



Government Service for Land and  
Water Management  
Ministry of Economic Affairs



# Schiphol Trade Park

Bio-Based Economy cluster &  
cellulose as raw material for a circular economy

march 2014





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# Inhoud

page 2: Artist impression the Valley  
Schiphol Trade Park

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# Schiphol Trade Park & the Bio-Based Economy cluster

Schiphol Trade Park is a new business park close to Amsterdam's Schiphol Airport and the A4 motorway. It is a multifunctional, sustainably developed area with possibilities for a diversity of trade and logistics. Created by the Schiphol Area Development Company (SADC), the municipality of Haarlemmermeer and Schiphol Real Estate, this site combines a spacious park-like setting with an excellent BREEAM\* environment for innovative business. The area termed the Valley is especially suitable for companies, wishing to contribute to the creation of a bio-based economy.

## Phased development of Schiphol Trade Park

The development of Schiphol Trade Park will be carried out in phases over a period of around 30 to 40 years. However, future developments may well reduce this timeframe. The next decades will see a transition from an agricultural landscape to a landscaped environment that is innovative and sustainable. The area surrounding the road called Rijnlanderweg will be developed first, with an Expocenter also serving as educational headquarters at the heart of the enterprise. The phased approach allows for temporary productive use of the agricultural land, for instance by cultivating Tallgrass, *Miscanthus sinensis giganteus*, or other crops playing an important role in the creation of a bio-based economy.

## Partners in the Bio-Based Economy (BBE) cluster

Schiphol Trade Park, Wageningen University Research Department (UR) and the Miscanthus-group have signed an agreement to cooperate in trial cultivation of tall grass and other crops with economic bio-based potential. The large scale trial cultivation of tall grass, known as THE GREEN DEAL, resulted from an agreement between the Ministry of Economic Affairs (Government Service for Land and Watermanagement), Ministry of Infrastructure and Environment, the Miscanthus-group and Wageningen UR.

## Our Joint Mission

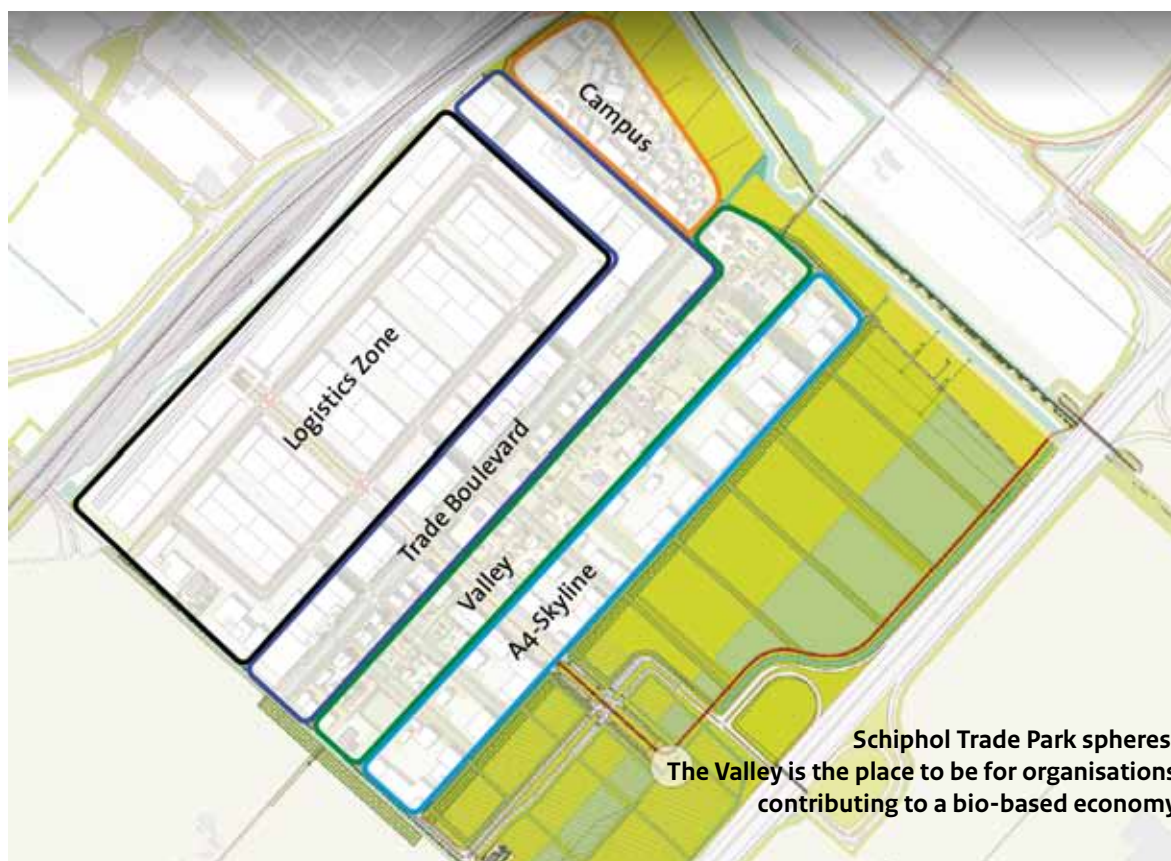
- Sustainable logistics
- Bio-based economy
- Sharing and developing knowledge
- We are developing an innovative industrial area where cellulose as raw material will be grown and processed in a fully sustainable cycle.
- We aim to apply this technology in innovative concepts together with national and international partners.
- We wish to achieve this by organising international knowledge exchange in close cooperation with our own knowledge institutions along with other prime movers in commerce and industry.



Artist impression birds eye view Schiphol Trade Park

\* BREEAM is the world's foremost environmental assessment method and rating system for sustainable buildings

## Schiphol Tradepark & the Bio-Based Economy cluster



This 'Green Deal' aims to investigate the effect of tall grass on the population of geese around airports while exploring sustainable businesscases for the crops. The same participants cooperate in the development of a bio-based economy cluster. In addition these partners collaborate with The SOLID GROUNDS BV and the group known as BetterBeGreen, in building a network of knowledge based companies within the bio-based economy cluster.

### The Bio-Based Economy cluster includes

- **Bio-Based Economy Expocenter** (page 6 - 7)
- **Trial cultivations** (page 8 - 11)
- **Educational programme**  
Education and research related to the cellulose cycle chain and a circular economy within a landscape of trial cultivations.
- **Network of knowledge institutions and companies**  
Sharing knowledge and developing research in primary, and high-end production, working together with other prime movers, be they national or international, universities and research insitutions both public and private world-wide.



# Bio-Based Economy Expocenter

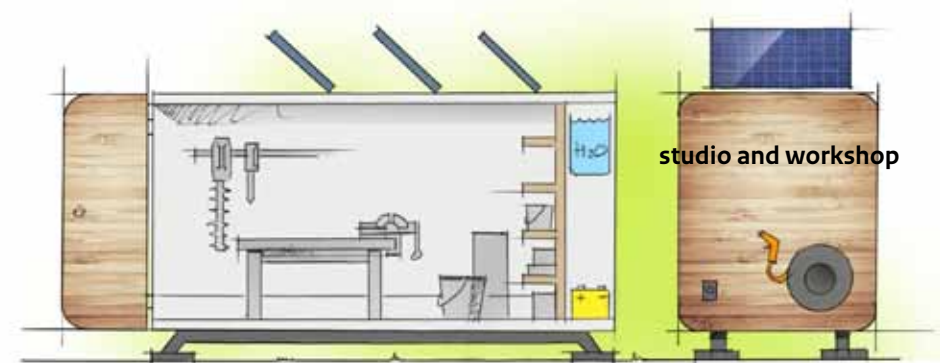
A former private house on the Rijnlanderweg road, and the surrounding area is being transformed into an exposition- & experience centre, to visualise the sustainability concept of the Schiphol Trade Park. Designed to attract a broad international audience, it will present potential applications for bio-based products and provide opportunities for companies to showcase their methods and products. It will also provide opportunities for students to do research on potential products and applications based on tall grass and other crops. The centre is located at the heart of the trade park, south of the nearby town of Hoofddorp and to the west of the main Schiphol airport.



Rijnlanderweg 958: exposition- and experience center in development



Design for paper tube construction  
by: Shigeru Ban



First sketches and design for possible reuse of terminal bridges Schiphol.  
Design innovation lab 2013



## Bio-Based Economy Expocenter

### What will the Bio-Based Economy Expocenter offer?

The Expocenter is about seeing and experiencing:

- Expositions on new materials
- Ideas for sustainable recycling, for instance re-using the Schiphol terminal bridges
- The processing of materials into for example non-polluting fuels, kitchen utensils, bottles and furniture
- Research by students on potential new bio-based products and applications
- Interactive symposia, involving national and international companies and knowledge-based institutions.

The Expocenter opened on the 16th October 2013. It displays new products, new developments and possible new applications for the crops grown. The Tall grass field trials, together with the bio-refinery to be established for the processing of tall grass, will visualise the entire chain from sowing up to processing a whole series manufactured goods as well as possibilities for different forms of use.

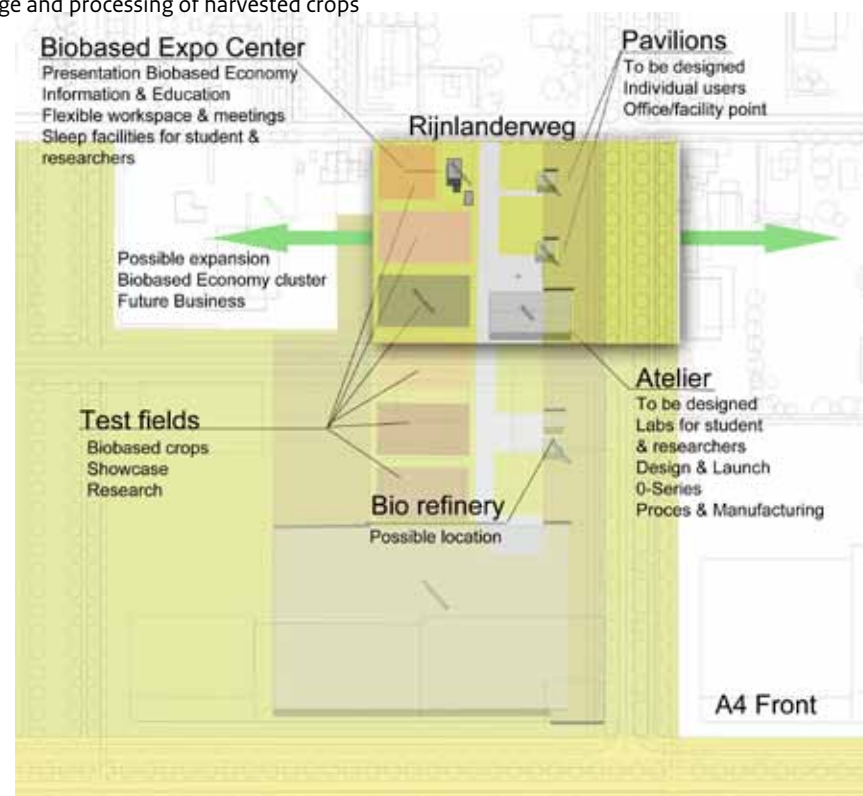
### Sustainable design and growth

The Expocenter will develop over time. Currently the Expocenter provides meeting and reception rooms, space for exhibitions, film and visual displays as well as student accommodation. The Expocenter is conceived as a story-telling location and a breeding ground for research on the application of tall grasses and other relevant crops. The Expocenter will expand to suit future developments. The design will focus on developing a centre low in energy & carbon footprint and in balance with the concept of a sustainable and bio-based economic development, including recycling.

### Expansion and development

The Expocenter plan shows future possibilities along with the existing elements. Additions to be realised will include:

- Two (bio)refinery units
- Studios for product design and manufacturing
- A showroom for bioplastics, shop fitting, furniture and bio-based building materials
- Small fields for trials and small-scale demo cultivation of crops
- Large scale storage and processing of harvested crops



# Planting plan and Tall grass (Miscanthus)

The strategy of Schiphol Trade Park is to develop an area that is innovative in all its aspects and where sustainability is of paramount importance. The cultivation of tall grass during the development stage adds to the image of sustainability and innovation. It offers possibilities for a circular economy and it has great advantages for aviation safety at Schiphol Airport, as it substantially reduces the risk of birdstrikes.

## Cultivation of Tall grass (Miscanthus)

The planting plan for Tall grass (*Miscanthus sinensis giganteus*) is designed to accommodate flexible use and warding off bird flocks for aircraft safety.

- Tall grass was found to be unattractive to geese and other bird flocks thus preventing collisions with airplanes at Schiphol International Airport. Growing Tall grass offers an attractive alternative to compensating farmers financially for early plowing of leftover grain and straw.
- Tall grass appears to provide opportunities for a more sustainable crop rotation. The economic competitiveness is currently being tested by the Miscanthus group.
- Tall grass cultivation combines effective noise reduction and substantial capturing of carbon dioxide contributing largely to prevent climate change.

## Planting plan and landscape design

Schiphol Trade Park has currently reserved 85 ha. for a trial on Tall grass cultivation. The planting plan takes into account future business development in the area. Patchwise planting of Tall grass enables research on required volume and maximum planting distances between Tall grass cultivations for these to be bird flock repellent.

The Expo center at the Rijnlanderweg is incorporated in the landscape design.





## Planting plan and Tall grass

### Application of Tall grass

The biomass production of Tall grass (*Miscanthus sinensis giganteus*) is very high, and it can be used as fodder for cattle or as a sustainable energy crop. In addition the high elasticity of the stalk makes the plant very suitable as raw material for building materials. It can be used in chipboard, and is currently incorporated in a certain brand (Xiriton) of reinforced concrete, which captures carbon, is very light, tough and strong.

With sufficiently large volumes of Tall grass production, refining the Tall grass to biopolymers will be a viable option. These biopolymers can be used as raw material for bioplastics, textile and biokerosine.



Tall grass briquettes



Tall grass torrefied



Tall grass pellets



Schiphol in view through Tall grass plantation



Tall grass harvest Haarlemmermeer april 2013

# Crops for the Bio-Based Economy (BBE)

Since trial cultivation started by local farmers of the Miscanthus-group in spring 2013, Schiphol Trade Park shows a bright palette of colours. Mixed in with 60 hectare of tall grass they planted various other crops on a small experimental scale. The smaller scale cultivations seek to determine their potential contributions to a Bio-based economy. In the spring of 2013, sorghum, poppy, hemp, flax, quinoa, mustard, rapeseed and fodder radish were sown. To stimulate the curiosity of researchers and future users, the Miscanthus-farmers also planted a 'mystery-crop'. Students from different educational programmes will be engaged in the research on cultivation of different crops. Research and development will take place in and around the Expocentre.



Flax, Fodder radish and Poppy in bloom

## Poppy

Poppyseed is a historic crop in the Haarlemmer-meer region; poppy was widely grown in the western part of Holland. Poppyseed is used to decorate bread. The Miscanthus-farmers want to re-introduce this crop, as it is attractive, both because of the beautiful red flowers, and financially.

## Hemp

Fibre hemp is a variety of cannabis (*Cannabis sativa*) that is primarily cultivated for the fibres and is not hallucinogenic. At Schiphol Trade Park hemp is cultivated as an energy source and a building material. Hemp is also known to repel birds. Hemp fibres are a beautiful and versatile material. In the past, hemp yarn was indispensable for shipbuilding, especially for ropes and sailcloth. Hemp was later replaced by cheaper materials such as sisal and jute.

## Quinoa

Quinoa (*Chenopodium quinoa* Willd.) was cultivated by the ancient Inca people of South America. The word Quinoa means 'mother grain' or 'super grain'. The Incas used the seeds as rice and regarded Quinoa as their 'holy food'. Quinoa has a high nutritional value; it is rich in high-quality protein and other important nutrients. Quinoa is rapidly becoming very popular, because of its organic cultivation and its status as 'superfood'. Quinoa is bird repelling, and it provides a food alternative for the foodcrops currently grown.



## Crops for the Bio-Based Economy (BBE)

### Sorghum

Sorghum is one of the oldest grain species worldwide. However, it is not very well-known in the Netherlands and Europe. Sorghum cultivation is very beneficial on fallow plots to help control nematodes (parasitic worms). In addition sorghum considerably increases the amount of organic matter in the soil, and it repels birds. The goal of the trial cultivation of sorghum is to measure the energy value of the crop. The plant produces a large amount of biomass. Levels of production may reach over 70 tons of fresh weight per hectare. This implies that it may be a useful crop for bio-fermentation, one of the proposed means to achieve the sustainability ambitions of Schiphol Airport. In time sorghum might be fit for consumption, but this will require special harvesting procedures.

### Flax

Flax is often cultivated in crop rotation with grain and rapeseed. The seeds of flax contain high quantities of oil: up to 40%. Planted in March, the fields turn blue with flowers in June and are harvested in August when the flaxfields have turned golden. The oil is used in food, pharmaceuticals, fodder and industrial uses, e.g. in linoleum, floors and paints. The cultivation at Schiphol Trade Park aims to study the possibilities of the oil as resin in polyester. Whilst bio-based polyester already exists in the USA, the resin component is not yet bio-based. The research may lead to Linseedoil-based manufacturing of resin- and polyester-based products.

### Rapeseed and mustard

In the summer of 2013, yellow lanes of flowering rapeseed indicated the future layout of Schiphol Trade Park infrastructure. Rapeseed is cultivated for the oil. Mustard is sown on the small lane where a pipeline for gas will be installed. The mustard plant is a small annual plant with yellow flowers. It is often mistaken for rape which looks similar and is also related. Seeds of mustard are smaller, approximately 0,5 to 1 mm. It is used especially in the Netherlands and Belgium as a condiment for seasoning.

### Fodder radish

Fodder radish (*Raphanus sativus* subsp. *oleiferus*) is a variety of winter radish that forms few tubers. It is used as a green manure and enhancer of the soil quality. The Miscanthus-group planted horse radish in those areas of Schiphol Trade Park where soil structure improvement was most needed for the cultivation of other crops. Fodder radish is cultivated for seed production.

### 'Mystery crop'

The mystery crop was hardly cultivated in Europe before 2011. The mystery crop is a perennial, like tall grass. From the second year onwards, the crop may reach a height of 3 metres. The crop has a high lignin content; lignin is more valuable than cellulose. However, extracting the lignin is a difficult process. Research focuses on ways to separate the pure high quality substances in the crop to enable development of high end products thus increasing the crop's potential to create new cost-effective cyclic production chains.



View from Rijnlanderweg 958: sorghum, mystery crop and Tall grass

# Cellulose Cycle Chain (C3)

The circular economy is a framework that builds on insights from living systems. It includes a shift from fossil fuels to the use of renewable energy, and the role of diversity as a characteristic of resilient and productive systems. It considers that our systems should work like organisms, processing nutrients that can be fed back into the cycle, whether biological or technical, hence the “closed loop”. Schiphol Tradepark and especially the area designated as ‘The Valley’ offers an ideal environment for companies in search of new opportunities in the bio-based economy.

## Cellulose Cycle Chain (C3)

Planting 60 hectares of Tall grass at Schiphol Tradepark enables the participants of the Bio-Based Economy cluster to process an estimated 1200 tons of raw material yearly. The cellulose harvested from Tall grass and other trial cultivations is excellent research material.

In January 2014 equipment was installed to investigate possibilities to develop different semi-finished products as a first step towards manufacturing end products in a cellulose cycle chain.

Factors in the production process to be tested are grinding, additives and compounding. Variation and a range of different combinations will eventually lead to the specific characteristics needed for a range of high end products

## Bio-based products and economic potential

Bioplastics, clothing and building materials can be produced, using (Tall grass) cellulose as a basis. Bioplastic end products could be as diverse as snack trays, packaging material, credit cards, sunglasses and soda bottles. Furthermore the paper industry has shown interest in tall grass as a local cellulose source.

Tall grass is an ideal material for a sustainable production cycle and an important step in the transition from a fossil-based to a bio-based economy. Waste material can either be fed back into the primary production cycle or fed forward into a catalytic cracker producing biokerosene and biofuel for transportation and logistics.





## Closed Cellulose Cycle Chain (C3)

### Local chains

Schiphol Airport uses a variety of plastic products such as plastic bags and plastic plates and cutlery for flight catering. The aim is to create a fully operational catering and retail cycle based on cellulose by the end of 2014, while developing other possible applications in parallel. The cellulose cycle offers many possibilities to develop local sustainable chains. Cellulose can also be used to produce low polluting biokerosene for aircrafts or fuel for trucks and packaging material for logistic undertakings.

### Pilot C3 landscape

Schiphol TradePark offers generous testing grounds within an attractive international business climate in many fields of knowledge: from area development and agriculture to industrial production, chains and market analysis and obviously innovation and good governance. Cooperation with governments, companies and knowledge institutions is essential. Thus an innovative cluster of companies will evolve, connected with the landscape and local producers. In short, cooperation and innovation is what Schiphol Trade Park is about.

*In Dutch, Tall grass is synonym for Elephant grass*



Growing



Grinding



Additives



Simmer



Black liquor & cellulose granules

# Partners in cooperation invite you

Schiphol Trade Park, Wageningen University and the Miscanthus-group are partners in the large scale trial cultivation of 'Tall grass on Schiphol Trade Park'. This resulted from the GREEN DEAL agreement with the Ministry of Economic Affairs (the Government Service for Land and Watermanagement) to study the effective use of Tall grass around airports. Along with The Solid Ground BV and BetterBeGreen organisation the consortium invites all other prime movers to meet our leading lights and talk beneficial business at the Expocenter.

**TO SIGN UP please contact**

[expo@schipholtradepark.nl](mailto:expo@schipholtradepark.nl)



## Schiphol Trade Park

- Invites national & international innovative companies in the logistics sector.
- Creates a sustainable high quality business area.
- Creates a facilitating environment for innovation and knowledge exchange to make the C3-landscape happen.
- Offers attractive participation and partnerships for users, governments, knowledge institutions and educational institutes.
- Develops the area for sustainable logistics.
- Provides the area used for cultivation of C3-crops.
- Manages the Expocentre.

## Schiphol Area Development Company (SADC)

- SADC develops international and regional business areas around Schiphol airport and along the western logistic axis of Amsterdam.
- Schiphol Trade Park is one of several businessparks developed by SADC.
- SADC develops sustainable business areas in the Schiphol airport region, of which the BBE-cluster at Schiphol Trade Park is an excellent example.



Partners in cooperation invite you!



#### Miscanthus-group

- Cultivation of Tall grass (*Miscanthus sinensis giganteus*) and other Biobased economy crops
- Contributes to the sustainability of the Schiphol area
- Product development and expansion of market opportunities to create new business cases for arable farming.



#### Biobased Connections

- Expands and reinforces the Bio-Based Economy cluster by connecting private and public parties in the Amsterdam region
- Biobased Connections strives to close cycles, e.g. processing waste products to be fed back into cycles as high quality resources.
- Biobased Connections has catalysed the implementation of different innovative projects. Biobased Connections facilitates the growth of a 'eco' community where companies, governments and other participants can interface with each other. In this atmosphere gathering and sharing of knowledge can lead to new innovations.



#### BetterBeGreen

- Produces bio waste carriers.
- (Bio)refines waste into packaging, materials and building components.
- Develops company, regional and global roadmaps for the reduction of carbon emissions.
- Introduces low carbon products tot worldwide retail.



Partners in cooperation invite you!



#### The SOLID GROUNDS BV

- TSG is knowledge broker for the green economy.
- TSG aims to connect governments, knowledge institutions and public & private enterprises to find common grounds where solid cooperation can be realised.
- An artisan workplace has opened, as a start to match supply and demand of knowledge and know-how.
- To work in conjunction with international networkers in the field of energy, the environment and climatic adaptive solutions such as Dutch based Phoenix Network International, VDT Energy and international universities.



#### Wageningen University & Research

- Provider of knowledge and expertise in the area of crops, cultivation, cycles, cooperation in chains and land use innovations.
- Create a network of knowledge institutions.
- Sharing knowledge and cooperating in research with civil society and economic parties.
- Developing a special educational program on the C3-landscape, creating an attractive learning environment for the green economy.



Government Service for Land and  
Water Management  
*Ministry of Economic Affairs*

#### Government Service for Land and Watermanagement (department of the Ministry of Economic Affairs)

- Provider of knowledge and skills about environmental integration and effects of Tall grass in the landscape.
- Provider of knowledge and skills on land lease constructions, allowing the cultivation of perennial crops.
- Enlarging the contiguous area for trial cultivation of bird repelling crops that can be used for the biobased economy.
- Assists knowledge transfer and communication about the project with the municipality of Haarlemmermeer, the Noord-Holland province and other Governing bodies involved.





Corporate, government and other interested visitors world-wide can find this unique  
TRADE & INNOVATIVE PARK within a short drive from Schiphol Airport. It is at the  
western gateway of Europe and connected by air, sea and land to everywhere in the  
world.

A VENUE NOT TO BE MISSED

**Schiphol**  
**Trade Park**  
**Valley**  
*BioBased Economy*

