MADE IN HOLLAND
ENERGY INNOVATION

Dutch answer to a global challenge

The energy innovation centre of the Netherlands • Europe's largest commercial subterranean gas storage • Green gas is the future • Pivotal innovation role • Land of water and energy • Noord-Holland has the wind in its sails

Holland

Pioneers in international business

Full of energy

Wind, water, sun, green gas: Noord-Holland Noord is becoming the centre for new technology and business in the field of sustainable energy. And it is innovation in energy where the province sees the engine of a sustainable economy.

Noord-Holland Noord stands out as the place for the development of sustainable energy. One look at the landscape and you can see why: water, wind and sun (the region with the country's most hours of sunshine). Offshore wind farms, the City of the Sun, energy-generating dikes – these are the symbols of this energy region. And yet, less visibly, Noord-Holland Noord is brimming with energy. Hidden under the surface is one of Europe's largest gas storage sites, strategically vital to the security of the gas supply in northwest Europe.

Growth

Innovation in the energy sector is the engine of economic growth and employment, provincial administrator Jaap Bond reflects. "We are fully committed to the development of sustainable energy. It's a choice that pays dividends: from sustainable energy to a sustainable economy. We are cutting CO2 emissions, working on a more independent energy supply, creating scope for entrepreneurs and creating new jobs." Noord-Holland Noord is perfectly located from a strategic perspective: at the intersection of international gas, electricity and communication networks, just a 30-minute drive away from the capital Amsterdam and Schiphol airport, with Den Helder and Amsterdam key seaports, and with a very strong agribusiness that offers many crossover opportunities with the energy sector. Not only that, but in ECN the province has an internationally renowned energy research centre. In addition, the energy multinational TAQA isnot only investing a billion euros in its gas storage and treatment plant bust is also committed, along with the municipality of Alkmaar, to the Energy Innovation Park, a business cluster for energy development.

Expertise

One of the main initiators is the Energy Board, in which vice governor Bond brainstorms with top executives from ECN, TAQA, the container storage company Vopak, the power grid company Alliander and the action group Urgenda, among others. "Their expertise and input help get promising, innovative projects off the ground and put a special focus on the business cases." The province also established a participation fund in 2014 to invest in companies that are geared to innovative sustainable energy. The cooperation between business, research and government makes Noord-Holland Noord an incubator for sustainable technology with strong national and international appeal.

EIPA:

The energy innovation centre of the Netherlands

The Energy Innovation Park will become the heart of new energy development in the Netherlands. From small, smart SMEs to large international players – this is the incubator in which they can ramp up their innovations for the commercial market.

Around the TAQA gas treatment plant in the Boekelermeer, situated in the Alkmaar and Heiloo area, a business cluster will rise up and focus on innovative and existing energy technology. This Energy Innovation Park is an initiative of the municipality of Alkmaar, the province of Noord-Holland, TAQA and the Development Agency for Noord-Holland Noord (NHN). "Noord-Holland Noord is already an energy intersection, and now we want to add an incubator," says TAQA manager Bas Froon, project leader for the Energy Innovation Park. "That's why we are creating scope for entrepreneurs that want to turn innovative ideas into commercial products."

The Energy Innovation Park is an attractive location for companies from both inside and outside the region, especially due to the clustering of energy-related companies and projects. The park offers an excellent energy infrastructure for high-quality heating, connection to the national gas grid and a high-voltage grid (150 kV). In addition, the park is well situated between the ports of Amsterdam, IJmuiden and Den Helder, and there is direct access to the A9 motorway.

Synergy

"The combination of companies, knowledge institutions, networking organisations and government will enable Noord-Holland Noord to become the premier energy innovation region of the Netherlands," says Mayor Piet Bruinooge of Alkmaar. The 'Triple Helix' model will generate the required synergy. It is a model that is based on cooperation between three parties: government, education and entrepreneurs. "Research institutions, businesses and educational establishments are given the scope to experiment with a variety of technologies and to extend their knowledge of gas," the Mayor suggests. "And then the innovations are brought to market. Because ultimately, of course, the idea is to earn money and create employment."

A key role at the park has been set aside for an incubator: a breeding place for new start-ups, with opportunities to share knowledge and work together. These new entrepreneurs will share the space with educational or knowledge institutes and because they are close together, they can inspire each other, share knowledge and generate new ideas and initiatives more quickly. Many different parties are already enthusiastic about this concept.

Gas

Opting for security

In Noord-Holland Noord lies Europe's largest commercial subterranean gas storage, a crucial node in the gas hub.

When people think of energy innovation, they tend not immediately to think of fossil sources like oil and gas, but these are forms of energy that are very much part of the picture. Indeed, so long as renewable energy sources like wind, sun and water continue to be faced with the problem of 'storage', we need oil and gas every moment of the day to ensure that we have a secure supply of energy all year round.

Node

The gas storage in the Bergermeer, operated by TAQA Energy, is a subterranean storage site in a traditional, natural gas reservoir that has been pumped empty. Natural gas was produced there between 1972 and 2007. Now it is one of Europe's largest subterranean gas storage sites and one of the nodes in the 'gas hub', which ensures that gas can be pumped in and out at strategic moments. So that there is a constant pressure in the subterranean gas fields, a volume of around 4.5 billion cubic metres of 'cushion gas' is maintained. This cushion gas has to keep the pressure in the gas wells, sometimes up to three kilometres deep, at between 45 and 80 bar. In addition to the cushion gas, there is space for the storage of around 4.1 billion cubic metres of 'usable' gas.

The Netherlands, specifically Noord-Nederland, has substantial gas reserves, an extensive gas infrastructure and the requisite expertise and knowledge. The government wants to maintain this position by positioning the Netherlands as the gas hub of northwest Europe and thereby creating more security of gas supply for all European consumers as new gas flows emerge between the European countries.

The Bergermeer gas storage site is not the exclusive premise of TAQA gas. Gas suppliers can also lease storage space there. "I sometimes suggest jokingly that TAQA has built a car park where customers can park their gas," says Jan Willem van Hoogstraten, managing director of TAQA Energy. "They can lease space for the short or long term and store their gas there or use it when they need it."

Substantial production

In the course of 2015 the gas storage site will be fully operational but it has already been in partial use since April 2014, with gas being injected that is transported to Alkmaar via pipelines from Groningen, Germany, Belgium, Norway and Russia as well as the continental shelf. The gas that is pumped up first passes through TAQA's gas treatment plant in the Boekelermeer, in the heart of the Energy Innovation Park Alkmaar. The plant dries and purifies the gas, getting it to the right pressure for the Dutch gas transport grid. Daily gas production capacity is around 57 million m3.

Biomass

Green gas is the future

There are wonderful opportunities in Noord-Holland Noord to produce green gas from biomass. The potential flow of dry biomass in the region is sufficient to operate a demo gasification plant and to use the knowledge that is gained as an export product for larger power stations.

Green gas can be produced from biomass in two ways: by fermentation or gasification. The latter has a number of advantages over fermentation: more gas is produced per quantity of biomass, production takes minutes rather than weeks and the gasification process does not depend on microbiology, which is relatively difficult to control. However, biomass gasification is still a relatively new technology that is yet to be proven on a large scale.

Milena

So the demonstration plant that ECN (Energy research Center of the Netherlands) is having built in Alkmaar, in cooperation with their partners, is very important. This demo plant works according to the Milena process developed by ECN. "Milena has a very efficient conversion of biomass to green gas. We get a yield of 70 per cent, which is unprecedented for gas from biomass," says Robert Kleiburg, COO of ECN. "The Alkmaar demo plant is essential for the development of the technology. It is the step from lab to application. In Alkmaar there will be a 4 MW plant, which is a nice intermediate size for experimentation, testing and ongoing development. Ultimately, Milena plants will increase to 100 to 400 MW in size. The first full-scale Milena plant should be in place by around 2020."

Expertise centre

The demo plant is, in fact, the flywheel for the biomass gasification expertise centre that will be realised in the Energy Innovation Park Alkmaar and will work according to the INVESTA (Institute for Valorisation and Expertise in Thermochemics Alkmaar) concept. It offers research organisations, businesses and educational establishments scope to experiment with different technologies and to extend their knowledge of gas. Torrgas and The Waste Transformers are two of the many companies that have already committed to establishing themselves in the centre.

Education is also taking advantage of these developments. The InHolland university of applied sciences in Alkmaar began a new Bachelor minor in September 2014: Biomass and Green Gas, part of its Mechanical Engineering course. The College is also obtaining a lectureship in Sustainable Energy.

The region can gain optimum benefit from these initiatives, such as links with the traditionally strong agrisector, including the cultivation and supply of biomass and smart heat and CO2 exchange.

ENERGY DEMAND

+47%

Worldwide energy demand grew by 47% between 2010 and 2013. In Europe this figure is estimated at 18%. In the Netherlands demand is likely to rise by 7% until 2017 (from 2010) and then stabilise.

INVESTMENTS

2.7 billion

Noord-Holland Noord is investing 2.7 billion euro between 2010 and 2020 in energy development, about half of which is intended for sustainable energy and the energy transition.

COMPANIES

1390

In the Noord-Holland Noord region almost 1.400 companies are active in the energy sector and related branches. For 200 of these companies energy is the core business; the other 1.200 companies are suppliers, service providers or advisors.

TEST FACILITIES

6

Noord-Holland Noord has five test and development plants for (sustainable) energy: the ECN wind turbine test farm in Wieringermeer, the Knowledge Centre WMC in Wieringerwerf, the Seaweed Centre on Texel, the High Flux Reactor in Petten and the Tidal Testing Centre in Den Oever. 2014 will see the launch of the Expertise Centre for Biomass Gasification.

JOBS

32.500

The Noord-Nederland energy sector employs almost 32.500 people full-time while in Noord-Holland Noord 7325 people are employed full-time in the energy sector or related branches.

ENERGY VALLEY

Along with the northern provinces of Drenthe, Friesland and Groningen, Noord-Holland Noord forms the 'Energy Valley', the main supplier of energy in the Netherlands and the heart of the 'Gas Hub' and Electricity grid of northwest Europe.

SUSTAINABLE ECONOMY FUND

The province of Noord-Holland launched the Sustainable Economy Participation Fund in 2014 to provide an incentive for investments in biomass, sustainable building, solar energy and offshore wind. The fund of 30 million euro can be extended to a maximum of 85 million euro. The province wants to use the participation fund to promote the development of sustainable energy as well as boost the economic potential of the sector and employment.

STUDENTS

116.000

In Amsterdam there two universities serving over 53.000 academic students. The unversities of applied sciences INHolland and HvA serving 63.000 students. In Bergen the European School offers international primaire and secundaire education for 600 students. In Den Helder a dedicated minor of oil & gas is offered.

ECN:

Pivotal innovation role

In ECN (the Energy research Centre for the Netherlands), Noord-Holland has a world-renowned institute for sustainable energy within its borders.

Just in the coast, in the dunes of Petten, lies ECN (the Energy research Centre for the Netherlands), the biggest knowledge institute for energy in the Netherlands. The institute can trace its roots to its nuclear reactor – which still produces more than 30% of the isotopes for medical research – but more than thirty years ago it began to focus on its role as a research and innovation centre for renewable energy sources, like solar and wind energy, biomass and (industrial) energy efficiency.

Bridging science and business

ECN, with branches in Amsterdam, Eindhoven, Brussels and China, bridges the fundamental research of universities and applications for business and industry, chief operational officer Robert Kleiburg explains. "Developments in energy demand not only major investment but also the requisite period of time before they can really get to market. This development horizon is simply too distant for many companies. In that process from idea to commercial application we play an important role." To give an idea: in half of all the solar panels produced all over the world, there is a bit of ECN technology. In wind energy the institute and its partners are diligently searching for ways of reducing the cost of offshore production by 40%. "Wind at sea is still rather expensive, yet we have to be able to reach a competitive price by 2020. But it's not just the technology that is a factor, here. Policy plays a key role," says Kleiburg.

Biomass

Another spearhead is biomass, which is essential in the sustainable energy mix since it can compensate for the volatility of the supply of wind and sun. And without biomass the CO2 targets for 2020 are almost not achievable. ECN has developed a breakthrough technology, known as Milena, to be able to quickly, and at an unprecedented yield, convert dry biomass – mainly wood pellets – into biogas, whose quality, after treatment, is comparable with that of natural gas. A demo plant near Alkmaar will get the technology ready for market.

Clean tech

According to Kleiburg, Noord-Holland Noord has everything going for it to become an energy development region of international standing. "Its situation, the institutes and companies as well as a government that sees the value in this. The establishment of a fund for a sustainable economy is likely to be a powerful incentive." And it's money well spent, Kleiburg is convinced. "The annual market for 'clean tech' is now 250 billion dollars but that will rise in the next few years to a thousand billion."

Energy dikes:

Land of water and energy

The Afsluitdijk is the symbol of the Dutch battle against the water. Now the dam will also become a sustainable source of energy.

A very royal visit in Noord-Holland Noord: King Willem-Alexander and Queen Máxima came to Den Oever in September to find out about innovations in sustainable energy. The king, who is knowledgeable about water and delta technology, took a closer look at the large underwater turbine that will be used to generate electricity from the tidal currents.

Tidal currents is one of the sustainable energy projects in Noord-Holland Noord. At the head of the Afsluitdijk is the Tidal Testing Centre where scientific experiments are performed for energy production from water. One of the initiators of the test site is Hans van Breugel, director of the Noord-Holland company Tocardo, a pioneer in tidal energy. Tocardo produces underwater turbines and develops the related systems. In the annual report of the Energy Board, Van Breugel lists the benefits of this kind of sustainable energy. "Compared with the wind, there are significant advantages. The energy density of water is 800 times more than air, so smaller blades suffice. Moreover, tidal energy is more predictable."

In about fifteen years, it is expected that 10% to 15% of the Netherlands' energy needs can be met by water: by tidal energy or osmosis technology that uses the differences between freshwater and saltwater to generate electricity, also known as blue energy.

In the Energising Deltas project different companies – turbine manufacturer Tocardo, blue-energy company Redstack and the construction company Strukton – are cooperating with the scientific institutes ECN, Deltares and the Erasmus University of Rotterdam to find ways of using dams to generate more energy. The Afsluitdijk – one of the most iconic dams of the Netherlands – plays a major role in this. In the renovation of the 30 kilometre-long dike, four projects have been integrated with the aim of producing energy from the water. An example is the thirty turbines in the Kornwerderzand sluices that generate 2.5 MW of electricity.

Since many companies and institutes in Noord-Holland are focused on sustainable energy innovations, there is a lot of astonishing cross-fertilisation, such as Tocardo's cooperation with the windmill builder WES, solar panel manufacturer ZonEnergie and battery producer ES Technologies to develop a new battery technology to store energy from the sun, wind an tide. It goes by the name 130 Renewables.

Surrounded by water, Noord-Holland Noord appears an ideal location to boost knowledge of and experience with water energy. A market with international allure and potential.

Windenergy:

Noord-Holland Noord has the wind in its sails

Onshore and offshore, Noord-Holland sees wind energy as one of the main spearheads of the energy policy. In terms of onshore wind energy the province has already gained a strong position within the Netherlands, and there are also plenty of opportunities in the offshore wind sector.

The province has signed up to the target of 685.5 megawatt (MW) of wind energy by 2020. Currently the 300 or so wind turbines in Noord-Holland are generating a total power output of 343 MW. With the scheduled building of the Wieringermeer wind farm at the northern tip of Noord-Holland, this capacity will be extended by about 250 MW. To reach the target of 685.5 MW the province will be restructuring the outdated solitary wind turbines and linear arrangements.

Wieringermeer

In the Wieringermeer wind farm, too, a similar restructuring process is taking place in addition to a significant expansion of the number of turbines. The current windmills in the Wieringermeer polder will be scaled up and aligned in neat linear rows (the linear arrangement). The initiators of the wind farm are Nuon (and partners), ECN and the Wieringermeer Wind Collective, which is cooperating closely with the municipality Hollands Kroon, the province of Noord-Holland and the State under the name Windkracht Wieringermeer. The Wieringermeer wind farm will be one of the largest in the country, supplying green energy to 275,000 households. The initiators expect construction to begin in 2017.

Offshore

Onshore wind energy was also the catalyst for developments in the offshore wind energy sector, like the construction of the Luchterduinen wind farm, taking place 23 kilometres off the coast at Noordwijk aan Zee, and the planned construction of wind farms off Ameland en Schiermonnikoog.

But such developments are not confined to the construction of Dutch wind farms. In Denmark, Germany and Great Britain the North Sea is a hive of activity. And this is an opportunity for the region, for the port of Ijmuiden, with its wind turbine assembly facilities, Den Helder Airport and the Port of Den Helder, with its long tradition in offshore energy and strength in the logistics processes of offshore activities. Den Helder is also pivotal in the offshore wind knowledge cluster, which comprises different, well renowned knowledge institutions, companies and educational establishments like TNO/Endures, Imares/WUR, ECN, NIOZ and TU Delft.

Den Helder and IJmuiden can therefore be important ports for offshore wind activities. Not just for Dutch wind farms but also for the construction and maintenance of British and German wind farms. The offshore wind sector is expected to generate extra employment in these towns.

Heading into CO2-neutral neighbourhoods

The City of the Sun is one of the symbols of sustainable energy – a new neighbourhood development that is fully CO2-neutral, largely by making smart use of the sun. The province of Noord-Holland sees solar energy as one of its spearheads.

Solar energy is one of the sustainable energy spearheads of the province of Noord-Holland, with an accent on the built environment, which accounts for some 40% of the energy consumption. The province wants to make buildings self-sufficient energy users. In this respect, solar energy and energy efficiency play a key role.

Energy and work

The sun currently supplies a very modest 5% of sustainable energy production in the province. All the operational solar power projects produce a total of 83 TJ (terajoule) annually, which helps reduce CO2 emissions by 5500 tonnes. Moreover, the installation of solar panels also generates employment. It has been estimated that that 42 jobs are created for every megawatt of solar panels. So it is easy to see why the province is investing in projects and tools that boost the share of solar energy. Like the subsidy scheme 'Solar Power in Schools' in 2012 that equipped more than a hundred schools with solar-power units. Or 'Herman the Solar Power Distributor' in which collectively generated solar power is distributed fairly among the residents of apartment buildings, and the SolaRoad in Krommenie, a cycle path that works like a solar panel. There is also a farmer subsidy scheme, 'Replace Asbestos with Solar Panels', and the province provides incentives for housing corporations to purchase solar panels.

City of the Sun

A much talked-about project is the 'City of the Sun': to the south of Heerhugowaard, bordering the municipalities of Alkmaar and Langedijk, a new urban district is being built with around 3000 homes and a recreational area. All the homes are energy-efficient and use a renewable energy source, specifically the sun. This City of the Sun is CO2-neutral: it generates as much renewable energy as it uses for all its functions (living, working and traffic).

The source of inspiration in both the parcelling and architecture, is the sun. Optimum use is made of active and passive solar energy. Eighty per cent of the parcelling of the City of the Sun is in a north-south alignment so that the solar panels are automatically south-facing to enable the best possible solar yield. The active solar energy of 2.45 MW is generated by photovoltaic (PV) solar panels on the roofs of the homes and various other buildings. The solar panels are just one of the measures being taken to realise a CO2-neutral neighbourhood. Other measures are the building of energy-efficient homes (known as ISO++ homes) and the erection of three wind turbines in the recreational area. These environmental measures make this neighbourhood a model project both for the Netherlands and abroad.

ENERGY INNOVATION © BY DUTCH ORIGIN NOORD-HOLLAND NOORD

Holland.

nhn