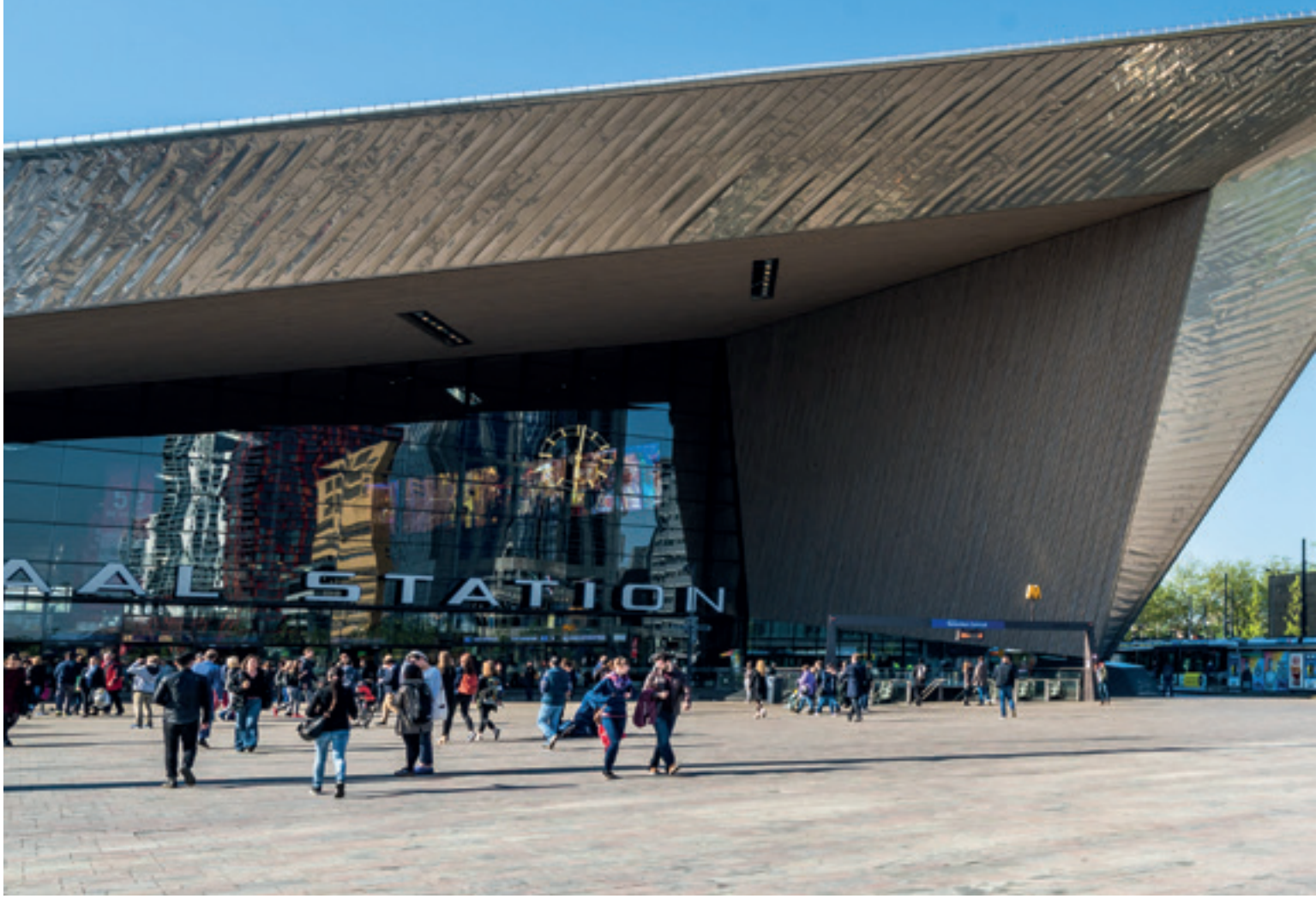
Netherlands

Clean Energy Guide

Introducing the Dutch Clean Energy Sector

Technology that shapes our world

The Dutch have been developing creative solutions to societal challenges for centuries. They have turned a small, flood-prone delta into one of the world's most densely populated and prosperous countries. Their unique brand of innovation – flexible, pragmatic and open – is once again proving its value as we tackle the great challenge of our times: managing the global energy transition.



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Solving global challenges together

The bigger the challenge, the less likely you are to find an effective solution on your own. And challenges don't come much bigger than the fight against climate change. As a global society, we urgently need to drastically reduce our carbon emissions and build a sustainable future for our people, our planet and our economies. This is an unprecedented task, certainly under the current economic conditions, yet it is vital that we stick to our commitments. The sheer scale of that task means that we must work together.

Cooperation is especially important when it comes to developing and rolling out technological innovations. From boosting energy efficiency to enabling the energy transition and building a circular economy, cleantech will have a decisive impact on the future of our planet. In the Netherlands, we are proud to have a large and sophisticated technology sector, with hundreds of companies focusing on sustainable solutions in many key areas: from renewable energy generation to biobased technologies and energy-efficient process technology. If anything characterises their portfolio of clean technologies as 'typically Dutch', it is probably that many of them bear the stamp of intensive collaboration. Our natural circumstances – the centuries-old struggle to protect ourselves against flooding in particular – have fostered a spirit of pragmatism, an openness to new ideas and a strong awareness of the need to work together.

That mindset has also affected our approach to innovation. We have a long tradition of fruitful collaboration between the government, academia and industry. One major advantage has been that new and sometimes radical ideas are quickly taken up, explored and scrutinised for their technical and economic feasibility. The Netherlands has in many ways become a testing ground, a pilot facility for refining and scaling up sustainable innovations.

The impact of these innovations is not limited to our own country. The Netherlands has long been an outward-looking country, whose economic prosperity derives to a large extent from exports and international cooperation. Our companies are remarkably adept at understanding the context in which international customers operate, establishing partnerships and co-creating tailor-made solutions.

Building a more sustainable society is a long-term project which will pose new questions along the way. None of us have all the answers. But, as this brochure illustrates, the Dutch technology sector is ready to play its part as a valuable, reliable partner in developing solutions which have a genuine impact.

Hanneke Schuiling
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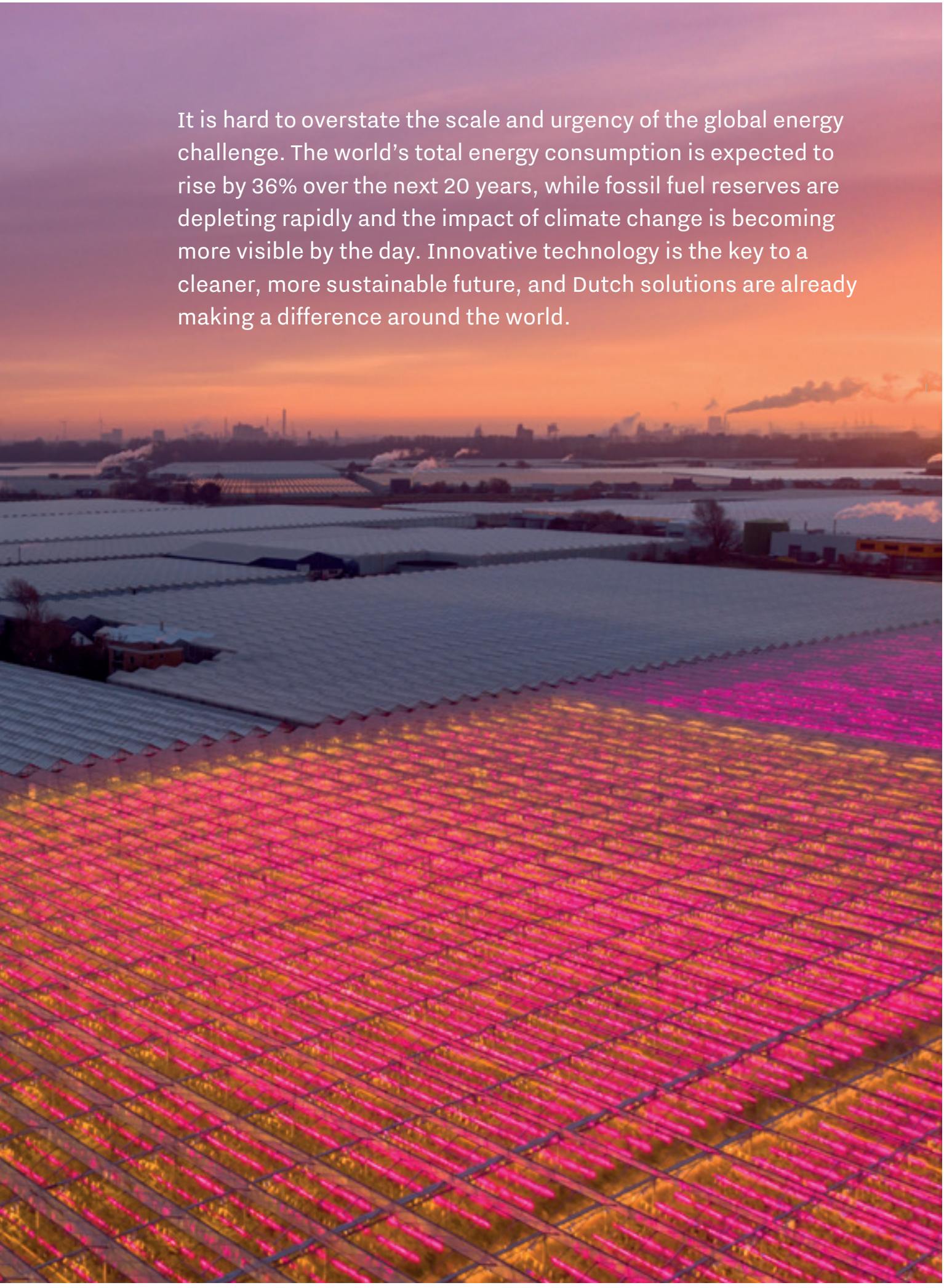
Dutch perspectives on the clean energy challenge



It is hard to overstate the scale and urgency of the global energy challenge. The world's total energy consumption is expected to rise by 36% over the next 20 years, while fossil fuel reserves are depleting rapidly and the impact of climate change is becoming more visible by the day. Innovative technology is the key to a cleaner, more sustainable future, and Dutch solutions are already making a difference around the world.

The global energy transition is well underway, yet huge challenges remain, which is certainly the case in the Netherlands too. The country is committed to achieving and, where possible, exceeding the goals laid down in international agreements. European climate targets have been enshrined in Dutch law and, in 2018, the country revealed a detailed Climate Agreement in which the public and private sectors and NGOs plotted a detailed transition path (see the box). The almost 80 signatories include a wide range of trade associations and industry bodies.

The Netherlands is ranked second in the Global Innovation Index and has the second highest number of patent applications per million inhabitants in the world

This Climate Agreement is a typical example of how the Dutch approach complex challenges. The country has a long tradition of cross-sector cooperation and partnerships. For centuries, the country has managed much of its natural environment through water boards - democratically governed regional authorities in which farmers and landowners joined forces to maintain dykes and protect their low-lying and often reclaimed land. As the country developed into one of the world's most advanced and most densely populated urban deltas, scarcity of space again forced the Dutch to work together and find creative solutions addressing the interests of multiple stakeholders.

This creative and pragmatic mindset has also enabled the Dutch to translate their ideas and technology into solutions that work in very different environments and cultures. The Netherlands, despite its modest size, is the world's fifth largest exporter of goods and the fifth largest international investor. The country is home to thousands of technology providers and manufacturers with a global reputation for innovation, who on average derive more than half of their turnover from exports. The Netherlands is ranked second in the Global Innovation Index and has the second highest number of patent applications per million inhabitants in the world.

However, such innovations are not developed in splendid isolation. The Dutch approach to innovation is open, transparent and pragmatic. There are strong links between technology companies and the country's world-class network of universities and research institutes. Many authorities in their respective fields combine work in the private sector with part-time tenures as professors. The country's compact size makes it easy to establish and maintain contacts and launch innovation projects and consortia. International visitors are often surprised by the ease with which companies who are competitors in their respective markets work together in such joint innovation platforms.

This rich and productive ecosystem of companies and research groups is particularly strong in the field of clean technology. The Netherlands has a strong backbone of internationally renowned research groups, both at universities and independent knowledge institutes, who have been conducting groundbreaking research in such diverse areas as PV technology and biobased materials for decades. The country's technology providers also benefit from a substantial home market for technological innovations, for example in the strong (petro)chemical sector, food & beverage industry and the country's globally active offshore construction industry.

A small country with a big impact:
how the Netherlands performs in global rankings

2ND highest number of patent applications per million inhabitants in the world

2ND in the Global Innovation Index (GII, 2018)

4TH most competitive economy in the world

7TH largest foreign investor in the world (1,256 billion US dollars)

In all of the foregoing, the technology sector benefits from the active role played by the Dutch government and regional/local authorities. The Dutch public sector often acts as a 'launching customer' for innovative technology. It also facilitates long-term cooperation platforms, such as the country's 'Top sectors', in which coherent innovation programmes are coordinated. These have already resulted in a wide range of proven and market-ready innovations, and new solutions are reaching advanced Technological Readiness Levels (TRLs) every year. It all makes for an innovative climate in which ideas are quickly translated into pilot projects, and in which, at an early stage, proven concepts are viewed through the lens of building successful business cases – which help to keep the energy transition on course, both in the Netherlands and abroad.

The Netherlands, despite its modest size, is the world's fifth largest exporter of goods and the fifth largest international investor.

The Dutch Climate Agreement

Over 100 signatories of the Dutch Climate Agreement have agreed on legally binding targets to achieve a 49% reduction in CO_2 by 2030 (compared to 1990 levels):

Electricity
-20.2 Mt

How?
Large-scale investment in renewables, energy storage and smart grid technology.

Mobility
-7.3 Mt

How?
Electric cars, biofuels, emission-free logistics and investment in public transport.

Industry
-14.3 Mt

How?
Energy efficiency, electrification, CCSU, green hydrogen, circular manufacturing and use of residual heat.

Agriculture
-3.5 Mt

How?
Energy-efficient greenhouse technologies, sustainable biomass production, reuse industrial CO_2 and residual heat.

Built environment
-3.4 Mt

How?
Alternatives for natural gas-fueled heating, increased energy efficiency.

Technology for a biobased economy

Climate action requires not only a large-scale transition to renewable energy sources, it also means we should try and find alternatives for fossil-based fuels, chemicals and raw materials. In both cases, biomass is an important part of the solution - and Dutch technology is helping to extract more value from it.

Biomass already contributes substantially to the world's energy mix: in 2019, roughly 7% of all our energy was derived from traditional biomass sources. Yet biomass contains much more than energy. When we burn biomass, we also destroy a range of compounds that, with the right technology, can be transformed into valuable raw materials.

Many Dutch innovations aim at exploiting this hidden potential. As part of a nationwide research programme, businesses and universities are developing new technology using the 'cascading' principle. The idea is to separate biomass into its constituent components. Those with the highest added value can be used in complex chemical manufacturing processes. Less valuable components may be suitable for producing bulk materials. Finally, the remaining biomass can be used to generate energy in the form of electricity or heat.

This approach is a natural extension of a way of thinking that has been strongly embedded in the Dutch mindset for years. As a small country with a disproportionately large and highly productive agricultural sector, the Netherlands has a long history of making the most of every square metre of arable land. For decades, farmers have invested in finding new uses for agricultural 'waste', thus generating extra income. There is also a strong tradition of forming partnerships along the way, both among farmers and/or with technology providers and research groups.

In addition to its high-tech agricultural and horticultural sectors, the Netherlands has a large chemical industry, including multinationals with a strong track record in innovation, such as AKZO Nobel and DSM. Along with the country's three technical universities, research institutes such as the TNO (the Netherlands Organisation for applied scientific research) and Wageningen University and Research (named the world's best agricultural university four years in a row), this means the Dutch 'biobased technology' sector has access to world-class expertise and research facilities.

Recent innovations by Dutch companies are based on a range of technologies. In addition to thermal conversion techniques such as torrefaction, pyrolysis and gasification, these include chemical-catalytic conversion and fermentation processes. Applications include the production of high-quality fertilizers, bioplastics and aromatic compounds (important building blocks for complex chemicals), from diverse feedstocks including beet pulp, potato starch and wood waste. Other innovations focus on the last step of the 'cascade', by developing more efficient and/or sustainable ways of generating energy from biomass. For example, instead of growing crops for the purpose of burning them, such innovations allow genuine but 'difficult' waste or residue flows to be used, such as sewage sludge.

The next step: solar capture technology

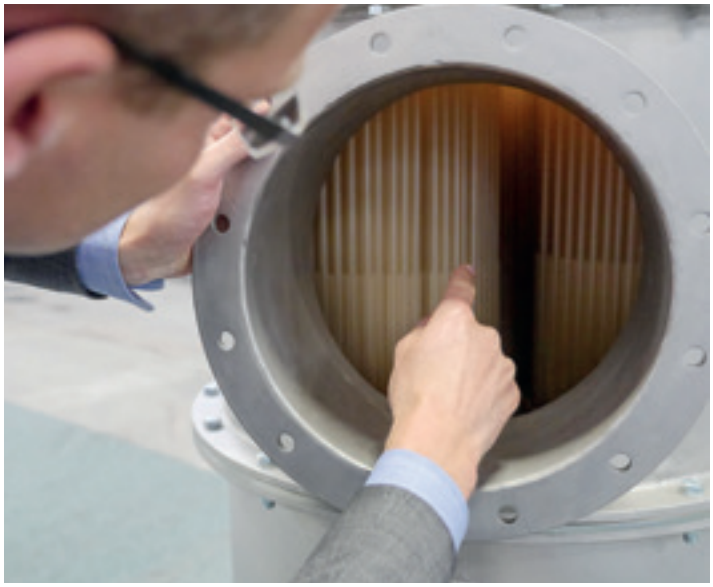
Essentially, biomass is an intermediate step in a process that converts sunlight into chemical energy, through photosynthesis. However, photosynthesis is not a very efficient process: it only manages to convert 1% of the solar energy it receives into chemical energy. Dutch experts in catalytic processes, biomaterials and biomolecular design are now exploring ways of boosting this efficiency, by capturing solar energy and converting it directly into 'solar fuels'.

Dutch biomass technology group BTG is already producing bio-oil from wood waste. It recently announced it is building the world's first refinery for converting this oil into 100% sustainable marine biodiesel for ships.

In the heart of the Dutch mushroom-growing region, Upcyling Gemert developed a smart way of processing the casing soil used to cover mushrooms. Its closed fermentation installations convert this soil into heat and a high-quality fertilizer - and can do the same with virtually any type of compostable material.

Isobionics has created a sustainable and reliable biotechnological fermentation process for manufacturing 100% natural flavours and fragrances for the food & beverage, flavour and perfume markets.

In the northern province of Friesland, a movable cycling bridge is being built with two decks made entirely from biocomposite (100% flax fibres and 80% bio resin): a world first at this scale.



Recovering heat from flue gas is an attractive option, since the gas is usually emitted into the atmosphere at relatively high temperatures. However, the gas also contains corrosive acids that damage traditional metal heat exchangers. HeatMatrix has developed a polymer heat exchanger that can withstand temperatures of up to 225°C.

Ioniqa, an Eindhoven University of Technology spin-off, has developed a technology which makes it possible to recycle PET and polyester clothing endlessly.

Decarbonising industry

Global climate targets can only be achieved by concerted efforts across society - and few sectors will have such a decisive impact as industry. In the Netherlands, industrial activity accounts for 40% of greenhouse gas emissions. However, a growing portfolio of sustainable technology looks set to dramatically reduce industry's carbon footprint.

By 2030, the Netherlands is aiming for a 49% reduction in carbon emissions compared to 1990. Industrial energy consumers intend to make a substantial contribution: in the country's Climate Agreement (see p. 9), they have committed to reducing their overall CO_2 emissions by 20 million tonnes. And by 2050, Dutch industry wants to be completely carbon-neutral.

These goals can only be achieved by making the most of innovative technology. Over the last few years, the Netherlands has already proved to be a remarkably effective breeding ground for such innovations. Technology providers, industrial energy consumers and research institutes have set up hundreds of pilot projects, open innovation programmes and technology 'field labs'. It is probably no coincidence that several multinational industrial companies are using their Dutch site(s) as a hub for developing, testing and refining energy-saving process innovations.

Such innovations focus on a wide range of decarbonisation strategies. For example:

1. Energy efficiency. The most fundamental way of reducing your carbon footprint is to reduce energy consumption. Innovations in this area include more efficient drive technology and process automation, as well as the use of smart software and artificial intelligence to track down and remedy inefficiencies. Other technology focuses on storing and reusing residual heat or locally generated electricity.

2. Sustainable process heat. A key area targeted by many Dutch innovations is process heat, which is responsible for 70% of all industrial energy consumption in the Netherlands. While industrial processes generate huge amounts of residual heat, much of it as steam, its temperature is generally too low to be suitable for reuse. New technology, such as recompression techniques and next-generation heat pumps, allows residual heat to be upgraded to temperatures of up to 220°C.

3. Electrification. Switching from fossil fuels to electricity (from renewable sources) can radically reduce industry's carbon footprint. A range of technologies are needed. Dutch research and innovations focus on two types of electrification. Power2Heat is aimed at generating high-temperature process heat from electricity, through hybrid and electric boilers or by large-scale use of green hydrogen (see p. 22). A second form of industrial electrification is Power2Products: the focus here is on directly producing (chemical) products from electricity, either through electrochemical reactions or by using electricity to produce mechanical energy or to power separation processes.

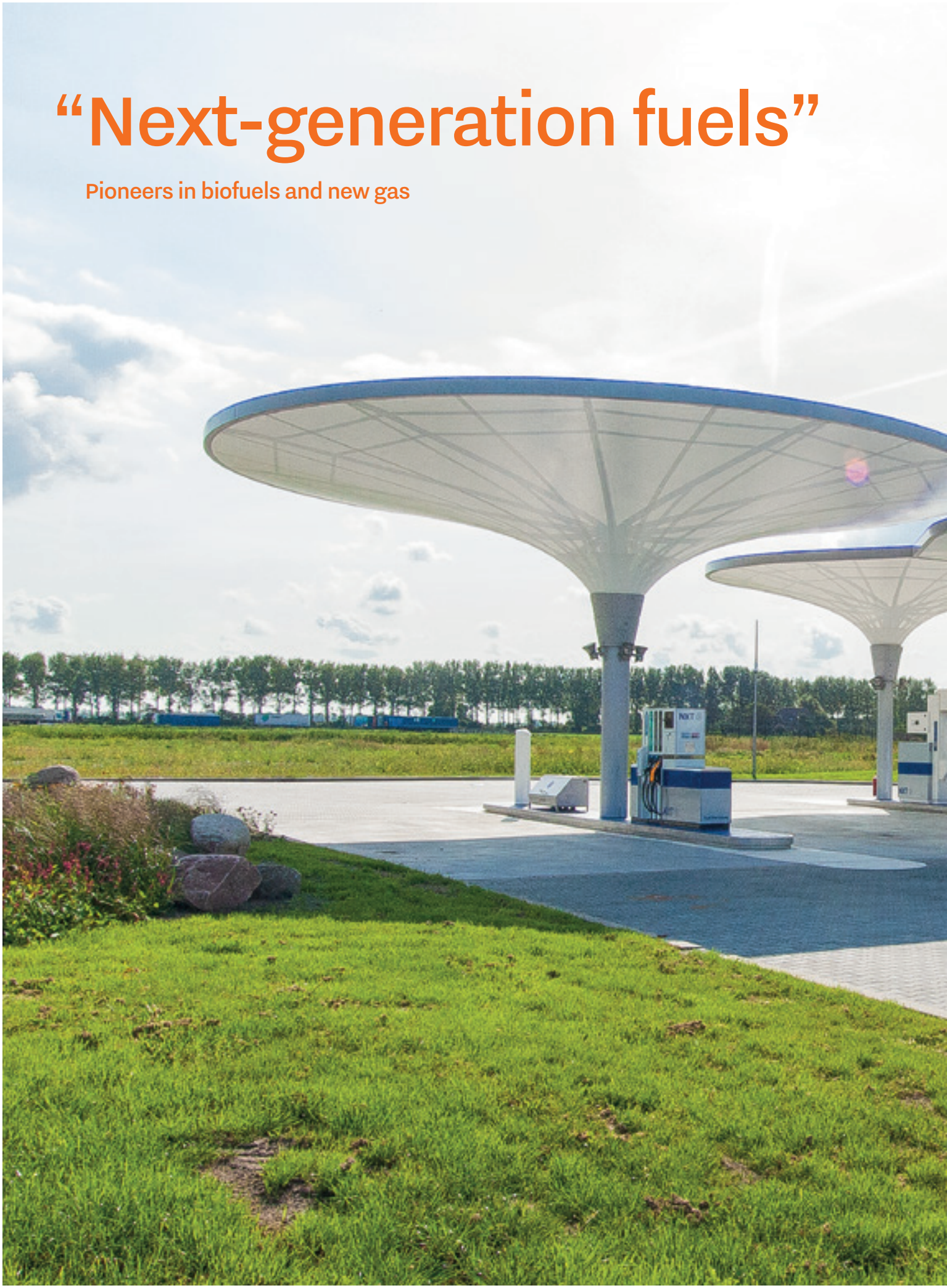
4. Circular manufacturing. An indirect but considerable part of industry's overall carbon footprint is the use of large quantities of raw materials and fossil-based feedstock. The goal for Dutch industry is to enable a fully circular economy by 2050. With 1,700 kg of recycled waste per person, the Netherlands is already one of the top performers in Europe, helped by a technologically sophisticated recycling industry. Dutch mechanical recycling technology is used across the world and new avenues are opening up all the time. For example, Dutch companies are increasingly focusing on capturing valuable chemicals and materials from wastewater or flue gas. And by 2030, Dutch industry wants to capture and reuse 5 million tonnes of CO_2 each year.

Other examples of Dutch industrial cleantech:

- enerGQ's energy management software uses self-learning technology to track and visualize excessive energy consumption, resulting in sustained energy savings of 10% to 30%.
- In a series of projects with TNO, Bronswerk is creating next-generation heat pump technology, enabling low-temperature residual heat to be used for steam production at ever higher pressures and temperatures.
- Hybrid steam boilers by Stork Thermeq offer maximum flexibility by enabling steam production at up to 500°C from both electricity and gas.

“Next-generation fuels”

Pioneers in biofuels and new gas




NXT
NXT LNG
ENGIE

Future grids

Over the next few decades, the demand for electricity looks set to increase by more than 200%. Power grids will need to be upgraded to cope with this growth. Dutch grid operators and technology partners are investing in a future grid that is not only bigger, but especially smarter and more flexible.

The prospect of large-scale electrification is a matter of urgent concern for grid operators around the world, and in the Netherlands there are additional reasons to be prepared well in advance. The Dutch grid is in excellent condition, but by international standards it is relatively light. It bears the hallmark of a country where the vast majority of households rely on natural gas rather than electricity for the bulk of their energy needs.

But this is about to change. Electrification is well underway in the built environment. Homes built from 2018 onwards are no longer connected to the natural gas grid, and over the next ten years, 1.5 million existing homes are scheduled to swap natural gas for alternatives, in many cases electric heating, cooling and cooking. Meanwhile, the proportion of electric cars in the national fleet is the second highest in Europe and the country has the continent's densest network of charging facilities. On the supply side, the rapid growth of wind and especially solar energy is already causing congestion on distribution grids.

In other words, the country urgently needs to increase both the capacity and flexibility of its power grid. In addition to grid expansion projects, the Dutch are also looking to get the most out of existing infrastructure by managing energy demand. These efforts are helped by the fact that nearly all Dutch households have a smart meter suitable for continuous data collection. The country also has an advanced and very open electricity market, attracting new suppliers as well as providers of innovative services and software.

One example of increased flexibility is that Dutch consumers have access to dynamic pricing contracts, giving them the same flexibility as large commercial consumers in terms of adapting their electricity consumption to real-time price developments. This in turn has boosted the development and market introduction of home energy management software. For industrial consumers, Dutch companies have developed a range of solutions for predicting and optimising on-site energy generation and consumption.

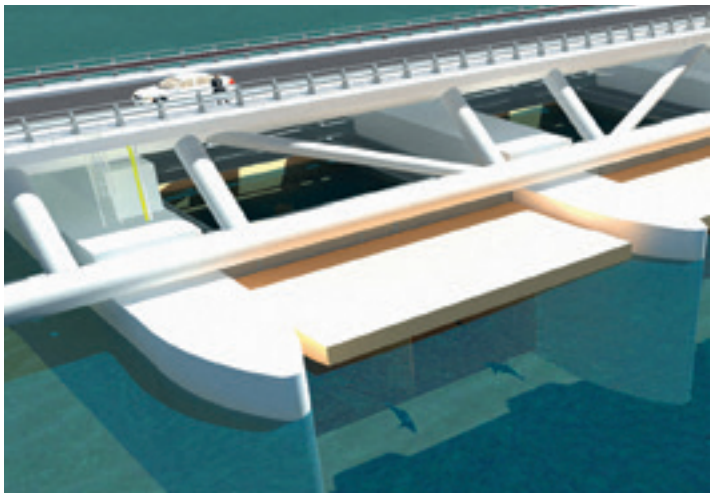
Meanwhile, in recent years grid operators have invested heavily in digitizing their transport and distribution networks. An extensive data acquisition infrastructure has been built up, allowing grid operators to monitor high- and medium voltage networks with a level of detail that often surprises international visitors. Interestingly, large car manufacturers have now initiated partnerships with Dutch grid operators, recognizing the value of real-time grid data to improve and optimize their cars' charging capabilities. Such cooperation contributes to a smooth grid performance even when large numbers of electric cars need to be charged.

Another way in which the Dutch are securing the reliability and flexibility of the future grid, is by looking beyond electricity. Instead of viewing the power grid, heat networks and (green) gas infrastructure as separate entities, the country is working towards a more integrated energy system, in which energy can be converted from one carrier to another at various points in the transmission and distribution chain. Dutch companies are researching and implementing a range of new technologies that allow energy to 'change shape' according to the current needs.

The city of Utrecht is an e-mobility hotspot: 15% of cars in the region are electric. It is a fertile testing ground for innovations. Many current projects focus on bidirectional charging and integration with solar power, allowing car batteries to be used for storage and grid balancing.

The Netherlands is home to a number of international suppliers of smart charging infrastructure and services, including Alfen, EVBox, Allego and Greenflux. Heliox focuses on charging solutions for public transport, and recently unveiled the world's first battery-integrated charging station for fast-charging e-buses and e-trucks.

Dutch technology by GreenFlux was at the heart of the world's largest smart charging trial, in which 700 UK households participated. The trial demonstrated that smart charging technology can be used to manage a high demand for electricity without expensive network upgrades.



Tidal Bridge builds modular, 100-metre-long floating elements that can double up as a bridge and a tidal power plant. The company will use the technology to build, finance and operate a floating bridge and power plant across Indonesia's Larantuka Strait.

The Afsluitdijk dam separates the Wadden Sea from Lake IJssel, the Netherlands' largest freshwater reservoir. Dutch company REDstack built a pilot plant which generates electricity from the difference in salt content on either side of the dam, using reverse electrodialysis.

Marine Energy

Marine energy is an indispensable part of the future energy mix. It has huge potential: by 2050 global capacity could reach 300 GW, enough to power 350 million households. Dutch companies are developing and refining not just the required technology, but also the business cases needed to make marine energy a competitive proposition.

Compared to other renewables, marine energy has one crucial advantage: it is highly predictable. Tidal movements are as regular as clockwork. Waves may vary in intensity, but can provide a much more stable and reliable supply of energy than either solar or wind power. And where salt water and freshwater meet, osmotic technology can be used to capture 'blue' energy 24 hours a day.

Because of its reliability, marine energy is an ideal, carbon-neutral source of baseload power. And its potential is substantial. It is estimated that, in theory, wave power alone could generate as much as 80,000 TWh, five times the global electricity demand. The question, as always, is: how much of this potential can we convert into robust and economically viable projects?

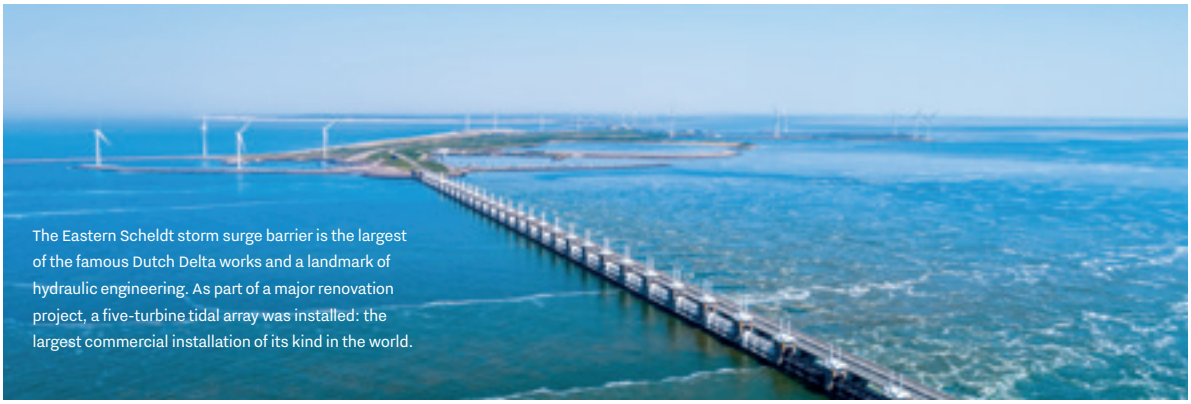
Unsurprisingly, given their strong track record in water management and offshore construction, the Dutch have been developing marine energy technology for years. The Netherlands is home to a strong and vibrant marine energy community, with over a dozen companies specialising in different technologies (tidal, wave, saline gradient and ocean thermal energy conversion). These companies often work in partnership with leading offshore construction companies and internationally renowned research institutes. They also benefit from the presence of no fewer than 24 facilities for testing and demonstrating marine energy technology.

Yet even the most sophisticated technology is only useful when it is put into practice, on a large enough scale to make a difference. The Dutch approach to marine energy is therefore a very pragmatic one: its scope extends beyond the technology itself and, from a very early stage, includes crucial topics such as funding, lifecycle management and long-term ecological impact. Dutch companies also increasingly join forces with project developers and financial partners, in order to develop turnkey solutions and even entirely new business models.

Funding in particular can be a challenge. As a 'standalone' solution, marine energy often cannot compete with other types of renewable energy in terms of cost price and ROI, which makes it harder to finance a project on attractive terms.

One way to boost the (financial) feasibility of marine energy projects is to combine them with other infrastructure. In the Netherlands, tidal turbines have been included in large-scale renovations of two of the country's most iconic hydraulic structures: the 20-km-long Afsluitdijk causeway and the 9-km-long Eastern Scheldt storm surge barrier. This approach is now being taken a step further: in Indonesia a Dutch consortium (Tidal Bridge) is building and financing a floating bridge connecting two islands - which incorporates the world's largest offshore tidal plant.

Find out more about Dutch solutions for marine energy at www.dutchmarineenergy.com.



The Eastern Scheldt storm surge barrier is the largest of the famous Dutch Delta works and a landmark of hydraulic engineering. As part of a major renovation project, a five-turbine tidal array was installed: the largest commercial installation of its kind in the world.

“Making waves”

Making the most of the huge potential of marine energy

New gas

Reducing our dependence on natural gas is an important aspect of the energy transition. While in several cases large-scale electrification can replace the use of gas, in many other areas this is not possible or economically feasible. In other words: new and carbon-neutral gases are needed.

In the Netherlands, this challenge is particularly urgent. It is the EU's largest natural gas producer and an important hub in cross-border trade. Almost every Dutch home is connected to the national gas grid, and household consumption is twice the European average. So phasing out natural gas presents a huge challenge and will take time. Yet the country's extensive expertise and sophisticated gas infrastructure also give it a head start in developing alternatives.

Scaling up green gas

Currently, the Netherlands produces 9 PJ of biogas each year. More than half of it is processed into green gas (or bio-methane), which can be used interchangeably with fossil-derived natural gas. The ambition laid down in the Dutch Climate Agreement is to produce 70 PJ (or 2 billion m^3) of renewable gases by 2030. Dozens of companies in the Netherlands have specialised in the required technology. Most green gas production so far is based on fermentation of 'wet' biomass such as household organic waste, manure or wastewater sludge. Further innovations are looking to optimise this process, while at the same time companies are developing new technology such as thermal gasification of dry biomass and supercritical gasification, which is a promising technology that can convert biomass into green methane, hydrogen, minerals and clean water.

Building a hydrogen economy

Hydrogen is one of the most versatile energy carriers and feedstocks. It can be used as a raw material, fuel for industry, vehicles or residential heating, or as a storage medium for surplus solar or wind energy. Building on its expertise, its extensive gas infrastructure and strategic location, the Netherlands is investing in a hydrogen economy. New and established companies are developing technology for each step of the supply chain, including electrolysers, fuel cells, distribution technology and central heating systems. In the north of the country, in the first European 'hydrogen valley', plans have been revealed for Europe's most ambitious hydrogen project, including a huge offshore wind farm and onshore (and possibly offshore) hydrogen production. The project's goal is to produce 800,000 tonnes of hydrogen annually in the future, using existing gas infrastructure to transport it to industrial customers throughout Northwest Europe.

Carbon capture, utilisation & storage (CCUS)

CO_2 is not in itself a problem gas, provided we can prevent uncontrolled and large-scale emissions into the atmosphere. In fact, it is a valuable commodity. The large Dutch horticulture sector needs vast amounts of CO_2, while it can also be a useful raw material for producing (bio)plastics, biofuels and building materials. More than 40 companies and research institutes in the Netherlands have joined forces in a national R&D programme for CCUS technology. Another consortium focuses on developing new applications for captured CO_2, with the goal of reducing CO_2 emissions at Mt scale per year. Such efforts have helped to develop new techniques for capturing and storing large amounts of CO_2 in the petrochemical and steel industries, as well as from waste incineration plants.

Liquefied Natural Gas (LNG)

LNG is an important 'transition fuel', especially for the road transport and (inland) shipping sectors. It's still a fossil fuel, but compared to diesel, emissions of CO_2 are up to 20% lower. Dutch technology providers have been at the forefront of developing a reliable and safe LNG supply chain, with the port of Rotterdam as Europe's largest LNG distribution hub. Recent innovations include robotised fuelling technology for trucks and mobile LNG-fuelled shoreside power systems for large vessels such as cruise ships. Other Dutch companies focus on the next stage in the transition, by scaling up the production and distribution of biobased LNG.

Plans have been announced for the world's first offshore hydrogen plant, which will be built ten kilometres off the Dutch coast. The PoshYdon project will use disused oil & gas platforms and existing pipelines to produce and transport green hydrogen made from solar and wind power.

Over a hundred million cubic metres of green gas is produced in the Netherlands each year, mostly using anaerobic digestion technology. Supercritical gasification of biomass will enable much higher production volumes. SCW Systems and Gasunie New Energy have built the world's first industrial-scale pilot plant, which can process a wide range of 'wet' waste including manure and sewage sludge, and are currently planning new facilities with a total capacity of around 20 PJ.

AVR is a Dutch energy-from-waste operator which produces steam, district heating and power. Together with technology partners including TNO and Tebodin it built a facility for CO_2 capture from the flue gases at its site in Duiven. The captured CO_2 is supplied to the greenhouse horticulture sector with an expected off-take of 60,000 tonnes per year. A similar facility is planned on AVR's site in Rotterdam.

Nordsol uses biogas from organic waste streams to produce BioLNG for the long-haul, heavy duty transport sector. It is one of the initiators of the BioLNG Euronet project, which facilitates the mass scale adoption of LNG as a road fuel in Europe, for example by building a network of filling stations covering key transport routes from southern Spain to eastern Poland.

Sif Group is a global leader in monopile foundations for offshore wind farms. It is already manufacturing the huge monopile foundations required for larger turbines, with a diameter of up to 11 metres and a maximum weight of 2,000 tonnes.

GE is currently building and testing the world's largest wind turbine, on the North Sea coast near Rotterdam, in close cooperation with ECN part of TNO. The Haliade-X turbine is 260 metres high, with 107-metre-long blades, and has an unprecedented capacity of 12 MW: enough to deliver electricity for 16,000 households.

Offshore wind

Over the past ten years, offshore wind energy has emerged as one of the drivers of the energy transition, with year-on-year growth rates of nearly 30%. Yet the untapped potential is still huge: according to the IEA, it has the potential to generate more than 18 times the current global electricity demand.

The Dutch, too, expect offshore wind to underpin the country's energy transition. By 2030, 11 GW of wind farms are expected to be up and running in the North Sea. And the Netherlands has a vast reservoir of expertise to draw on. The country's offshore wind sector has extensive experience in important aspects such as site surveying, optimising wind farm design, transport and installation and engineering challenges specific to offshore wind. Current research programmes focus on making offshore wind more affordable, reliable and environmentally friendly. For example, by developing intelligent sensor and monitoring systems and robotisation of inspection and maintenance activities.

Although the Netherlands doesn't produce offshore wind turbines, it is a highly valued R&D partner for international manufacturers, who work closely with Dutch research groups and in some cases have established their own Centres of Expertise in the Netherlands. For example, advanced modelling and monitoring by TNO Energy Transition (a business unit of the Netherlands Applied Research & Technology institute TNO) plays a crucial role in the development of rotors with a capacity of over 10 MW. Dutch companies are also working on related innovations, such as the large monopile foundations and installation vessels that will be needed to install this next generation of 'super turbines'.

Offshore transport and installation of wind turbines – regardless of size – is a special area of interest for many Dutch companies. The country boasts a large and internationally renowned maritime services sector, and Dutch contractors are world leaders in installing offshore wind turbine foundations. In various partnerships and consortia, these companies are looking to develop faster, more efficient and ecologically responsible ways of installing turbines and their foundations.

Foundations, in particular, are receiving a lot of R&D attention. The traditional installation method uses hydraulic impact hammers, which create underwater noise, potentially damaging nearby marine life and ecosystems. Dutch innovations are aimed at minimising noise while retaining (and preferably improving upon) the speed and efficiency of the traditional method. One such technique 'turns' the foundation piles into the ground rather than driving them, and is appropriately called Gentle Driving of Piles (GDP). Another solution combines a noise-reducing 'vibratory hammer' with other equipment to enable the entire installation process – lifting, upending, positioning and driving down the pile – to be carried out in one single operation.

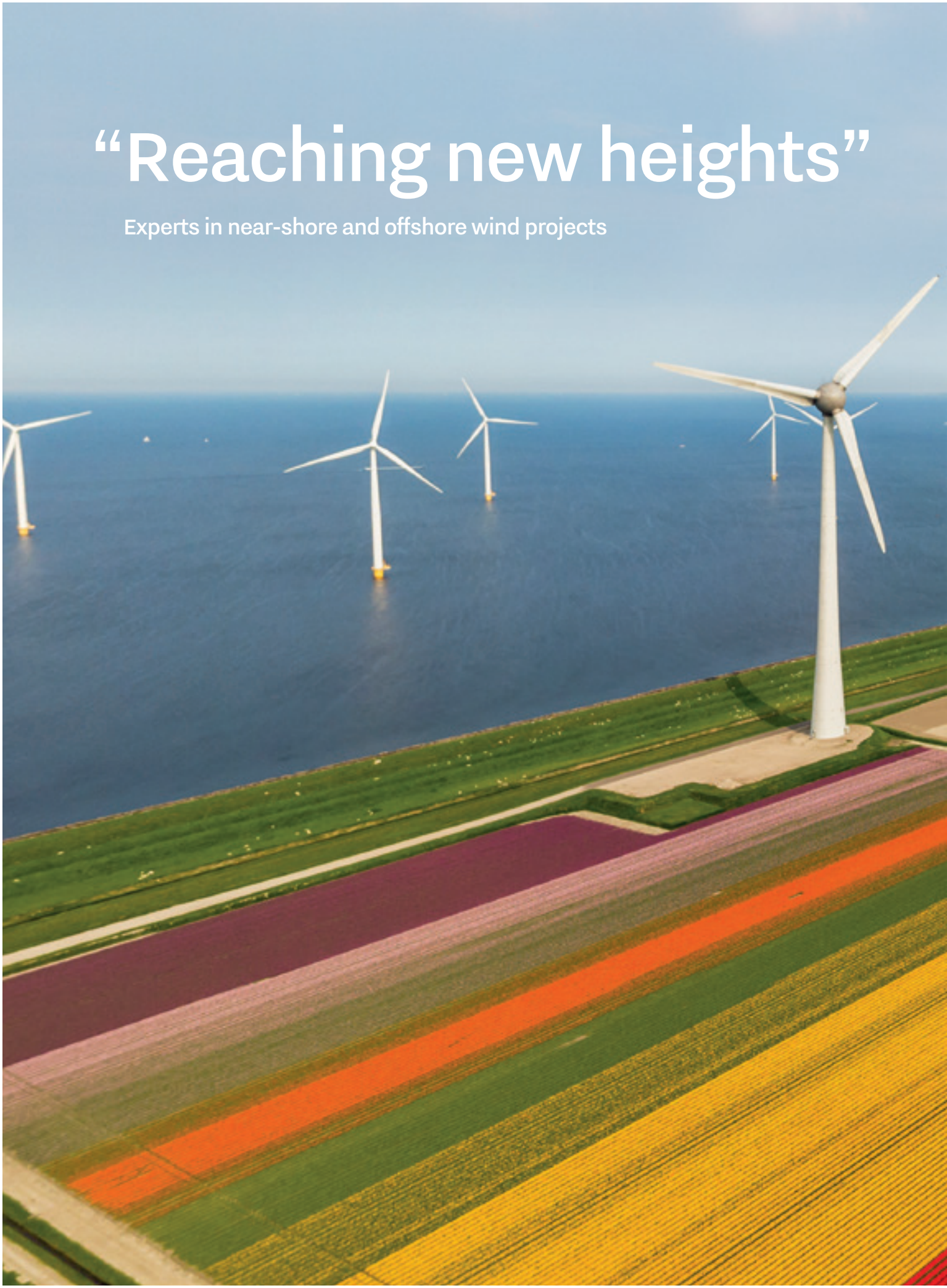
Another challenge is to optimise the process of connecting turbine towers to the foundations. Current methods use bolts or grout, both of which require regular inspections and maintenance. Several Dutch companies are working on more elegant and efficient alternatives. One such innovation 'wedges' the tower into place, resulting in substantial savings in installation and maintenance costs. Other companies are adapting the 'slip-joint' method, which is already used on land, to the specific requirements of offshore installations. This technology uses the tower's weight to 'slide' over cone-shaped monopiles, in a process which can save up to 20 million euros in installation costs per wind farm.

While, on the one hand, many new wind farms are being built, the first generation of wind farms is already nearing the end of its lifecycle. As more and more turbines are replaced with newer models, the question arises what should be done with the turbine's foundations, which are sunk dozens of metres into the seabed. So far, the traditional approach was to cut off the top of the steel piles and leave the rest. However, a new hydraulic technique developed by Deltares and tested by various Dutch companies allows the entire monopile to be removed in a faster, cheaper and, above all, more circular process.

The Borssele Wind Farm Zone consists of 5 sites, one of which has been designated as an innovation site. In addition to the maintenance-free slip-joint method for connecting the monopile and transition piece, innovations include a new coating technology, eco-friendly scour protection, a new type of cable entry hole and a new ICCP monitoring system.

“Reaching new heights”

Experts in near-shore and offshore wind projects



Next-generation solar technology

Solar energy is growing rapidly, yet its growth rate will have to triple in order to achieve internationally agreed climate ambitions. Smart technology is needed to lower production costs, to boost efficiency and to develop creative ways of incorporating solar technology into our everyday environment. Dutch companies and researchers are among the global pioneers taking up this challenge.

Averaging around 1,500 hours of sunlight a year, at first glance the Netherlands does not appear to offer the best possible climate for the development and large-scale deployment of solar energy. Yet for decades it has been one of the global leaders in both fundamental and applied solar research. The Dutch were among the first to build a fully functioning solar energy system and have developed crucial patents still used by numerous international manufacturers.

One of the factors behind the sustained success of the Dutch solar sector is a healthy home market. In terms of annual installed capacity, the Netherlands is among the top 3 countries in Europe and in the top 10 globally. The Dutch government's CO_2 reduction commitments are accompanied by an active innovation policy, and there is a vibrant ecosystem of companies and research institutes covering virtually the entire solar technology chain: from materials to device design, manufacturing equipment, software, high-end solar modules and project development.

As in other areas of sustainable technology, the Dutch solar sector has a strong tradition of joint research and innovation programmes. Much of this effort is currently focused on making solar energy more competitive. In a joint innovation agenda, the sector states that the manufacturing costs of solar panels and thin films can be halved, yield can increase by at least 25% and the average lifespan can be extended by at least 10 years.

Important innovations that contribute towards this goal are surface passivation and bifacial solar cells, for which Dutch researchers laid the foundations almost 30 years ago. More recently, substantial progress has been made in the development of tandem structures, in which several types of solar cells are combined. The Netherlands also has specific expertise in thin-film photovoltaics. And, crucially, in developing production methods for 'new' types of solar cells, as well as in making existing production processes more efficient.

A growing number of companies in the Netherlands currently focus on another question: how to integrate solar technology into (roadside) infrastructure, buildings or agricultural settings. As in many other urban areas, space in the Netherlands is scarce and multiple land use is encouraged. This has led to innovations such as high-end building components with integrated solar cells, and new materials and films that offer greater freedom in terms of colour, shape, flexibility and size. The Dutch are also building floating solar farms in more and more challenging wind and wave conditions. Automated, sun-tracking installations are developed that fit in with the natural landscape, or can be combined with agricultural land use.

This increased focus on how to fit solar technology into the landscape and urban environments leads to an intensive cross-pollination of technology and applications. Entirely new value chains are created, in which suppliers of PV technology join forces with architects, contractors and installation companies, and with organisations responsible for infrastructure and public spaces. It has also led to an even sharper focus on the long-term reliability of solar technology, and on advanced monitoring solutions and calculation models to accurately predict anticipated yields.

Solar-tracking floating PV

Based on extensive experience built up with floating solar modules near Rotterdam harbour, Floating Solar has realised one of the world's largest solar-tracking PV systems in a reservoir next to a water purification plant. Special Weather Risk Management technology will minimise the risk of damage by automatically repositioning solar panels during storms.

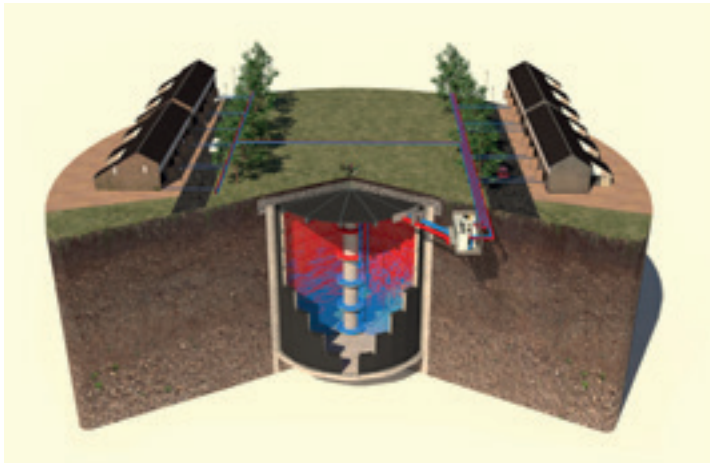
Dutch solar expertise hits the road: Lightyear recently unveiled the world's first fully solar-powered car, the first commercial models of which are scheduled for delivery in 2021

Building-integrated PV

In Kameleon Solar's coloured solar modules, cells become invisible from a distance of more than 5 metres. The technology has been used to incorporate stunning images and to create interactive, energy-producing façades. Wellsun's sun-tracking façade panels (pictured above) produce solar energy (with an efficiency of 30%), control natural lighting, act as a heat barrier and, at night, can be used as a media wall.

Production technology experts

Dutch research and equipment developed by machine manufacturers such as Levitech and Solaytec, have helped to convert the traditionally very slow atomic layer deposition (ALD) process into a continuous workflow capable of processing thousands of wafers per hour. Smit Thermal Solutions' equipment, as pictured above, allows solar manufacturers to deposit semiconductor layers on large substrates.



The Ecovat is a huge subterranean buffer tank which can store heat in water of 90°C, with an energy loss of less than 10% over a six-month period. In The Hague, the technology is used in combination with solar thermal collectors to create a year-round heat supply for over 800 residential homes and 8,000 m2 of office space.

In the former mining town of Heerlen, mine corridors have been transformed into an innovative circular energy network which provides heating and cooling to homes, offices, shops and industrial companies. When demand drops, residual energy is stored in existing underground corridors or power plants with buffer vessels.

Heating and cooling the built environment

Over 75% of all the energy needed in the built environment is used for heating (and cooling) spaces and tap water. Decarbonising these processes is a major challenge - certainly in the Netherlands, which since the 1960s has relied heavily on natural gas. The Dutch are preparing for a second 'Heating Revolution', driven by technological innovations that pave the way for a carbon-neutral heating and cooling infrastructure.

Whereas in many countries natural gas is seen as a relatively clean transition fuel, compared to oil and coal, the Dutch have started the process of phasing out natural gas from the country's residential heating system. It's a considerable challenge for a country where 90% of all energy needed for residential heating is produced using natural gas. When the Dutch discovered their natural gas fields in the 1950s, it triggered a 'heating revolution' in which nearly every residential house was connected to the national gas grid.

Now the Dutch Climate Agreement (see p. 9) aims for a second revolution. As the first milestone, no fewer than 1.5 million existing homes must be energy-neutral and gas-free by 2030. Local authorities are drawing up plans to disconnect whole neighbourhoods from the gas grid. Home-owners are encouraged (and are often eligible for subsidies) to invest in new technology that reduces their dependence on gas, such as heat pumps and solar-powered water boilers, in combination with extensive insulation measures.

Dutch technology providers have been quick to respond. For example, the country is home to some of the world's top manufacturers of central heating boilers, who have expanded their portfolio with heat pumps and developed important innovations. One example is the hybrid heat pump, which combines a highly efficient gas-fuelled boiler with an electric heat pump. Other technology focuses on heat recovery, for example from waste air flowing through mechanical ventilation units, or from shower water.

Whereas heat pumps offer 100% electric heating, they are not suitable for every existing home (or budget). Several Dutch manufacturers have come up with innovations that enable a gradual transition from gas to electric heating. For example, Inventum and Itho Daalderop produce and export hybrid heat pumps which combine highly efficient combi boilers with an electric heat pump, in configurations that are easy to fit into existing homes.

An important premise in the Dutch strategy is that no single energy source will be able to replace natural gas. Fully electric heating, geothermal energy, and even using the existing gas infrastructure to transport 'green gas' or hydrogen, will all play a role in the country's future heating and cooling infrastructure.

In densely built-up areas, especially with many high-rise buildings and older homes, district heating can also be an efficient way of decarbonising residential heating, provided it uses residual heat that was generated using renewable sources. Currently, 4% of homes in the Netherlands are connected to a large 'thermal grid', and thousands more to one of roughly 200 smaller initiatives. Dutch companies and research institutes are working on solutions for a next generation of thermal grids, which will have to cover larger areas and transport heat along greater distances with much smaller losses than existing networks.

Another focus area for innovations is heat storage. Storing heat is an important complementary technology to electrification, since it can compensate for fluctuations in the supply of renewable energy and help to relieve the strain on the electricity grid when demand peaks. Available solutions and continuing research use different technologies to store heat, either in water, using thermochemical storage or phase-change materials. Particularly interesting are new technologies to store large quantities of heat underground with minimal heat loss. Innovations such as the Ecovat (see page 30) enable large heat buffers to be built up during summer, and stored for six months or more.

The storage question also sheds a new light on the large and sophisticated gas infrastructure the Dutch have built up over the years. Even as natural gas itself is phased-out, this infrastructure remains a crucial asset. It will allow both natural gas and, increasingly, alternatives such as green gas and hydrogen to be used as an energy reserve, underpinning the success of the second 'heating revolution'.

Five benefits of doing business with the Dutch

1. Quality and reliability

The Dutch combine first-class technical expertise and innovative strength with a commitment to delivering high-quality, reliable products and solutions. Working with Dutch technology means you can be certain of compliance with the highest (European and international) standards.

2. An international outlook

The Dutch have been doing business abroad for centuries. They understand what it takes to work successfully across borders and cultures, and are regularly ranked as having the world's most proficient non-native English skills.

3. High-tech excellence

The Netherlands has a long history in high-tech innovation. In terms of the number of patents per capita, it ranks second in the world. It is home to world-class research institutes in clean energy technology, global players in semiconductor technology and excellent machine manufacturers.

4. Joint innovation

The Dutch excel in creating flexible, fast-moving networks of specialist companies and research institutes. The Netherlands is home to dozens of 'field labs' in which such networks translate fundamental research into innovative solutions and test them in real-life pilot environments.

5. Easy access to specialist expertise

The Netherlands has organised its clean energy expertise into national consortia. These networks offer fast and easy access to the right technology providers, researchers or combination of specialists.

Dutch clean energy expertise in brief

Looking for specific expertise or technological solutions? In this section over a hundred Dutch technology providers with international track records introduce themselves and their portfolios. Consult the table on p. 36/37 to identify possible partners in your next step towards a cleaner future.

Supporting clean energy

Energy is a necessity of life for people all over the world and global demand for energy is increasing rapidly. One of the greatest challenges of our time is to provide reliable, affordable and renewable solutions for all. Besides increasing demand for energy, we also have to prepare for global climate change. Climate change requires a different kind of energy supply and calls on us to develop new solutions and systems for a durable supply of clean energy.

The Netherlands has made substantial strides in the areas of renewable energy and energy efficiency, attaining a leading position in offshore wind, biomass processing and greenhouse farming. The energy sector contributes substantially to Dutch national revenue, exports and employment.

Approaching complex energy issues

The Dutch energy sector enjoys a strong global position. This success is founded on a typically Dutch quality: the willingness to share knowledge within tight-knit alliances between industry, research, NGOs and government. This has made us a frontrunner in public-private research and open innovation partnerships and is how we prefer to approach complex energy issues.

Effective and clean solutions

This cooperative approach is manifest in our clean energy solutions, which offer complete, effective and coherent products and services geared to what people and companies truly need. The Netherlands regularly paves the way from knowledge to skills to new products and services, leading to integrated, sustainable, effective and clean solutions to meet energy demand.

Win-win solutions

The Dutch energy sector is an ideal partner with experience, knowledge, products and services in the field of clean energy. The Dutch offer solutions to deal with complex energy supply and demand, both in developed and developing countries. Cooperating and doing business with the Netherlands means all parties invest in a win-win solution. Citizens, companies, research institutions, investors and governments can all work together to achieve results that make a difference.

The Clean Energy Guide showcases innovative Dutch organisations operating in the clean energy sector. It is with great pride that we present these organisations to you.

Manon Janssen
Chair Top Sector Energy

TOPSECTOR ENERGIE
Empowering the new economy

	WIND	OFFSHORE WIND	SOLAR	BIO ENERGY	ENERGY FROM WATER	GEOTHERMAL	SMART GRIDS	DISTRICT HEATING/COOLING	SUPPLY	ENERGY STORAGE	NEW GAS	ENERGY EFFICIENCY	ELECTRIFICATION	HEATPUMP	RESEARCH/ ADVISORY	ASSOCIATION	PAGENUMBER
A de Jong							●			●	●	●		●	●		38
Adverio				●											●		38
Air@Work					●			●				●		●			39
Arcadis															●		39
Asimptote			●		●	●		●		●	●	●	●	●	●		40
ATEPS							●			●		●					40
Biobased Energy Solutions BV				●											●		41
Biogas Plus				●													41
BioGasJG				●													42
BIPV			●														42
Blackwood				●													43
Blockheating								●				●					43
Bright Biomethane				●	●					●	●						44
BTG-Bioliquids				●													44
Byosis				●													45
Centrica			●	●			●	●		●	●	●	●	●	●		45
Colson				●	●						●	●			●		46
Colubris Cleantech				●													46
Crownstone							●					●	●		●		47
Delta21		●	●		●	●				●					●	●	47
DMEC					●					●		●	●		●	●	48
DMT				●													48
DNVGL			●				●								●		49
DSM			●														49
Dutch New Research															●		50
Econvert				●													50
Ecorys															●		51
Ecovat					●		●	●		●					●		51
Edvisory				●											●		52
Ekinetix	●	●	●	●	●		●		●	●	●	●	●		●		52
Electron											●	●	●				53
ELEQ	●	●	●	●			●			●							53
E-Magy										●							54
Energy Floors			●										●				54
EnergyStorageNL										●						●	55
ENKI Energy				●											●		55
Envaqua				●	●											●	56
ESDEC			●														56
Fluor			●	●	●				●	●	●	●	●	●			57
FME			●	●			●		●	●	●	●	●		●	●	57
Frames				●						●	●	●			●		58
GreenFish	●	●	●	●	●	●	●	●		●	●	●	●	●	●		58
GreenLink			●							●		●	●				59
GreenMac				●													59
H2arvester			●				●			●	●	●					60
Hans Moor															●		60
Heatmatrix								●				●					61
Holland Home of Wind	●	●														●	61
Holland Solar			●													●	62
Host				●	●			●		●	●			●			62
Hovyu				●							●				●		63
HydroPV			●														63
IkbenRa			●					●		●							64
Inductecc			●				●			●		●			●		64
Inventum												●	●	●			65
Itho Daalderop						●	●			●				●			65
Kara				●				●					●				66

	WIND	OFFSHORE WIND	SOLAR	BIO ENERGY	ENERGY FROM WATER	GEOTHERMAL	SMART GRIDS	DISTRICT HEATING/COOLING	SUPPLY	ENERGY STORAGE	NEW GAS	ENERGY EFFICIENCY	ELECTRIFICATION	HEATPUMP	RESEARCH/ ADVISORY	ASSOCIATION	PAGENUMBER
Krohne			●	●								●					66
Levitech			●														67
Logisticon												●					67
Lovink Enertech									●			●					68
Mavitech				●													68
MTT				●			●				●	●	●				69
Morphotonics			●														69
Netherlands Enterprise Agency	●	●	●	●							●						70
NWEA	●	●														●	70
New Cosmos	●	●	●	●			●	●	●		●						71
Nijhuis				●													71
Oryon Watermill					●		●			●							72
Paques				●													72
Pentair					●							●					73
Pentari Haffmans				●													73
Proton Ventures	●	●	●							●	●				●		74
Redox										●							74
Redstack					●					●							75
Rivusol			●														75
Rolls Royce				●			●			●	●	●					76
SeaQurrent					●												76
SemioticLabs												●					77
SkyNRG				●													77
Smit Thermal Solutions			●														78
Solar Century			●														78
Solar Fields			●														79
SolaRoad			●														79
SolarTechno			●							●							80
SoluForce									●								80
Summit Engineering										●	●	●		●	●		81
Sun Projects			●												●		81
Sympower				●			●						●		●		82
Synova				●													82
Talent voor Transitie	●	●	●	●	●	●	●	●		●	●	●	●	●	●		83
Technip				●						●	●	●	●		●		83
TWD	●														●		84
Tempress			●														84
Tidal Bridge					●												85
Tizzin										●		●					85
TKI Urban Energy			●				●	●		●					●		86
TNO	●	●	●				●				●				●		86
Tocardo					●												87
Torque Wind Turbine	●																87
Torrgas				●													88
Transition Hero				●	●			●		●	●	●	●	●	●		88
Triogen				●													89
Van der Kooy				●				●									89
Van Der Valk			●														90
Van Oord		●															90
Victron			●						●	●							91
Water2Energy					●							●			●		91
Wellsun			●														92
Wiefferink				●													92
Woodside							●			●				●	●		93
Yilkins				●													93
ZigzagSolar			●														94

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De Jong Group is a family business specialized in environmental and energy technology. Our five operating companies are specialized in two product groups: HVAC installations and industrial burner systems.

Environmental and energy technology are closely related to sustainability. It is our mission to manage our living environment by developing and deploying safe, clean and efficient air conditioning, energy and burner system applications. All our products reduce energy consumption and emissions.

The relationship with our clients begins at the design stage, proceeds through implementation and continues on into management, service and maintenance. We are a dedicated group of professional engineers and technicians that strive for excellence in our work. We believe that good customer care leads to personalized solutions.

And to offer you customized HVAC installations and industrial burner systems, we gladly walk that extra mile. We explore your core business and get to know your needs and desires This is how we unburden our customers. Through our years of experience and extensive knowledge, we effectively respond to various environmental factors and to your specific customer requirements.

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Adverio's focus is on engineering (EPCM) and realization of the energy projects based on processing of organic (waste) streams into the most suitable form of renewable energy, from initiation till realization. Our philosophy to the client is about finding the technical partner you can trust and work throughout the entire process and long after the start-up. Choosing the right partner will ultimately guarantee the best return on client's investment.
Adverio's objective is finding practical solutions and innovative technology which is business driven, but is above all about people, about building relationships and working towards optimum satisfaction.

Over 30 years of experience has taught us what works – a collaborative approach to engineering and project management that shares clients vision to build renewable energy projects, whether a small scale waste-to-energy project or a large scale energy plant. We say what we do and we do what we say and adhere to a fast and direct interaction. We don´t just work for you, we work with you. Based on Design to Built.
Adverio is a network company. Through our international partnerships we have a global presence. Adverio provides a full spectrum of service for clients all over the world. Adverio has worked in China, Korea, Russia, Middle East, Africa, South America and most of Europe.

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Air@Work advise and deliver energy efficient and environmentally friendly air handling and air conditioning systems. Air@Work offers solutions with low investment & maintenance cost for the climate control of non-residential buildings and industrial spaces.

Fresh, clean air and a comfortable temperature is a necessity for a healthy working and living environment. Unfortunately, this no longer seems obvious. As well the climate change and air pollution are increasingly more challenging.

Air@Work has developed the Purified Fresh Air system. A complete air handling solution. This system ensures clean and conditioned air in a sustainable and energy efficient way.

Filtering of the air intake is the first step with an electrostatic filter and collecting the fine and ultra-fine particles by specially developed collector plates. Operation is 99% guaranteed with an exceptionally low pressure drop, up to 90% lower than conventional (HEPA) filters, resulting in low energy consumption. Cooling or heat recovery is the second step in the system to bring the air to a comfortable temperature. This is done with a high efficiency counter flow heat exchanger with an integrated indirect evaporation cooling system. The evaporation power of water saves up to 80% on the cooling costs. The Air@Work Purified Fresh Air system is highly energy efficient and exceptionally well applicable for schools, health institutions, offices and industry.

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A reliable power supply is crucial to a flourishing economy. For decades, we have relied on fossil fuels to meet our power demands; but because of their detrimental impacts such as global warming, air quality and land degradation, de-carbonization through a shift to renewable energy has never been more urgent. Society starts to realize the impacts of climate change; governments are racing to create sustainable strategies. Industries are evaluating their strategies and the transitions they have to make. At Arcadis, we understand that navigating energy transition can be both a source of risk and opportunity. This is why we draw on our technical expertise and extensive international experience to assure our clients that we can help them in making strategic choices toward investable, affordable and future-proof energy solutions. Aside from our technical expertise, our approach recognizes local communities as key stakeholders thus we adopt a holistic approach to project setup and employ inclusive stakeholder engagements to mitigate delays in delivery.

Guided by our mission ‘Improving quality of life’, we believe that, together, we can create cleaner energy sources and secure a sustainable future for us all. For years we try to lead by example, by running our company in a responsible manner. In the last eight years this resulted in a 40% reduction of our carbon footprint. For our clients we leverage our deep understanding of sustainability and energy transition to deliver groundbreaking projects and solutions that create value for our clients and make positive contributions to the environment and society.

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Asimptote's mission is to provide the most advanced expertise and software tools to the energy engineering market. We bring the latest knowledge and computer programs in the thermal energy conversion field straight from the best universities to your company. We do this by conducting studies touching on the front of technology and supplying our advanced design and simulation software, which is continuously developed at leading scientific institutions.
Asimptote is a conduit of expertise from internationally renowned researchers to industry. Through our permanent cooperation with scientists, we have access to top-level expertise in all the aspects of modeling, design and optimization of energy systems and components. This means that we can provide you with consultancy and software for challenges that go well beyond current technology and practice.

Our market consists of all the companies and institutes involved in the thermal energy conversion chain. These include:

- Utility companies
- OEM's of power systems and components (R&D departments)
- OEM's of propulsion systems and components (terrestrial and aerospace)
- Divisions specialized in energy engineering and/or energy savings for the manufacturing industry (e.g. chemicals, oil and gas, etc.)
- Suppliers and operators of gas turbine fleets and aircraft engines
- Energy engineering firms and companies
- Government agencies
- Research institutes

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ATEPS develops, builds and supplies battery-based Energy Storage Systems. We make sustainable energy storage accessible, safe and attractive through smarter management of electrical energy. Store your energy when it is available and use it at a later time.

ATEPS supplies systems in either stand-alone 1"racks or containerized systems. The 10, 20 or 40-feet, containerized systems range from 100kW/100kWh to more than 1MW1MWh. Their modular design makes it easy to expand our storage systems by connecting multiple battery racks or converter systems together.

Our stand-alone PWR boosters are configured with 19" cabinets, a 30kW converter and Li-ion batteries with a total capacity of 35kWh. Just as with the containerized systems, multiple racks can be configured together to increase storage capacity and/or power by adding modules. This flexible design makes it possible to respond to the latest developments, now and in the future.

ATEPS systems can be used for energy exchanges and the imbalance market, frequency of the electricity grid, prevention of peak loads, buffering of energy and off-grid use. All of the ATEPS installations can be connected to a MS Azure cloud application to get insight information from the systems. The storage system sends data to this cloud via a wired or 4G modem so you get easy and safe access to the system via your PC, Tablet or Smart Phone.

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BIOBASED ENERGY SOLUTIONS BV

Biobased Energy Solutions (B.E.S.) is on an international level involved in sustainable development projects. B.E.S. plays a role in different innovations, both large (centres of excellence) and small (private developments). B.E.S. reviews these projects on strengths and weaknesses and looks into possibilities to combine them with other developments. If optimization is possible, B.E.S. develops a business case, including possible financing and more.

We are currently supporting a large-scale forest renewal project we have developed in Switzerland, where old wood is converted into electricity. We also take inventory in the reduction of the CO_2 footprint and convert it into tradable certificates.

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Biogas Plus

Biogas Plus specializes in the design, engineering, construction and operation of biogas installations. Biogas Plus has over 12,5 years of experience with all kinds of biogas installations, both large industrial and farm scale.

The design philosophy implicates that an installation must be capable of handling all kinds of substrates. Robustness, simplicity and flexibility are key for a successful biogas project. Biogas Plus advocates a separate hydrolyses phase.

Biogas Plus has developed some specific key components like the innovative pump system Vacuum Pressure Tank. The pump system makes it possible to pump sludges with a relatively high dry matter in combination with low maintenance and a very high reliability. The components can also be delivered stand-alone. Biogas Plus also delivers biogas upgrading systems for the production of biomethane.
Since April 2018 Biogas Plus is part of Engie. Engie is a leading international energy and technology company.

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BiogasJG

Since 2014 BiogasJG supports biogas producers in managing their desulphurization process and improving their methane production. BiogasJG supplies additives that can be supplied directly into the digester and products that can desulfurize the biogas as an end-of-pipe solution. With the support of their partner laboratory in Slovakia, biological analysis can be done, and advice can be provided to improve the biological process in order to increase the methane production.
Our main product, FeSfix, is a nano powder based on iron oxide (FeO and Fe_2O_3) and contains valuable trace elements. The iron oxide reacts with hydrogen sulphide (H_2S) in the digestate during the process of anaerobic fermentation. The trace elements are nutrients for the micro-organisms that will increase their yield on methane. On top of the trace elements that are naturally in our product, BiogasJG can also supply some of the commonly used trace elements, which are not already in FeSfix, as well as enzymes in order to provide a one-stop-shop for biogas producers.
With our latest product FeSfix-G we offer an alternative for active carbon as desulphurization medium in filters. FeSfix-G is based on our regular FeSfix and can be supplied in different particle sizes to fit any active carbon size or form. FeSfix-G can be used as fertilizer and doesn't need regeneration, incineration or disposal via land fill.

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BIPV Nederland
Slim en mooi bouwen met zonne-energie

BIPV Nederland is a business association for partners active in the BIPV world. Typical partners are BIPV producing and selling companies, knowledge institutes and universities and associations active in the energy sector. BIPV Nederland's mission is relating to 'smart and beautiful building with solar energy'.

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Blackwood Technology is a leading biomass torrefaction technology company. Its FlashTor® technology can be used to transform woody biomass and/or agricultural residues into torrefied biomass, a high grade solid bio-fuel. Torrefied biomass is a renewable drop-in replacement for fossil coals in power stations and/or steel plants.
The FlashTor® technology was developed by Blackwood's predecessor Topell Energy, one of the early pioneers of biomass torrefaction. The technology was proven in a commercial scale demonstration plant in Duiven, the Netherlands. And Blackwood has worked with large European utilities to conduct successful co-firing tests of torrefied biomass in pulverized coal power stations.

The company's technology development was funded by Innogy Ventures Capital, the renewable venture capital fund of German utility RWE, which is still a shareholder.
Blackwood has started its international roll-out in 2016 by signing a first licensing agreement with South African utility Eskom. Currently Blackwood is working on several projects in Asia and North America. Blackwood seeks partnerships with parties which have a strategic interest in setting up supply chains of torrefied biomass.

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Blockheating offers recycled heating for greenhouses for a sustainable food chain. We build a compact, watercooled datacenter next to a greenhouse, in order to use the waste heat directly at the location. By modifying the existing datacenter hardware, the waste energy can be extracted at high temperatures, without the need for a heat pump, or additional infrastructure at the greenhouse.

In 2020 we will launch a full scale pilot version, with up to 400 servers, delivering up to 180 kw of heat at 55-60 degrees. The goal is to increase this temperature later on to a maximum of 65 degrees. Since a datacenter is used day in, day out, our solution is great for delivering a baseload of heating, in combination with alternative sources like boilers, cogeneration, biomass or other alternatives.
On the datacenter side we offer cloud computing/storage solutions for Edge applications and HPC. Due to the nature of our infrastructure our datacenters will be close to residential areas, on locations where a typical datacenter cannot be built. This integration in the landscape allows Blockheating to develop a fine grid of micro datacenters in the vicinity of the end user.

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BRIGHT BIOMETHANE

Bright Biomethane offers biogas upgrading systems using membrane technology to upgrade biogas to biomethane. Bright's PurePac systems are designed to upgrade biogas from any form of waste or biomass feedstock and are applicable in any industry. Due to a standardized, but modular system, Bright is able to deliver a total range from small to large biogas upgrading systems suitable for any existing or new biogas plant type.
Biomethane is flexible in its application. Likewise is the produced biomethane in a PurePac which is suitable for injection in the gas grid, compression to bio-CNG for use as vehicle fuel and compression for the use in a virtual pipeline system. At a virtual pipeline, the gas is compressed to a high pressure enabling it to be economically and safely transported to a remote facility with grid entry point where the gas is injected into the pipeline. This is an ideal solution when no pipeline or grid infrastructure exists at the production location.
For the separation of carbon dioxide (CO_2) to obtain biomethane, membranes with the highest selectivity are used. The 3-step membrane arrangement assures high biomethane quality, according to specifications, with maximum methane recovery of >99.5%.
Biogas purification is a valuable and attractive alternative compared to using a combined heat and power (CHP) system that generates electricity and heat. The PurePac system can be extended with a CO_2 recovery module to recover and liquefy the gaseous CO_2 that is produced during the upgrading creating an extra source of revenue for the plant owner.

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btg-btl
biomass-to-liquid

As BTG Bioliquids we replace fossil fuels by Fast Pyrolysis Bio-Oil (FPBO), an advanced biofuel that can be used directly as a renewable heating fuel to replace heating oil or natural gas, and that can also be converted into a drop-in fuel for transportation. The associated greenhouse gas savings are up to 93%. As a technology provider and product leader we are committed to the commercial deployment of our fast pyrolysis technology. We built the first commercial pyrolysis plant in the Netherlands (Empyro) in 2015 and are currently constructing two more plants in Scandinavia; one in Finland for Green Fuel Nordic and one in Sweden for Pyrocell.

The Empyro plant produces 20 million litres/year of pyrolysis oil using the pyrolysis process developed by BTG. The plant is self-sustaining and produces an excess of renewable electricity and steam as by-products, which are supplied to nearby factories. The plant for Green Fuel Nordic will also produce 20 million litres of pyrolysis oil per year that will be used as a renewable heating oil. The plant for Pyrocell (operational in 2021) will produce around 25,000 tonnes of pyrolysis oil.These developments show that our fast pyrolysis is proven at commercial scale and worldwide capacity is expanding. Further applications of FPBO are under development.

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Byosis stands for practical, feasible and customer specific solutions. Whether the input material is crops, agricultural residues, industrial waste, green waste, sludge, municipal waste or highly contaminated wastewater, Byosis offers solutions to recover the nutrients, remove ammonia and significantly improve the efficiency and capacity of your process. We strongly believe in and contribute to the circular economy.

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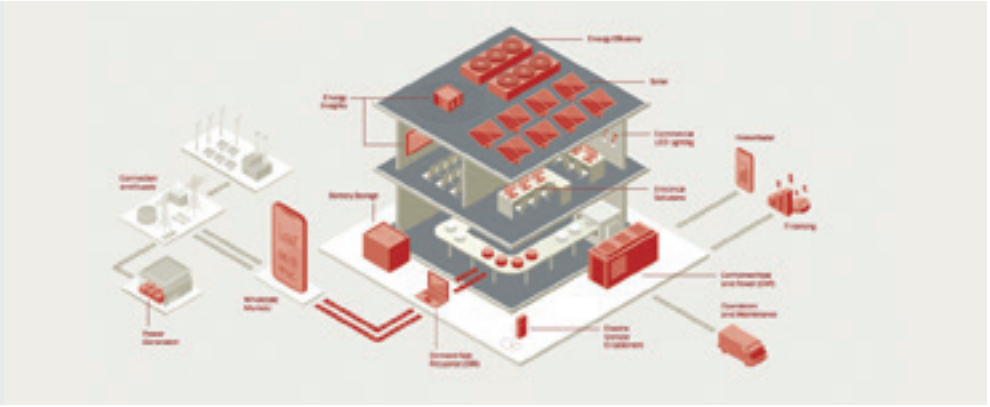

Centrica Business Solutions operates across the UK and Ireland, Europe and North America and is at the forefront of the distributed energy market. With price predictability a thing of the past, increasing volatility of supply, and new energy technologies emerging, we provide energy expertise to help our customers become economically and environmentally sustainable.

Through our acquisitions of market leading energy specialists ENER-G, Panoramic Power, REstore, Vista Solar, CES Energy and SmartWatt, we can provide the innovative thinking as well as the energy insights, optimisation and on-site generation solutions our customers need to achieve their goals.

We provide end-to-end distributed energy solutions to power performance, resilience and long-term value for our customers. Changing views around cost and carbon footprint are leading to greater adoption of energy efficiency solutions. These energy efficiency measures are providing a springboard for businesses to invest in smart energy technologies such as demand side response, combined heat and power, solar, battery, energy management platforms and electric vehicles that enable energy optimisation and resilience.

Tomorrow's innovation is available today from Centrica Business Solutions, which is a global leader in developing and operating AI controlled smart grids. In 2018 we launched the world's most advanced Virtual Power Plant. Our patented AI VPP solution monetizes distributed energy flexibility from the most lucrative markets.

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Colsen
water, energy & environment

Colsen represents an innovative company with technological solutions in wastewater treatment, biogas technologies and nutrient recovery. We have a track record of more than 30 years successful problem solving and delivery of sustainable technologies in these fields for a wide variety of industries, water boards and municipalities, both national and international.

In collaboration with a variety of universities we have developed own water treatment, digestion and nutrient recovery technologies, among which anammox nitrogen removal, thermophilic digestion, biogas desulphurization, and many more.

With offices in the Netherlands, Italy, Spain and South Africa and a global partner network, we can provide local support, driven by our desire to find solutions. Short lines of communication, flexibility and innovation come first in all the branches of this family business. By working with technology experts, designers and project teams, we provide our customers with sustainable, tailor-made solutions, working on today's practice and tomorrow's innovation.

As a family based company, we believe in transparent, open and fair communication. Hence your business will benefit from the ecological and economic added value of our knowledge. We are there to listen to and serve you from our very first contact.

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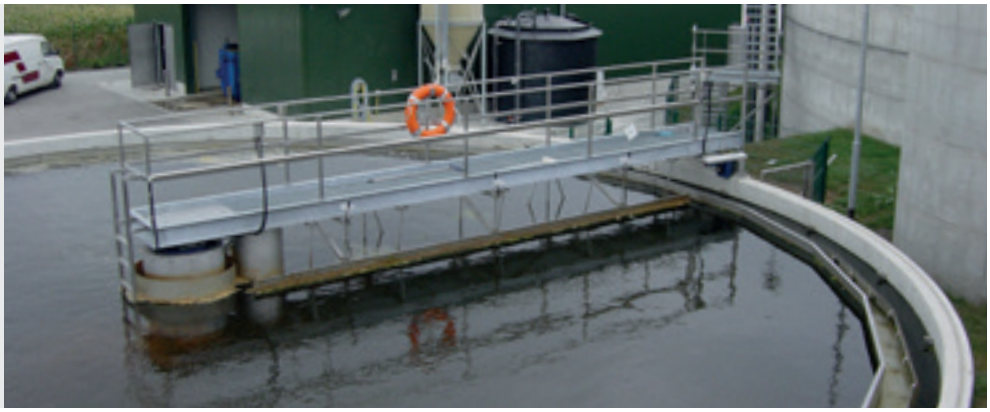

COLUBRIS
cleantech

Colubris Cleantech is a collective of specialized brands with over 35 years' experience in environmental technologies. We are committed to purifying industrial wastewater, separating a wide range of waste flows and offering a variety of bioresource solutions. We offer complete tailor-made projects, from design and construction to hand-over and maintenance. We work towards a circular economy.

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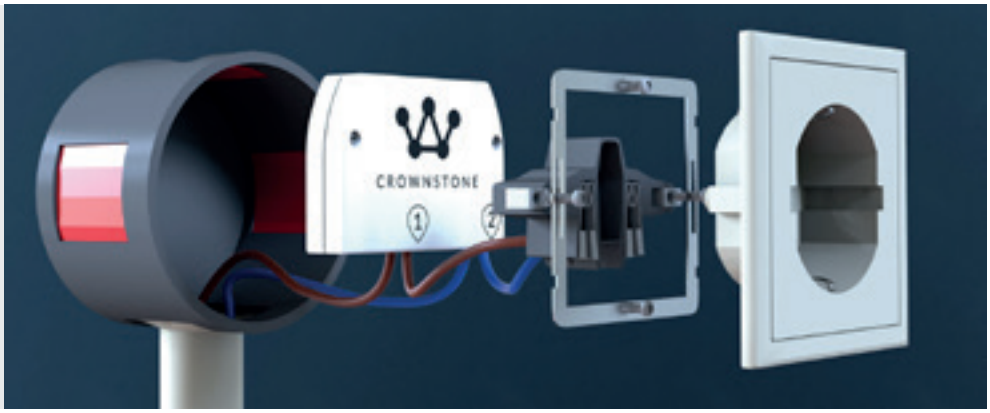

CROWNSTONE

Crownstone's mission is to create truly smart homes and offices. Personalized lights and devices that are aware of your presence. Indoor positioning will become as important as outdoor positioning. Crownstone builds electronic hardware with many functions integrated (the Crownstone Built-in One is an integrated switch, dimmer, power monitor, standby-killer, and beacon).

Crownstone uses Bluetooth Low Energy to directly integrate with smartphones and wearables. Bluetooth Mesh is used to communicate over a large network of nodes. Fingerprinting, using Bluetooth LE signal levels, is used to perform smartphone tracing or asset tracking. Crownstone brings a full Smart Home solution to the market. Users only have to walk into the room and the lights go on automatically. Users can leave the house and devices that use energy turn off automatically.

Crownstone integrates its technology as OEM party in products of partners. Crownstone is able to speed up your R&D timeline using its in-depth in-house skills on electronics (miniaturized 110V/240 circuits) and firmware (Bluetooth LE, mesh, LED dimming, algorithms, classifiers).

Crownstone's primary goal is comfort for the users. Crownstone's secondary goal is to reduce energy consumption: when a building knows where there are no people, it can reduce energy consumption significantly.

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DELTA 21

A new concept with three ambitions makes Delta21 unique: Flood Safety, Pumped Hydro Energy Storage and Nature Restoration. The concept not only addresses important elements of the National Climate Agreement, but also offers an alternative to dyke and barrier constructions, which can also absorb significant sea-level rises.

Primary the Delta21 concept aims to provide better protecting against flooding near estuaries. A huge pumping capacity is installed to discharge the excess water, during an emergency case, directly to the sea or ocean. The remaining time however, the pump-capacity offers a large-scale 'battery', which becomes available to store sustainable electrical energy.

By choosing a suitable location, the plan also offers attractive opportunities for the salt and brackish water ecology and nature restoration. By using Dutch proven technology on pumps and turbines, together with dredging, offshore industry and civil engineering, the Netherlands is well placed for the construction of this hydraulic engineering work worldwide. More than thirty cases have been selected where the Delta21 concept can be applied. In South Holland, the Haringvliet offers an appropriate location for a 1,8 GW Energy Storage Lake, plus 1 GW solar park and 1,2 GW aquabattery-park. TUDelft and the Wageningen University and more than 15 companies are closely involved in the development process. See also www.delta21.nl

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DMEC is an internationally operating consultancy organisation in the marine energy sector. Our believe is that the enormous amount of energy stored in our oceans, seas and rivers will be a crucial driver to realise our global energy transition and foster sustainable growth. To accelerate the commercialisation of marine energy solutions, we focus our activities around the topics of Innovation, Capital and Policy.

We collaborate with clients in various market segments to identify, explore and realise tailored solutions using innovative marine energy technologies. By investing in our Accelerator, we create knowledge on the development of new technologies, certification, and innovative financial mechanisms. This will fast-track technological development plans and growth strategies of high potential companies.

The DMEC team is dedicated to make this sector the next big thing in energy. By accelerating innovation, mobilising capital and shaping policies, we create impactful energy solutions. Join us in our journey and lead the Blue Ocean playing field together.

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When it comes to biogas upgrading and recovering resources from biomass streams, there is no doubt that DMT should be your choice. Equipped with over 30 years of experience we serve our customers and help them with their environmental challenges. DMT has developed a vast amount of biogas treatment and resource recovery technologies. DMT offers one or a combination of technologies to economically manage your project. By not pushing one technology, DMT can provide the best solution for your specific project. DMT is your partner, a reliable total solutions provider who helps you with your biogas treatment project. Our cost-effective solutions help you to achieve your goals! From start to finish we are there, every step of the way.
Our sustainable technology for the recovery of raw materials and nutrients from waste water is one of the most efficient technologies on the market to date. Biomass Hydrolysis of waste activated sludge (WAS) results in up to 35% more biogas during the digestion process, and 30% TS more dewatering can be achieved.
By using TurboTec® the capacity of existing digesters can be increased, or smaller digesters can be installed for new treatment plants.

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DNV GL is empowering decisions and actions based on expertise and trust. Our power and renewables experts around the globe combine their technical, digital and in-depth industry knowledge to help customers take decisions and actions based on expertise and trust.
We offer independent advice and expertise spanning energy generation, including onshore and offshore wind and solar PV, transmission and distribution, grids, storage, e-mobility, as well as energy management, energy markets and regulations. Our aim is to help improve our customers' business performance and build a safe, reliable, efficient, and sustainable energy supply.

We analyse and understand the facts and data that shape the energy system and we help identify and manage the opportunities and risks involved. Our work crosses borders, sectors and technologies, and our independent expertise covers testing, inspection, certification, advisory, cyber security, software, digital solutions and energy management. Our open industry platform, Veracity, in combination with data quality and analytics, supports business-critical activities across the energy value chain. Together with our customers, we create impact for a safer, smarter and greener energy future for all.

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Royal DSM is a global purpose-led, science-based company active in Nutrition, Health and Sustainable Living. DSM's purpose is to create brighter lives for all. With its products and solutions, DSM addresses some of the world's biggest challenges while creating simultaneously economic, environmental and societal value for its stakeholders, customers, employees, shareholders, and society-at-large. DSM and its associated companies deliver annual net sales of about €10 billion with approximately 23,000 employees. The company was founded in 1902 and is listed on Euronext Amsterdam. In the solar industry, we apply our 100-year plus track record in materials sciences innovation to create a range of unique, sustainable technologies and products that reduce the Levelized Cost of Energy (LCoE) - supported by extensive research and outdoor testing at test sites across the globe. Our Anti-Reflective and Retrofit Anti-Reflective coatings for PV modules lead the industry by enabling a 3% power gain compared to untreated glass; and the technology has now been extended to create an Anti-Soiling coating that harnesses more energy by reducing soiling losses in arid climates. Meanwhile our Endurance and Conductive backsheets are redefining the way manufacturers safeguard their modules by delivering both enhanced protection, reduced electrical losses, and higher energy gain. Same sun. More power.™

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DNERESEARCH

Dutch New Energy Research is the fastest growing research agency for the renewable energy sector. For eight years we publish our insights on the solar sector and are able to assist companies with actionable data for their strategy, marketing and sales. Besides insights on the solar sector, we publish annual research reports on renewable heating, describing the development of district heating and heat pumps. Dutch New Energy Research is known from the Dutch Solar Trend Report and the Solar Business Day. DNE Research stems from Good!, known from the trade fair Solar Solutions International. With the Dutch Solar Quarterly we publish the most complete insights on the Dutch solar PV market:

- 5-year forecast installed solar PV capacity
- Pricing insights
- Installed capacity solar PV and distribution to sector and region
- Market shares solar panels and inverters
- End-user insights: consumer perceptions
- SDE+(+) subsidy insights
- Levelized Cost of Energy (LCoE) insights solar PV in the Netherlands
- Due diligence
- Investment climate: politics & policy

On a regular basis we publish white papers on hot topics such as subsidy-free solar PV projects, business cases for storage batteries and the impact of the corona crisis.

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econvert Water & Energy

We believe in a world in which people are responsible for their ecological footprint, and where they're able to control it. A world in which 'waste' is a word used by people who lack the imagination to see the true value of residues. That's why we continuously work to perfect the art of reuse. Econvert designs and implements technology for the treatment of industrial wastewater and biogas. Wastewater is a valuable source of energy and raw materials, in a world where they are becoming increasingly scarce. Econvert develops reactors for recovering and utilizing valuable resources like biogas from industrial wastewater. Founded on in-depth process knowledge, Econvert offers customized solutions. The company focuses on the food industry, paper industry, breweries and distilleries, as well as companies working with chemicals, flavors and fragrances.
We can help you to save money in a green way. We design and construct the following water treatment plants: UASB (Upflow Anaerobic Sludge Blanket), EGSB (Expended Granular Sludge Bed), IR (Internal Recirculation) and Dsulph (biological biogas desulphurization).

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Ecorys is a leading international research and consultancy company, addressing society's key challenges. With world-class research-based consultancy, we help public and private clients make and implement informed decisions leading to positive impact on society. We support our clients with sound analysis and inspiring ideas, practical solutions and delivery of projects for complex market, policy and management issues.

Throughout the years, Ecorys expanded across the globe, with offices in Europe, Africa, the Middle East and Asia. With over 550 employees from over 40 nationalities, speaking over 20 different languages, we provide our clients with valuable support to meet their needs.

We value our independence, our integrity and our partners. We care about the environment in which we work and live. We have an active Corporate Social Responsibility policy, which aims to create shared value that benefits society and business. We are ISO 14001 certified, supported by all our staff. Since 2019 we are also carbon neutral.

Ecorys excels in seven areas of expertise:
- Transport and Infrastructure;
- Regions and cities;
- Natural resources;
- Social policy;
- Security and justice;
- Economic growth;
- Public sector reform.

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The ECOVAT energy system constitutes a decentralized energy supply chain covering production to consumption. Producing, distributing and storing thermal energy from either wind power or solar thermal sources allows for a flexible energy system that is adaptable based on local weather conditions and reduces the need for back-up solutions. By decreasing the dependence on electricity to meet the heat demand, the peak electricity demand will be lowered, resulting in reduced grid generation requirements. The system has a lower building and maintenance cost compared to existing options while being highly efficient with less than 10% heat loss over a six-month period.

The Ecovat demonstrator built in Uden, the Netherlands in 2014 – 2016 was a great success which enabled Ecovat to reach the market introduction phase. In 2020/2021, Ecovat expects that with public investment, the first seasonal storage tank will be placed in the ground in the Netherlands. This system will provide 750 up to 8000 households per system with sustainable energy throughout the year.

Ecovat enables 100% renewable energy for heating and cooling. Additionally, Ecovat ensures predictable costs for heating and cooling. Financial savings, at a national system level, were calculated by Berenschot as an annual reduction. The cost saving with Ecovat is between € 97,000 and € 167,000 per year through the elimination of peaker plants and reinforcement costs. For the Netherlands, the system has a potential annual cost reduction between € 380 billon and € 650 billion per year.

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EDVISORY

Edvisory supports companies with project development, EPC project management advise and business development. The focus is in the markets for renewable energy (waste-to-oil, waste-to-chemicals) and its interface with the oil & gas / petrochemical markets.
The forms of support can vary, with the following key possibilities:

- Market studies
- Business development
- Management support and project execution strategy
- Project management support
- Training and workshops for effective project management, using the Edvisory methodology

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ekinetix
Realizing energy transition

Ekinetix is a leading advisory and engineering firm that provides knowledge and skills to companies and governments that are eager to turn to innovative business models in the field of sustainable energy. Within the energy transition, we perform projects along the complete value chain. This ranges from concept development and feasibility studies (right figure) to the complete realization of complex technical installations. Examples include the realization and commissioning of hydrogen fuelling stations for fuel-cell electric vehicles; the design and construction of installations for green hydrogen production; technical CCUS applications in industry.

Ekinetix engineers have been involved in nearly all novel product-market developments for hydrogen in the energy transition in the Benelux. This is possible due to our extensive expertise and specialistic knowledge in high-tech solutions.

Expertise, people and organizations are increasingly finding one another, which translates into market growth. Ekinetix is at the intersection of these developments and is therefore in a position to develop sustainable energy solutions through collaboration between our staff and our broad network of partners.

By the realization of our projects we aim to contribute to realizing the energy transition. The basis for the success of the organization is a close team with knowledge of the energy sector, ambition and intensive collaboration as key components.

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electron
thermal processing equipment

ELECTRON Thermal Processing Equipment is a specialist provider of thermal processing equipment, gas-to-electric conversion solutions, thermal recycling equipment, heat recovery systems and air-pollution control systems. Continuous innovation is the main driver for our success as we continue to develop new solutions and applications. Recent innovations include technology and equipment for Supercritical Gasification of sewage sludge enabling a highly efficient process for reclaim of phosphates and nutrients followed by conversion of the remaining organic components into a biogas.

The road to zero emissions. Many industrial high temperature processes are gas fired. With the ever increasing requirements for reducing CO_2 emissions the use of electric heating systems is a true game changer in high temperature industrial processing environments. Electric heating systems from ELECTRON can be introduced in the vast majority of refinery, steel and aluminium operations to modernize or replace existing furnaces and thermal processes. ELECTRON provides engineering support, manufacturing, supply and implementation of High Power and High Temperature Electric Heating Systems resulting in improved workplace health and safety, eliminate CO_2 and NO_x emissions, boost productivity, reduce operational cost and establish future-proof environmental compliance.

Please contact us if you are interested to learn how ELECTRON can improve your business. The best people are the best option!

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ELEQ
mastering electricity worldwide

ELEQ designs and manufactures smart electrotechnical applications for protecting, measuring and connecting electrical energy and works worldwide for renowned power companies, system builders and installers. Together with our clients we anticipate on the future and on required innovations.

ELEQ is a true producer and partner of clients and relations who are professionally involved in energy and public lighting systems and who rely on continuous precision and high services.

ELEQ delivers all its products and applications in accordance to the high Dutch and German quality standards and serves markets in Europe and beyond from its locations in the Netherlands (Steenwijk) and Germany (Kerpen).

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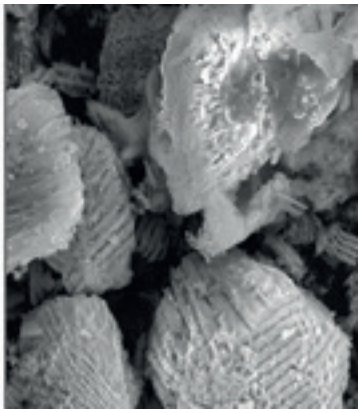

E-magy is a supplier of nano-sponge silicon material for advanced Li-ion batteries. With the battery anode material, electric vehicles can achieve such weight and cost reductions that they will sooner become the first choice for the consumer, accelerating the transition to electric mobility.

The company has applied its silicon manufacturing know-how and proprietary crystallization technology to design and manufacture a uniquely structured silicon material which enables a 40% capacity increase of Li ion batteries.

Benefits for the battery and automotive manufacturer are:

- Increased energy density
- Increased charging rate
- Cost effective process and raw materials
- Drop-in solution
- Unrestricted high-volume supply

E-magy is located near Amsterdam in the Netherlands and has established co-operations with leading companies, universities and research laboratories.

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We are Energy Floors and it's our mission to help speed up the energy transition and we do this by creating as much awareness about renewable energy as we can, in the most exciting way. With floors that are smart, interactive and make sustainability visible, so everyone who steps on them realizes that they can really have an impact. We believe that all technology is available to create a sustainable world. We just need to realize this and embrace these technologies into our everyday lives. We keep innovating by tapping into new sources of renewable energy that were ignored until now. Our floors have the ability to convert kinetic energy from the public and solar energy into electricity that can be used on the spot. So, dance, jump, play, walk, have fun and realize that together, we are making impact towards a better world. That's why we simply say: Get On It!

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Energy Storage NL POWERED BY DUTCH TECHNOLOGY

Energy storage is a key technology for the future. The importance of storing renewable energy is rapidly increasing in the transition towards a fully sustainable and clean energy supply. Energy storage and energy conversion technology is vital for a sustainable, reliable and affordable energy system.

Energy Storage NL represents over 70 Dutch companies and organizations that develop, manufacture and apply innovative energy storage and conversion technologies (electrical, thermal, chemical and mechanical). Our ambition is to help create sustainable business case for energy storage and conversion technology, as well as a level playing field for a flexible energy supply.

Our activities include efforts to bring energy storage to the attention of politicians, media, professionals in related disciplines and the wider public. We initiate and contribute to projects and studies and add Dutch input to the European activities of EASE. And through regular meetings with a sophisticated network consisting of manufacturers, developers, academics, research institutions, energy companies and system operators we bring together key players in the field of energy storage.

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enki ENERGY

Enki Energy is an expert on small-scale anaerobic digestion. Enki Energy developed a compact, anaerobic digester with an advanced process control system (patent granted). The digestion process is fast. Small-scale installations are available for many applications. The biogas produced is used to generate heat or electricity on site, or it can be used for cooking. The compact systems of Enki Energy are well suited for small and large waste streams. They are used by restaurants, neighborhoods and food processing industry. Anaerobic digesters have been placed inside (apartment-)buildings. Larger installations are mostly placed outside existing buildings.

Enki Energy selected and grew a (proprietary) unique bacterial culture. All micro-organisms are of natural origin. Enki Energy builds (demonstration) digesters. Furthermore, Enki Energy executes feasibility studies and demonstration projects.

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ENVAQUA
Dutch Environmental & Water Technology Association

ENVAQUA is the industry association of ambitious water and environmental technology companies. We work together to keep our environment liveable and healthy and our mission is to limit and control climate change. Technological solutions are indispensable for returning to clean fresh air, water, soil and raw materials. ENVAQUA has 108 leading member companies that are active worldwide in the depth of these four sectors and at the intersections between them. With a combined turnover of 4.2 billion euros and 20,000 FTE, we are therefore the point of contact for clients and other stakeholders at home and abroad.

The advantages:

- Joining a large network: government, knowledge institution and business
- Meeting colleagues from the industry at member and expert group meetings
- Meeting existing and future customers at theme meetings
- Access to export facilities (fairs, meetings, subsidies)
- Influence of laws and regulations

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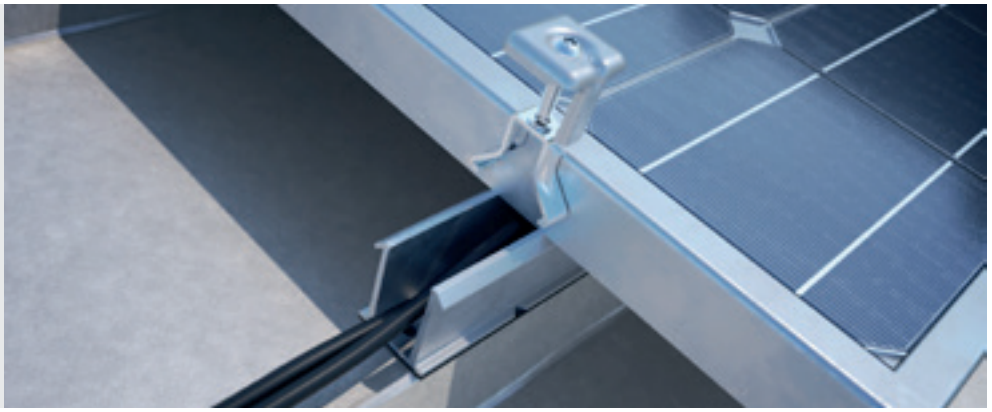

ESDEC
INNOVATIVE MOUNTING SYSTEMS

Since 2004 Esdec supplies universal mounting systems for roof-mounted PV installations, both for flat and pitched roofs. With over 15 years of experience and over 9GW of solar panels installed, we have developed into an international market leader. Esdec was founded by installers, so convenience for the installer has always been the priority in the design of our products. Our mounting systems consist of light, sturdy components that can be mounted quickly and easily.

We believe it is important that all our products apply the latest technological developments. That is why we combine international expertise and continuously invest in innovation and R&D.

Our mounting systems are extensively tested and meet the strictest safety standards.

In recent years, ESDEC acquired the American companies Ecofasten, Iron Ridge and Quick Mount PV. With these acquisitions, we are now also the market leader in the U.S. in the segment of residential PV. From 2020 on, we will continue to focus on growth in Europe, in countries like Germany, France and Sweden. We aim to increase the knowledge in the market and fulfil the growing demand for expert installers. Therefor we regularly provide (on line) training courses for partners and installers in our Innovation Centre. Every year, we train > 1000 installers.

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Fluor is one of the world's largest publicly-traded engineering, procurement, construction (EPC) and maintenance companies. We work with Clients in diverse industries globally to design, construct and maintain their capital projects.

We promote a caring, preventative culture where no one gets hurt. Our sustainability mission is to conduct business in a responsible manner to the benefit of current and future generations. Clients rely on us to help address sustainability challenges and issues, including the need to improve energy efficiency, reduce greenhouse gas emissions and to design and build more environmentally friendly, less costly facilities. Our Clients expect ethical conduct; high levels of employee knowledge and expertise; excellence in health, safety and environmental matters; and an aggressive supply chain and procurement methodology.

With offices located in Hoofddorp, Bergen op Zoom, Geleen and Rotterdam. We successfully completed projects in Europe for more than 75 years using a multi-office execution approach.

Our comprehensive solutions span the entire project life cycle and deliver capital efficiency. Industries served includes Advanced Technologies & Life Sciences, Oil & Gas, Refining, Chemicals and Petrochemicals, Gas Processing & Underground Gas Storage.

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FME is the Dutch employers' organisation in the technology industry. The 2,200 affiliated companies include technology start-ups, trading companies, small and medium-sized industrial enterprises as well as large industrial conglomerates. Our members are active in the fields of manufacturing, trade automation and maintenance in the metal, electronics, electrical engineering and plastics sectors. Around 400 members are active in the renewable energy sector. FME members employ a total of 220,000 people, have a combined turnover of € 91 billion and their exports total € 49 billion. FME members therefore account for one-sixth of all Dutch exports.

We connect and mobilize companies, knowledge institutes, end users and investors in order to find solutions to the global challenge for a greener future.

Please connect with us if you are looking for a specific company, product or service. Let's work together!

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Frames designs, builds and delivers process installations for:

- Biogas upgrading for off-grid, grid injection and bio-LNG applications
- Pre- and post-combustion CO_2 capture (CCS/CCU)
- Hydrogen generation and storage

At Frames, we feel it is our responsibility to offer sustainable systems and solutions for energy production. Our systems and solutions are energy-efficient, reliable and are accompanied by minimal operational costs, and environmental footprint. We do this by developing and implementing innovative technologies.

We have decades of experience in managing and realizing turn-key systems and solutions with lowest total cost of ownership, which means we can offer complete solutions for complete biogas upgrading and CO_2 capture installations along with our offering in hydrogen systems and solutions. We play an important role in the decarbonization of the global energy consumption.

We are headquartered in the Netherlands and have seven international offices worldwide. Visit our website or send us an email to see how your project can benefit from our solutions.

GREENFISH
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With more than 250 Greenfishers across Europe, we work together to build a sustainable world. Using our expertise in engineering, strategy and environment, it is our priority to integrate sustainability into your business model – making your business lean, clean and green. Now proudly existing over 2 years in the Netherlands, we develop sustainable businesses and deliver support for positive impact projects by offering both technical team support and strategic advisory.

By offering an ambitious and dynamic environment fueled by a passion for sustainability, we are able to attract the very best engineers who also have a 'get-things-done'-mentality. These engineers can add extra expertise, more positive impact and flexibility to your projects or teams in a wide range of topics related to the energy transition. From project management for the building of solar parks or district heating networks to data analysts at waste-to-energy plants.

With our strategic advisory service, we can help you define, implement and support your sustainability targets and projects, to create positive impact that is financially sound at the same time. With our technical experience and internal research department we can offer a variety of projects: from creating a Corporate Social Responsibility program to realizing cost-efficient energy reductions in the process industry.

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Greenlink

Greenlink is specialized in on-grid, off-grid and Hybrid energy solutions. Greenlink provides energy solutions in The Netherlands, but also for the most challenging situations in Africa. From Private homes to villages, remote schools, off-grid hospitals, Lodges & camps, that want to reduce their dependency on fossil fuel or the grid, all are typical customers where Greenlink comes in action. Greenlink works with its customers in a holistic approach, not simply looking at the energy requirement, but with a philosophy about increasing Energy Efficiency, generating as much as possible in a renewable manner, and optimize the use of fossil fuels where they can't get around them (yet). Greenlink has an extensive experience of projects in Africa ranging from countries in West to the East of the continent. Greenlink developed the first solar powered water desalination plant with a capacity of 70.000 liters per day. Greenlink is also partner in the Healthy Village program.

Greenlink's expanding base of office locations ensures direct local support for all their customers, with a unique lease and service model in several countries! Greenlink is based in The Netherlands and its subsidiaries are based in Kenya, Tanzania, Gambia, Zambia and Guinee Bissau.

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GREENMAC
biogas upgrading

Greenmac is specialized in amine and membrane based systems for biogas upgrading.
We design, supply, start-up, commissioning and maintain (24/7 support) the systems all over Europe. The state-of-the-art systems are efficient, reliable, highly automated and controlled.

Greenmac is a pioneer in the biogas upgrading market. In 1987 we built the world's first Vacuum Pressure Swing Adsorption (VPSA) plant for biogas-upgrading. We were also the world's first company with an amine wash system for biogas upgrading (2001). In 2005 we built our first membrane upgrading installation.
Although the amine wash system has some big advantages (low methane emission of 0.1% and low electrical consumption), the membrane system is in general more feasible for lower capacities because of the low CAPEX and no heat consumption.

For both systems high-quality components are used, which results in high availability and low maintenance costs. The systems operate fully automatically with an advanced control system, which quickly adjusts the installation to fluctuations in biogas and capacity. All systems are supplied with extensive remote process monitoring. This makes it easy to change settings and contains an extensive trending, alarm and error analysis. The installations can be supplied in capacities of 60-5000 Nm^3/h and adapted to further customer specific requirements.

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H2ARVESTER

H2ARVESTER is a unique solution for generating clean energy through the use of abundant agricultural land and conversion into hydrogen. Existing solutions with solar meadows and the supply of the generated electricity to the network have the following drawbacks:
1. Extracting productive agricultural land;
2. High load on the electricity grid. Double use of agricultural land for the generation of solar energy among arable farmers and dairy farmers is a huge opportunity for that sector.

Because the solar power plant is mobile, travels between crops, H2ARVESTER can be seen as an 'extra crop' in rotational cultivation that many arable farmers use. For dairy farmers, where H2arvesters cross the land between cattle or across ditches, this is literally double use of agricultural land and extra income is generated.

H2ARVESTER is a matrix of solar panels, assembled on a lightweight construction and equipped with wheels, which can move autonomously across agricultural land, above ditches etc. The solar energy can be processed into hydrogen (H_2) and stored locally. The hydrogen supply is then used locally when needed; the surplus is supplied to third parties, such as agricultural cooperatives, energy companies or industry.

The solution to convert the generated electricity directly into hydrogen not only ensures an autonomously functioning installation. H2ARVESTER is also a solution to the need to balance the production and use of the energy generated, without increasing the electricity grid.

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HANS MOOR ARCHITECTS

Hans Moor Architects is an office for architecture, infrastructure and housing related to energy. Designing involved with projects according to sustainability and energy: bridge with innovative light, wind and water related to infrastructure. Specialized in adaptive design process with complex information.

1. A high degree of collaboration is important, where each participant in the design process can bring their own sources of quality and can transform them to benefit from increased quality and custom architectural space.
2. The approach of the task is economical and architectural. The realization of generic 'simple' systems and/or standardization, which simultaneously enable as much multi-purpose features (diversity)as possible. With this, the architectural space can be more a response to user demand.
3. Sustainability means a continuous development in relation to lifestyle. Lifestyle will increase the quality of life. Quality of life also implies individual expression, health, green living conditions etc.
4. Sustainability is part of the overall universal feedback loop of life. This is an organizing principle that requires an innovative approach from the designer. The ideas arrived upon should serve as input to improve and adapt towards a new relevance and a better future spatial perspective. This is the accumulation of design '
5. Open process.

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HeatMatrix
TURNS WASTE HEAT INTO PROFIT

HeatMatrix turns waste heat into profit. HeatMatrix helps you recover heat from your flue, exhaust and off-gases, even if acid corrosion and fouling have been stopping you to do so before. Reduction of the heat loss via your stack improves your energy efficiency, reduces your CO_2 emission, decreases your Opex and makes your operation more sustainable.

In the industry, about 10% of the thermal energy is lost via stacks. Complexity, fouling or acid corrosion may have been preventing you from recovering this heat. We at HeatMatrix specialize in challenging heat recovery projects from flue gas or exhaust air from thermal processes. Our innovative heat recovery systems (Air Preheaters, Economizers and Condensers) include polymer exchanger technology that allows heat recovery from potentially acidic flue gas or fouling exhaust air. The recovered heat can be used to preheat:

- Combustion / drying air
- Return condensate and cold BFW
- Process / cleaning water
- Heating Grid water
- Thermal Oil

Our heat exchangers are installed on boilers, dryers, ovens, furnaces, CHP's, waste gas incinerators, calciners and kilns in many different industries, like food, steel, paper, refining, ceramics and chemicals. A reduction of 5 to 20% in fuel consumption can be achieved, which results in a payback of 3 years. Complexity, corrosion and fouling should no longer stop you from recovering more heat. Let's discuss where to apply the recovered heat. Contact us to see what savings are possible on your units!

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Holland Home of Wind Energy

Holland Home of Wind Energy (HHWE) is the professional export partner of Dutch wind energy companies in existing and emerging wind markets across the globe. We represent, facilitate and promote our members and the Dutch wind industry as a whole. We do this by actively initiating and supporting marketing and promotional activities that will positively influence the image of the Dutch wind energy sector abroad. Quality, innovative strength and knowledge sharing are the key drivers of our result driven export strategy.

With networking events, market intelligence and an extensive export agenda, HHWE actively supports and facilitates its members in entering emerging wind energy markets for offshore (e.g. China, Japan, Korea, Taiwan, US and France) and onshore wind (e.g. Turkey, Brazil and Canada). Our wide range of activities include close monitoring of potential new markets through market surveys and explorations. We regularly organize incoming and outbound trade missions and coordinate joint participation at international wind energy fairs with a Netherlands Pavilion.

With its extensive network and expertise in organizing trade missions, matchmaking and trade show participation abroad, HHWE offers a range of services and activities within its export agenda to support members and wind companies in their export ambitions. By combining forces and placing the organization of these activities in the hands of HHWE our members will save time, effort, and money.

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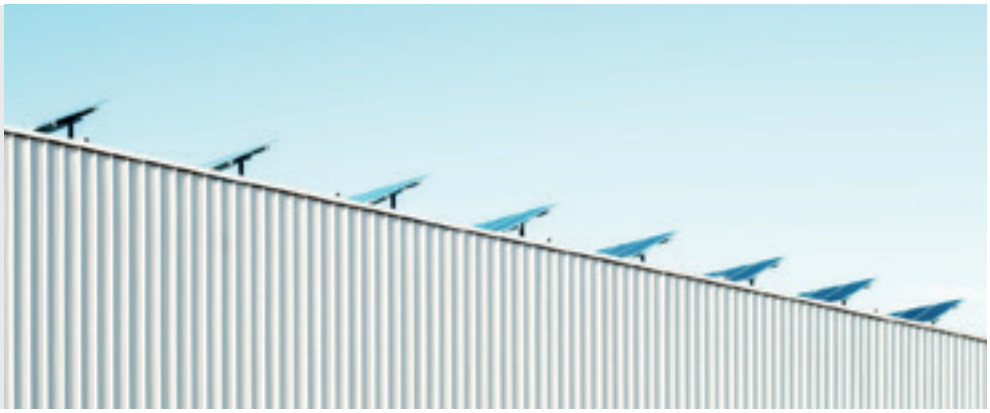

Holland Solar, founded in 1983, is the key organisation for professional solar energy experts, companies and institutions in the Netherlands. Members are active in both solar thermal energy and solar photovoltaics, comprising the complete chain from R&D and production until consultancy and installation. The activities of Holland Solar are aimed at serving the interests of its members, by supporting and promoting the application of solar energy in the Netherlands, ensuring the quality of solar energy applications.

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HoSt, headquartered in the Netherlands, is a major turn-key supplier of bioenergy systems. Offering a total bioenergy plant solution for the anaerobic digestion, combustion, and gasification of all organic waste and biomass streams, HoSt successfully realized hundreds of bioenergy projects worldwide. HoSt biomass energy plants contribute to ensuring the success of a circular economy by producing renewable energy, solving waste management challenges, and creating valuable end-products from waste. HoSt's expertise focuses on the technological development and innovation of the processing of biomass and waste streams. The range of bioenergy plants designed by HoSt include: biogas plants, biogas-to-biomethane upgrading systems, biomass heat and power plants, biomass boilers, and gasification plants. All types can be adapted and supplied in different sizes, capacities and for various industries and available feedstock.

Taking care of the entire process is part of the total solution that comprises of: engineering, supplying, constructing, commissioning, and 24/7 service and maintenance. HoSt can also perform feasibility studies, process analysis, process optimization, laboratory tests, obtaining permits, and project development and engineering activities.

HoSt is a growing company and is actively expanding. Therefore, HoSt is always looking for starters, professionals, interns and graduates who would like to share their passion for energy technology with us to fuel our and your future growth.

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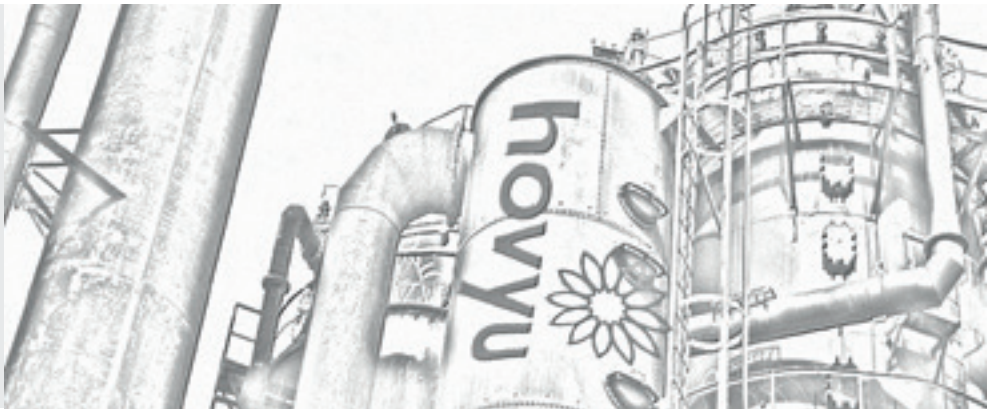

Hovyu stands for green in Tupi-Guarani language. Our name reflects our passion: to contribute to the development and implementation of sustainable processes. We participate in the transition towards a sustainable and responsible industry by providing technical assistance services in the fields of carbon capture and utilization (CCU), biogas cleaning and upgrading and waste valorization.

Our current projects focus on the production of green energy and biofuels, with activities such as techno-economic feasibility studies, conceptual plant designs and engineering support. Hovyu is currently assisting the implementation of several biogas cleaning and upgrading units in Brazil. We design tailor-made solutions for each gas source: either biodigesters or landfills. Our optimized solutions for H_2S and CO_2 removal and gas dehydration increase the lifetime of generators, lowering the costs of green electricity, and lead to cost-competitive biomethane with fuel- or pipeline-grade.

Hovyu is also actively involved in waste valorization and the promotion of a circular economy. In this way, we mitigate the costs and environmental impacts associated with waste disposal. For organic wastes, we offer a range of solutions including composting, gasification and bio digestion via partnerships with multiple technology suppliers. In this way, Hovyu can help defining the optimal technology for each application.

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HydroPV Technologies Floating PV systems for convenient generation of electricity and conservation of water optimised for hot sunbelt countries with high solar irradiation.

HydroPV Technologies has signed a joint R&D development program with MASEN in the NOOR area in Ouarzazate, Morocco. The annual solar irradiance in this area is 2650 kwh per square meter per year and we expect annual electricity yields of 500 kwh per square meter of PV module area and an extended PV module lifetimes thanks to the cooling effect of the water.

Apart from saving up to 40,000 m^3 of water per hectare per year, about 3,600 solar panels can be installed per hectare of water surface with a capacity of 1.5 megawatts or 4,000 megawatthours per year of photovoltaic power generation.

With the HydroPV Technologies Floating PV Systems on 10 percent of the Inland water surface of the Netherlands, the total current fossil Electricity production of the Netherlands could be generated with non-fossil clean solar energy without any emission of CO_2, NO_x or Black Soot Particulate matter and with more yield through more solar radiation from cleaner air.

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Ik ben Ra

Under our brand name 'Ik ben Ra', we focus on advise, design, installation and maintenance of large scale solar thermal energy systems for district heating, apartment blocks, hotels, hospitals, swimming pools, greenhouses, agricultural farms etc .

We convert sunlight into heat and heat into cooling.

Ik ben Ra (I am Ra), in the Egyptian mythology I am the God of the sun. I dream of a world where only renewable energy is used of which solar (thermal) will be the most important one. Because the sun is an unlimited source of energy that is clean, has no CO_2 emission, is for free and available to everyone.

With my continuous innovation and improvements in the use of solar thermal systems, I aim at a widespread use of this renewable form of energy.

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Indutecc
RENEWABLE SOLUTIONS

Indutecc Industrial Solutions provides concepts to responsibly meet a growing need for sustainable solutions. We only do this with top manufactures with the same philosophy as we have. Solar power and Energy storage are our main competences.

For energy storage systems we offer different solutions; from plug and play home batteries to large-scale energy storage systems. With Nilar we have an unique battery in our portfolio. This patented NiMH on the market. Nilar has no transportation restrictions, is 100% maintenance-free and fully recyclable.

The robust industrial structure is ideally suited for the growing demand of large storage systems in applications such as storing the excess solar and wind power, peak shaving, energy trade, grid balancing and neighborhood batteries. As it is the most save battery, it can be placed indoor without the need of a container solution. With the new 58kWh modular rack solution we offer a scalable, good looking and fast installable system. To make it a complete solution we combine the Nilar batteries with Ferroamp DC systems. Ferroamp offers Energyhubs from 7 till MW solutions with state of the art, real time monitoring. Indutecc advise, engineer and deliver custom-made projects that meet the needs of our customers.

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inventum

Safe and trusted. That is a promise we have been fulfilling for more than 100 years A promise that actually starts with innovation, and the enthusiasm of our employees to do things differently, preferably better. We work on sustainable, energy-saving solutions in everything we do. That often makes us the leader when it concerns innovative ventilation and hot water systems. By actively collaborating with partners, we provide overall concepts which also give you an advantage through their safety, comfort, long life and low energy costs.

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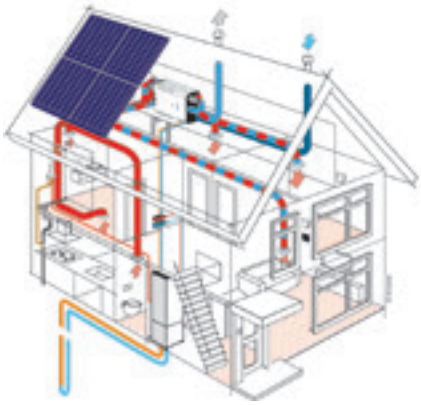

itho daalderop
Climate for life

With its innovative products and systems (heat pumps, ventilation, boilers, control technology), Itho Daalderop ensures a comfortable, healthy and energy-efficient indoor climate. The company already makes energy-neutral living – according to tomorrow's climate requirements – possible today.

As early as 2002, Itho Daalderop brought self-developed and produced ground-based water / water heat pumps to the market, making it the market leader in new construction. Many thousands of these are now monitored in real time. In addition to these heat pumps, Itho Daalderop also supplies air / water heat pumps, both with and under the outdoor unit.

All products are developed and produced in-house. In total, the Itho Daalderop Group employs more than 450 employees.

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KARA Energy Systems believes in the strength and value of bio-energy. From biomass combustion towards energy. From 250 kW to 15 MW. We have the ambition to use high-quality technology and development to make a contribution to the energy need of and optimal return for our customers. Always custom-made, entirely engineered and produced in The Netherlands, turn-key delivered and functioning in accordance with the strictest emission and environmental requirements. KARA Energy Systems is a worldwide partner and offers you an energy source for: warm water, steam, thermal oil and/or electricity. From the first idea to the first flame.

Our roots are in biomass, based on wood or wood related products. Dry or wet biomass (with a moisture content up to 58%) is the fuel for our installations to start up the bio-energy combustion process. But there are also other eco-friendly or sustainable energy sources available to be used as a fuel. What about combustion of straw or reed? We know the ins and outs.

Since 1910, KARA has been dealing with the following practical applications: heating buildings; heating for drying kilns; steam for process heating; generation of electricity, for personal use or sales to the utility grid; district heating.

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KROHNE ranks among the world's leading companies involved in the development and production of innovative and reliable process measuring technology for all sectors around the globe.

Founded in 1921 in Duisburg, Germany. Steadily grown to more than 3.500 employees and a turnover of over 500 million euros, the company has 17 production facilities and owns 44 companies and joint ventures.

KROHNE develops, manufactures, supplies and services products and systems which measure, transmit and control process information. Enabling our customers to operate and manage processes in a safe, reliable, economical, profitable and environmentally responsible way.

Our customers are involved in diverse branches of industry that include chemicals, water, wastewater, food & beverages, pharmaceuticals, oil and gas, powerplants, mining and shipping.

For KROHNE, service starts at our first contact with the customer and lasts throughout the life of our systems installed. Quality and reliability are key to maintaining the highest service standards. All KROHNE feeder factories are ISO 9001 certified.

When it comes to process measurement, our level of expertise is unique, not just in standard applications but also for those challenges that demand customized solutions.

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Levitech is a global player in production solutions for the IC and photovoltaic industries. A spin-off of ASM International, Levitech was established in 2009 around its core product, the Levitor® system. This system is based on a revolutionary patented technology and used in the semiconductor industry for Rapid Thermal Processing (RTP).

The Levitor 4300 and Levitor 4200 are leading-edge 300mm and 200mm tools for advanced RTP processes in high volume. The Levitrack™ ALD system is a state-of-the-art production solution for the solar industry and is based on the innovative concept of precursor separation in space, instead of time, in combination with the unique floating wafer and conductive heating technology used in the Levitor RTP products. For more information, visit Levitech's web site at www.levitech.nl

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With over 28 years' experience Logisticon Water Treatment builds high quality water treatment plants at our own facility. These are in-house designed and built for many applications: drinking water, process and waste water treatment, groundwater treatment and environmental technology and water re-use. The fact that everything is built in-house represents our guarantee of quality and flexibility.

All out installations are built according newest ideas with energy saving technologies and options for re-use of waste water, reclaim of valuable components and reduction of CO_2 print and chemical use.

If you want to be sure the technology you would like to use in the future will fulfil your desired goals, you can contact Logisticon for its broad range of small or even full scale pilot installations. Being Europe's largest company when it comes to short, medium and long term rental solutions of water treatment and purification equipment Logisticon can supply installations for a broad range of purposes.

If you would like to receive more information and 5 tips for energy saving, water re-use opportunities in the water treatment and water purification please contact Logisticon Water Treatment.

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Lovink Enertech – specialists in liquid silicone insulated cable joints. We develop, produce and supply innovative and reliable cable accessories, that comply with all possible requirements, now and in the future. Our LoviSil® technology is distinctive from all shrink and push on technologies and offers the best protection. Thanks to the construction and characteristics of the silicone based insulation material, LoviSil® joints are particularly suitable for applications in clean energy networks. The liquid LoviSil® insulation guarantees perfect and long-lasting insulation of the cable connection. The silicone based insulation is resistant to high temperatures and has the inherent ability to suppress partial discharges.
LoviSil® medium voltage cable joints can boast 30 years proven field experience all over the world, with an extremely low failure rate. We produce cable joints for every cable combination such as transition, straight, branch and feed-in joints up to 36 kV. Application of LoviSil® feed-in joints in wind and solar parks offer a cost-saving solution. These branch joints save extra joints and cable length and require a shorter installation time.
For more than 100 years Lovink Enertech helps to establish reliable electricity grids. We do this by combining smart engineering with proven technology. Together with a team of technical specialists we are working on the best solutions for your energy demands every day.
All this makes Lovink Enertech an attractive partner. Get in contact and let us convince you of our technical solutions and added value. Effective collaboration results in good connections: We connect your power.

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Mavitec Group is specialized in rendering, gasification and green energy solutions. We provide complex process solutions in a simple, efficient and cost effective way, customized to our clients' needs. Mavitec is an expert in engineering, designing, manufacturing, installation and servicing from individual components up to complete turnkey projects. Mavitec, international leader in the rendering industry, is known for its high quality systems and equipment for rendering animal by-products that create the best nutrient values in the market. The key of this technology is successfully applied into two other divisions. Mavitec Green Energy's food waste and depackaging solutions handle, depack and resize organic by-products and provide the highest separation results in the market. The Paddle Depacker separates the organic material from the packaging and delivers a very clean organic output (>99,5% clean) that is extremely suitable for use in biogas installations. Recently Mavitec Environmental developed an innovative gasification system that converts various kinds of manure into green energy and high value EcoChar: a new way of solving manure issues! Gasification offers a multitude of advantages such as volume reduction up to 85%, production of renewable energy and EcoChar - a powerful soil improver - and CO_2 reduction. The produced energy can be used as steam, hot water, electricity and hot air.

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Micro Turbine Technology (MTT) is an innovative company specialised in development and commercialisation of micro turbines for various applications. MTT collaborates with leading research institutes, industry partners, energy utilities and qualified installers.

MTT's EnerTwin is a heating system that also produces electricity. Based on MTT's micro turbine, this is a micro CHP system (Combined Heat and Power) that will change the game in the distributed energy market. The highly cost-efficient EnerTwin produces up to 15,6kW heat and 3,2kW electricity. Maintenance costs are only a fraction of those of competing micro CHP systems, and installation is done within half a day. The lifetime is equal to traditional boilers. EnerTwin fulfils the latest emission standards and it is CE certified for use of a wide range of clean fuels including biomethane, green gas, natural gas with up to 23% hydrogen content and biogas. Fuel flexibility, remote monitoring system and relatively low weight make this system suitable for remote locations too. Also in large economies that still lean on coal-fired, centralised energy generation, EnerTwin can be one of the first steps in their energy transition processes.Installing an EnerTwin in a building can lead to a better energy certificate, improving it by up to two energy efficiency classes in only one day. This can be particularly interesting for historic buildings and industrial buildings built before the end of the 20th century, where the costs of renovation and greening can skyrocket unexpectedly. EnerTwin offers an environmentally friendly solution for these locations: greening can be achieved fast in a simple and sustainable way.

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Morphotonics B.V. (www.morphotonics.com) develops and sells roll-to-plate (R2P) OEM production technology for imprinting nano- or microstructures on large area substrates. Our cutting-edge technology and machines have unique features that radically improve our customers' products in the display and solar industry. We enable holographic or 3D imaging in smartphones or AR/VR displays and substantially increase the energy efficiency of solar panels. For PV modules in general a durable light trapping or anti-reflection texture can be applied on the outside of the module. For bifacial modules the AR textures can be applied on both sides of the module, trapping the light within the glass-glass sandwich like is currently being demonstrated within the Dutch Polaris project.

The application of such textures can be carried out cost-effectively by nano-imprinting. This technology can dramatically reduce the LCOE as it significantly increases the kWh output of modules especially during the morning and evening hours and for the backside performance of bifacial PV panels (diffuse light conditions), next to an overall higher optimum due to an optimal PV panel front side, back side and solar cell optimization which can even be customized for a certain panel type or mounting system.

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Netherlands Enterprise Agency

The Netherlands Enterprise Agency stimulates entrepreneurs in sustainable, agricultural, innovative and international business. It aims to improve opportunities for entrepreneurs, strengthen their position and help them realise their international ambitions with funding, networking, know-how and compliance with laws and regulations. As a government agency, it operates under the auspices of the Ministry of Economic Affairs and Climate Policy, and its activities are commissioned by the various Dutch ministries and the European Union. The Netherlands Enterprise Agency runs a number of programmes and supports business initiatives with various grant schemes.

Energy and Climate is one of the agency's key topics. The Dutch government is investing billions of euros in energy efficiency, sustainable energy and CO_2 reduction. In line with this, the Netherlands Enterprise Agency supports Dutch and international entrepreneurs and researchers in developing sustainable projects related to energy, climate and the environment. Innovation and public-private partnerships are key to the Dutch approach: the government, private sector, and academia co-operate on topics such as sustainable energy technologies, green materials, built environment, sustainable mobility, chain efficiency, sustainable electricity, new gas, and greenhouses as a source of energy.

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NWEA
Nederlandse WindEnergie Associatie

The Netherlands Wind Energy Association (NWEA) is the wind energy sector's branch association. NWEA promotes the development of wind energy to achieve a sustainable Dutch energy supply. Together with, and on behalf of its members, NWEA is working on creating a robust wind energy sector, in combination with new and relevant policy.

On behalf of the sector, NWEA maintains contacts with national and regional authorities and politicians, with policy makers, with scientists and academic institutions, with businesses and with environmental and other NGOs in the Netherlands. This gives NWEA members their own voice in the national energy transition and climate discussions.

In addition, NWEA is active on topics such as subsidy policy, employment and training, safe working conditions, International Corporate Social Responsibility (ICSR) and the Environment and Planning Act. NWEA also participates in international partnerships, such as with foreign wind energy associations. The Export Commission, set up at the end of 2018, prioritises the promotion of members' export opportunities. NWEA supports the sector with market research & information and an active calendar of events and trade missions with the aim to create enhanced visibility for the Dutch wind sector.

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NEW COSMOS - BIE
Gas Detection Solutions

New Cosmos - BIE is a manufacturer of stationary, portable, and personal gas detection equipment, mixing high qualified gas detectors with smart forms of communications suitable for applications in a wide range of industries. You can find our detectors in production areas (clean rooms) for solar panels and electronics production, in and around fuel cells, at hydrogen filling stations, at biogas plants but also at residential areas near hydrogen or methane smart gas meters or boilers. With more than 60 years of experience in gas detection, New Cosmos – BIE serves beside Europe also customers in the Middle East and North Africa. Our mission is to create a safer global environment with a reduced number of accidents.

Our strengths: Sensor technology in house; Over 60 years of experience; Reliability; Unique Selectivity; Long lifetime; Extended range of sensors for different gases.

Solutions for the following markets: New Energy Markets; Oil & Gas Exploration; Chemical & Petrochemical; Automotive Industry; Laboratories; Micro Electronics; PV Industry; Residential areas.

Product range: Fixed gas detectors (diffusion/ suction); Portable gas detectors; Control panels; Software supervision systems; Grease/ oil dust meter; Odor level indicators; Residential detectors.

Services: Maintenance; Upkeep; Repair; Training; Survey.

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nijhuis
INDUSTRIES

Nijhuis Industries delivers solid solutions for sustainable water use and resource recovery, with the highest level of intelligent innovations across a wide range of industries. We meet today's challenges as well as those of the future, as a response towards a circular economy in a 'fluid' world. To accommodate the customer requirements, Nijhuis offers customized installations, to create profit out of (waste) water, process water and waste.

Our mission is to help customers to reduce, reuse and recover water and resources to create profit. We help our customers to meet their increasingly demanding sustainability requirements, lower their environmental footprint, combine productivity and energy efficiency and reduce life cycle cost at the same time.

We provide a multidisciplinary team and a unique in-house portfolio, realizing smart and game-changing solutions and systems in sustainable water use and resource recovery, combined with our intelligent services.

With headquarters in the Netherlands, Nijhuis Industries is active in all geographical regions around the world, serving over 2,600 references from its Sales & Service Centers in China, Dubai, England, Poland, Russia, Singapore, USA & Latin America.

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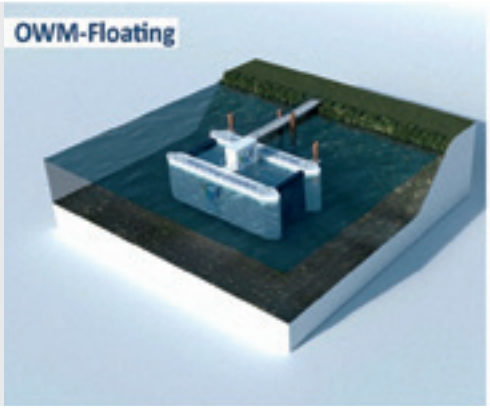

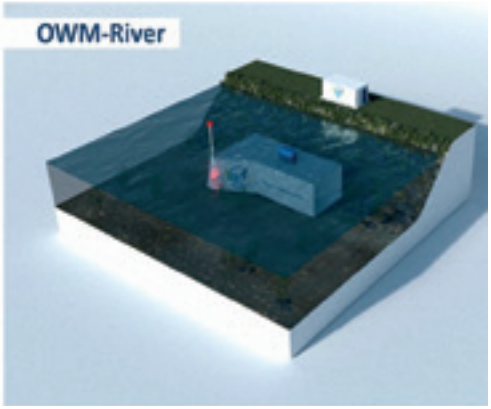

The Dutch Oryon Watermill is a 100% fish-friendly modular hydropower plant that can always be adapted to the local water flow profile. This solution can generate renewable energy from flows with a flow rate of 1 meter per second. They can be placed in rivers, tidal currents, in river groynes or civil works such as dams, bridges and large fixed pumping stations without affecting the natural ecosystem.

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For more than 35 years, Paques has been one of the world's leading companies in the field of development and construction of cost-effective purification systems for (waste)water and gases, based on innovative biotechnology. With 3,000 reference installations worldwide, Paques has helped companies and municipalities to contribute to one of the major challenges of today: to reduce their water and carbon footprints and reclaim valuable resources. The biogas produced by the wastewater treatment plants can be used as green energy in boilers or gas engines. Paques has subsidiaries and/or production locations in Russia, China, Brazil, Argentina, Colombia, United States of America, India, Malaysia, Thailand and Vietnam. In many other countries, Paques is represented by licensed partners.

Paques is world market leader in the field of anaerobic purification plants. With BIOPAQ® technology, bacteria convert organic pollutants in industrial wastewater into biogas, which can be reused as (green) energy. In this way, effluent discharge costs are reduced while green energy is produced. BIOPAQ®ICX is the latest new development in the BIOPAQ® product line. BIOPAQ®ICX is a flexible anaerobic effluent treatment based on BIOPAQ®IC technology and implementable in existing assets of any supplier. With THIOPAQ®, Paques has introduced innovative (bio) gas cleaning processes for removal of inorganic compounds. The ANAMMOX® process is a recent breakthrough in efficient and cost effective nitrogen removal from wastewater.

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Pentair's Winterswijk (NL) branch offers the industry's most complete set of solutions, products and services to municipal and industrial customers. A wide variety of pumps and fish friendly water turbines serve multiple markets including water supply, sewage handling, flood control, power generation, desalination, agricultural irrigation and fire protection. Pentair also delivers professional services including installation, maintenance, repair and training.

Pentair developed two specific types of fish friendly hydro turbines of the Pentair Fairbanks Nijhuis brand:

The fish friendly axial flow run of river turbine. The turbines can be supplied in a wide range of capacity and allow the safe passage of fish and eel without the need of fine screen or other fish deterrent systems. The revolutionary fish friendly design is adopted from our renowned fish friendly flood control pump range.

The fish friendly bi-directional tidal range turbine that harnesses energy from the tides. The patented and proven fish safe design features a fully reversible impeller to maintain optimal performance in both flow directions during a complete tidal cycle. The turbine can be placed in a dam type construction and operated as a pump strengthening its water management and flood control functions.

Pentair's Winterswijk branch is part of Pentair. Pentair delivers a comprehensive range of smart, sustainable water solutions to homes, business and industry around the world.

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Pentair is a global leader in providing smart sustainable solutions for life that empower our customers to make the most of life's essential resource. One of the strong branded product lines of Pentair, Pentair Haffmans, located in Venlo, the Netherlands, supplies quality control equipment, microfiltration, carbon dioxide (CO_2) and biogas upgrading systems for the food and beverage and industrial markets. We focus on optimizing our customers' processes and collaborating with them to achieve their sustainability and performance goals.

Carbon footprint reduction and the utilization of waste as green energy is pushing requirements in the industry. With our biogas upgrading technology, we take the next step into a sustainable world combining biogas upgrading with CO_2 Recovery. This offers two substantial advantages compared to conventional systems.

1. The upgrading systems recovers 100% of the methane, which eliminates the environmentally harmful 'methane slip'.
2. In addition, by product CO_2 is recovered as well, and can be sold, providing you with an additional source of income.

A true example of: Creating Value. For Life.

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PROTON VENTURES

Proton Ventures is an engineering company specialized in ammonia related technology and products. Proton is experienced in building and running pressurized and refrigerated ammonia terminals. Furthermore, it has experience in storage concepts as part of the energy transition next to fertilizers for agriculture and horticulture.

Whether you need an application built from the ground up, or an existing application upgraded, we can help you. Our team consists of talented engineers, developers, process designers and project managers who will develop and execute a proposed plan, to meet your requirements, and exceed your expectations.

We design small-scale ammonia plants with our NFUEL concept. As a feedstock for this ammonia production electricity produced from renewable sources (wind turbines, PV) can be used. This new concept makes it possible to produce green decentralized ammonia which can be further used as:

- Nitrogen carrier (fertilizer)
- Hydrogen carrier
- Energy storage
- FUEL

As a basic design Proton Ventures offers three different capacities. Within the range of the capacities Proton Ventures deals with the supply and demand of the energy market in order to produce decentralized ammonia.

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Redox
Storage Solutions

Redox Storage Solutions offers innovative proprietary Redox-Flow-Battery storage/power systems from 4 kW to multi MW continuous power output and 10 to multi MWh storage capacity. Our systems are used for decentralized storage of renewable energy sources (solar, wind) and decentralized energy distribution (swarm solutions) for use in commercial energy storage applications. The extreme cycle stability and associated long life benefits of our systems compared to traditional batteries allow for special applications like:

- High power – Normal response time:
  Secondary reserve market applications where the Redox Flow Batteries in hybrid systems cover the seconds to minutes part
- High power – Fast response time:
  Primary reserve market applications (and UPS / Emergency storage applications) where the Redox Flow Batteries cover the power needed from milliseconds to minutes
- High power – Low capacity:
  Systems targeting fast charge / discharge applications with high cycle numbers for automotive or marine

The Redox Storage Solutions high-quality products are:

- In-house manufactured innovative Redox Flow Battery Stacks
- Large energy storage systems (>100 kW to multi MW containerized solutions) tailormade to the customer requirements
- Standard 'off-the shelf' battery system

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REDstack is a Dutch impact-scale-up company, developing and implementing the Blue Energy Technology. The Blue Energy Technology is generating full sustainable power out of contacting two water flows with different salinity; thus where a river flows into the sea, the Blue Energy can be generated. Also other waterflows with different salinity can be used, like salty process flows, brines and treated domestic sewage.

The Technology is based on Reverse ElectroDialysis, using two types of ion-selective membranes, assembled in RED-stacks. A pilot plant is operating successful since 2014 at the Afsluitdijk in the Netherlands, using real seawater and river water, and supplying sustainable power back into the grid. Now the technology is ready for upscaling into a 1 or 2 MW demonstration plant.

Once fully implemented, the Blue Energy Technology is able to generate up to 12% of the world power demand. The technology is not only cost-effective and full sustainable but also full continuous in supply, as it is not depending on sun or wind; therefor it is supporting grid stability and reducing the need of costly conversions and storage of other electricity sources.

Thanks to its innovative character, its contribution to the energy transition and Sustainability Goals and enormous worldwide potential, the full Dutch Board of Ministers has awarded the title of Dutch National Icon to REDstack and her technology.

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Rivusol is a company specialized in solar thermal energy. It supplies solar thermal energy systems to installers in the Netherlands, Belgium and Germany. Rivusol's roots go back as a part of Philips. From the mid 70's to the mid 80's Philips developed, produced and sold its ETC collector (evacuated tube collector) in several countries around the world. In 2007 Rivusol was taken out of one of Philips subsidiaries, Matino, and founded as a separate company.

Rivusol sells standard solar thermal systems for family homes, multi-family residences, swimming pools, camping sites, old people's homes etc. We also support installers with training and technical advice on design and installation. Our systems have on-line monitoring of its operation and performance, indicating daily, weekly and monthly energy production and actual status of its operation.

For our solar thermal system we have different type of solar collectors: evacuated tube collectors, flat plate collectors, air collectors combined with a large range of different type of boilers and all the auxiliary equipment. Depending of the application and circumstance we can design the optimal solar thermal system and integrate it for optimal performance with gas fired boilers, heat pumps, wood stove etc.

Rivusol is also involved in innovation with regard to thermal chemical storage together with its sister company 'Ik ben Ra' (I am Ra), who in turn is specialized in large scale solar thermal systems.

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Rolls-Royce Power Systems AG

Rolls-Royce provides world-class power solutions and complete life-cycle support under the product and solution brand MTU. Through digitalization and electrification, we develop drive and power generation solutions that are even cleaner and smarter and thus provide answers to the challenges posed by the rapidly growing societal demands for energy and mobility. We deliver and service comprehensive, powerful and reliable systems, based on both gas and diesel engines, as well as electrified hybrid systems. These clean and technologically-advanced solutions serve our customers in the marine and infrastructure sectors worldwide.

The MTU EnergyPack is the ideal energy storage solution for whenever and wherever you need power the most. Similar to a big battery bank, it's packed with all the latest technology built to withstand harsh environments and housed in a 40-foot steel container. MTU EnergyPack stores electricity from any source – grid power or local output from solar panels, wind turbines or generator sets – ready to deliver power at the flick of a switch. Whether you need a fully autonomous off-grid facility or simply want to manage your power supplies more efficiently – such as engaging in peak shaving, load-shifting or grid stabilization – the MTU EnergyPack is a scalable, plug-and-play solution that provides reliable power, anytime and anywhere.

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SeaQurrent release tidal energy

SeaQurrent® develops the TidalKite™, a patented multi-wing underwater kite. TidalKite with its '3D-harnessing' now also enables generating clean electricity from shallow (> 10 metres) low velocity tidal and ocean currents (from 0.7 metres/second). This broadened deployment potential brings benefits for commercialisation:

- Near-shore environments lower deployment and maintenance costs and increase uptime thanks to higher accessibility
- Low-velocity environments mean lower survivability requirements leading to a more cost-effective system structure
- Larger deployment results in economies of scale, also supported by the design versatility enabling to scale unit size (simply adding more wings), to local conditions

These factors result in a breakthrough in price, resulting in affordable electricity.

The lift force created by TidalKite™ (1) is transferred via the Tether (2) to the Power Take Off (3). The PTO comprises a hydraulic cylinder and a hydro motor-generator combination for clean electricity production and is fixed to the seabed by a Mooring structure (4). An export cable (5) transports the electricity to the national grid.

TidalKite offers 100% predictable and reliable electricity, 24h/365 days. Combined with the fully submerged deployment enables easy integration in the environment and electricity grid. TidalKite is 100% recyclable and its design inherently minimises impact on sea-life for truly sustainable electricity.

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SEMIOTICLABS

Semiotic Labs develops predictive maintenance systems for AC motors and rotating assets such as pumps, compressors and conveyors. Six high-frequency sensors measure current and voltage from the safety of the motor control cabinet. The self-learning artificial intelligence algorithm analyzes the resulting signals to detect equipment faults as soon as they start to develop, and identifies the specific failure mode at play. At our installed customer base, Semiotic Labs has detected more than 90 percent of developing faults up to five months in advance, increasing uptime and overall equipment effectiveness.

All industrial companies want to become more energy efficient, but to do so they need hard data that will help them optimize their processes and the motors they use. The good news for our customers is that the required data is already being collected and analyzed. Because it measures both current and voltage, our system has the raw data to estimate the efficiency of the motors and processes it monitors. AI functionality then operates on that data to extract actionable sustainability insights.

Semiotic Labs is also a key stakeholder in ERGO, a research project involving a number of industry leaders. ERGO's goal is to develop and validate system-level monitoring features in our technology to detect energy inefficiencies and provide data-driven insights to reduce industrial energy consumption by 15–30 percent.

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SkyNRG

SkyNRG is the global market leader for sustainable aviation fuel (SAF) solutions. Having supplied over 30 airlines on all continents, it is our mission to make SAF the new global standard. SkyNRG sources, blends and distributes SAF, guarantees sustainability throughout the supply chain and helps to co-fund any price gap over conventional jet fuel. At the same time, SkyNRG focuses on developing regional SAF supply chains -e.g., DSL-01, that offer a real sustainable and affordable alternative to fossil fuels. To ensure we make the right decisions regarding the sustainability of our operations, projects and products, SkyNRG is structurally advised by an independent Sustainability Board, which includes representatives from WWF International, the European Climate Foundation, Solidaridad and the University of Groningen. Also, SkyNRG's operations are certified by the Roundtable on Sustainable Biomaterials (RSB), the highest possible certification standard for sustainable fuels.

SAF is a clean substitute for fossil jet fuels. Rather than being refined from petroleum, SAF is produced from sustainable feedstocks such as waste oils from biological origin, agri residues or biogenic CO_2. SAF is a so-called drop-in fuel, which means that it can be blended with fossil jet fuel and that the blended fuel requires no special infrastructure or equipment changes. Once it is blended, our fuel is fully certified and has the same characteristics and meets the same specifications as fossil jet fuel.

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SMIT THERMAL SOLUTIONS

Smit Thermal Solutions is a leader in innovative thin film applications for cost-effective high-volume mass production equipment. Furnace pioneers for nearly 80 years, our in-house ''out-of-the-box'' solutions maximize throughput while minimizing your ''cost of ownership.'' We understand your market and the need for efficient, durable and cost-effective in-line or batch type thermal solutions to gain a competitive advantage. You can rely on our made-to-measure solutions for your custom-designed processes.

- Deposition techniques: VTD, APCVD, CSS and PECVD.
- Deposition of active layers for Thin Film using different vacuum and atmospheric techniques such as CSS and VTD.
- Functional layers in silicon wafer applications.
- Thermal activation and annealing in controlled process atmospheres.
- Decorative and functional layers using thermal processes and/or s-ALD technology.
- Selenization and crystallization for CIGSe layers in S2S and R2R.
- Drying and sintering for printed electronics and Perovskites.

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solarcentury

It is Solarcentury's mission to provide a solution against climate change by realizing solar energy projects worldwide. With more than 1500 MW of solar panels – comparable to the electricity consumption of half a million people – our company is the market leader in Europe. Part of our international and the Benelux activities operate from our location in Den Bosch where we work with a team of more than 20 people on large-scale solar farms.

With a sustainable, landscape integrated design of our solar farms we are realizing an increase in biodiversity. We develop our projects in close cooperation with local residents, who have the option to participate financially as well. Solarcentury is experienced in the entire process from project development, engineering, construction, financing to the long term operation and maintenance of solar farms. Solarcentury remains the single point of contact for its relations throughout the entire development and operational period.

In 2006, Solarcentury set up the charity SolarAid to help combat climate change and poverty in developing countries – Kenya, Tanzania, Malawi, Uganda and Zambia – by providing access to solar energy while at the same time reducing the unsafe use of kerosene lamps. Solarcentury donates 5% of its net profit to SolarAid, providing more than 10 million people in Africa with access to safe and sustainable solar energy to date.

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SOLARFIELDS

Improving the world with sustainable energy is what Solarfields represents. We are a producer of renewable energy with the realization of large solar systems in the Netherlands. We are proud to be market leader in large land-based solar plants.

Solarfields works in a professional way, with great care for the environment. Our first 6 solar plants have been realized and we will build many more in the upcoming years.

We develop our projects on various locations, such as ground, roofs, old landfill sites and parking lots. All with the aim to produce clean energy for the Netherlands. We apply the latest technologies, thus offer the best solutions.

Sustainability is in the DNA of Solarfields and our employees. Our dedicated team operates from 3 locations in the Netherlands. We develop our own projects from scratch to operation. We additionally offer financing solutions for third party projects.

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SolaRoad

SolaRoad BV (The Hague, The Netherlands) develops, produces and markets road pavements that harvest solar energy and convert it to electricity. State-of-the-art solar technology is integrated into robust, prefabricated concrete elements. SolaRoad pavements, combining infrastructure with solar energy production, turn roads into large, decentral solar plants: invisible, inaudible, durable, and vandalism proof.

Electricity from our pavements can be used to power a range of applications, including public lighting, traffic management systems, households, and electric vehicles.

In The Netherlands, a road section of 10 m SolaRoad pavement produces an estimated 3500 kWh per year, enough for one household, or 25.000 electric vehicle kilometers. The green electricity is generated without claiming extra space, without disturbing environment or nature, simply by multifunctional use of the roads that we build and use anyway.

SolaRoad has been successfully applied in bike roads in The Netherlands and in France since 2014.

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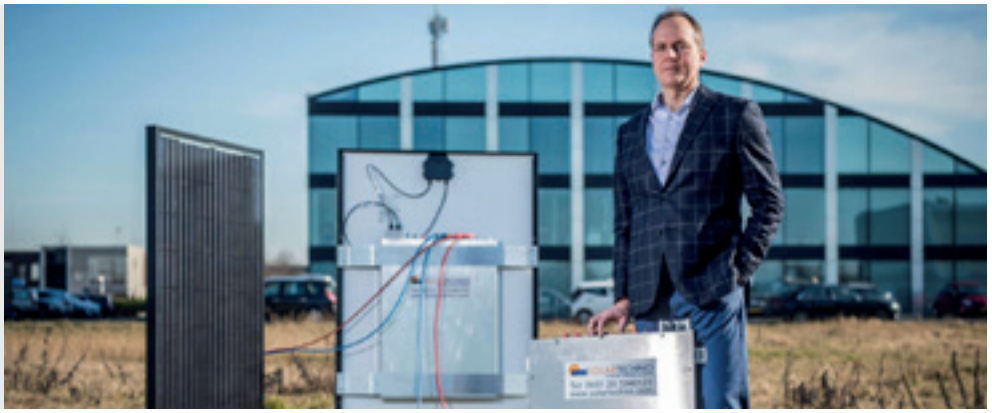

Solartechno is a specialist in solar power systems, supplying custom-made turn-key off-grid systems for customers in the Middle East, Africa and Europe. We design smaller systems using an innovative plug-and-play modular battery pack that integrates Lithium-Ion cells and related electronics directly on the back of each photovoltaic panel. For larger systems we use both new and recycled lithium battery cells. Recycled cells are sourced from Japanese car manufacturers and retain an electricity storage capacity or more than 80% of their initial capacity, at a very low cost. Cells are certified to operate at temperatures of up to 60°C. Our larger systems can be preassembled into a container making it easy to install them on location.

Our expertise is in powering buildings as well as a variety of industrial and agricultural installations such as farms and telecom base stations and antennas. Very often we integrate our system into an existing power supply based on a diesel genset. This allows customers to lower the operational cost of running the diesel genset.

Solartechno can handle the entire project life-cycle, from the technical-financial feasibility study, through to the definition of the technical specifications and system installation, including on-site training. In addition to off grid systems we can also provide consulting services to investors.

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SoluForce is the originator and technological leader of high pressure Reinforced Thermoplastic Pipe systems (RTP, also known as Flexible Composite Pipes or FCP). They are used for many applications, such as hydrocarbons, water, offshore and mining. The SoluForce system is completely flexible, meaning it can go round corners, up hills, down slopes, across gullies, under water and more with ease. Being non-metallic, it is also fully corrosion- and scaling-free and is quick and easy to install. Our solutions further include various fitting systems that make it easy to connect our pipe systems to existing infrastructure.

The SoluForce RTP system has now also been certified for hydrogen applications up to 42 bar of operating pressure. Unique in the world of hydrogen transport and a global first. This significant milestone has a major impact on the feasibility of hydrogen, and is a new step towards a sustainable energy mix.

First application of the SoluForce Hydrogen solution will be at Groningen Seaports, where four kilometers (2.5 miles) of SoluForce infrastructure will be installed. This infrastructure will ultimately distribute green hydrogen produced by wind mills in the North sea to companies in the chemical and industrial sectors in the Eemshaven.

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summit engineering
Your partner in CO_2 reduction

"Leaving a world to thrive in for future generations." We want to use our personal energy for that.

Summit Engineering was founded by Arjan Hartemink and Robbert van der Pluijm after a trip to Mount Kilimanjaro. The journey to the top and back, has inspired them in many ways. The glacier at the summit is becoming smaller every year due to global warming. Being confronted with this so closely, was the final push: we have to do something.

Summit Engineering now supports companies and governments with their Energy Management and Sustainable Energy Projects. We also share our knowledge with the future generation by teaching classes at universities. Together we work on reducing CO_2 emissions and on taking steps towards a CO_2 neutral world. We provide concrete advice and excellent project support you can count on. Whether you are at the concept phase of your project or already working towards project implementation.

At Summit Engineering we work with the four I's principle: Insight, ideas, Integration and Implementation. This work process offers you guidance along your journey to reduce your CO_2 emissions. To enable the process, we have various tools and options available, these include energy management (ISO 50001), sustainability (green gas, hydrogen or solar and wind energy) or integrated energy solutions (power to hydrogen, energy storage). We use our knowledge, experience, as well as our extensive sector network, to provide a tailor-made programme for achieving optimal results.

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SUN PROJECTS

As an innovative EPC Sunprojects is specialized in realizing large turn key solar projects. Started out as a family business we have been installing PV since 2005, on solar fields, on water and on top of roofs of companies, factories, retail centers, educational facilities and large sports accommodations. In total we've installed well over 150 MW of solar, in The Netherlands and Belgium, as well as in France, Romania and Portugal.

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Sympower unlocks revenue streams by maximising the value of flexibility across energy markets and industries. Flexibility means temporarily adjusting power generation and consumption based on its value and the grid's needs. We buy flexibility to stabilise the grid, rewarding our customers in return.

Our highly-scalable platform is secure by design thanks to exceptional software developed in-house. Our non-intrusive solutions, which combine software and hardware when required, allow our customers to enhance the value of their energy assets, from air conditioners and heating devices to machines and motors.

Our advanced and automated demand response capabilities monitor and balance electricity supply and demand in real-time. Connecting to our platform does not incur any upfront costs. We offer services independently from a particular energy company, meaning that we can work with any industry, grid operator or utility. This allows us to support fast and unrestricted scaling across sectors and countries.

Sympower was born international. With dedicated teams based in five countries, we are able to react quickly and create extra value wherever opportunities arise. Our outstanding international cross sector knowledge and experience is actively contributing to a carbon-free future.

Flexibility is vital for a successful energy transition, that is why we are pushing traditional industries to be more sustainable and enabling the shift from fossil fuels to renewables.

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Synova provides breakthrough technologies to deliver cost-effective, mass-scale solutions that transform biomass and waste, as well as mixed-material and contaminated plastics, into valuable gas for the production of chemicals, fuels and electricity. Synova's revolutionary process upcycles waste into clean, dense and hydro-carbon rich gas at high efficiency. In turn, Synova delivers on the mandates for sustainable development goals, addressing the energy transition to a circular economy and improved waste management.

Synova is disrupting the world's approach to wastes:

- A feedstock flexible process that minimizes the need to sort, clean, and pre-process while maximizing the variety all types of waste — including plastics, paper and cardboard — more affordably than any other system.
- Valuable output options (chemicals, fuels, electricity), due to high conversion efficiency and hydro-carbon rich gas.
- Standard design approach allows Synova to quickly replicate its process, limiting construction risk and enabling a faster time-to-market.
- Scalable solution – via its MILENA gasifier and OLGA tar removal systems.

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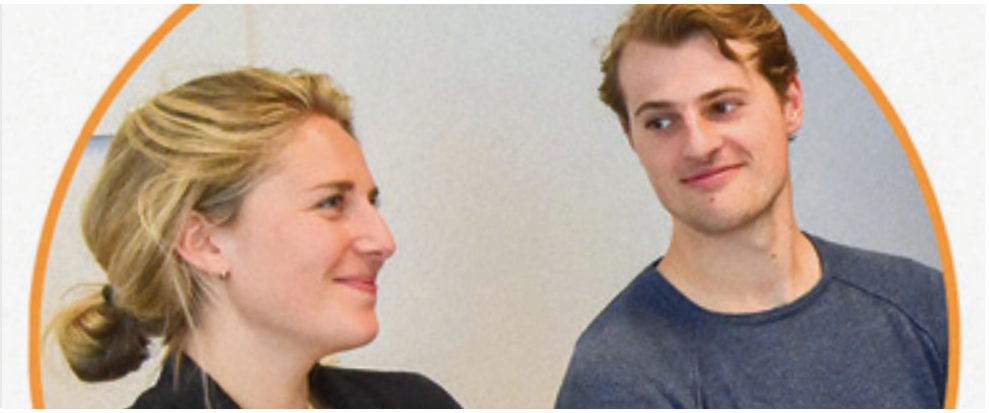

Talent voor Transitie

The energy transition is in full swing, but it must and can accelerate. A generation of highly motivated young talent wish to contribute to this. We match curious and enthusiastic young talent with organizations in need of experimentation skills and guts. Our goal is to accelerate the energy transition through our learning community. Together with the young talents, who we call transition accelerators, and our partners, we form a learning community in which partnership and development dominate.

As a partner in our community, you have access to the skills and expertise of our transition accelerators. We facilitate matchmaking based on the need of your organization. The transition accelerator will work together with your team to complete the assignment successfully. Their experimentation skills and guts result in a team with bubbling energy and new ideas. On completion of the assignment, your organization welcomes the next transition accelerator, or you may have gained a new team member!

Transition accelerators receive intensive training to further develop their knowledge and skills. The two-year development program focusses on personal development, project and stakeholder management, forming coalitions and creating impact. Thanks to our approach they develop a broad network of young inspiring people and they identify where they can personally make the biggest impact.

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TechnipFMC

TechnipFMC is a leader in the refining industry and is committed to meet the world's energy challenges by leveraging its refining experience to provide alternative 'green' energy and bio-based products. Our 50+ year experience with hydrogen plants includes not only grey hydrogen, but also blue hydrogen, featuring CO_2 capture. Driven by our historical track record in grey and blue hydrogen projects, we see our involvement into green hydrogen as a logical next step in our contribution to the Energy Transition.Our bio-based offerings include Fast Pyrolysis Bio-Oil (FPBO) technology which converts biomass into pyrolysis oil. Pyrolysis oil is a renewable, second-generation bio-liquid that can be used as a sustainable alternative to fossil fuels for the production of renewable energy and chemicals. FPBO technology transforms non-food lignocellulosic biomass into liquid. All kinds of biomass residue, such as wood residues, straw, sugar cane bagasse, and sun flower husks – can be used. Pyrolysis oil is easy to store, transport, and conveniently used in versatile applications including heat, power, transportation fuels and in bio refineries for a bio-based economy. TechnipFMC delivers complete turnkey FPBO plants, based exclusively on BTG Bioliquids (BTL) FPBO licensed technology. BTL's experience in the design and commercial operation of one of the world's first FPBO production facilities (Empyro located in the Netherlands) combined with TechnipFMC's global strength in technology, engineering, procurement and construction, fosters our joint commitment to provide our customers with proven technology, EPC expertise and commercial pyrolysis oil production facilities.

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TWD
TEMPORARY WORKS DESIGN

At TWD we improve challenging construction by providing innovative solutions and designs for our customers. Our thorough knowledge of structural and mechanical engineering, hydro-dynamics, finite element methods and design for offshore conditions, enables us to develop the optimal solutions that meet the wide variety of your demands. We continuously want to make construction easier. You play a key role in offering solutions towards a sustainable future for generations to come. And we play our part in helping to meet your ambitions. At TWD we engineer the future together!

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TEMPRESS
Innovating the future

Tempress: The expert source in horizontal diffusion – and CVD furnace equipment. Ranging from small batch laboratory systems up to fully automated high volume manufacturing equipment. Besides the furnace equipment, we develop state of the art PV Cell Technology in order to provide our customers with best in class processes to manufacture high efficiency PV Cells.

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TIDAL BRIDGE

Tidal Bridge develops a new approach of tidal applications were tidal energy is converted into electricity, hence reducing installation and overall maintenance cost, increasing the power output and creating alternative uses. The installation costs are reduced with 40 to 50% while power output is increased with 10 to 25% allowing the electricity to be produced at competitive prices.

Tidal Bridge is a joint venture between BAM International and Dutch Expansion Capital, who both have extraordinary experience in the world of marine, near shore and tidal applications. The company has activities in Europe and Indonesia. Tidal Bridge BV works on the development of the Palmerah Tidal Bridge project, a 900-meter long bridge over the Larantuka Strait in East Flores in Indonesia. Tidal Bridge's eco-friendly tidal-turbines will be installed underneath 400 meters of the projected bridge. These environmentally friendly turbines will produce 100% renewable and green energy, serving more than hundred thousand citizens in the region with green electricity. The Palmerah Bridge project is part of the Indonesian national investment plan, has the Indonesian National Strategic Project status and complies to the 2020 Paris Climate Agreement. It will become the largest tidal power plant in the world and will enable the development of the remote area of East Flores. We work with PLN, the Indonesian stated owned electricity company and Dutch Development bank FMO. In Q2 2020 we started the contractual phase, aiming at a closing by the end of the year. The construction of the bridge is foreseen to start in 2021.

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TIZZIN
COOL SOLUTIONS

Tizzin is specialized in cooling products for small and medium-sized equipment rooms and street cabinets, based on Thermal Energy storage (Phase Chance Materials) and Free-Air. This allows you to reduce the energy consumption for the cooling of the rooms up to 95% with our proven, price- and user-friendly cooling solutions.

The best way to cool equipment rooms is using direct Free-Air. Direct Free-Air cooling is the cheapest, the greenest, most eco-friendly choice for cooling your equipment rooms. The Thermal Energy storage also known as Phase Change Materials (PCM), supports the Free-Air cooling in hours that the outside air temperature rises above the required temperature. Thermal Energy storage in Phase Change Material (PCM) can best be compared to a battery or better a 'thermal battery'. The battery absorb heat from the sun and equipment (during the day) and discharged this this stored energy in a later stadium (during the night).

Tizzin has succeeded in developing Phase Change Material in a smart way since 2010, we make it possible to cool equipment room and street cabinets and to reduce the electric consumption extremely. This results in a high energy saving and very low CO_2 emissions. PCM-cooling has no refrigerant, is non-flammable and non-toxic. PCM and Free-Air cooling are easy to install with very low maintenance. It's a reliable and proven cooling technologies for your equipment rooms.

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TKI URBAN ENERGY
Topsector Energie

TKI Urban Energy focuses on speeding up the Dutch energy transition by enabling energy-related innovation in the built environment. We do so by creating connections. We connect companies and research institutes by creating networking opportunities, bringing together supply and demand, and by helping to create project consortiums. We connect with expertise: by keeping consortiums up to date with the latest developments, by enabling and commissioning research and by informing policy makers about current ideas and developments in the urban energy sector. And we connect with funds: we help innovators and researchers identify potential sources of funding and subsidy.

TKI Urban Energy acts as an intermediary between the public and private sector and takes the lead in defining the Netherlands' national innovation programme. For international companies, researchers, governments and manufacturers, TKI Urban Energy is the gateway to Dutch energy innovations for the built environment. We provide them with up-to-date information on current research, the latest innovations and the general development of the Dutch energy transition. If you are interested in building partnerships with Dutch technology providers, TKI Urban Energy can help you identify and access the right people with the right expertise.

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TNO innovation for life

A sustainable future is the only future. The energy transition requires major technical and social shifts in all sectors of the economy, among the authorities and citizens. Therefore innovation is crucial. As an independent research organisation TNO applies knowledge and research that boost the competitive strength of industry and the well-being of society in a sustainable way. We work together with partners and the government to accelerate the energy transition so that in 2050 the Netherlands will have an energy regime free of CO_2 emissions. The challenge is to reduce CO_2 emissions by phasing in sustainable energy and gradually phasing out fossil energy while keeping the energy supply secure, robust and affordable.

With over 500 employees dedicated to renewable energy R&D and access to more than 3400 professionals across TNO, we are one of the most experienced and competent energy expertise centers in the world.

TNO focusses on the following roadmaps which have a major part to play in the energy transition:

- Towards ubiquitous solar energy
- Towards large-scale generation of wind energy
- Towards a societally embedded energy transition
- Towards an energy-generating built environment
- Towards CO_2-neutral fuels and feedstock
- Towards a CO_2-neutral industry
- Towards a reliable sustainable energy system

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It is our mission to bring clean and reliable power to people and organisations all over the world, by harnessing hydro power driven by the gravitational pull between the earth and moon.

Tocardo is fully owned by HydroWing Ltd. and QED Naval Ltd. This tripartite, collaborative partnership brings together decades of multisector expertise as well as a blend of well tested, complementary products. The joint venture provides a truly end to end service with a spectrum of turbines, foundation systems, marine operations, as well as design, support and service expertise.

Tocardo is active in the energy market in the segment of power generation. The turbines make use of the tidal and river streams to propel the blades. Tocardo is one of the world's leading independent tidal turbine developers renowned for the robust and reliable turbines resulting from a development history spanning the sectors entirety and has the largest portfolio of projects operated by any developer in the sector. We deliver medium size turbines up to 0.5 MW each which can be installed in larger numbers enabling projects from community up to utility scale. The turbines can be independently controlled enabling continued generation in the event of individual failure.

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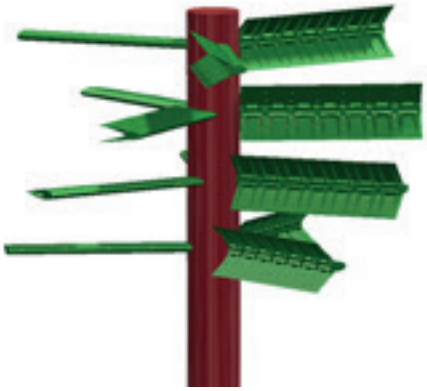

The Torque is a small, modular build, vertical wind turbine of the newest generation, with countless advantages. Due to the sophisticated and patented design the Torque is the best working small wind turbine under all wind circumstances. The dynamic blade system optimizes the conversion of wind energy while moving with the wind direction and minimizes at the same time the loss of energy while moving against the wind. Because of this the wind turbine is very efficient in the conversion of wind energy to electricity, also during the frequent wind direction and wind speed changes at lower height. Already at low wind speed the drag and lift forces enable the turbine to produce electricity and even during a storm with strong wind gusts the Torque can supply useful electricity without to bolt.

The Torque does, due to its relatively low height, hardly disturb the landscape scene, burden neighbors with moving shadows and makes thanks to the design also nearly no noise. On top of that it was designed to be at least 10 years maintenance free. The Torque is just doing what a wind turbine should do: produce as cheap as possible a lot of clean energy.

The Torque is due to its power range, height and limited noise extremely suitable for companies in the agriculture sector, houses on the countryside, small villages and for use as 'light pole' alongside highways.

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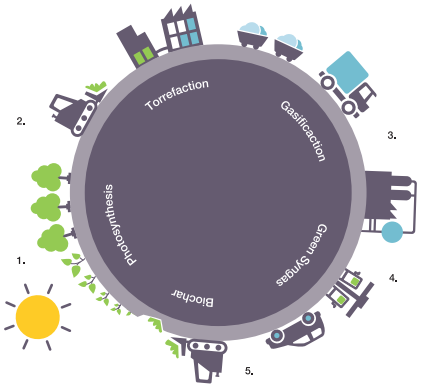

Torrgas Holding is a privately held technology licensing company that has developed a disruptive, proprietary and scalable biomass gasification technology. The company provides novel and economic routes to building blocks (synthetic gas) which serves as a biobased feedstock for synthetic chemicals and fuels but also for de-centralized heat and power production. Torrgas unique and patented process provides a sustainable pathway to produce platform chemicals that serve as building blocks to biobased products. The Torrgas technology creates zero waste and only valuable products. This is the basis for a process that is disarmingly simple, yet innovative and effective. Torrgas technology distinguishes itself by two essential aspects:

1. Scalable & modular; by applying a moisture free, high energy density, torrefied biomass gasifyers can be scaled to 100 MW or more.
2. Affordable; co-production of biochar and liquified CO_2 creates a superior business model that produces biobased molecules at fossil competitive costs.

Torrgas projects under development:
Torrgas Delfzijl, a 25 MW SNG plant to be operational in 2021-2022. This plant will apply torrefied recycled wood as feedstock. Project partners include Gasunie, the national Dutch natural gas infrastructure and transportation company operating in the Netherlands and Germany and Groeifonds, a Groningen based investment fund.
BrigH2 Chemelot, a 50 MW green hydrogen plant. This plant will apply torrefied recycled wood as feedstock and produce 7.000 mt per year of green hydrogen. BrigH2 is a JV between Torrgas and Chemelot Inq.

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We are TransitionHERO, the engineering firm tailored for industrial Green Technologies. We believe in Green Technology as solution for delivering positive impact to climate change and transforming the industry into something better. We love the challenge of growing green technologies and supporting ambitious industry leaders to create impact. Our creativity and professional experience combined with our algorithmic solutions are key to our approach. And having a bit of fun along the way. We design and scale up green technologies smarter and faster.

Probably your design journey started already with the idea, tested in a lab and verified in a first pilot. Your next challenge is to scale-up to an industrial demonstration or full-scale plant. We have developed especially for Green Technologies our IndustryReady program. In short design cycles we tackle business uncertainties and design challenges. We use our extensive industrial background to bridge the gap between the greentech and industrial companies, by speaking the same language and having the same mentality.

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TRIOGEN

Triogen is making Organic Rankine Cycle (ORC) a viable technology for converting relatively high temperature residual heat into electricity. Main heat sources are heat from reciprocating engines and industrial processes, and heat from the combustion of off-spec fuels like biomass. Since 2001, Triogen has focused on developing and deploying a compact, modular, highly efficient ORC power plant. We have sold over 50 ORCs in 11 European countries and accumulated over 1,000,000 operating hours. ORC power plants in combination with gas or diesel engines increase the power output of the engine by up to 10% without requiring any additional fuel. For engines in the 1 - 3 MW range, a single ORC is the best fit. The major suppliers have approved connecting a Triogen ORC to the exhaust of their engines.

Triogen ORC power plants enable Combined Heat and Power (CHP) at a decentralized scale for local district heating networks and/or drying processes, and provide power to the grid. As an example, the ORC unit is combined with a 1,2 MWth furnace consuming 2.500 - 3.000 tons of solid biomass per year. The Triogen ORC has a typical heat intake of 940 kWth at 530°C and provides up to 200 kWe power and 680 kWth heat at 80°C or higher. Triogen focuses on supplying the ORC; in addition, we gladly provide engineering support for the system integration with different burners. As the flue gas can enter straight into the evaporator, the cost and complexity of an intermediate loop is eliminated.

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van der Kooy
Pijnacker B.V.

Van der Kooy is a family run company originated in 1958 and operates in a waste refinery factory. From our location in Oosterhout, The Netherlands, we upgrade contaminated oils and fats to a clean BioHeating Oil (BHO). The Oosterhout location has a storage capacity of 25.000 m^3 plus an additional 6.500 m^3 for bulk loading.

Van der Kooy is specialized in producing renewable liquid biomass, Bio Heating Oil, to use as renewable fuel in district heating systems.

Benefits of Bio Heating Oil:
- High in Energy content > 36 MJ/kg
- Low ash content < 0.05%
- Short CO_2 cycle due to annual crops
- Not competing with food or feed chain
- Easy to use as fuel during demand peaks

Our fully equipped in-house laboratory monitors each step of the refining process in the factory. This allows us to produce Bio Heating Oil that meets the client's specifications and sustainability criteria. Yearly audits and the strict schemes of REDcert/ISCC ensures the end user to receive a proven CO_2 reducing Bio Heating Oil that meets the European Renewable energy directive.

When you are looking for a reliable partner to supply high quality renewable liquid biomass, Bio Heating Oil, please don't hesitate to contact us for further information or inquiries.

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VAN DER VALK
SOLAR SYSTEMS

Van der Valk Solar Systems is an established developer and producer of solar mounting systems and is currently active in 13 countries. It has main offices in Monster (the Netherlands), Sandwich, Kent (the UK) and Madrid, Spain. Its dedicated team has answers to every technical question, design or project. As it holds large stocks, the systems for flat roofs, pitched roofs and open fields can be dispatched in days within Europe. Van der Valk Solar Systems is specialised in commercial and residential projects. Its customers are mostly wholesalers and major installers (EPC).

Benefits of Van der Valk Solar Systems:

- Solar mounting systems for pitched roofs, flat roofs and open fields
- Competitive prices
- Innovative systems developed in line with global norms
- Reliable partner with its own modern machinery, large stocks and reliable logistics partners
- Personal approach and good service by assigning a permanent contact person
- System supplier since 1963
- Large flexibility in solutions, for example high(er) roofs (standard is up to 25m)
- Systems are fitted for earthing and lightning protection (NEN1010)
- Free to use calculation tools: ValkPVplanner and ValkKITSplanner
- Easy and quick mounting thanks to premounting of essential components
- Various systems can also be supplied as ready-made kits

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Van Oord
Marine ingenuity

As a global maritime contractor, Van Oord focus on dredging, oil & gas infrastructure and off shore wind, offering innovative solutions to marine challenges. Safety and sustainability goes hand in hand in this respect. Climate change and the need to reduce CO_2 emissions are drivers for the rising demand of renewable energy sources. With proven experience and an impressive 20-year track record, Van Oord is leading the way in the energy transition towards renewable energy by constructing offshore wind projects. We furnish all-round solutions, often as turnkey projects including engineering, procurement, and construction in order to assume full responsibility for entire projects for our clients. We focus on Balance of Plant contracts (all supporting components and auxiliary systems other than the wind turbines) and on Transport and Installation projects. We also provide services such as scour protection and inter array cable installation. During the last years we invested in our organisation, fleet and in innovations. We acquired the MPI offshore organisation in the United Kingdom and two of its jackup installation vessels, to strengthen our global offshore wind installation works. Our offshore installation vessel Aeolus was upgraded with a new impressive 1,600 tonnes crane, making the vessel ready to handle the latest generation of foundations and turbines for future offshore wind projects. Another addition to our fleet is subsea rock installation vessel Bravenes. This vessel is able to install rock very close to offshore platforms, such as monopiles. Finally we have extended our cable laying and burial capabilities, with the newest trencher Deep Dig-It, a remote-controlled trench jetting and cutting system.

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Victron Energy develops and manufactures electric power conversion products for battery-based energy systems. Founded in 1975 by Reinout Vader, Victron Energy is based in Almere-Haven in The Netherlands. In the last 45 years, Victron Energy has grown from a one-office technology company to become an international enterprise with nearly 1000 different products sold worldwide. Our solutions play a key role in solar energy systems, recreational and commercial boating, overland transportation as well as industrial settings.

The product range includes sinewave inverters, sinewave inverters-chargers, solar chargers, battery monitors, DC/DC converters, remote monitoring & control solutions, battery chargers and even more. Victron Energy enjoys an unrivalled reputation for technical innovation, reliability, and quality, enabling it to become a world leader in the supply of power solutions. Our network of distributors, authorized dealers and service partners covers more than 100 countries.

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Water2Energy designs, constructs, installs and maintains vertical axis water turbines and floating platforms to mount these turbines. Our turbines are robust, efficient and proven fish friendly. Our team builds on years of experience in offshore engineering and tidal energy. We developed a range of turbines adapted to the local environmental conditions at cost levels competitive with solar and wind energy but with more reliable, continuous and predictable energy production. W2E stands for reliable and sustainable energy solutions.

Vertical Axis Water Turbines (VAWT) are turbines with a vertical shaft. Foils connected to the vertical shaft makes this typical water turbine. The standard version is called a Darrieus turbine. Pitch control is developed for maximum efficiency and a high fish friendliness. The pitch control enables energy extraction from water currents at lower speeds.

Since the foils have a standard and constant cross section, they can be fabricated very cost effective. Furthermore, the vertical axis gives the advantage to place vital components like the gearbox and generator above the water surface. This lowers the requirements and therefore the costs for these components. Since the gearbox and generator are easily accessible, maintenance will therefore be more cost effective. In a team of international experts at the Protide project, the turbine of Water2Energy with pitch control was tested on fish friendliness. In the older Kaplan-turbines, fish mortality up is to 20%, but the turbine of Water2Energy showed a mortality lower than 1%.

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wellsun
welcome the sun

At Wellsun, we believe that improving the energy performance of the building environment should be a great experience. Only then will people have the motivation to do what needs to be done. Only then can we accelerate and create the momentum that leads to change. Only then can we change the world. Wellsun has developed the Lumiduct which makes livable, transparent, and energy producing buildings become reality. The Lumiduct enables full glass façades, like the project at Mondial Movers, which generate more energy than closed walls completely covered with traditional solar panels.

The Lumiduct saves energy and creates an ideal indoor climate by selectively shielding the intense, direct light which is responsible for glare and heating up of the building, and turns it into electricity. At the same time, the Lumiduct is transparent for the soft, diffused light which is then experienced as pleasant daylight.

With the Lumiduct, the building comes to life. During the day, the façade is activated by the brilliant transparent solar panels, enabling the building to generate and save energy. At night, the façade is activated by the integrated LEDs making it possible to create a beautiful atmosphere and communicate with the community. The Lumiduct creates awareness and makes living in and around the building a great experience.

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flexible storage
and cover systems

wiefferink

Wiefferink is an internationally oriented supplier of flexible cover and storage solutions. We work on products with diverse applications in agriculture, energy production and industry. Our portfolio is varied: from the storage of manure and gas in biogas installations to flexible water depots. The company is built on craftsmanship, since many of the steps in production and mounting can't be automated. Our dedicated team consists of people who know how to roll up their sleeves. As well as people who use their expertise to develop new products and applications.

In order to offer maximum quality, we like to keep the entire process in our own hands. Design and production for example, but also the assembly.

Wiefferink has spacious and modern equipped production halls in Oldenzaal and Wykroty (Poland).The assembly is done carefully by our own experienced teams. Going international is an important part of our mindset. The centre of gravity of our activities lies in Europe, but we also worked on some exciting projects in countries farther away, such as Guatemala, Thailand, Japan and South-Africa. Wiefferink has been founded in 1956 and has more than 60 years of experience in processing all kinds of foil for multiple applications.

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We provide professional project management and consulting service to our clients worldwide. We guarantee value for money by utilizing our extensive experience to create tangible business benefits. We craft specific solutions for strategy definition as well as operational improvement processes. We can take your business to the next level of performance and deliver projects of superior quality on time and within budget. 'No cure no pay' is always an option for high risk projects.

Our expertise lies in the field of sustainable energy and technology, acquiring government subsidies, and a long lasting partnership with the Top Sector Energy. With our partner network we build worldwide connections, bringing together inventors and industry, researchers and entrepreneurs, business and markets.

Why not contact us for an informal get-together and provide us with a challenge.

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Yilkins enables modern biomass conversion and optimizes value chains. We develop and manufacture fully integrated, mobile, small-scale as well as large-scale solutions for economic drying and torrifaction of a wide range of biomass materials, from high value foodstuff up to and including upgrading of low-value forestry & agro residues. Yilkins plants are modular, semi-transportable and have a compact footprint. They are scalable, which makes them suitable for both small- and large-scale projects. Our innovative and revolutionary dryers apply the principles of 'Fluidized Bed'. We have designed our process for lowest capital and operational costs. We are working closely together with our customers to integrate our modular technology in the most effective manner. Our technology also allows distributed manufacturing as it can be operated remotely and autonomously. This allows to optimize total costs of supply. An independent due-diligence by a reputable, international organization has classified Yilkins' torrefaction technology as proven and 'bankable'. Among other Yilkins licenses its patented drying and torrefaction technology for the production of wood pellets for small and large-scale industrial energy generation.

The Yilkins team will work with you to find the best, customized and sustainable solution that enables the circular economy.

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ZigZagSolar offers special kits for building solar facades. ZigZagSolar offers engineering, training and guidance. We support challenges in architecture, facade technology, building physics, energy efficiency and quality. We have an international presence. ZigZagSolar is based on patented technologies and proprietary simulation tools. ZigZagSolar supports you in the design and realization of superb solar facades. Thanks to proven reflection technologies the yield can be 28% better. ZigZagSolar performs best in the hours of solar scarcety. ZigZagSolar: Guaranteed – Affordable – Economic – Elegant – Energy.
Our mission: make cities a better place to live in. We are a high-tech company with a clear focus on technical perfection and flawless execution. ZigZagSolar works on 8 SDG's.

Main objectives are:

- Bring affordable clean energy to cities; financially attractive solutions
- Fight air pollution, climate change, power cuts and the use of generators
- Save energy and create circular solutions for energy efficient buildings
- Make cities look good

ZigZagSolar offers technologies for cold facades, warm facades, curtain walls, structural glazing, windows, solar thermal, photovoltaic and PVT. ZigZagSolar offers matching add-ons like surge protection, lightning arrestors, monitoring, etc. ZigZagSolar harvests solar energy and offers high thermal insulation. ZigZagSolar is integrated in the largest solar facade in the BeNeLux. ZigZagSolar guarantees the performance of its products.

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