smart and **sustainable**

Venco Campus

Texts:
Ad van de Ven – Adviesbureau Ad van de Ven
Eugene Peeters – P&H Adviseurs Bouw- en Vastgoed bv
Nina Box – Vencomatic Group

Design:
Gielen Druk Print Webmedia

smart and sustainable

The Vencomatic Group's new premises were opened by His Majesty King Willem-Alexander on 13 September 2012. In coming to Eersel, the King was showing his appreciation for Vencomatic as a company and, in particular, for its new premises, known as the Venco Campus. The Venco Campus was built with high ambitions in terms of sustainability and smart building.

The opening by King Willem-Alexander

The Vencomatic Group is a global supplier of innovative, welfare-friendly systems for the poultry sector. The group is made up of Vencomatic, Agro Supply, Prinzen, Vencosteel and Rondeel and has achieved strong growth over the last few years. The Venco Campus was created in order to facilitate this growth and to make it possible for some parts of the company to be based in one single location. The addition of the word "campus" to the name emphasises the innovative nature of the building, the cooperation between those occupying it and the building's scenic surroundings. The Venco Campus has become not only an exceptional building, but also an exceptional site.

The Venco Campus was built with high ambitions in terms of sustainability, smart building and blending into the environment. And these ambitions were achieved: the building has been awarded the Slimbouwen (Smart Building) certificate and is a zero-energy building. The Campus is also the most sustainable and most energy-efficient commercial property in Europe. This is why Cor van de Ven, the owner of the Vencomatic Group, was presented with the first certificate with an 'Outstanding' rating from BREEAM-NL.

One of the principles maintained by Cor van de Ven in commissioning the building was for the design and building process to be transparent. All of the facts remained out in the open and were available for anyone to see. In this respect, this project can serve as an example to others. While the building work was taking place and after the opening, many groups were given a guided tour of the Campus and information about it was provided from different points of view. It is great that the building has been recognised as being the most sustainable building at present, but it will be even better if it is just one of many very sustainable buildings in the future. We hope that this booklet will make a contribution to this becoming a reality.

The decision to write this booklet was taken after the BREEAM certificate was awarded to Vencomatic Group. The objective is to set out all of the relevant information and make it available to a broad audience. The booklet covers aspects including the ambitions, the way the building was constructed, its design, technical building services, how the building is used and the innovations it contains. We also explain how we managed to obtain an 'Outstanding' rating from BREEAM and what lessons can be learned from the project.

The building team was involved in the writing of this booklet. The back cover of the booklet lists the names of the contracting parties that made a contribution to the development and realisation of the Venco Campus.

Start of design phase:	**January 2010**
Start of building preparation work:	**March 2011**
Start of building work:	**September 2011**
Industrial space taken into operation:	**July 2012**
Office section occupied:	**September 2012**

The ambitions

The Vencomatic Group is a family-owned business comprising a number of innovative companies active in the poultry sector. The foundations of the Vencomatic Group were laid in 1983, when Cor van de Ven and his wife, Han, started the Vencomatic company. Cor developed a groundbreaking nesting system that automated the collection of hatching eggs. There was soon international interest in this nesting system, resulting in the growth of Vencomatic. The company then sought to cooperate with other businesses in order to expand its product range. This led to the forming of the Vencomatic Group.

Cor van de Ven: *"The success of our group of companies is based on synergy. Each company is a specialist in its own range of products: Vencomatic specialises in poultry housing, Prinzen is an egg-handling specialist, and Agro Supply offers expertise in the field of climate solutions. Through combining our solutions and knowledge the benefits become apparent, as 1 + 1 = 3 in the Vencomatic Group."*

The idea was for the Venco Campus to become more than just a commercial property with space for logistics, warehousing, production and offices. It also had to become an international centre of expertise for poultry farming. It would be a place where mechanical engineers, animal scientists, agricultural technicians and poultry specialists could come together with poultry farmers in order to work on developing and improving products. The new building for the Vencomatic Group and its surroundings should reflect the innovative strength of its companies and its centre of expertise and be an excellent place in which to work.

The Venco Campus also needed to become a sustainable campus. This applies to the surroundings, but is certainly also true of the new main building. It is as self-sufficient as it can be (it is a zero-energy building) and has as little impact on the environment as possible. In order to manage sustainability and make it measurable, it was decided to work with BREEAM-NL (Building Research Establishment's Environmental Assessment Method). In the Netherlands, this international quality mark for sustainable buildings is awarded by the DGBC (Dutch Green Building Council). If the sustainable qualities of the building can be demonstrated, then a certificate is awarded with one of the following five ratings: Pass, Good, Very Good, Excellent or Outstanding. At the start of the development process, the ambition was to obtain an 'Excellent' rating, with energy neutrality and a healthy indoor climate as the main aims.

Airtight construction with Kingspan wall panels and aluminium frames for triple-glazed windows

The Vencomatic Group has carried out several building projects in the past. A lack of flexibility was an important aspect noted from these experiences. When the organisation and the work processes changed, the buildings could only be adapted to those changes with expensive alteration work. Flexibility was therefore an important principle for the Venco Campus.

Flexibility is also one of the objectives of Slimbouwen (Smart Building), a vision of innovative construction as described by Professor Jos Lichtenberg of the Eindhoven University of Technology. Smart Building also strives to significantly reduce building mass (less transport, less waste) and to achieve more efficient construction with fewer failure costs. Following his first discussions with Professor Lichtenberg, it was clear to Cor van de Ven that the Venco Campus would be built in accordance with the Smart Building concept.

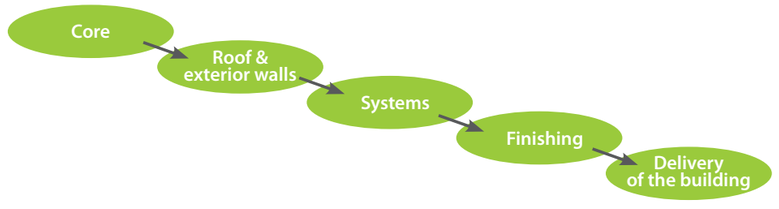
Jos Lichtenberg: *"Smart Building was developed on the basis of the observation that traditional building processes, as we know them, have reached the end of their life cycle. They are fragmented and lack an overall view."*

Smart Building also makes a contribution to the management of building costs. The client had equally high ambitions in this respect. Cor van de Ven wanted to strive for the greatest possible transparency in the cost development for the project, and wanted to be very much involved and have a direct say in matters. This formed the basis for building under his own management.

Opportunity for innovation was a feature of the development of the Venco Campus. This was not only because innovation is something that is in keeping with the company's culture, but also because combining the company's ambitions with traditional solutions would have been a difficult task. The manufacturers of building products were invited to share their ideas about innovative solutions. This is only possible as part of an open building process, within which there is space for knowledge integration.

A good example of this is airtight construction. Thermoflor (frames) and Kingspan (wall panels) made great contributions towards the results achieved. The approach selected also made it possible to carry out tests during the building process and to use the results in the final work.

Process Smart Building:



Building in **a different way**

The process of building in a different way was based on building under one's own management. The client was closely involved in the process as a whole and each party was contracted individually by the client. There were very few subcontractors active on the building site. This means that all risks were also covered by the client. In order to ensure there was sufficient capacity and to limit risks, a team was formed around the client. The size and the expertise of the team were decided in accordance with the requirements resulting from the process. The process manager, Eugene Peeters, played a central role. He was in charge of the team and acted as the client's right-hand man. People from the Vencomatic Group were always on hand to answer questions regarding the schedule of requirements, or to help think about specific solutions (for logistics and ICT, for example).

The request for transparency meant that the contracting parties' existing revenue models were challenged on several occasions. This was not without its problems, but it did ultimately lead to a good result.

Eugene Peeters (process manager): *"Many of the contractors worked on a cost-plus basis. An hourly wage is agreed rather than a fixed contract price, and agreements are made regarding the purchase of materials. We purchased materials collectively in order to guarantee quality. Building on a cost-plus basis is an expression of trust. The client risks more hours being involved. So it was our task to ensure that people were able to carry out their work quickly and efficiently, while quality was maintained. The result is a realistic, competitive and transparent price that is a close reflection of the actual value."*

The project costs can be divided up as follows:

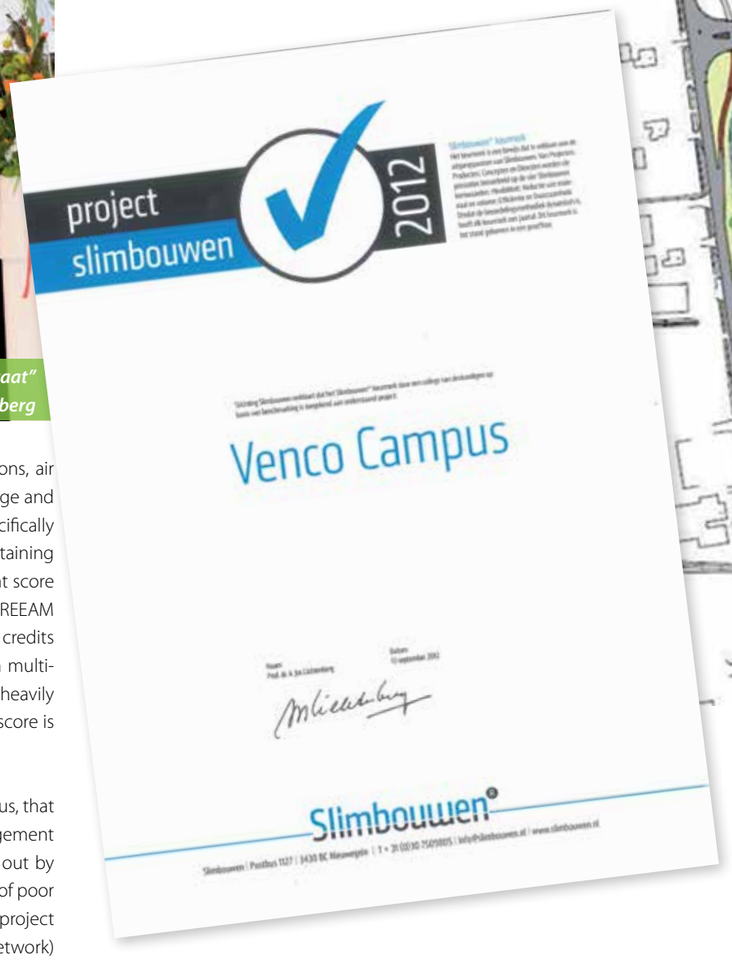
- Additional costs 6 %
- Structural costs 50 %
- Site costs 4 %
- Electrical system 14 %
- Mechanical system 13 %
- Sprinkler system 4 %
- Solar energy system 7 %
- Furnishings and fittings 2 %.

Despite the fact that the building was built under the company's own management, the additional costs and site costs were low. The extra investment in sustainability and energy neutrality amounted to approximately 5.2%. The organisational costs involved in obtaining the BREEAM certificate amounted to 0.4% of the total project costs.

A significant part of Smart Building is related to the design and building processes. Smart Building can be summed up in four words: flexibility, reduction, efficiency and sustainability. The basis for Smart Building is formed by a clear division between the phases in the building process - core (structure and floors), shell (roof and exterior walls), systems and finishing. These stages were differentiated as much as possible during the construction of the building. It was not always possible to do so - for example, in the case of the office roof deck and when the time for completion was under pressure. The objectives of this approach were efficiency and keeping failure costs as low as possible. Failure costs in the building sector are high and are estimated to total between 10 and 20%. During the building of the Venco Campus, the failure costs (avoidable costs) were continuously recorded and ended up totalling 2%.

BREEAM was selected at the beginning of the building process in order to provide proof of sustainability on completion. But it was also chosen for the purposes of managing the sustainability ambitions. BREEAM is all about quality, specifying quality requirements (performance) and guaranteeing performance. Where the airtightness of a building is concerned, a level of performance can be specified in advance (for example, Qv10=0.15 $dm^3/s.m^2$). Only by taking a measurement afterwards is it then possible to establish whether the performance level has been achieved (Qv10-0.14 $dm^3/s.m^2$ measured).
BREEAM divides sustainable building into nine categories and a series of credits are specified for each category.

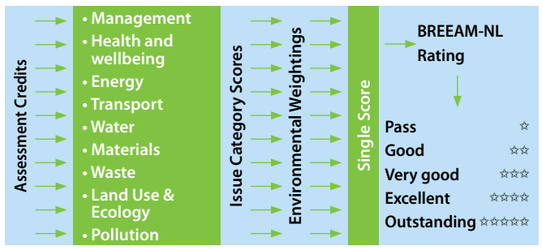
Presentation of "Slimbouwen certificaat" (Smart Building certificate) by Jos Lichtenberg



There are requirements relating to these credits (CO_2 emissions, air quality, water saving, for example). It is then possible to manage and test based on these requirements. The client then knows specifically which qualities the building has. Credits can be used for obtaining points, which are then weighted to produce a total score. That score determines the sustainability rating of the building. In the BREEAM methodology for calculating the score, the percentage of credits obtained for each category is first looked at and that is then multiplied by a weighting factor (energy and health are the most heavily weighted). Then the percentages are added up and the total score is checked against the sustainability rating (the certificate).

In the case of large building projects, such as the Venco Campus, that are not built in the traditional way, communication and management of information are extremely important. This was also borne out by our failure cost records. The majority of failures were the result of poor communication. It was therefore decided at the start of the project to work using the SPIN (Synergetic Project Information Network) method and software programme. Harald Krijger from Connecting Projects developed SPIN because, as an architect, he had noticed that the wrong information was often used. In SPIN, all documents are stored and managed centrally and the same information is available to everybody. At the end of the building process, all of this information can be handed over to the client. The Venco Campus was a pilot project for SPIN. Using the experience gained on the project, the product will now be more widely distributed.

The Venco Campus was built in a revolutionary way, and not in accordance with a traditional model. The result is that it is an innovative and sustainable building that took a short time to build, is better in terms of quality and costs the same. It was the first building in the Netherlands to be awarded a Slimbouwen certificaat (Smart Building certificate) for all aspects.



The design

The surroundings

The site intended for the Vencomatic Group's new building was too small to accommodate a building measuring approximately 30,000 m². In order to obtain sufficient space, the decision was made to integrate the building with an existing fish pond and a former waste site. This integrated approach resulted in the Venco Campus. The main part of the building consists of an industrial space for logistics and assembly work. A smaller but not unimportant part of the building is reserved for offices, a showroom, education and a canteen.

Due to limited space, the building came to be partially situated in the existing fish pond. This meant that the building needed to fit in with its surroundings well. Following liaison with the user of the fish pond (a fishing club), the plan was developed in more detail. The ecological qualities of the surroundings were identified and these played an important role in the landscaping. Facilities for the fishing club were planned in. The result is a place where work, recreation and nature fit together seamlessly.

The site as a whole covers a surface area of 17 hectares. Of this, 29,745 m² is built on, 72,833 m² is water surface area, 28,293 m² is surfaced and 39,129 m² is natural. The building has a volume of 327,192 m³ and a gross floor space of 36,432 m². Of this 7,251 m² is office space. The building is 164 m wide, 243 m long and has a perimeter measuring 860 m.

Rainwater on the site is collected in a large retention pond. From there it can infiltrate the ground or drain away to the fish pond through a channel containing helophytes that purifies the water. The water also forms a natural barrier between publicly accessible areas and private grounds. Wherever possible, the design team assigned double functions to parts of the design. The channel with helophytes is a good example of this.

Jeroen Klerks (landscape architect):*"In the end it became one large ecosystem, tailored to the business operations and the surroundings, and based on existing elements, such as the fish pond, the old waste site and the flora and fauna present."*

The outdoor terrace

Relationship of the building to existing surroundings
Photograph: Peer van Rooij

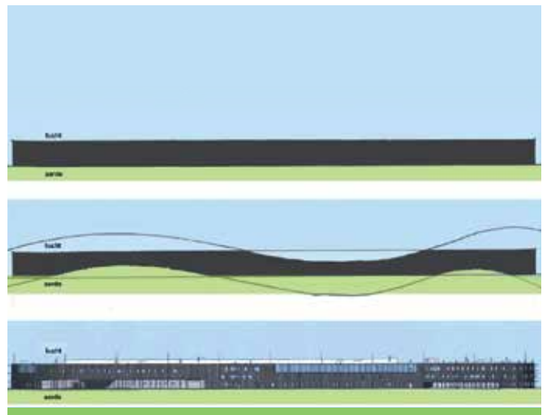
Together with the ecologist (Staro BV), the landscape architect looked at which areas of the site could be made particularly suitable for both those species already present and species important to the region. Indigenous trees and plants were used for landscaping the green areas. Particular attention was paid to the ecological qualities of the surroundings. Results included provisions for bats, kingfishers, little owls, sand martins and organic water purification. Special attention was paid to bats, which use the fish pond as foraging territory. The quality of the area was maintained by keeping an important row of trees in place and using amber-coloured, bat-friendly outdoor lighting. Bat boxes were attached to the walls of the building, too.

The new plants fit in well with the existing biotope and along with indigenous species go to strengthen the biodiversity present. Wooded banks were later added following consultation with the fishing club. These serve to separate the public road (Biesvendreef) from the fish pond and also serve as a nesting place and foraging area for small birds and insects.

Karel Kusters (ecologist): *"In addition to the measures required by the Flora and Fauna Act, more than sufficient measures were taken to ensure the greatest possible biodiversity on the site. The Venco Campus will serve as a regional ecological stepping stone for unusual plants, bats, birds, amphibians and insects between the wildlife areas to the east and west (De Kempen, De Wolfshoekse Heide and Oeienbosch).*

One of the breeding boxes for the little owl

Bat boxes are located behind the wooden panels



Venco Campus facade development

Amber-coloured, bat-friendly outdoor lighting

Future staff will have a lovely view and will be able to make optimum use of the rural surroundings during their breaks. The Vencomatic Group is not the only company privileged to work in such beautiful surroundings: its 'neighbour', HSV De Gender (the fishing club), has been able to move into a smaller version of the egg. In addition, the car park is open to the public and offers back-up parking capacity for the E3 beach nearby. The site is partially (70%) accessible to fishermen and ramblers. Safe routes for cyclists and pedestrians were planned into the landscaping of the site.

The design

The building is in the shape of a large egg. This organic shape fits in well with the company and makes the building look less colossal. The shape also gives the building a favourable volume in relation to the wall surface area, a positive aspect in terms of material use and energy savings. The way the building fits in with its surroundings is further improved by it being panelled with black, vertical planks (modified pine with an FSC label). By removing sections of these and replacing them with glass, the sky becomes reflected in the outer wall. Elsewhere plants have been incorporated in order to soften the look of the outer walls with greenery. This means that a boring, flat shape was avoided and "the egg" came to life.

Harrie van Lierop and Bert Spierings (architects): *"We wanted to erect a building that did not look too bulky in relation to the natural surroundings. The simplicity of the building and its colour scheme were also of importance. The agricultural landscape of the province of Brabant features many stables, sheds and barns that are painted black and this building is actually just a very big, modern barn. That is why the outside is panelled using preserved pine that is stained black."*

The largest section of the building is the industrial space. In order to make this a flexible area, this part of the building was constructed as one large space with an ingenious grid of columns (23.40 x 23.40 m). Loading and unloading take place inside the industrial space. This means that no goods are stored outside of the building, something that is also beneficial in terms of the building fitting into the landscape.

The industrial space was fitted with a sawtooth roof that lets in plenty of north light. This also allowed space for solar panels on the roof's sloping south faces. An extended stretch of the top sections of the exterior wall is glazed. This way more daylight reaches the industrial space and it breaks up the wooden exterior. At workspace level, windows have been positioned at very regular intervals, affording views of the natural surroundings.

Ground floor of the office area: in the center the showroom, on the left the entrance hall, on the right the cafeteria, above the auditorium, below the meeting places.

In the office section of the building, some daylight is let in through the exterior walls, but much of it also comes in through the glass roof above the atrium, which is centrally located in this section. The atrium is home to the Vencomatic Group's showroom on the ground floor. Flexibility in this section has been achieved through the use of a modular design and the use of a Slimline floor, combined with a raised floor. All facilities (lighting, sprinkler system, electricity, ICT, heating, cooling and ventilation) have been located in the floor and are available at any point, if the modular dimensions allow. The office section is made up of three floors. The ground floor accommodates the showroom, the canteen, meeting rooms, knowledge transfer areas and rooms for the use of third parties (30% of the office section is available for use by third parties). The other two floors are where staff carry out their work, mostly in open-plan offices with special areas for consultations and concentration. The office section is equipped with a lift, but also has four staircases for promoting contact between the floors and for limiting the use of the lift. A green wall has been incorporated into the atrium in order to bring the natural world even closer to the work areas. The wall adds a lot of atmosphere to the building and attracts the attention of anyone visiting it.

The structure

The basic structure consists of a steel frame with balanced dimensions, which reduced the amount of materials used. The height offered by the sawtooth roof, for example, was used to incorporate lattice trusses. Two consequences of this are a greater clear height and a light foundation.

The foundation is made up of footings with foundation strips and a retaining wall. This type of foundation was developed in cooperation with Van Berlo of Veghel. The foundation was fully prefabricated and then assembled and cast using infill concrete on site. Through the combination of footings, strips and a retaining wall, a 40% saving was made on materials and work, which reduced construction time by six weeks.

It was possible for the foundation to be light as a Slimline floor (a thin layer of concrete attached to steel IPE beams) had been selected for the upper floors and the roof of the office section. The ground floor of the industrial space is made up of reinforced concrete without a membrane that was directly poured onto a bed of crushed demolition waste. In mixing with the demolition waste, the mortar thereby formed a strong substrate. This method makes it possible to reduce the amount of concrete used.

Showroom with heat exchanger

A foundation element

The steel structure with Slimline floor

The shell

The exterior walls are made up of made-to-measure Kingspan sandwich panels with very high thermal resistance (Rc = 7.36 m^2.K/W). Prior to building, an investigation was carried out into whether the panels selected would be able to follow the curvature of the building without the risk of any air leaking out. Windows and doors were then incorporated into the exterior walls in accordance with the rhythm of the panels. High requirements were made of the airtightness of the exterior walls. Field tests relating to a number of crucial details were therefore carried out during building. The results of these tests resulted in improvements in the details. The exterior walls are covered with open wooden panelling. Sunblinds have been incorporated into this panelling.

The flat roof is traditionally constructed with profiled steel roof sheets, insulation and a roof covering. The insulation layer is composed so that it also achieves an Rc value of 7.4 m^2.K/W. A layer of bitumen was applied underneath the insulation in order to guarantee airtightness. White PVC was chosen as the roof covering. Kingspan sandwich panels were used on the sawtooth roofs and the solar panels were directly mounted onto these. The glazing in the sawtooths and in the windows in the industrial space is HR++. The office section windows are triple -glazed. The innovative aluminium frames were specially developed for this project by Thermoflor and have a U-value (thermal resistance) of 0.8 W/m^2K. A lot of attention was paid to airtightness in the details of the sawtooths. This was worthwhile, as following completion a blower door test was carried out and demonstrated unprecedented airtightness (Qv10= 0.14 $dm^3/s.m^2$).

Blowerdoor test by Isoproc

Flexible floor covering by TON

Systems

The industrial space and the office section are served by various ventilation, heating and cooling systems. Heat and cold are generated together for the various systems (in the plant room). The industrial space is fitted with underfloor heating and cooling. The industrial space also uses heat from the air extracted from the offices and the assembly area in the industrial space. Ventilation in the industrial space is natural. Heating, cooling and ventilation are integrated in the office section. The system has been incorporated into the flexible floors as much as possible and the floor plenum is used for transporting air. The showroom, constructed as an atrium, plays an important role in the ventilation system. At the top of it there is a heat recovery unit, developed by Agro Supply, a company of the Vencomatic Group. The green wall in the showroom is also an eye-catcher. However, this has only a slight influence on the conditioning of the indoor climate.

Finishing

Finishing was kept to a minimum. For the industrial space in particular no extra finish was applied to the structural work. Finishing work was carried out only to create the offices, the electrical engineering assembly area and the sanitary areas. This was done using either sandwich panels or metal stud panels and plaster fibreboards.

The interior of the outer walls in the office section was finished with false walls and plaster fibreboards. The closed parts of the layout were constructed in the same way. All of the plaster fibreboard walls were finished with Vescom vinyl wallpaper. The rest of the layout of the office section was achieved primarily using aluminium sections with glazing. The offices and the meeting rooms therefore form one transparent whole.

The upper floors of the offices are made up of a combination of Slimline floors and raised floors - floors made of smooth concrete slabs on the bottom with solid, recycled wood fibre tiles on top. These can be removed so that the systems lying underneath the floor can be reached at any time. It is for this reason that the floor covering is also made of tiles. Desso carpet tiles, which incorporate recycled materials, were selected for the offices and meeting rooms. Rubber Nora tiles were used in the canteen, showroom, sanitary areas, assembly area and hall. The assembly department is fitted with PVC tiles (100% recycled materials) made by BTB-Moulding.

The partitions for the offices and the meeting rooms are clamped between the floor and the ceiling and do not contain any systems. This makes it easy to move them if an alternative layout is preferred. No demolition work or waste is then involved.

The Venco Campus has turned out to be a unique building which, despite its large dimensions, is in harmony with its natural surroundings. This is mainly due to its receding walls, which means that the building never appears to be as big as it actually is. The subtle scale and colours of the exterior materials also contribute to this effect. The users of the building, those passing by and architectural critics are all enthusiastic about it.

Chris Manders (Eindhovens Dagblad): *"Industrial estates generally insult their surroundings with their merciless hardness and coldness, making no allowances. The Venco Campus is a positive exception to this rule: it has a pure beauty, with clean structures that follow the functionality of the building."*

The building site

BREEAM also makes performance requirements in respect of the building process and the building site. A lot of work went into ensuring that the Venco Campus building site was a good one, with the smallest possible environmental impact.

The building site was clearly laid out, with clear access roads for freight traffic and parking spaces for workers and visitors. The site hut could be accessed without entering the building site, was equipped with good sanitary facilities and was accessible to the disabled. Warning notices in several languages and with clear pictograms were positioned next to the entrance points. People in the surrounding area were informed about the building activities. A telephone number and an e-mail address could be used for making complaints and people living in the surrounding area were invited for a tour of the site during the building process. There were hardly any complaints.

There was just one site board at the building site and this referred readers to the Venco Campus building website. The website detailed the ambitions the project was aiming to fulfil and the parties involved in the build. Photographs also illustrated the progress being made. Involved parties and the Vencomatic Group's staff and suppliers were kept up to date with the design, the construction and the infrastructure of the building through 14 newsletters. Vencomatic Group staff were given a guided tour of the site, as were the municipal council, building cooperatives, members of industrial associations and students at the Eindhoven University of Technology.

In an environmental and sustainability policy plan and an ecological work protocol, the outlines were drawn for the building activities having the smallest possible impact on the environment. So, for example, FSC-certified wood only was used on the site, and the most energy-efficient lights were selected for illuminating the building site. As the building work was carried out under the client's own management, there was no possibility of a principal contractor having certification. The building site and the building process were therefore given ISO 14001 environmental certification as an independent activity. The certificate was obtained and during the final audit it was stated that the Venco Campus should be regarded as being an example to any building site. The building site manager was Lex Burgmans.

An important aspect of reducing environmental impact is waste management. A specialised waste processing company was brought in for this purpose. Baetsen BV of Veldhoven ensured that waste was not only processed correctly, but that any unnecessary waste was prevented. The waste processing company drew up a plan that prescribed the separation of waste into seven main streams from the start of the project. Three additional streams were later added, so that there were ten streams in total. Following completion of the project it became clear that 16 waste streams could be identified. A waste manager monitored waste policy. The company issued a statement that reported that 92.5% of the waste was recycled.

Waste containers by Baetsen

power consumption during construction:	**57,669 kWh**
water consumption during construction:	**2,142 m³**
(of which 940 m³ for filling the sprinkler tank)	
transport to and from the building site:	**551,036 km**

Systems

Energy neutral

The client's ambition was clear: the building had to be energy neutral. This would apply not only to the energy associated with the building itself, but also to the energy required by its users. This objective was achieved initially through aiming to make energy savings and then by generating sustainable energy on or near the building. The objective of a zero-energy building would not have been achievable without so much effort being put into saving energy.

If the Venco Campus had been built in the traditional way, then the building would use approximately 4,300,000 kWh annually. With energy savings, this figure has been reduced to around 1,240,000 kWh. It was possible to generate this amount of energy through putting solar panels on a large section of the roof.

The energy savings were achieved by building with high levels of insulation and airtightness, and by making plenty of use of daylight. Thermal heating in the summer is avoided as much as possible, and only energy-efficient equipment has been installed (the lift and the server, for example). A lot more additional energy was saved by using sustainable systems.

Heat recovery

An important principle for the design of the system was heat recovery. If a building is well insulated and very airtight, most heat is lost through ventilation. It is therefore important not to ventilate more than necessary and to reuse the heat from inlet air.

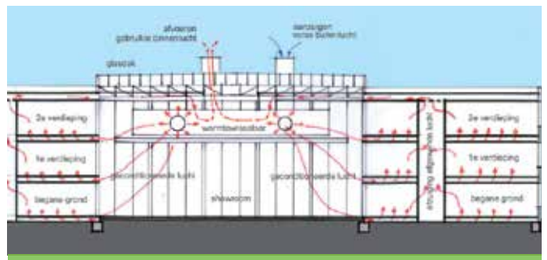
This resulted in there being no ventilation system installed in the large industrial space. The space is so large and so few people work in it, relatively speaking, that only a little ventilation is required for it. That ventilation occurs naturally as the doors are regularly opened and closed. The air quality in the industrial space is constantly measured, also because trucks drive through it daily. CO_2, NOx and CO meters have been installed. These are connected to the building management system so that the values can be recorded and so that an alarm can be sounded if concentrations are too high. Up until now the alarm has not been sounded and the CO_2 values are comparable with those of outside (approximately 350 ppm; the limit is 800 ppm, 50% more stringent than usual). The office for logistics and the electrical assembly area have been fitted with a balanced ventilation system, with the extracted air being transferred to the industrial space. This means that 100% of the heat in that air is used for heating the industrial space.

The energy use of the Venco Campus in comparison to traditional construction

	traditional construction	Venco Campus
electricity	1,100,000 kWh/j	740,000 kWh/j
heating	3,200,000 kWh/j	500,000 kWh/j
total	4,300,000 kWh/j	1,240,000 kWh/j
solar panels		1,300,000 kWh/j

An impressive system

The inlet air in the office section is measured at several points for its CO_2 content. If the quality of the extracted air is significantly under 800 ppm and therefore is good enough to be used for ventilating efficiently, then the air is recycled. This means that there is 100% heat recovery in the building. If the extracted air is too polluted or is too warm, then it is blown off and fresh air is drawn in. Using a heat recovery unit, the heat from the extracted air is transferred to the supply air. The unit performs at 84% efficiency and is situated at the top of the showroom in a visible position.



Cross section of the office area with air flow for ventilation, heating and cooling

Heating and cooling

Heat pumps that can achieve an efficiency of 486% (COP = 4.86) are used in the Venco Campus for heating and cooling the air. The three heat pumps, with 2,130 kW of power in total, are connected to a thermal energy storage unit (TES).

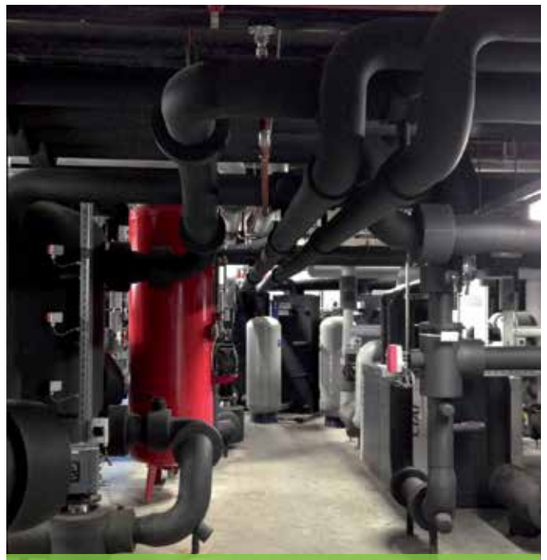
Six doublet wells approximately 40 m deep were sunk around the building by GEBO of Dessel (Belgium). The cold wells are located on the east side of the building with the warm ones to the west.

In winter, heat is withdrawn from the warm wells and the heat pumps make the heat suitable for using to heat the spaces. The by-product of cold resulting from this heating process is stored in the cold wells. These are then used for cooling the building in the summer, without the heat pumps being used. Only the air-conditioning units are actively cooled by one of the three heat pumps. The by-product of heat that results from this is initially transferred to the building system or is stored in the ground or the well on a temporary basis.

In the plant room, the heat or cold is exchanged through three exchangers and is stored in buffer tanks. In the buffer tanks, the water is brought up to temperature by the heat pumps. The temperature in question is 30 to 40°C, which is sufficient for a low-temperature system and conditional for the heat pumps being able to work efficiently. The ground floor of the industrial space and the showroom is fitted with underfloor heating and cooling. The underfloor heating is the basic source of heating in the industrial space. It was decided not to attach radiant panels to the ceiling as they would have made the steel structure of the space heavier. The large area covered by the industrial space (approximately 27,000 m2) is ideal for bringing heat back into the thermal energy storage system through cooling, thereby restoring the balance in the ground.

The offices, meeting rooms and canteen are conditioned by heating or cooling the inlet air. The air-conditioning unit with heating and cooling units is connected to the heat recovery unit. From here, the conditioned air is blown into the atrium through two high-induction fabric hoses. The air is then extracted from the atrium using speed-regulated fans in the raised floor and blown into the various offices and corridors. Floor diffusers have been fitted into the floor for this purpose. The amount of air/fresh air for the office section is determined on the basis of the CO2 content and the desired temperature. The air in the office section is extracted using four extractor fans in the central shafts. A dry cooler on the roof of the office section is used for removing excess heat from heat pumps when they are in cooling mode and/or from the MER and SER room. This cooler also removes heat for the purposes of restoring the energy balance in the TES system.

One of the 12 wells, built by GEBO



Plant room by ENVO

Indoor lighting

The basic temperature of the air in the offices can be adjusted (by +/- 2°C) using recirculation units in the floor plenum. Staff are able to operate these units themselves by logging on to the building management system. The system is controlled on the basis of 54 CO_2 sensors and 184 temperature sensors. All of the sensors are connected to the building management system. The grilles are incorporated into the tiles of the raised floor and can therefore easily be moved. This makes the layout of the offices and the way in which they are used flexible. The systems in the floor are accessible at any point.

The heating and cooling for the separately located offices for logistics and electrical assembly work along the same lines, but small conditioning units specially for this purpose are situated in the industrial space. The system for ventilation, heating and cooling was designed and put in place by the ENVO GROEP BV of Eindhoven.

Lighting

LED lighting was selected as lighting for in and around the building. It was chosen for its energy efficiency, adjustability and long lifespan. The lighting was designed by Philips, which also supplied the various light fittings. The lighting for indoors is controlled by the amount of daylight there is and by the presence of people. The Philips lighting controls in the industrial space and the TACS lighting controls in the offices are connected to each other.

In the industrial space, a distinction is made between the area where goods are set ready and the area with the storage racks. Additional sensors were mounted between the storage racks in order to be able to regulate the desired level of lighting per warehouse corridor.

The light fittings in the offices were mounted in a grid pattern measuring 2.34 x 2.34 m. The lighting is controlled through the building management system. The amount of artificial light is automatically adjusted to the daylight available. Users of the offices can log in to the building management system and adjust the level of lighting in their working environment.

Indoor lighting

Outdoor lighting

Sunblinds

Sunblinds (screens) have been mounted on the sunny side of the building where the rooms are occupied. The objective of these sunblinds is to prevent sunlight shining into the building (heating) and to prevent light nuisance (on monitors). The sunblinds react automatically to the conditions outside (the weather and geographical orientation) and can also be infinitely adjusted by individual users by logging into the building management system.

Sustainable energy/solar energy

The sawtooth roofs on the industrial space were designed to offer an ideal position for solar panels on their south side. The solar panel system was designed and installed by Alius Energy of Eersel. During the design phase, it was forecast that in order to be energy neutral, the required energy would be 1.3 million kWh. The number of PV panels put in place was based on this: 5712 with a peak of 285 watts.

The SolarEdge inverter is split into an optimisation module per panel and a central control box that controls the modules and converts the module voltage to a mains voltage (approximately 49 optimisation modules per inverter: number of inverters - 119). The functioning of the panels can be read at a distance.

Sprinkler tank

The average yield calculated for the solar PV system is 1,400,000 kWh per year (including 20% degradation after 25 years). This compares to estimated consumption for the building and for usage of 1,326,000 kWh.

The building's electrical system has been checked for "higher harmonics", caused by the solar PV system in combination with the LED lighting. Measures have been taken to prevent problems occurring.

Ton van de Ven (Alius Energy): *"Using this system, there is no risk of electrocution during assembling or in case of fire (firefighter safety). The PV system switches off up to each Solar panel if a malfunction occurs, as a result of a cable breakdown, for example. In addition, we are able to monitor each solar panel individually, so that we immediately know exactly where a problem is located."*

Sprinkler

As a flexible building was required, no fire compartmentation was involved. It is for this reason that, early on in the design process, the decision was made to install a sprinkler system. With sprinkler systems, the automatic assumption is that ceilings are flat. This made it difficult to obtain a certificate for the system. The world of manufacturing, consultancy and certification appeared to be very closed off and unwilling to help think in solutions. But the tenacity of the client finally led to a solution being found. The sprinkler system was designed and installed by the ENVO GROEP BV.

Building management system

The cherry on the cake where systems at the Venco Campus are concerned is an advanced building management system. The system was set up in order to support the objectives in terms of sustainability and to make managing the systems easier for the facility manager. The building management system ensures that the systems heat, ventilate and cool efficiently.

The building management system makes it possible for each individual user to have an influence on the conditions around his or her work area (temperature, lighting, sunblind). The building management system also generates information about the functioning of the system and makes this visible.

The following are connected to the building management system:

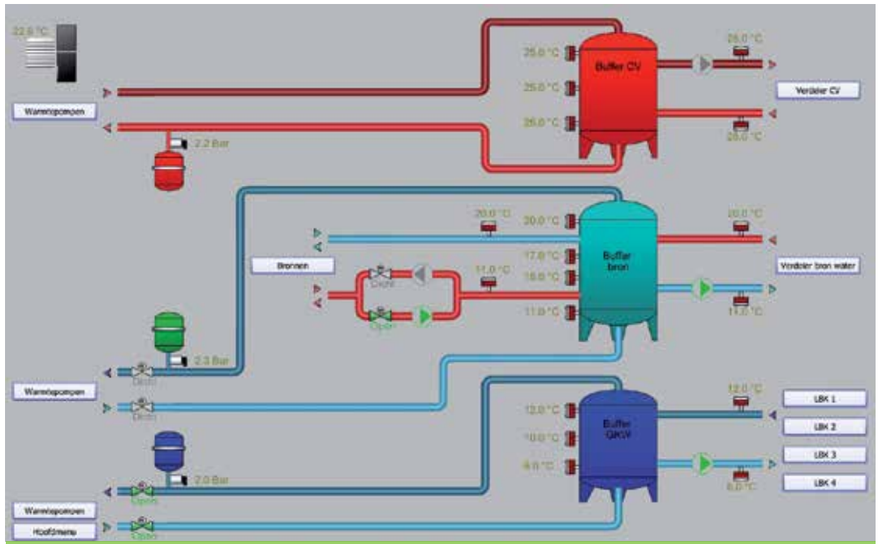
- **the ventilation, heating and cooling system**
- **the sunblinds**
- **the solar panels**
- **the electrical system and the lighting**
- **the admission system, video surveillance, CCTV system and intercom.**
- **the fire protection system and the burglar alarm system**

The system works on a three-step basis: measure, compare and improve. All of the information from the various systems is processed as a whole. The building management system is a Schneider StruxtureWare unit and was installed by TACS BV. Through a combination of monitoring and controlling the energy consumption of all of the systems, energy savings of 30% can be achieved.

Various performance data for the building and its systems are made visible through an information display unit in the reception area. The unit was presented by TACS/Schneider.

The result

In September 2013, the building had been in use for one year. In that year a total of 1,432,573 kWh of electricity was used. The solar panels on the roof generated 1,446,372 kWh of electricity over the same period of time. Note should be taken of the fact that in this first year the systems, and in particular the building management system, were not yet optimally adjusted. The expectation is that consumption will therefore decrease over the coming year. On the basis of both the calculations made in advance and the results of the first year, we can state that the Venco Campus as a whole is indeed a zero-energy building.



Building Management System display

Building use

In drawing up the schedule of requirements, the existing situation serves as an important point of reference. In the case of the Venco Campus, lessons were of course learned from experience, but a lot of thought was put into future use. There was the realisation that a move would bring a lot of changes and would offer great opportunities.

Where logistics are concerned, this resulted in the decision to concentrate loading and unloading inside the building. This means that work can always be carried out under good conditions and that there is no inconvenience for the surroundings. A rest and wash-and-brush-up area, open 24/7, is available for drivers who have come a long way.

Inno-Experts were brought in to advise on the use and the layout of the office section. They looked at the users' work processes in great detail. Based on their observations, they presented recommendations for modifying the layout and the routing. It was recommended that the ground floor be reserved for reception, meetings, consultations and knowledge transfer, and that the offices be set out as open spaces with informal meeting points, flexible workspaces and quiet booths for making telephone calls. The recommendations were supported by calculations indicating their influence on operating costs. This allowed the client to consider matters from a broader perspective when deciding whether to invest more now in order to earn back that investment during operation.

Marloes Kursten (Inno-Experts): *"We make recommendations about business premises and in doing so study the processes of the end users of the building closely. We consider how the premises can best be made to match requirements now and in the future. Generally, the total cost of construction for a building is concentrated on, while premises make up an average of around 10% of the total operating costs, but do have a strong influence on them. Making smart investments in premises can therefore result in considerable savings in operating costs."*

The recommendations served as a confirmation of the ambition to construct a flexible building - a supple building that is able to move with the changes in the organisation. The floor structure in the office section is extremely important in terms of that flexibility. The floor accommodates all of the required facilities and they are accessible at any point and easily moved. The walls are clamped in place between the floor and the ceiling, do not contain any facilities and can be easily rearranged.

Auditorium

One year on from when the building was first occupied, it can already be stated that the goals set have been achieved. The staff are very happy with their new working environment and improved performance of 10% has been realised through improved cooperation.

One of the most striking aspects is the use of the ground floor by third parties. It is used intensively by both companies and organisations within the region and those further afield. The numbers have exceeded all expectations.

Koen Boot (Vencomatic Group): *"The thing we were most concerned about was the climate in the offices. The concept is no run-of-the-mill one, but working together with the contractors, we managed to come through a cold winter and a hot summer well. All of the facilities processes turned out to work as well in practice as we had anticipated. This makes the Venco Campus such a great working environment, particularly when combined with the fantastic landscape surrounding it."*

BREEAM also made requirements in terms of the accessibility of the building. A transport plan with the aim of reducing CO2 emissions was therefore drawn up. A bicycle scheme, a bicycle storage space within the building (with charging points) and safe cycling routes were included in order to stimulate the use of bicycles. The Venco Campus is not situated close to any public transport stops, so a shuttle bus drives between the Venco Campus and the nearest bus station in order to collect staff and visitors and take them back to the station. An information point, at which information about public transport (buses, trains, planes) can be found, was set in the reception hall of the Venco Campus.

The Venco Campus also anticipates the development of electric transport. Twelve charging points for electric cars have been installed in the car park.

The Venco Campus was intended to provide a comfortable and healthy working environment. By investing in a healthy indoor climate, a transparent building with plenty of daylight and views of natural surroundings, this objective was achieved. The green wall in the showroom that can be seen from almost every work area is a supplementary bonus. Over the coming years it will become clear whether all of this has improved work performance.

Conference room

Charging points for electric cars

Information point for public transport

Innovations

The Vencomatic Group comprises innovative companies that are always looking for improvements and new products. The Venco Campus is a good reflection of the character of these companies. The building is not a standard one, but is special and unique.

BREEAM not only awards credits in line with the nine categories defined, but also gives points for innovation (a maximum of 10%). Firstly, innovation points can be scored for Exemplary Performance (EP) in association with a number of credits. This means that performance is exceptional for the particular component in question. The Venco Campus achieved seven EP points, amounting to a score of 9%.

BREEAM also allows projects to make their own suggestions for innovation points. These are measures that are not yet included in the assessment guideline, or are not yet prominently included, but do improve the sustainability of the building. Nine such measures were detailed for the Venco Campus (including the flexible floor structure, the use of SPIN, green in the working environment).

However, once it became clear that just one more point could be scored with these innovations, that assessment of them would take up a lot of time, and that the score required for an 'Outstanding' rating had already been achieved, they were not formally submitted. But they are measures that underline the innovative nature of the construction process and the Venco Campus building itself.

Exemplary Performance:
- **Environmental impact of building site**
- **5 optional management measures**
- **CO_2 reduction; energy efficiency**
- **Use of sustainable energy**
- **Alternative transport**
- **Water meter**
- **NOx-emissions**
- **Waste management for the building site**

A number of products were specially developed for the Venco Campus or were used for the first time. For Connecting Projects, it was the first time that SPIN had been used in practice. Thermoflor used frames in the outer walls that came straight from the drawing board, and the same applied to a number of LED light fittings from Philips. It was the first time that Renders had planted a vertical garden, and it was one that also happened to be indoors, was very large and was equipped with an irrigation system that uses no more water than strictly necessary.

The main innovation, however, was the fact that the Venco Campus proved that building work can take place in a transparent way and can lead to better results. There is more space for innovations if the building method is different. It means that a project environment comes into being that allows for knowledge integration as responsibilities and revenue models are not strictly separated.

Afterword

Facade of wood and "air"
Photograph: Peer van Rooij

In September 2013, the Venco Campus was awarded BREEAM certification with an 'Outstanding' rating. This meant that at that time it was the most sustainable building of its type (industrial/ office building) in Europe.

Initially, a rating of 'Excellent' was the aim, but towards completion of the project, it became clear that a rating of 'Outstanding' could also be achieved. A score of 85% or more is required for an 'Outstanding' rating. Please refer to the table below for our score. In order to achieve a high score with BREEAM, the sustainability performance criteria need to be included in the design and execution of the project from the very start.

Category	Score for industrial space	Score for offices	Mixed score
Management	10.40 %	10.40 %	10.40 %
Health	13.64 %	11.25 %	13.13 %
Energy	17.54 %	17.54 %	17.54 %
Transport	7.33 %	7.33 %	7.33 %
Water	4.00 %	4.00 %	4.00 %
Materials	2.88 %	2.88 %	2.88 %
Waste	6.25 %	6.25 %	6.25 %
Land and ecology	7.27 %	7.27 %	7.27 %
Pollution	7.50 %	7.50 %	7.50 %
Innovations	9.00 %	9.00 %	9.00 %
Totals	85.82 %	83.43 %	85.30 %

Evidence for the points scored was submitted by the construction team. An independent assessor verified the evidence and submitted this, together with an assessment report, to the DGBC (Dutch Green Building Council). It was this organisation that ultimately awarded the certificate.

Paul Zonneveld (assessor): *"When I was asked to submit a quotation for a BREEAM assessment for the Venco Campus in 2011, and once I had heard about the ambitions and seen the plans for the project, I immediately wanted to be a part of it. The atmosphere surrounding this project and the plans already in place made it clear that this was a project that would really put sustainable building on the map. After an initial meeting with Cor van de Ven and finding out that he was putting his entrepreneurial drive behind the project in order to make it a success, I was ever keener to be a part of it."*

Mayor Thijs (municipality of Eersel): *"The current location of the Venco Campus was not an obvious one in terms of planning. However, Cor van de Ven managed to convince the council of his high ambitions in terms of sustainability, innovation, energy neutrality and landscaping. It is good to see that he achieved all of his ambitions."*

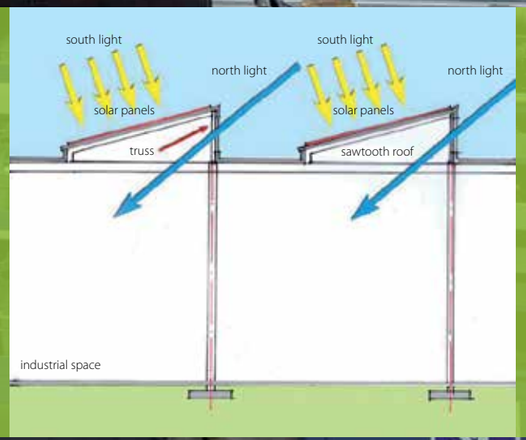
The BREEAM certification process was new to all of the parties involved. In such cases it is important that all of the parties are open to working with the process, even if this means changes to usual practices. By involving all parties, including the assessor, in the project right from an early stage, BREEAM could be taken into account from the very beginning. The BREEAM assessment guidelines (BRL 2011 V1.0) were applied in the preparation of designs, drawings, contract documents and calculations. The right experts were involved in the project in good time. An efficiency drive such as this is important in terms of keeping the costs and time associated with an assessment in hand.

In the Netherlands (and also further afield), BREEAM is now generally recognised as being the right aid for giving structure to a sustainable building project and making it open to discussion among all of the parties involved.

Paul Zonneveld (assessor): *"Through my experience in using this instrument and the results of other projects, it has become even clearer to me that the Venco Campus really stands out when compared to other projects. Carrying out this assessment was an educational experience for me."*

BREEAM® NL

Using the BREEAM methodology not only resulted in a great certificate, it also made a contribution to the building being better, as it presented opportunities for specifying qualities and for measuring them. In those terms, BREEAM dovetailed well with the open and transparent building process.
An efficient and innovative method was sought for building the Venco Campus. That method was found through making clever combinations and by deviating from the usual paths. One example of this in the design is the sawtooth roof. For the building process, the combination of building under one's own management, Smart Building, BREEAM and SPIN proved to be a strong approach.



In building the Venco Campus, alternative paths were often taken. They were not always the easiest paths to take, but they did produce better results, both qualitatively and financially. This most sustainable of buildings was not more expensive to construct than a traditional building, and it is certainly not more expensive in operation.

This must be an indicator for the building world that the time is ripe for a different approach. The current crisis has hit the building sector hard and is definitely grounds for thinking about how things can be done differently, and how they can be improved. Lessons can be learned from the Venco Campus.

Cor van de Ven: "What I would really like is for large construction companies to do something with this example. I am not saying that the Venco Campus is the be-all and end-all, but I do think that this method of building can offer the building business in the Netherlands possibilities, including financial ones."

The following parties contributed to the realisation of the Venco Campus:

Van de Ven Beheer bv	Client	www.vencomaticgroup.com
Municipality of Eersel	Development plan and infrastructure	www.eersel.nl
Province of North Brabant	Physical planning and economy	www.brabant.nl
Van Lierop Cuypers Spierings	Architecture and procedures	www.vanlieropcuypersspierings.nl
Greencurve	Landscape architecture	www.greencurve.nl
P&H Adviseurs Bouw- en vastgoed bv	Building management	www.phadviseurs.nl
Adviesbureau Ad van de Ven	Sustainable building and BREEAM	www.advandeven.nl
3Dplus1 Bouw + Vastgoed	Planning and purchasing	www.3dplus1.nl
Lex Burgmans Bouwbegeleiding	Building site manager	www.lexburgmans.nl
Connecting Projects	Information management (SPIN)	www.connectingprojects.com
Inno-Experts	Usage consultancy	www.inno-experts.nl
Staro bv	Ecological advice	www.starobv.nl
Adviesbureau Kerkers BV	Construction	www.kerkers.info
Van Beers Hoogeloon	Civil-engineering works	www.vanbeershoogeloon.nl
Strijbos	Garden landscaping	www.strijbosgroen.nl
Van Berlo	Foundations and ground floor	www.vanberlo.com
Moeskops Staalbouw	Steel construction	www.moeskops.com
Ad van Diessen Dakbedekkingen	Roofing	www.vandiessendak.nl
Kingspan	Exterior wall panels	www.kingspan.com
Thermoflor	External frames and glass roof	www.thermoflor.com
Kempen Cladding	Cladding	www.kempencladding.nl
ENVO GROEP BV	Systems	www.envo.nl
Boerboom Hout	Wood, indoor and outdoor	www.boerboom.nl
Baetsen	Waste management	www.baetsen.com
Alius Energy	Solar panels	www.aliusenergy.nl
TACS	Building management system	www.tacontrol.nl
Philips	LED lighting	www.philips.com
Desso	Floor covering	www.desso.com
Renders	Green wall	www.renders.nl
E3 interieurbouw	Interior	www.e3interieurbouw.nl
GEBO	TES system	www.gebo.be
ISOPROC	Blower door test and thermography inspection	www.isoproc.be
TON projectstoffering	Floor coverings	www.tonprojectstoffering.com
Flynth	Tax allowance schemes	www.flynth.nl