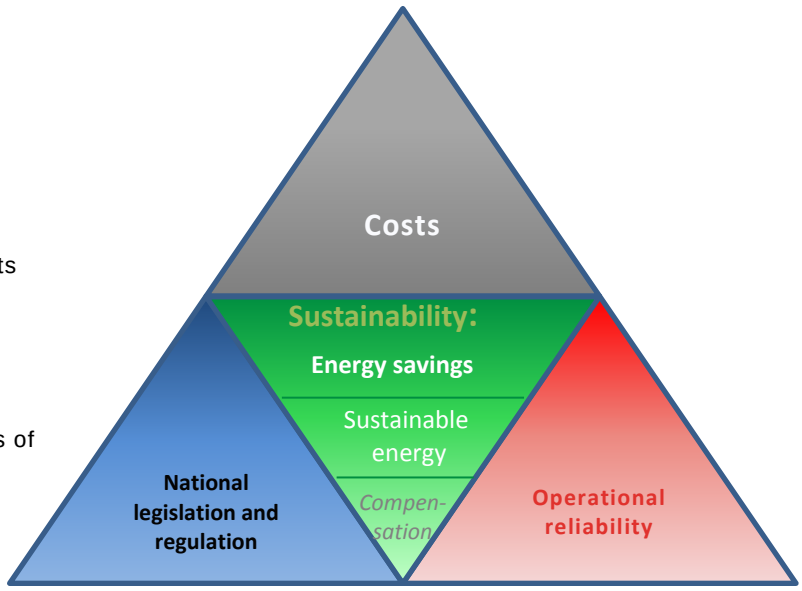


Figure 1: Elements of the energy supplies

The various stakeholders attach differing importance to the above elements. Commissioning parties such as clients, partners and issuers of grants increasingly include sustainability criteria in their tender documents or contracts. The government also has energy

ambitions and will employ covenants, legislation and regulations to call Wageningen UR to account for its Corporate Social Responsibility and sustainability. Sustainability is also an important issue for other external stakeholders such as the public, media, suppliers, alumni and donors. Moreover, much of the primary process derives its raison d'être from research and teaching relating to a sustainable future. A sustainable image for research and teaching needs to be accompanied by a sustainable approach to the organisation's operations [(5)]: 'practice what you teach'.

The other internal stakeholders, the Executive Board and the management councils of Wageningen UR's divisions, benefit from an appropriate image, low operating costs, high operational reliability and low vulnerability to the effects of sudden increases in energy prices. In addition, and self-evidently, compliance with the legislation & regulations and covenants is also necessary.
These various needs and requirements can be accommodated solely by adopting a holistic approach to energy and by incorporating an appropriate blend of the issues in the Energy Vision.

1.2 The contents of this document

The Energy Vision begins with a review of the current situation (Section 2), which devotes attention to the real estate, energy situation and the four sustainability, costs, legislation and regulations and operational reliability elements. Section 3 gives a vision for the expected situation in 2030, in the same sequence as in Section 2. The organisation will need to continue to devote attention to energy if the targets for 2030 are to be achieved. Section 4 explains how Wageningen UR can maintain the approach it has adopted to ensure that its energy management can continue to 'penetrate into the capillaries of the organisation' [(1)].

2 Energy in 2013 (reference point)

This Section begins with a review of the current situation needed to clarify the ultimate objective to be achieved in 2030, as well as the progress made in the past years.

2.1 Real estate

Wageningen UR's real estate portfolio consists of buildings at more than 40 branches in the Netherlands. Wageningen University owns buildings in Wageningen and its surroundings. DLO Foundation has buildings in Wageningen and in a large number of locations throughout the Netherlands. The total floor area of of the almost 500 buildings/sections of buildings amounts to more than 700,000 m^2. The buildings falling within the scope of the Energy Multi-Year Agreement 3 (MJA-3), i.e. the core complexes in Wageningen, Lelystad and IJmuiden, jointly account for 495,000 m^2. The real estate portfolio is still in a state of flux, albeit less than in the past 10 years. The concentration on Wageningen Campus has resulted in a great deal of construction work in the past years. As one of Wageningen UR's spearheads is to optimise the use of space, within the context of its policy the organisation is not expected to require any further construction work after 2016.

2.2 Energy consumption

The current energy consumption can be broken down into electricity consumption of about 60 million kWh and natural gas consumption of 8.3 million m^3 per annum. The electricity consumption of the buildings falling under the MJA-3 has remained virtually constant since 2005. During this same period natural gas consumption has fallen significantly, from 11.0 to 8.3 million m^3. As a result, the total primary energy consumption – the energy demand – has fallen by 10%, equivalent of savings of 1.4% per annum. These are good results when viewed from the perspective of the increase in the number of students, the improved indoor climate – achieved, for example, by the increasing use of cooling – and the national trend towards continually increasing demands for electricity.

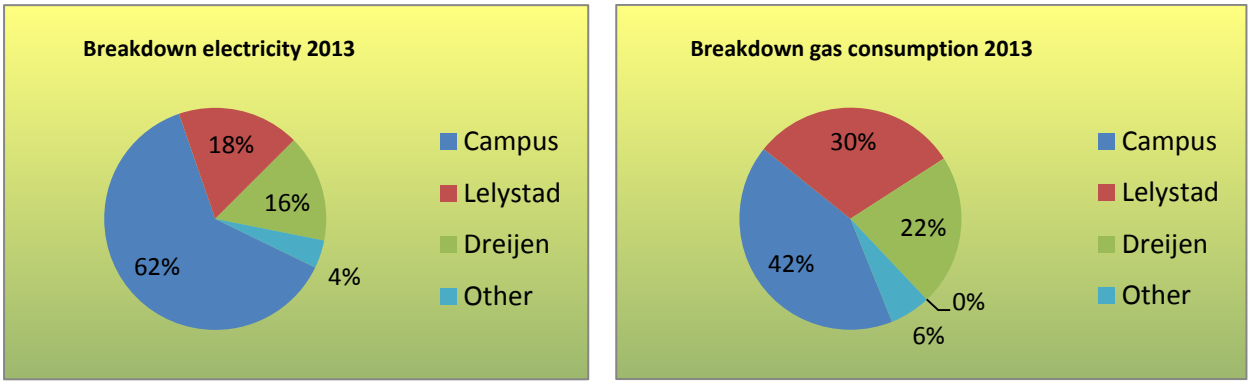
Table 1. Wageningen UR's energy consumption (MJA-3 complexes)

	electricity (MWh)	electricity Primary TJ	natural gas (x 1000 m3)	natural gas Primary TJ	Total energy (TJ)	CO2 (tonnes)	Index CO2
2005	59.582	536	11.032	349	**886**	**53,6**	**100%**
2008	63.685	573	9.924	314	**888**	**54,0**	**101%**
2010	59.600	536	9.790	310	**847**	**53,6**	**100%**
2011	58.987	531	8.103	256	**789**	**15,4**	**29%**
2012	59.795	538	8.324	263	**802**	**15,8**	**29%**

When indirect savings, i.e. savings in the chain, the in-house large scale generation of electricity with wind turbines and the procurement of green electricity are taken account, Wageningen UR has achieved a 71% reduction in its CO_2 emissions (see Table 1).

The breakdown of the energy consumption by location in 2012 [8] was as follows:

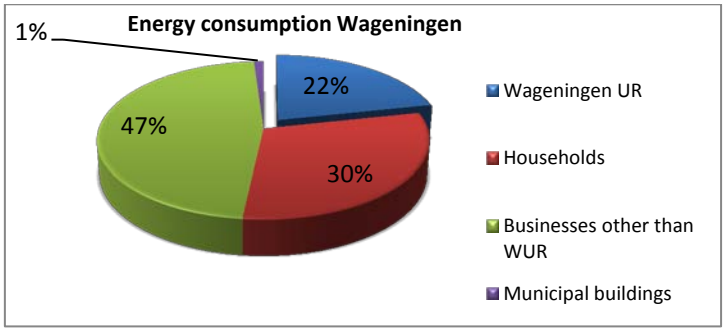
Figure 2: Breakdown of electricity and gas consumption in 2012



This reveals that Wageningen Campus is by far the greatest consumer of electricity and that Lelystad's consumption of gas approaches that of Wageningen Campus.

To place Wageningen UR's energy consumption in perspective, 22% of the energy supplied within the Municipality of Wageningen is destined for Wageningen UR buildings [9]. This figure is based solely on the Wageningen UR buildings within the jurisdiction of the Municipality of Wageningen.

Figure 3: Wageningen's energy consumption



A comparison of Wageningen UR with other universities reveals that Wageningen UR uses a relatively large amount of energy per m^2 floor area, the prevailing measure of energy efficiency [10].

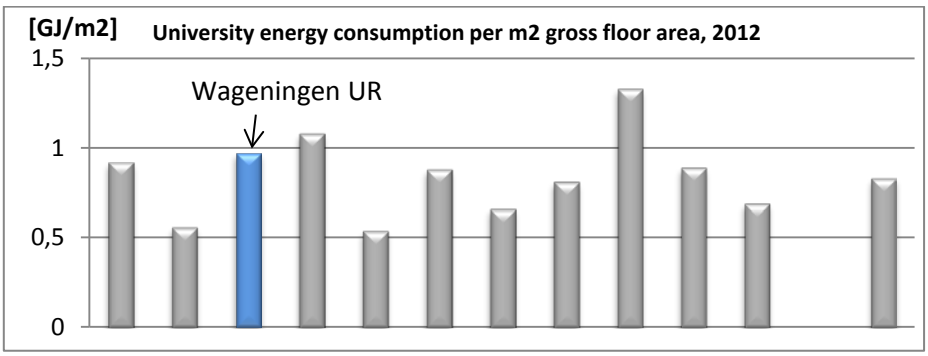
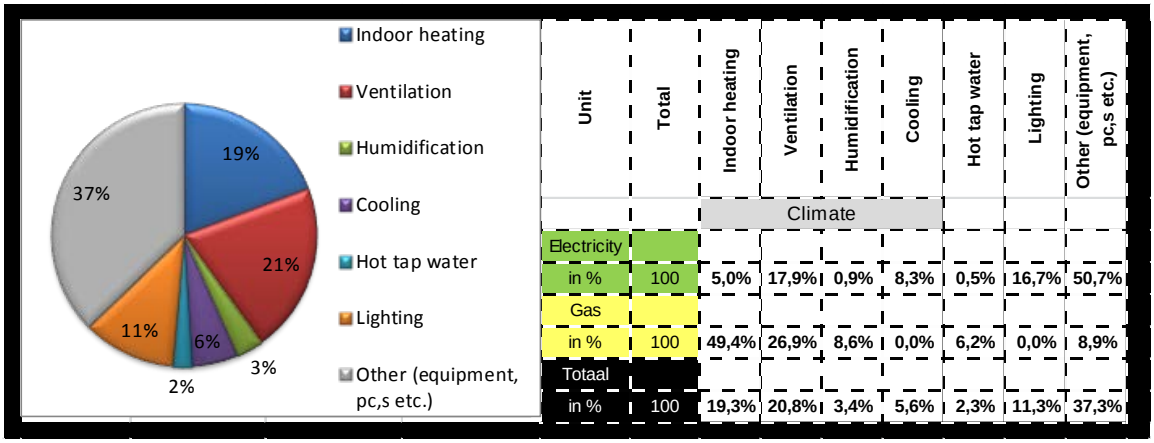


Figure 4: University energy benchmark

This high energy consumption per m^2 floor area is due to the relatively large amount of research that Wageningen University and the DLO Foundation carry out on animals and plants in the laboratories and climate-controlled areas. The greenhouses, climate chambers and two data centres are also large consumers of energy. Wageningen University gives less teaching in the form of lectures than other universities and more teaching in the form of practicals. The energy balance sheet[11] also clearly reveals that the process – the user's share – consumes a large amount of energy: this accounts for more than half of the electricity consumption and for 37% of the total primary energy consumption.

Figure 5: Wageningen UR's energy balance sheet in 2012



	Unit	Total	Indoor heating	Ventilation	Humidification	Cooling	Hot tap water	Lighting	Other (equipment, pc,s etc.)
			Climate						
Electricity									
	in %	100	5,0%	17,9%	0,9%	8,3%	0,5%	16,7%	50,7%
Gas									
	in %	100	49,4%	26,9%	8,6%	0,0%	6,2%	0,0%	8,9%
Totaal									
	in %	100	19,3%	20,8%	3,4%	5,6%	2,3%	11,3%	37,3%

2.3 Sustainability

Most energy visions are based on sustainability, which is also an important element of Wageningen UR's Energy Vision for 2030.

'Leading' sustainability ambition

The Wageningen UR Sustainability Memorandum [12] makes a distinction between for levels of ambition, namely Basic, Active, Leading and Innovative. The **Basic** level, the simplest level, consists of complying with the prevailing legislation and regulations. The **Active** level requires the organisation to demonstrably seek more sustainable alternatives and take account of these alternatives in the decision-making process. Neither level extends to the ambition to set an example. Organisations opting for the **Leading** or **Innovative** levels adopt an integral approach to sustainability and convey this approach outside the organisation. Sustainability is a self-evident element of the decision-making. At the Innovative level, sustainability considerations are decisive in the decision-making. At the Leading level, decision-makers are willing and able to account for any decision that does not make a contribution to the sustainability objective. The use of proven technology is an important condition within the Leading level. This decision is primarily based on the wish to avoid unnecessary hazards for the teaching/research and operations. However, this does not imply that there is no scope for innovative pilot projects and trials.

Measurable targets are an element of the Leading level of ambition [13]. These have been recalibrated for the period to 2016 inclusive [14]. One of these targets specifies that new buildings shall achieve a GreenCalc+ score of 330 (A+ label). The Municipality of Wageningen requires new buildings, including utilities buildings, within its jurisdiction to achieve a GPR (Green Performance Real estate) score of at least 8.0 [9].

CO_2 footprint

The developments in the organisation's sustainability performance have been tracked by annual calculations of the CO_2 footprint from 2010 onwards. These clearly reveal that the energy consumption of the buildings plays a very great role [15]. In 2010, the contribution was 69%. The procurement of green electricity with the Guarantee of Origin (GoO) seal of approval from Stichting Milieukeur, the Dutch Eco-label Foundation, has resulted in an approximately 40-fold reduction of the CO_2 footprint from the organisation's electricity supplies since 2011.

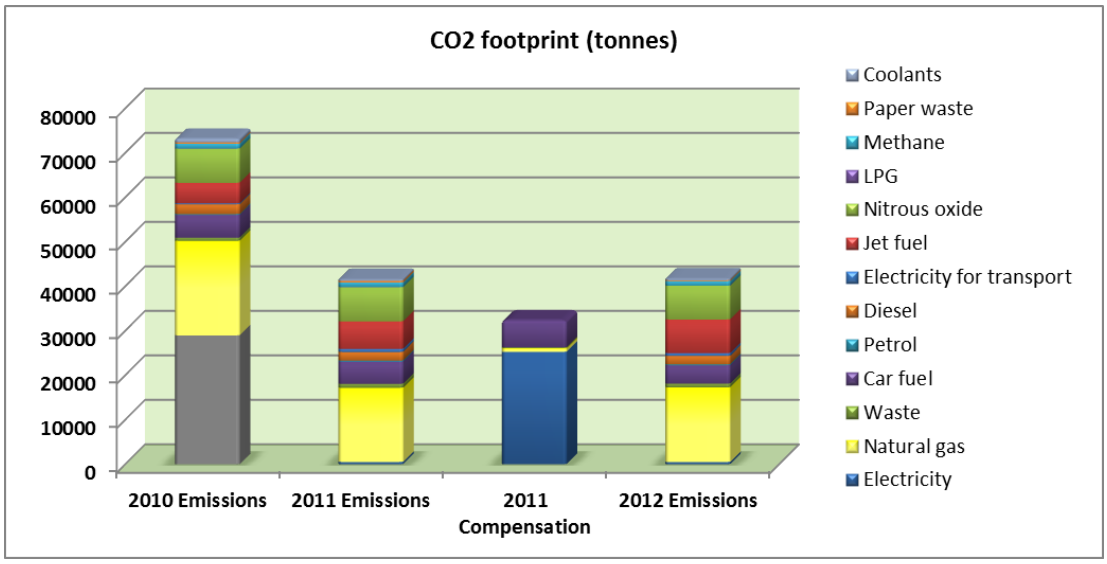


Figure 6: CO_2 footprint and CO_2 compensation

The organisation's consumption of natural gas currently makes the greatest contribution to its CO_2 footprint. The CO_2 compensation originates from projects that avoid CO_2 emissions here or elsewhere. The most important contributors are the wind turbines in Lelystad, biomass plants in Lelystad and Sterksel, and CO_2 compensation for flights via ESG. The sustainable energy obtained from the thermal storage system at Wageningen Campus also makes a contribution. The results from the CO_2 footprint reveal that Wageningen UR achieved 78% climate neutrality in 2011. The future purchase of CO_2 emission credits to cover the organisation's natural gas consumption would enable Wageningen UR to refer to itself as a climate-neutral organisation.

Preferential sequence

Wageningen UR's approach to the improvement of the sustainability of its energy supplies is based on the well-known *Trias Energetica* [16] concept. The preferential sequence is then as follows:

1. Energy savings, because 'the most sustainable form of energy is energy that does not need to be generated'.
2. Sustainable energy. The energy that is still required after these savings is generated in the most sustainable possible manner.
3. Compensation. In conclusion, green energy is procured and/or CO_2 compensation is implemented to further reduce the organisation's impact on the climate.

2.4 Operational reliability

The reliability of the energy supplies is an extremely important issue. The climate controlled processes and research processes are particularly dependent on reliable energy supplies and, moreover, a failure can result in substantial loss and/or damage. Emergency power systems are

available for many critical processes. The electricity on the Wageningen Campus site is supplied via ring mains. The four existing ring mains will be supplemented with a fifth within the near future. This fifth ring will supply buildings including the large, new Orion and Helix buildings.

There have been no major problems with the reliability of supplies to date. Any failures that did occur were generally rectified within a short period of time. Recent power failures have revealed that short power cuts can cause follow-on failures that can occasionally take longer to rectify. The relevant building managers, Technical Systems Services (TIB) and Liander grid operator have laid down agreements and procedures for the rectification of failures. A policy document on the reliability of the energy supplies is in preparation.

User satisfaction with the electricity supplies is a less acute but nevertheless important issue. This then primarily relates to an appropriate working climate and to suitable conditions for research. New Buildings are increasingly being equipped with cooling alongside the customary lighting, ventilation and heating. Laboratories also require humidification systems and, for specific processes, utilities including steam. However, all these systems consume large amounts of energy.

There are no standard optimum temperature, humidity and ventilation working climate settings: these are to some extent subjective, with great differences between personal preferences. Moreover, with the varying weather conditions it is in practice impossible to adjust the settings to levels that ensure that everyone is satisfied throughout the year. However, every effort is made to resolve complaints for as far as is possible. A balanced indication of user satisfaction is obtained by including this issue in the staff satisfaction survey.

2.5 Costs

The costs of the procurement of electricity and gas amount to about 10 million euros per annum. To place this in perspective, Wageningen UR's total costs amounted to €635 million in 2012, of which accommodation costs accounted for €47.7 million [(7)].

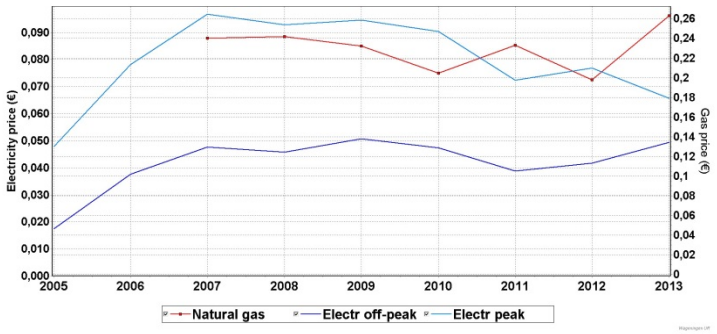


Figure 7: Gas and electricity commodity prices

Costs are also incurred in the installation and maintenance of the energy infrastructure, including the technical installations. Although detailed figures for these costs are unavailable, they are estimated to amount to some 20 million euros per annum. As a result, energy is an important cost item. The costs incurred in the procurement of energy are comprised of transport/grid management costs, energy tax and the commodity price of energy. Energy commodity prices fluctuate much more than other commodity prices, which results in budget uncertainty. As the energy market is a global market, customers have no control over prices.

An appropriate procurement strategy is required to find the optimum balance between risk and low commodity prices. The objectives of the energy procurement strategy adopted at the end of 2012 are to:

- set a lower budget than in the previous year, when feasible;
- gain from beneficial times in the market and fix low commodity prices;
- avoid excessive budget fluctuations from year to year.

Wageningen UR has a compensating factor: as Wageningen UR also generates sustainable energy from wind turbines and biomass, this limits the extra costs incurred due to higher electricity prices, as income from electricity also increases.

2.6 Legislation and regulations

Wageningen UR, along with all other Dutch universities, is a party to the Energy Multi-Year Agreement (MJA-3). The MJA-3 imposes an obligation to implement an energy management system and to draw up an Energy Efficiency Plan (EEP) once every four years. This plan specifies the measures to be implemented to achieve total energy savings of 30% in the 2005-2020 period. These energy savings are to be achieved both in the organisation and within the chain. The results are to be reported in an annual electronic Energy Environmental Report (e-MJV). The local municipality is the supervisory authority for the MJA. In view of the good relationship and communications with the Municipality, preference is given to this party continuing to fulfil the role of supervisory authority [(17)]. The Province would be the competent authority on the installation of large gas plants such as boilers and CHPs with a total burner capacity of more than 50 MW. The Province of Gelderland is currently the competent authority solely for the Wageningen Campus thermal storage system.

Alongside the MJA-3, the various installations are also governed by supplementary regulations. These relate primarily to environmental regulations governing issues including noise and emissions, and to municipal safety regulations.

New buildings must comply with the Buildings Decree. This legislation is currently focused on buildings with standard functions (offices, reception and teaching), whilst most of Wageningen UR's new buildings fulfil a number of functions. As a result, the Building Decree's EPC measurement method is not always applicable to these hybrid buildings and other buildings with different functions, such as laboratories and research facilities. However, specific requirements can be imposed on sub-functions of these buildings.

Animal welfare and working conditions legislation determine the requirements for the indoor climate and lighting. These are taken into explicit account on the construction of new buildings.

3 Energy in 2030 (target)

Many organisations have adopted 2030 as the 'point on the horizon' for their energy vision. 2030 is both sufficiently remote to offer scope for the inclusion of the specifications in major replacement projects *and* sufficiently close to ensure that the plans are manageable.

The ultimate destination can be reached solely by maintaining course and maintaining an appropriate speed. This Energy Vision for 2030 builds on Wageningen UR's achievements in recent years. The organisation does not need to accelerate the pace of its developments to achieve the targets for 2030: moreover, this would not be realistic in view of the current financial situation. A great deal can be achieved simply by maintaining the current speed and course. Consequently, the leading ambition for 2030 is still realistic.

3.1 Real estate developments

Wageningen UR will complete its Strategic Plan for New Construction in 2016. Pursuant to the Executive Board's long-term policy plan, any further growth of the organisation, where relevant, shall need to be absorbed within the existing real estate. After 2016, the emphasis will be placed on the optimisation of the use of the real estate and any construction work will be limited almost entirely to renovation work on the organisation's buildings. This, pursuant to the standard 15-year depreciation period for machinery, means that many replacement investments will be made in the 2020-2030 period. Solely the energy supply facilities for the North Campus, built in 1995, are scheduled for earlier replacement.

Land on the southern construction strip has been reserved for the third-party construction of new buildings which are compatible with the Campus Strategy for 2020 [(18)]. Pursuant to its real estate strategy, Wageningen UR does not exert a direct influence on these parties' energy supplies. However, the Wageningen Campus zoning plan does devote sufficient attention to this issue. Although the facility sharing agreements will have consequences for the organisation's energy consumption, these effects are expected to be limited.

The real estate plans, as is the case at every dynamic organisation, are not set in stone: a great deal is still feasible in the period until 2030. For example, the locations away from the core complexes are working on the further concentration of expertise centres, and sections of the organisation are giving attention to the optimisation of their accommodation at the core complexes in Wageningen and Lelystad. Practice has revealed that changing user needs result in alternations of buildings or sections of buildings earlier than the scheduled date of renovation work. For this reason, this Energy Vision is limited to a review of the main elements without detailed specifications at building level.

The above reveals that the strong emphasis on the construction of new buildings in recent years is now shifting primarily to maintenance and renovation work.

3.2 Movements in energy consumption

Predicting the movements in energy consumption is complicated by the great influence of the size of the future organisation and the processes that will then be necessary. However, in recent years a clear shift has become evident in which electricity is replacing natural gas as an energy carrier. Heating and cooling buildings with heat pumps rather than with conventional central heating boilers is interesting from both energy efficiency and cost perspectives. This shift to electricity also benefits sustainability, as all electricity procured by the organisation is green electricity, whilst this is not the case with natural gas. The full transition from natural gas to electricity – 'all electric' – is a lengthy process. The Energy Vision for 2030 states that the organisation's gas consumption shall in any case be reduced greatly and that its electricity consumption shall be reduced slightly in the same period. Although this electricity consumption target might not appear to be very ambitious, it

should be noted that the organisation's electricity consumption would continue to increase in the absence of savings measures [19] [20].
This is a national trend which is more pronounced at Wageningen UR due to the continuing increase in the number of students and the extended opening hours of many buildings. Moreover there is also a trend towards increasingly higher-grade research, which is usually accompanied by higher energy consumption. Reducing the electricity consumption is, in conclusion, also a challenge as replacing gas-fired boilers with thermal storage systems and heat pumps also increases electricity consumption. Solely the large scale introduction of LED lighting, use of more energy efficient equipment and the further intensification of the use of the buildings can achieve significant savings. It will also be necessary to continue to work on the optimum settings of the building facilities.

The movement in energy consumption may, on the basis of the forecast construction and renovation projects, the continuation of energy savings initiatives and the forecast climate changes, [21], be expected to be as follows:

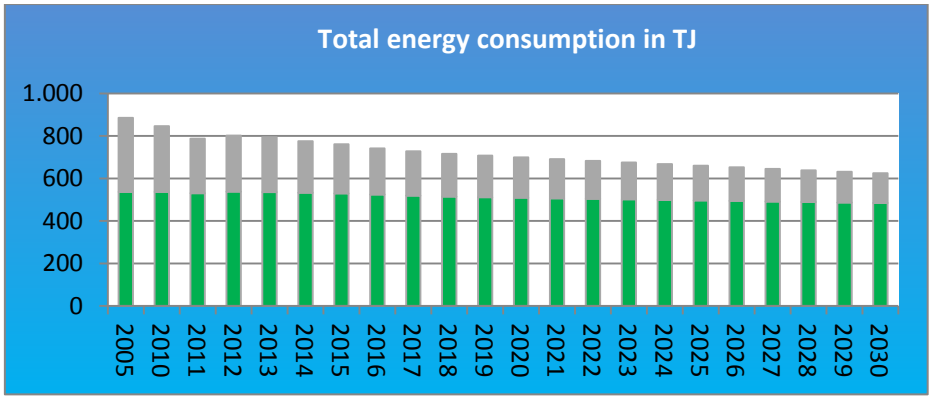


Figure 8: Forecast movement in energy consumption (2005-2030)

	Primary energy (GJ)	Index, electricity	Index, natural gas	Index, total	CO_2 (tonnes)	Index, CO_2
2005	**886**	100%	100%	100%	**53,598**	**100%**
2013	**793**	100%	74%	90%	**15,507**	**29%**
2020	**699**	95%	54%	79%	**849**	**2%**
2030	**624**	90%	40%	70%	**807**	**2%**

Table 2: Forecast movement in energy consumption and CO_2 emissions (2005-2030)

The disposal of older buildings and the more efficient use of space in the remaining buildings will result in a more rapid decline in energy consumption in the years to 2020 than in later years. The ultimate target for 2030 is a 30% decline in direct energy consumption as compared to 2005.

3.3 Sustainability

The previous subsection reviewed the required movement in energy consumption and the energy saving that needs to be achieved. The next step is the generation of sustainable energy. The sustainable energy technologies available to Wageningen UR now and in the coming years are wind energy, thermal storage, biomass and solar energy. Other technologies currently being developed, such as fuel cells, geothermal energy and energy from rivers or plants, could possibly make a future contribution to the achievement of the targets. However, these technologies need to be developed further before they can be implemented as proven technology on a large scale.

Wind energy
Wageningen UR currently has 26 wind turbines in three wind farms on its Lelystad site. These wind turbines deliver, depending on the wind, between about 65 and 70 GWh per annum. This is approximately equal to Wageningen UR's total energy demand. The wind farms were constructed in 2004 and 2006/2007. Wageningen UR also has a test location for prototypes of new wind turbines. The owner of the turbine or turbines, rather than Wageningen UR, supplies the electricity generated by these turbines to the public power grid.

Some wind turbines will be replaced before 2030. The Province of Flevoland has formulated a new wind policy. The effect of the policy conditions on what is referred to as 'redevelopment and scaling up' is not as yet completely clear. Current developments indicate that the some 660 wind turbines now in use could be reduced by at least half while simultaneously at least doubling their output (by the use of new technology and higher tip heights). The wind turbines will also be concentrated at four or five wind farms. However, it is clear that residents in the surroundings and, possibly, Wageningen UR staff could play an active role.

The replacement of all 26 wind turbines would increase the total output as a result of the use of new technologies. An increase in the output to more than double the present capacity is realistic in view of the current developments. Extra capacity could also be achieved by assigning the management of the test turbines to Wageningen UR at some time in the future. An increase in the current amount of wind energy allocated to Wageningen UR can also be achieved by administrative changes. However, the organisation's use of the electricity generated in the wind farms 'downstream from the meter' is not presently of interest, due to the prevailing legislation and prices. Nevertheless, this could be feasible for the Lelystad locations within the near future and, in the longer term, for all locations, depending on developments in prices and the legislation.

The organisation needs to retain this form of generation of sustainable energy if Wageningen UR is to retain its leading position in sustainability. At present, there are no other realistic alternatives to wind turbines for the generation of the large amount of sustainable energy required.

Installing wind turbines near Wageningen Campus could have a great effect on its image. However, this is not feasible at present due to the limited local support. Although urban wind turbines are beneficial to the organisation's image, they have a limited output and return on investment.

Solar energy
Solar energy, in particular solar PV (photovoltaic) energy, is an emerging form of sustainable energy generation. Solar PV is more scalable than wind energy, thermal storage and biomass, and is also suitable for a broader range of applications. Solar PV is also interesting in terms of permits and its benefit to the organisation's image. Solar PV currently makes a limited contribution to Wageningen UR's sustainable energy supplies. Solar panels, notwithstanding the technological developments and falling prices, are still far from yielding the return on investment for large-scale users required for the stipulated eight-year payback period. Moreover, a very large surface area or roof area is need to generate the required amount of electricity.

ACCRES, in Lelystad, already has a 'solar power meadow'. This, from an engineering perspective, is simple to expand and is much more flexible than a roof-mounted installation. Solar power meadows are an alternative should the plans for the replacement of the existing wind turbines be scrapped. Some 250,000 contemporary solar panels would be required to generate the same amount of electricity as the current wind turbines. As the area required to install these panels greatly exceeds the available roof area, large solar power meadows would also be necessary.
Solar panels on the roofs of staff or, conversely, supplies of solar energy to Wageningen UR's staff and students is also an option. Although solar power's contribution to the total energy supplies would be modest, this would enhance Wageningen UR's sustainability image.

Another form of solar energy, solar thermal energy, could be used to regenerate thermal storage wells or produce hot water supplies. This could be based on solar collectors or energy roofs. As energy roofs would compete with solar panels, preference is given to asphalt solar collectors built into roads or parking spaces.

Aquifer thermal energy and heat pumps

Thermal storage systems use aquifers as buffers to heat buildings in the winter and cool them in the summer. Wageningen Campus installed a thermal storage system in 2007. Forum, Atlas, Radix west, Actio, Impulse and Orion are connected to this system. Six well pairs are in use. The thermal storage system framework plan [(4)] provides for 19 well pairs. The system currently supplies about 1% of the organisation's sustainable energy. This could increase to between 3-5% in 2030.

The present thermal storage system uses low temperatures and is operated alongside conventional refrigeration units and central heating boilers. Heat pumps are used to bring the temperature of the water from the thermal storage system to the required level. This is much more energy efficient than conventional systems. The use of thermal storage can be expanded in the coming years by adopting one of the following approaches:

- optimisation of the existing system, with due regard for the permit requirements.
- expansion of the number of well pairs and the connection of additional buildings to the thermal storage system.

The low temperatures with thermal storage need to be taken into account when connecting buildings to the system. The greatest energy efficiency is achieved when the buildings are made suitable for low temperatures by installing standard heat pumps. When this would incur excessive costs then consideration will need to be given to the feasibility of using high-grade heat pumps to achieve the required temperature differences. This issue needs to be reviewed thoroughly before formulating the schedule of requirements for major renovation projects, as this has a great and long-term effect on the energy consumption and operating costs.

Other options, as viewed from a technological perspective, are the use of deeper aquifer energy (geothermal energy) or high temperature difference heat storage systems. However, these options are still very expensive and are not as yet based on proven technology. Aquifer energy is often less interesting for locations way from Wageningen Campus, usually because the subsoil is not suitable or because the heating or cooling demand is limited. In addition, the cost of modifying these buildings for low temperature heating will usually be excessive.

Biomass

Wageningen UR has two installations for the generation of green energy from biomass, VIC Sterksel and ACCRES Lelystad. These installations process manure and/or food and feed residual products and, as a result, are extremely sustainable. This manure fermentation offers a major benefit in that it provides an immediate solution for the regional manure problems. Although the current output from the biomass plants is lower than from the wind turbines, biomass nevertheless makes an evident contribution to the current generation of sustainable energy (more than 3% at present). Biomass is even more compatible with the current research and teaching than wind turbines. Biomass offers an excellent option, in which the primary process and operations can further enhance each other. When the plants are viewed solely from a financial perspective then the prevailing low electricity prices are a disadvantage and for this reason an expansion of the plants is not to be expected within the near future. Although ample supplies of green electricity are available, this is not the case with green gas. This offers opportunities for the future, although the costs incurred in preparing green gas for transport are higher than those for green electricity, which uses the existing infrastructure. There are also opportunities for the use of biomass in plastics and other building blocks for the biobased economy, as well as for the use of biogas as a transport fuel. This Energy Vision assumes that investments in biomass will not be made for the time being. Should future developments improve the prospects, then consideration could be given to an expansion of the biogas capacity. However, Wageningen UR does have the ambition to employ small-scale plants to upgrade biogas to a transport fuel.

Movement in the generation of sustainable energy

In summary, the movement in the generation of sustainable energy during the coming years could be as follows. The following table is based on the wind turbine scenario:

Sustainable energy	2005	2013	2020	2030
Wind turbines	0.0%	38.8%	44.1%	98.7%
Biomass	0.0%	2.0%	2.0%	3.0%
Thermal storage	0.0%	1.0%	3.0%	4.0%
Solar PV	0.0%	0.1%	0.5%	1.0%
Total generated	**0.0%**	**41.9%**	**49.6%**	**105.7%**
Total energy demand (TJ)	**886**	**794**	**699**	**624**

Table 3: Generation of sustainable energy, 2005-2030

The actual future amount of energy generated from sustainable sources depends on factors including developments in the technology and prices. Wageningen UR's ambition is to achieve energy neutrality by 2030, an ambition which can be fulfilled by the use of a combination of the various options available (including wind energy, solar energy, thermal storage, biomass and the production of bioethanol). The opportunities available for each of the various generation options could change over the course of the years.

CO_2 compensation

Reducing the organisation's energy consumption is the most important step, as this is of immediate benefit to both sustainability and costs. The next step, generating or increasing the generation of sustainable energy, will further improve sustainability and reduce the organisation's dependency on energy supplies. The in-house generation of sustainable energy sufficient to meet demand is not yet an economic proposition, in view of the current market conditions and the low prices of conventional energy.

As from 2011, all electricity procured by the organisation is green electricity (wind energy, with a Guarantee of Origin seal of approval from Stichting Milieukeur, the Dutch Eco-label Foundation). This seal of approval guarantees the provision of incentives for the development of new sustainable production plants. Natural gas is still being procured in the form of 'grey' natural gas: genuine green gas is scarce in the current gas market, and the certification is not yet completely watertight. The additional price charged for green gas (about 20%) is much higher than for green electricity (1.4%). A further option is the procurement of CO_2 emission credits to cover the use of natural gas, a form of compensation which is more economical.
It is expected that the costs incurred in procuring green gas will fall, both due to the further electrification of the energy supplies and to green gas' increasing share of the gas market.

The procurement of green energy offers the most rapid means of fulfilling Wageningen UR's ambition to reduce its CO_2 footprint. Should Wageningen UR fall short of its energy saving and generation of sustainable energy targets at some time in the future then the procurement of green energy will actually become necessary if it is to fulfil its commitments pursuant to the MJA-3. If the organisation succeeds in procuring both green electricity and green gas then its total CO_2 emissions will fall to zero and Wageningen UR will be able to refer to itself as one of the first large climate-neutral organisations.

3.4 Operational reliability

Self-evidently, the operational reliability of the energy supplies will also need to meet the requirements in 2030. For this reason the risks and any loss (probability times effect), where relevant, will need to be weighed against the costs of the facilities required to guarantee operational reliability. As electricity cables have a 30-year depreciation period, no major investments in cables are expected in the years to 2030. Other components in the electricity supplies and all heating,

ventilation and cooling equipment are, in accordance with the rules, depreciated in 15 years. When these components reach the end of their economic life then express attention will need to be devoted to a review of alternatives that at least offer adequate operational reliability and also score well for the sustainability and cost factors. Emergency power systems capable of absorbing power cuts will be required for critical processes. In some instances it will be possible to retain conventional systems to serve as a backup for new systems. Linking systems can also contribute to improved operational reliability, provided that this is not detrimental to the manageability, efficiency or flexibility of the linked systems.

User satisfaction will continue to play an evident role in the overall design of the energy supplies. Attention will continue to be devoted to the further optimisation of the indoor climate and lighting within the scope offered by the working conditions and animal welfare legislation.

3.5 Costs

As indicated earlier, a large fraction of the energy costs is outside the organisation's control. Supply prices can fluctuate greatly and, moreover, other elements of the price – in particular the tax and transport elements – are also outside the organisation's control. It is not easy to forecast the movements in energy prices. However, prices are expected to remain reasonably stable during the coming years, due to the current overcapacity in the electricity market and the poor economic conditions. The fluctuations in the price of natural gas are expected to be greater than those of electricity. Prices are generally expected to increase in the longer term, in part due to the continuing increase in taxes and grid costs. The organisation's procurement strategy will need to remain reconciled with the changing energy market in the years leading to 2030. However, increased in-house generation will reduce the influence of external factors. The organisation will strive to avoid further increases in energy costs by means including energy savings. Investments are, in principle, governed by the requirement stipulating a maximum of an eight-year payback period. Nevertheless, longer payback periods are acceptable in certain instances, for example when an investment is required to fulfil a statutory obligation or when it results in a materially increased level of sustainability, operational reliability and/or user satisfaction.

3.6 Legislation and regulations

There is no certainty about the content of new or amended legislation and regulations in the period to 2030. It will, in any case, be necessary to take account of the following:

- Further increases in the stringency of energy performance requirements governing new buildings. The Energy Performance Coefficient (EPC) will be reduced in increments. As from 2020, new buildings will need to be 'virtually climate neutral'. The relevant legislation (the Buildings Decree) currently addresses buildings with standard functions (offices, reception and teaching). However, most of Wageningen UR's new buildings fulfil a number of functions, such as laboratories and research facilities. It is not clear whether the scope of the Buildings Decree will be expanded in the future, although the provisions of the Buildings Decree will be of less relevance to Wageningen UR on the decline in the construction of new buildings during the coming years.
- New legislation and regulations to be introduced for renovation work could impose more stringent requirements on the energy performance and sustainability of renovated buildings. Existing government buildings offered for sale or lease must have an EPA-U label.
- The MJA-3 runs until the end of 2020. It is not clear whether this will be followed by an MJA-4 or some other form of agreement.
- The Social and Economic Council's draft Energy Agreement of September 2013 [(22)] specifies ten spearheads. The most important of these relate to energy savings of 1.5% per annum and to the Netherlands' generation of sustainable energy, with targets of 14% by 2020 and 16% by 2023. These are in line with the EU's targets [(23)]. The responsibility for implementation is increasingly being assigned to the parties involved. Specific agreements have yet to be reached for the years after 2023. On Wageningen UR's achievement of its sustainability targets it will also have achieved the national targets.

4 Integration in the organisation

4.1 Policy framework

Wageningen UR's Energy Vision needs to be compatible with the hierarchy specified in its mission and its sustainability vision derived from this mission. Wageningen UR's mission is 'To explore the potential of nature to improve the quality of life'. The sustainability vision derived from this mission is laid down in a number of strategic documents. This Energy Vision makes frequent references to these documents, which have been prepared on the basis of the principle that the contents of the documents are and shall remain reconciled with each other.

4.2 Energy management

The integration of energy management in the organisation is not only a requirement pursuant to the MJA-3, but is also a logical step in achieving sustainability. The organisation's energy

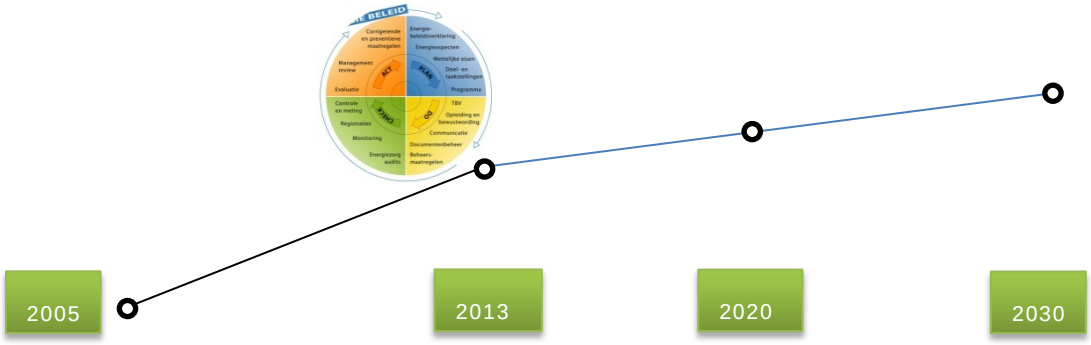


Figure 9: Energy management: continual improvement

management system has been developed in accordance with guidelines published by NL Agency (now the Netherlands Enterprise Agency) and the Plan-Do-Check-Act ISO philosophy. The energy management organisation is based on a specification of roles (duties, responsibilities and powers), with a division between corporate – assigned to Facility Services (FB) – and decentral (organisational divisions). FB is entrusted with a large proportion of the work, whereby the Energy Main Process Model makes a further division between the departments and FB sections. The energy management system is based on a number of important pillars:

Energy Efficiency Plan (EEP)
The MJA imposes the obligation to draw up an EEP once every four years. The EEP specifies the measures that will need to be implemented in the next four years to achieve the savings target. The most important categories of measures are technical projects, good housekeeping, projects in the chain and the generation and procurement of sustainable energy. The parties involved must jointly provide for the implementation of the planned or alternative measures.

Monitoring
Control of the organisation's energy consumption is feasible solely when accurate and reliable information is available and when the necessary control mechanisms are in place. The indoor climate of the buildings is adjusted via building management systems (GBS). Monitoring the installations provides the information required to adjust the settings to optimum levels as based on the balance between energy efficiency and comfort. The energy management system (EMS) records all energy and water flows and then converts the resultant wealth of data into usable information at a range of levels (meter, building, organisational division and total). The EMS also encompasses the relevant financial data, comprised of the procurement costs – and invoice control – and the on-charging of the costs to the internal and external end users.

Sustainable construction and sustainable maintenance

New construction projects and renovation projects offer ideal opportunities to make energy supplies as future-resilient as possible. New buildings is, as referred to earlier, need to meet increasingly stringent statutory sustainability requirements. These requirements are less evident for renovation projects. However, supplementary requirements will probably be introduced in the future, especially when the interim targets specified in the SER Energy Agreement are not achieved [(22)]. The Energy Agreement also lays down the ambition of achieving a national average of an A level building label by 2030. Wageningen UR, as the owner of real estate, needs to ensure that its buildings remain marketable. To support the national target, large renovation projects should also strive to ultimately achieve at least an A label (EPA-U). To achieve this, and to achieve the energy saving target, large renovation projects will need to result in an improvement in the label of at least one level.

Energy and sustainability will need to be further integrated in the maintenance of buildings, equipment and installations. This need will be taken into account on the preparation of a new sustainability multi-year maintenance plan and Management and Maintenance Vision. Concepts such as green lease [(24)] and performance agreements [(25)] can then also play a role.

Procurement

The Procurement department carries out its duties in accordance with the Procurement Policy, 2013 [(26)]. This, from the sustainability perspective, prescribes at least compliance with the sustainability guidelines formulated by NL Agency (now the Netherlands Enterprise Agency). This is verified with the annual sustainability scan. In 2012, 97% of the purchases were sustainable purchases [(7)], a level almost double the level agreed in the covenant concluded with the Association of Universities in the Netherlands (VSNU). The relevant target stipulates 100% sustainable purchases from 2014 [(27)]. No sustainability criteria have been formulated for products that are not classified into one of the NL Agency categories. The Wageningen UR product manager is then responsible for ensuring that sustainability is included in the tender or quotation requirements. This is also applicable to requests for quotations issued by divisions of the organisation, when the relevant division of the organisation is responsible for ensuring that issues including sustainability and energy consumption are included in the specifications for the quotation. Assurances for 100% sustainable purchases will be provided by including this issue in the sustainability scan.

Energy incentives

Financial incentives appear to be effective in today's culture. Energy incentives are provided to promote the organisational divisions' implementation of energy measures. The revenue from these measures is credited to the relevant division. This system, which was initiated for PSG in 2012, will be rolled out further in the organisation in coming years.

Link with research / teaching

Wageningen UR carries out a great deal of research and teaching which is compatible with the organisation's sustainability and energy ambitions. Universities including Eindhoven University of Technology[(28)] and University of Twente[(29)] introduced what are referred to as 'Living Labs' some time ago. Pursuant to this concept, sustainable technologies developed in house are implemented on a small scale in the organisation's operations. This not only creates a realistic test environment, but also serves as an appealing means of demonstrating the technology to clients and other interested parties. Away from Wageningen Campus, the VIC Sterksel biomass plants and all ACRRES Lelystad installations are excellent examples of this principle. PSG's research into the energy-producing greenhouse and the Environmental Technology research (AFSG) into heat storage systems are also examples of the link between the primary process and the operations. This link is referred to in several policy documents, on the basis of the 'Practice what you teach' motto. The foundation of the Wageningen Green Office is an example of an organisational step taken to enhance the concurrence of sustainability in the primary process and operations.

Communication

Appropriate communications are necessary to ensure that all stakeholders are kept informed of and involved in sustainability. This in turn requires a communication plan to streamline the internal and communications. Communication on sustainability has been no more than modest to date – whilst Wageningen UR is currently the most sustainable research institute. Major advances in this area have also been made in recent years [30], including the preparation of energy annual reports and environmental annual reports, and the provision of information via www.wageningenur.nl, the intranet and various SharePoint team sites. As from 2012, an integral annual report is published in accordance with the People Profit Planet concept and on the basis of the Global Reporting Initiative (GRI) guidelines.

In drawing up the organisation's CO_2 footprint and taking active part in sustainability and CSR rankings, Wageningen UR is increasingly seeking publicity and conveying its sustainability vision – both of which are elements of its leading ambition.

Studies such as the study carried out within the context of the MICRO2 research[31] and other feedback from the organisation's staff and students reveal that the nature of Wageningen UR's sustainability efforts are still not sufficiently clear. Moreover, sustainability is much less visible at Wageningen Campus – where most staff and students are based – than at other locations such as ACRRES Lelystad.

Energy Strategy for 2013-2016

Wageningen UR shall maintain the products from completed projects and carry out the following activities in the coming years:

1. Sustainability
   a) The implementation of measures specified in the EEP 2013-2016 for the achievement of the energy saving target of at least 8% (2% per annum).
   b) Whenever feasible, both construction and renovation projects will extend to the transition to electric heat pumps for heating and thermal storage for cooling. Natural gas will be avoided whenever possible.
   c) Wageningen UR shall, pursuant to its sustainable procurement policy, require potential suppliers of systems to submit a calculation of the energy and maintenance costs. Potential suppliers will also be requested to submit a calculation of the forecast annual impact on CO_2 emissions. The results from both calculations will be taken into account in the assessments.
   d) Maintenance programmes shall explicitly extend to the identification of profitable energy-saving measures and their immediate implementation. The preparation of a sustainability multi-year maintenance plan.
   e) The specifications for the renovation of buildings will include sustainability requirements compatible with the Leading ambition level. A building label (for example, EPA-U) will be made for all major renovation projects (>300,000 euros) and an improvement in the label of at least one level will be achieved.
   f) The procurement of green electricity will be continued.

2. Operational reliability
   a) A new operational reliability inventory will be made and the results will be interpreted in terms of updated policy, protocols and a schedule.

3. Costs
   a) The implementation of savings measures will be promoted by introducing energy incentives in the organisation whenever feasible.
   b) In principle, sustainable investments are governed by a maximum of an eight-year payback period. However, longer payback periods are acceptable in certain instances.

4. Legislation and regulations
   a) Wageningen UR will maintain its good relationship with the local competent authority and will comply with the relevant legislation and regulations and the agreements laid down in the MJA-3.
   b) New buildings will also achieve a GreenCalc+ score of >330 (A+).

Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
3b, 4a, 4b				1e	2a			1c		1e					1a, 3a
2013				2014				2015				2016			

Table 4: Planning for the activities laid down in the Energy Strategy for 2013-2016

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Glossary

Abbreviations

ACRRES Application Centre for Renewable Resources (www.acrres.nl)

CO_2	Carbon dioxide, the most important greenhouse gas, also used as a measure of an organisation's effect on the climate.
SE	Sustainable Energy.
EPC	Energy Performance Coefficient with the associated standards laid down in the Buildings Decree.
EMS	Energy Management System. Used in this context for the energy information system Erbis.
EPA-U	Energy Performance Advice-Utilities: advice with recommendations for the achievement of energy-efficient buildings. The associated energy label serves as an indication of the intrinsic energy efficiency of a building. The user's share is not taken into account.
FB	Wageningen UR Facility Services.
GBS	Building management system.
GJ	GigaJoule, unit of energy. One GJ is one billion Joules.
GPR	Score for the sustainability performance of buildings adopted by many municipalities.
GoO	Guarantee of Origin, the sole valid proof of the supply of sustainable electricity.
ISO	International Organization for Standardization
kWh	kilowatt hour, unit of energy.
LED	Light Emitting Diode, an energy-efficient form of lighting.
MJA	Multi-Year Agreement on energy efficiency.
MTO	Staff satisfaction survey
CSR	Corporate Social Responsibility
PV	Photovoltaic: the customary term for solar cells. Solar cells convert sunlight directly into electricity. Solar cells are connected in series and shielded from the weather to create solar panels. Not to be confused with solar boilers, which produce hot water.
SDE+	Sustainable Energy Incentive Scheme Plus: a Dutch scheme which provides grants to promote the increased production of sustainable energy.
SMK	Stichting Milieukeur, the Dutch Eco-label Foundation.
TIB	Technical Installation Services.
TJ	TerraJoule, unit of energy. One TJ is 1000 GigaJoules.
WKO	Thermal storage system.

Terms

CO_2 neutral: an organisation is CO_2 neutral when the amount of CO_2 produced as a result of the organisation's consumption of energy is equal to the CO_2 emissions avoided by the generation of sustainable energy from sources originating from the organisation.

Energy neutral: an organisation is energy neutral when all the energy consumed by the organisation is supplied from its in-house sustainable sources.

Climate Neutral: an organisation is climate neutral when the total amount of greenhouse gases (the total of CO_2 emissions resulting from the generation of energy and emissions of other greenhouse gases resulting from, for example, the storage of manure and industrial production processes) released by the organisation is equal to the emissions avoided by the organisation. This can be achieved by means of the organisation's generation of sustainable energy, as well as by CO_2 storage or CO_2 compensation, etc.

LT heat: low temperature heat. A system which heats areas with hot water of a maximum of 55 °C. A larger heating surface is then required than is available with conventional radiators. This is achieved by using floor or wall heating. Fundamental alterations may be needed to modify conventional buildings for LT heating.