Solar and storage synergies for a sustainable future

Dutch PV and energy storage technology

Netherlands

Next-generation high-tech excellence

Harnessing the potential of solar energy calls for creativity and innovative strength. The Dutch solar sector has been enabling breakthrough innovations for decades, thanks in part to close collaboration with world-class research institutes and by fostering the next generation of high-tech talent.
For example, Dutch student teams have won a record eleven titles in the World Solar Challenge, a biennial solar-powered car race in Australia.


KLM

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The Netherlands, a true solar country

If there's one thing the Dutch are remarkably good at, it's making the most of their natural circumstances. That explains how a country with a relatively modest amount of sunshine has built a global reputation as a leading innovator in the solar and storage value chain.

For decades, Dutch companies and research institutes have been among the international leaders in the worldwide solar PV sector. Not only with high-level fundamental research, but also with converting this research into practical applications. Both by designing and refining industrial production processes, and by developing and commercialising innovative solutions that enable the integration of solar PV into our built or natural environment or infrastructure.

This has first of all resulted in a thriving home market for PV technology. The Netherlands has the highest amount of installed solar capacity per capita in the world. And since solar power is by its very nature unpredictable, the Dutch have in recent years invested much effort in developing smart solutions for storing energy. In fact, PV and storage technology are increasingly part of an integrated value chain. In which Dutch companies and knowledge institutes have teamed up to create exciting innovations, that are already proving their value far beyond the country's borders.

How can you benefit best from Dutch solar and storage expertise and solutions? In this guide we will help you to answer that question and familiarise you with the Dutch solar and storage sector. This guide demonstrates the expertise that organisations in the Netherlands have in the various elements of the value chain, it shows which new applications have been developed with that expertise, and what future opportunities we envisage to give the solar revolution extra impetus.

It is with great pride that we present this guide and invite you to get in touch with us so we can help you achieve your ambitions. Together we can accelerate the solar and storage revolution and make a difference for our world, ourselves and future generations.

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The sunny side of the Netherlands

The global energy transition is gathering pace, and solar energy is one of the driving forces behind it. Smart innovations are needed to maintain this momentum, specifically in order to make solar energy more economical and reliable, and to enable large-scale integration into our built and natural environment.

“A vibrant ecosystem that covers the entire PV value chain”

Solar energy is growing at a rapid pace: in 2022 the worldwide installed capacity was 1.2 TWp, with an annual growth of 240 GWp. It is one of the few technologies that the IEA has labelled ‘on track’ to meet the Paris Agreement goals. Solar power is rapidly becoming the workhorse of our future clean energy supply. In scenarios published by the International Renewable Energy Agency (IRENA), electricity is expected to be the main energy carrier by 2050, with sustainable sources - especially solar energy - accounting for 86% of our energy needs.

Yet this will not happen automatically. Innovation is needed to keep the solar revolution on track. For example, to substantially 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.

The Netherlands: pioneer in solar energy

The Netherlands may not be the sunniest country, 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. The Netherlands is home to a vibrant ecosystem of companies and research institutes that covers virtually the entire solar technology chain: from materials to device design, manufacturing equipment, software, high-end solar modules and complete project development.

One of the factors behind the sustained success of the Dutch solar sector is a healthy home market. The Netherlands has the highest amount of installed PV capacity per capita in the world (1,386 watt), and ranks third globally. Even in absolute terms, it's a country that punches far above its weight, with the fourth highest figure for total installed capacity in Europe. The number of residential homes with solar panels grows by 30% per year and currently stands at 2.6 million: roughly a third of the overall number.

Meanwhile, the Dutch government's CO_2 reduction commitments are accompanied by an active innovation policy, and there is a strong tradition of companies and research institutes forming partnerships and consortia.

Through such cooperation, the Dutch solar sector is exploring ways of making solar energy more competitive, for example by developing more efficient production methods and increasing the yield and lifespan of solar technology. In a joint innovation agenda, the Dutch solar sector states that by 2030 the manufacturing costs of solar panels and thin films could be halved, yield could increase by at least 25% and the average lifespan could be extended by at least 10 years.

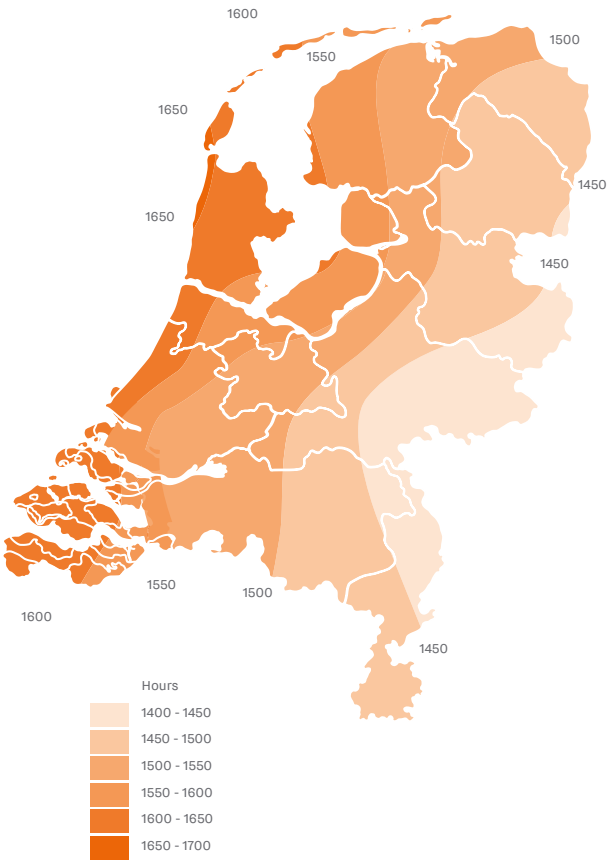
However, the future growth of solar energy is increasingly intertwined with other, new demands and challenges:

- How can we integrate large-scale solar energy into more complex environments, particularly in densely populated areas in which space is limited and expensive?
- How can we ensure that, instead of being a stand-alone solution or an optional extra, solar energy becomes an integral part of the design of buildings, infrastructure and public spaces?
- Can we make solar energy even more sustainable by reducing its ecological footprint, for example by using more sustainable materials and circular design?
- How can we incorporate huge quantities of solar energy into the existing power grid and the overall energy system, for example by introducing innovative storage solutions.

When tackling these and other challenges, the Netherlands benefits from its unique environment and history. Because space is scarce and the natural conditions are challenging, the Netherlands has built up a strong tradition of teamwork and integrated thinking. The Dutch have been manipulating their environment for centuries, reclaiming land from the sea and carefully sharing the available space. The ‘polder mentality’ of the Dutch has become synonymous with a mindset built around cooperation and shared interests.

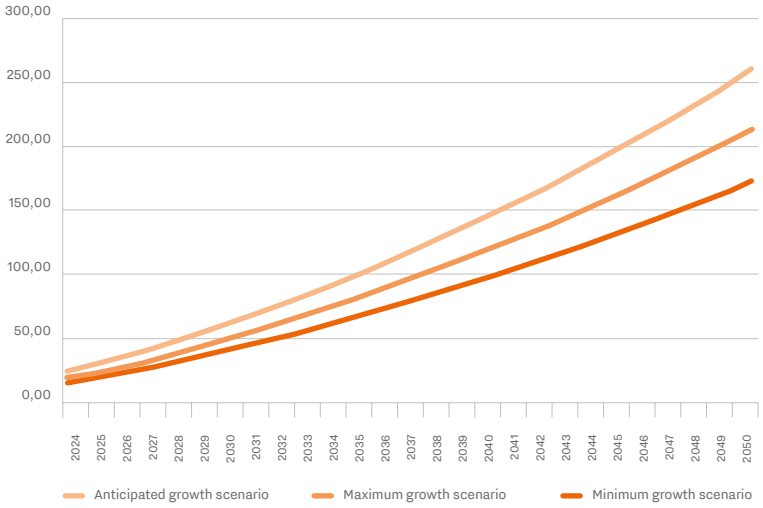
This mindset is alive and well in the Netherlands of today. It ensures that in a relatively small country international partners find a world-class network of solar specialists who in variable configurations contribute towards the growth, efficiency and success of solar projects far beyond the borders of the Netherlands.

Annual total hours of sunshine in the Netherlands

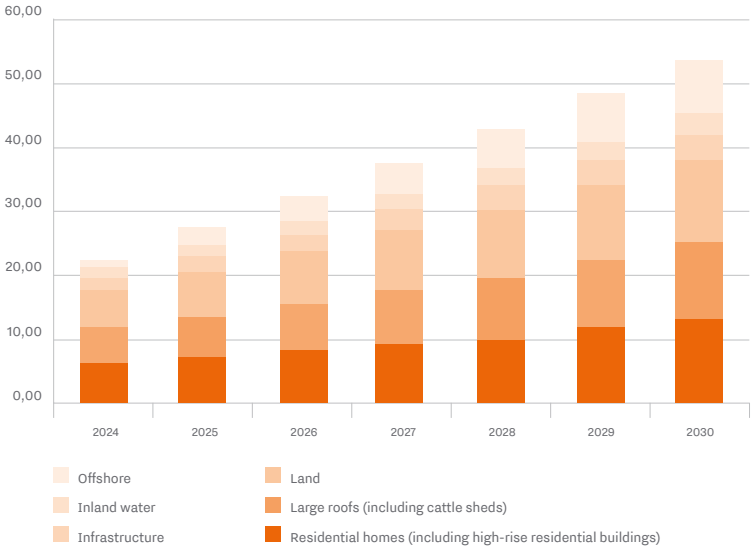


Source: Royal Netherlands Meteorological Institute (KNMI)

Growth scenarios installed PV capacity in the Netherlands



Expected growth PV capacity by type (in GWp)

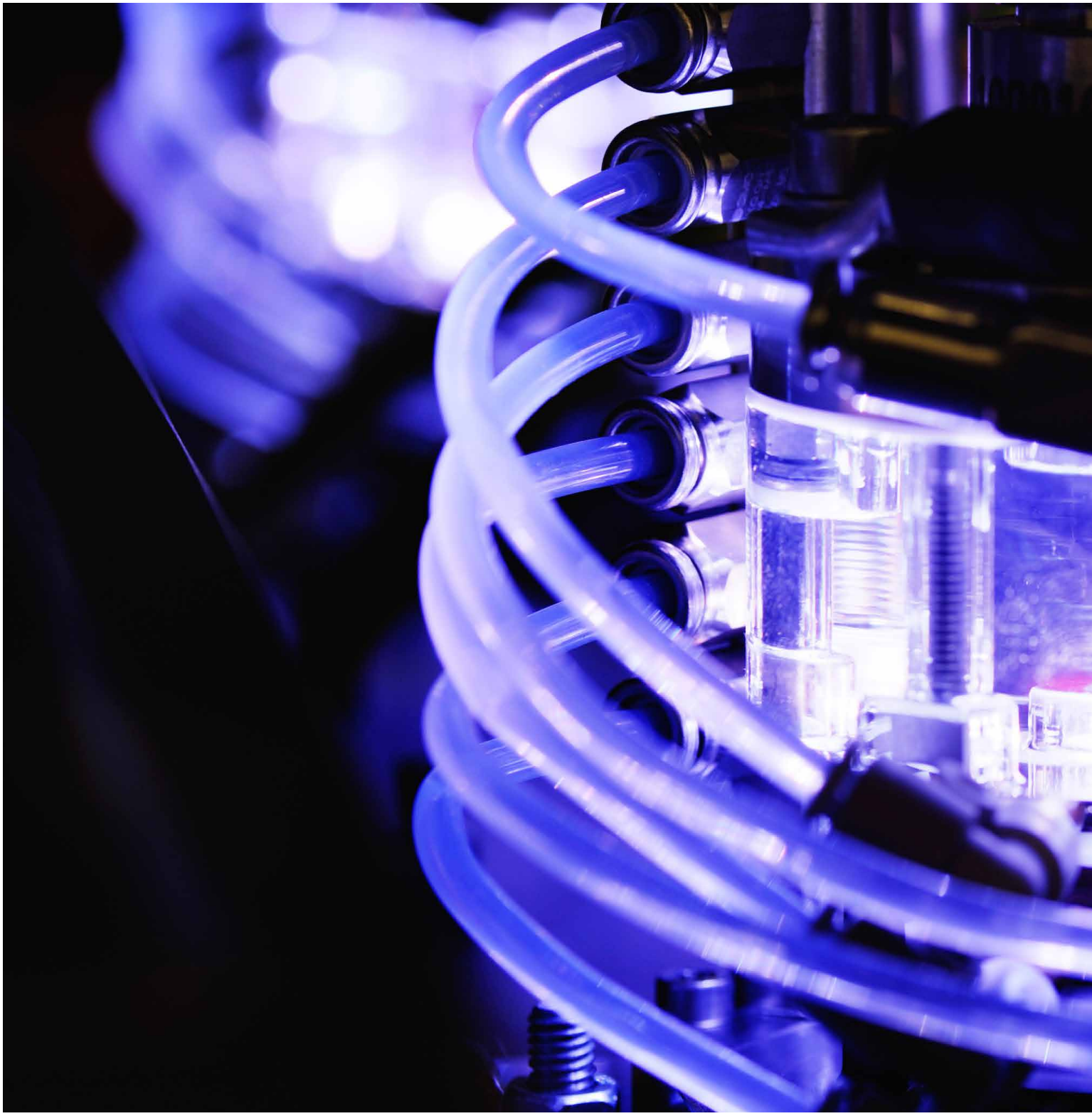


200 TWh

The potential annual yield of solar electricity in the Netherlands is 73% greater than the country's current total electricity consumption

The Dutch government aims for:

- **42 TWh** of land-based renewable electricity by 2030, including 7 TWh from small-scale (solar) installations in the built environment
- **a further 20 TWh** of solar energy per year by exploiting the untapped potential of roofs, facades, land and infrastructure in urban as well as rural areas.



Breeding ground for PV technology

At Eindhoven's High Tech Campus, research institutes Solliance and Holst Centre are working on technologies for organic and flexible solar cell production technology.

The solar technology of the future combines high efficiency and a lower cost with greater versatility, higher reliability and minimal environmental impact. Dutch companies and research institutes will help to shape this future with fundamental innovations and proven solutions that are used well beyond the borders of the country.

“A global leader in both fundamental and applied solar research”

In terms of technological innovation, the Netherlands is a world leader. It ranks in the global top 10 for patents filed and the number of patent applications per capita is the second highest in the world. A substantial part of that innovative strength is concentrated in the PV technology chain, where the Netherlands benefits from the presence of global players in materials science and semi-conductors, and from a strong tradition in high-value process technology.

Together, Dutch companies and research institutes cover the entire value chain of solar technology (see the infographic on p. 28). They have a prominent track record in the crucial first steps in the chain (design, materials, components and manufacturing equipment) as well as in developing new applications and innovative end-to-end solutions.

Next generation PV

Dutch researchers and companies are highly specialised in the development of new concepts and technology that increase the efficiency of solar cells. From surface passivation to the development of bifacial solar cells: Dutch researchers laid the foundations for these innovations almost 30 years ago. More recently, Dutch specialists have made substantial progress in the development of tandem structures, in which several types of solar cells are combined. This technology offers opportunities to significantly increase the efficiency of solar cells, to reduce costs and to minimise the amount of space required for solar energy generation.

The Netherlands also has specific expertise in thin-film photovoltaics. Much of this expertise is brought together in the joint venture Solliance, in which universities, research institutes and dozens of companies convert promising technologies and research into practical applications and production processes, assisted by large-scale laboratory and testing facilities.

Smart production technology

Solar cell and panel manufacturers around the world use machines and production lines built by Dutch companies. In close collaboration with research institutes and testing facilities, these companies develop production methods for ‘new’ types of solar cells. They also focus on making existing production processes more efficient, by increasing their output, reducing waste and thus minimising the cost price of solar cells.

To mention just one example: Dutch innovations in layer deposition for crystalline silicon cells have increased the production capacity of systems tenfold in just a few years, from a few hundred to more than 5,000 wafers an hour. Dutch expertise in thin-film technology paves the way for large-scale (roll-to-roll) production at increasingly lower costs.

Truly sustainable solar technology

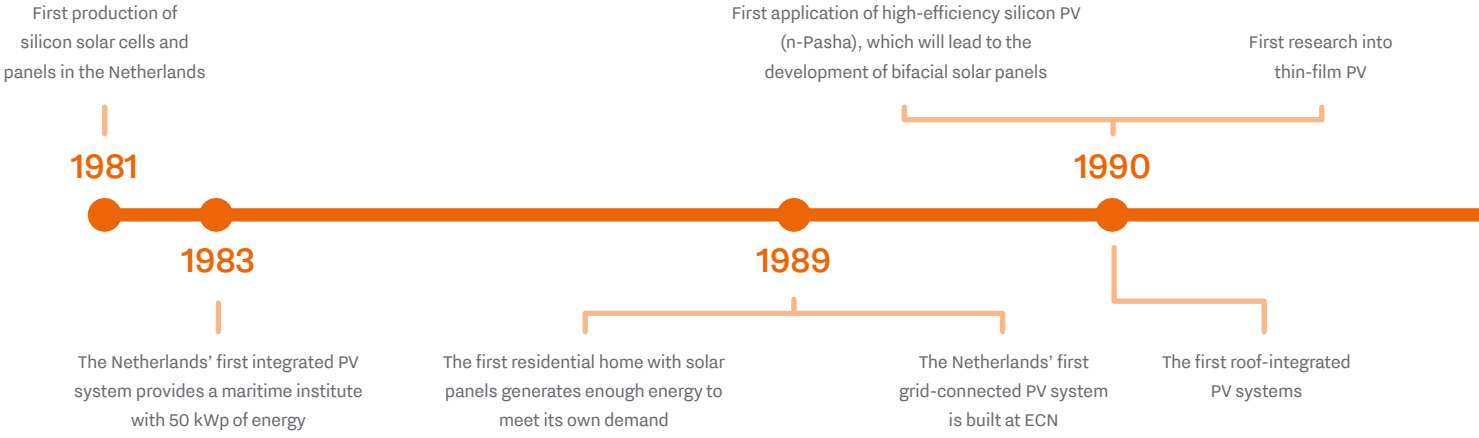
PV technology is an enabler for making the energy supply more sustainable – but how sustainable are the solar cells and panels themselves? Dutch companies focus explicitly on innovations that reduce the ecological footprint of solar technology. For example, by increasing the lifespan of PV technology and by developing components and (encapsulation) materials that can easily be disassembled and recycled at the end of a system’s lifecycle.

As well as making PV technology more sustainable, such innovations often boost performance and efficiency. For example, Dutch materials scientists have developed a new generation of back sheets for PV panels, which are not only 100% recyclable and fluorine-free, but are also more resistant to extreme weather conditions and offer very high optical reflection.

Breaking the 30% barrier

By combining a newly developed perovskite solar cell with an industrial bifacial crystalline silicon solar cell, researchers at ECN part of TNO and its Solliance partners have managed to create a bifacial tandem solar cell with an unprecedented efficiency of 30.2% – a third higher than the current generation of state-of the art industrial solar cells.

40 years of Dutch solar innovations



SolarNL: scaling up next-generation PV

The Dutch government and private financiers are investing nearly 900 million euros in the SolarNL program, a collaborative effort between industry and research institutes. The initiative focuses on the development and large-scale production of a new generation of solar cells and panels. The program aims to industrialize three innovative technologies, including high-efficiency silicon cells, flexible solar foils using perovskite, tailor-made solar products for integration in buildings and automotive applications, and “tandem” solar cells with even higher efficiency.

Production technology experts

Dutch research and ‘spatial ALD’ 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, even up to and beyond 2m^2 in a vacuum environment, with temperatures of up to 600 degrees Celsius.

1995 — Start development of back-contact silicon cells and modules, and of silicon nitride coatings for industrial production of silicon solar cells

2005 — Research, development and industrial application of ‘spatial ALD’ for surface passivation

2015 — Research and development of tandem technology (silicon/thin-film and thin film/thin film)

2019 — The world’s first real offshore PV system

2023 — Launch of SolarNL

Building work starts on City of the Sun, the world’s first large-scale energy-neutral residential area

Integrating PV into our environment

1. Dutch companies such as Exasun and BEAUSolar have developed integrated PV roof modules which can completely replace existing roof tiles.

2. HyET Solar produces flexible and extremely lightweight thin-film silicon solar cells on long foil substrates, which allow up to 90% of a roof surface to be used.

3. Solar Visuals' high-tech PV modules can incorporate any photo print, image or pattern – including that of a brick wall.

4. At Eindhoven University of Technology's campus, a consortium of eight companies has developed a new type of PV building module, made of coloured composites and integrated thin-film solar cells.

5. ZigZagSolar developed a unique energy-harvesting architectural façade, with fully optimised sun- oriented PV panels supported by reflecting panels.

Integrated PV solutions

The limited space available in and near urban areas encourages multiple land use. Dutch companies are at the forefront of integrating solar technology into infrastructure, buildings, vehicles or agricultural settings. For example, floating solar farms are being developed in more and more challenging environments.

This development 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.

Examples of focus areas for Dutch PV specialists include:
- the production of high-quality, semi-finished products that can be incorporated into integrated applications, such as individual cells, unwrapped films and specific types of plastic and glass;
- high-end building components with integrated solar cells (building-integrated PV, or BIPV);
- innovations that simplify the aesthetic incorporation of solar into public spaces, such as new materials and films that offer greater freedom in terms of colour, shape, flexibility and size.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"New value chains for integrated solar applications"


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Reliability and efficiency during the entire lifecycle

For a strong business case, it is important that anticipated energy yields are well-substantiated. Dutch companies and research institutes have developed advanced calculation models, measuring equipment and simulation setups. Based on extensive meteorological datasets and analysis of local conditions (such as shadow effects and light reflection), these solutions enable project developers to predict potential yields with more and more accuracy.

Whether potential yields are actually delivered also depends on the quality and reliability of the PV technology used. Dutch companies support end-to-end monitoring with advanced measuring equipment and software, from the moment components leave the factory to post-installation checks and monitoring throughout the system's lifespan.

Solar simulators, climate chambers and testing equipment by Dutch company Eternal Sun are used by the world's leading research laboratories and solar panel manufacturers to test performance and reliability with ever greater degrees of accuracy.

Lightyear Layer's VIPV modules deliver the highest average annual yield, resulting in the highest number of solar kilometres per m² on the market.

Integrating solar into our environment

The growth ambitions for solar energy around the globe are enormous. At the same time, in more and more places, project developers are encountering space constraints or resistance from residents. An increasingly urgent question is, therefore, how we can achieve optimal integration of solar energy into our surroundings.

At completion, the 'City of the Sun' in Heerhugowaard, 50 km north of Amsterdam, was the first CO_2-neutral residential area in the world. Solar energy played a key role in its design, with the majority of houses having a north-south orientation in order to maximise the yield of over 25,000 PV panels.

While in some areas large-scale generation under ideal conditions is possible, more and more solar capacity will have to be achieved at less straightforward locations – particularly in and around densely populated urban areas where demand is high and concentrated – but where space is scarce.

As the second most densely populated country in the world, the Netherlands has an impressive track record in terms of creative spatial solutions and multiple land use. The Dutch have built the world's largest greenhouse horticultural area as well as Europe's largest port, situated side by side in the heart of the Randstad metropolitan area. The Netherlands combines one of the densest and most heavily used railway networks in the world with a position as the second largest food exporter. All of this in a society which places great emphasis on aesthetic quality, the quality of life in public spaces and the protection of environmentally sensitive habitats.

If even the Dutch can find space for large-scale solar power generation in such a complicated environment, this offers opportunities for urbanised areas elsewhere. What ideas, innovations and proven solutions does the Netherlands have to offer the world?

Solar in the built environment

When integrating solar technology into the urban environment, buildings are a logical starting point. Huge numbers of solar panels are installed on roofs throughout the world each year. Nevertheless, we still only utilise a fraction of the potential offered by buildings. The next step is full integration of PV into roofs and façades.

To make better use of buildings, new solutions are needed. The Dutch solar sector's innovations for the built environment focus on high-quality design, technology and construction.

Beautiful design

In urban environments, there is a growing demand for inconspicuous or even invisible solar technology. While it may be possible to install solar panels in places that cannot be seen from the street, this severely reduces the potential yield. Solar cells are therefore increasingly integrated into prefab building modules, roof tiles, windows and façades. Solar collectors underneath roofs or façades enable solar energy to be used directly for heating and cooling, without negatively impacting the appearance of a building.

Another approach is to create solar technology that does not need to be camouflaged but actually enhances the visual appearance of a building. In a country famous for 'Dutch Design' and bold architecture, it is not surprising to find many companies experimenting with new shapes and applications, such as solar panels, solar films and BIPV modules in different colours or incorporating images.

Smart solutions

Other innovations focus on ways of maximising the generation capacity on and around buildings. Especially south-facing façades offer a huge potential. To take advantage of this potential, Dutch solar companies work with architects and other parties to design completely new, integrated modules. From the inception phase, this enables energy generation to be combined with other important construction aspects such as ventilation, cooling and roof and façade sealing.

The yield of BIPV installations can also be increased by improving the underlying technology. Examples of solutions developed by Dutch companies are flexible BIPV systems that compensate for shadow or the failure of individual cells, and smart software that continually monitors the functioning of systems.

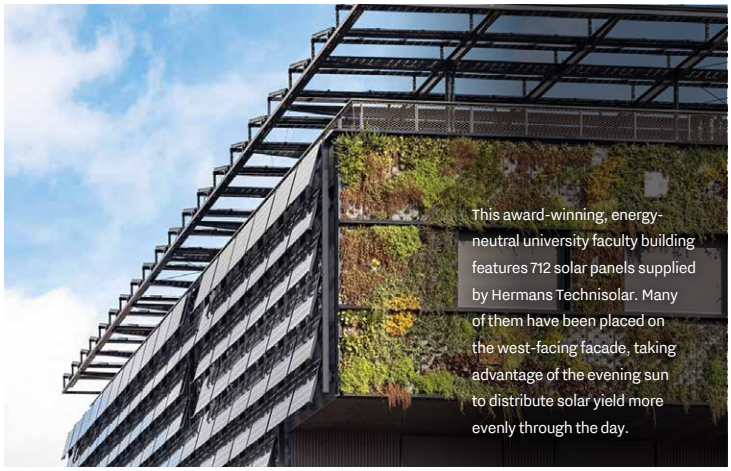
High-quality construction

Especially if PV technology transforms from stand-alone systems to fully integrated modules, it is crucial to guarantee a high level of reliability and quality. Users of Dutch BIPV solutions can be sure of compliance with the very strict and exacting Dutch as well as European legislation in areas such as fire safety, construction quality and indoor climate. To ensure that BIPV modules deliver the anticipated yield, Dutch companies develop their solutions in close cooperation with research institutes, where the performance of prototypes is monitored every second using very advanced equipment.

This theatre in the town of Middelburg incorporates Solarix' coloured solar panels, which match the existing brickwork, are a playful reference to stage curtains - and generate almost 3,500 kWh of clean energy per year.

In Kameleon Solar's solar modules, cells become invisible from a distance of more than 5 metres. The technology has been used to incorporate images, or to produce panels that in colour and size match the traditional zinc roof panels of monumental buildings.

Solarge has introduced a new generation of fully circular solar panels, which thanks to the use of PFAS-free polymers are only half the weight of glass-based panels.



This award-winning, energy-neutral university faculty building features 712 solar panels supplied by Hermans Technisolar. Many of them have been placed on the west-facing facade, taking advantage of the evening sun to distribute solar yield more evenly through the day.

Solar landscapes

Large-scale solar energy generation can be relatively simple – provided there is an abundance of useable space. If not, then smart solutions are needed, for example to facilitate multiple land use.

In densely populated areas it is crucial to ensure public support for large-scale solar energy projects. A consortium of Dutch companies, public authorities and research institutes is investigating innovative strategies, for example by developing new ways of visually integrating solar farms into the landscape, and by studying the (long-term) ecological impact of solar farms.

The same consortium also focuses on the options for combining solar farms with other types of land use. Agriculture in particular offers promising opportunities, as long as solar panel arrays do not interfere with crucial factors such as soil quality, rain infiltration and the incidence of light.

With the support of Wageningen University & Research, the Dutch solar sector is a global leader in developing solar farms that preserve or even boost biodiversity.

Bifacial potential

A key innovation in this area is the emergence of bifacial solar panels, in which Dutch companies and researchers have developed a high level of expertise. Bifacial panels are highly efficient, because they absorb energy on both sides directly, but also capture diffuse and reflected light.

These are key advantages in an agricultural setting: it means that they generate attractive yields even in an upright position, making it easier to incorporate these panels in, for example, horticulture and nurseries.

To enhance the potential yield of bifacial panels further still, Dutch companies have combined them with smart automation and sun-tracking systems. This ensures that panels are always at an optimal angle to the sun, and can be moved to an upright position if necessary for cultivation of the soil by agricultural vehicles or for irrigation purposes. All in all, innovations of this kind can increase the efficiency of solar panels by up to 30%.

Getting to grips with the yield

For a well-founded business case, a watchful eye is needed on the anticipated yields. In cooperation with research institutes, Dutch companies and project developers have access to advanced calculation models. Constantly updated parameters are added to these models for an increasingly more reliable result. For example, Dutch scientists carry out research into the impact of the albedo effect, which determines how much light is reflected by the environment. Different colours of grass or crops in the surrounding area, or possibly snow, have a direct impact on the yield of solar farms.

Sun and shade

Solar arrays can be integrated into existing farmland or can be the catalyst for introducing crop farming on currently unused land. Soft fruit cultivation in particular is suitable for 'double harvesting' of solar energy. Several Dutch companies and horticultural research institutes have developed successful projects to optimize growing conditions of these and other shade-tolerant crops.

Hybrid energy parks

Along the Haringvliet estuary, Vattenfall has built its largest hybrid energy park to date. By combining 115,0000 solar panels with 6 wind rurbines and 288 batteries, the hybrid setup minimises the total non-production times, enables more efficient use of network infrastructure and reduces the overall cost of renewable electricity.

Solar infrastructure

The Netherlands has a very dense and first-rate road network, an internationally unparalleled cycling infrastructure, and a high-quality public transport system. Integration of PV technology into such infrastructure offers unique opportunities to generate large-scale solar energy and make the transport system more sustainable.

When it comes to finding ways of combining solar energy generation with other types of land use, infrastructure offers some key advantages. By definition, roads and railways converge on (and connect) densely populated areas with a high energy demand. In fact, the infrastructure itself is used intensively, which means there is a large demand for 'on the spot' energy: from electric vehicles to railway stations and infrastructure. And since infrastructure is often designed according to similar specifications, innovative concepts for integrating solar energy can relatively easily be reused and scaled up.

Roads and roadside infrastructure

For years, Dutch companies and researchers have worked on the integration of PV technology into infrastructure such as noise barriers, bicycle lanes and road surfaces. Proven solutions are also available for roadsides, where existing technology has been adapted to take into account the specific, elongated shape of roadside solar farms and traffic safety concerns. The Dutch government is investing in the large-scale roll-out of roadside solar energy, as part of a wide-ranging program to make large amounts of government-owned land available for renewable energy projects.

Dykes, dams and bridges

However, infrastructure encompasses more than roads and railways. Dutch companies also have experience with installing solar panels on former landfill sites, and on dykes, dams and bridges.

When exploring and developing such new applications, not only do Dutch companies benefit from cross-pollination with scientists and researchers, but also from the strong involvement of the authorities responsible for managing infrastructure. Municipalities and provinces initiate pilot projects, and water authorities have identified the thousands of kilometres of dykes in the Netherlands as a unique opportunity to become net energy suppliers by 2030. The National Waterways and Highways Agency (Rijkswaterstaat) is the co-initiator of a consortium in which Dutch companies and researchers pool their knowledge and innovative strength for the benefit of the energy transition in the Netherlands and abroad.

The potential for solar carports is substantial, and where better to start than next to a beach? This car park, developed by renewable energy company Groendus for the coastal town of Bloemendaal aan Zee, is covered with 5,000 solar panels, generating enough electricity for 600 homes - although the energy can also be used to charge up to 30 electric vehicles.

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1. Delft Campus is the Netherlands' first energy-neutral railway station, thanks in part to an innovative roof, consisting entirely of PV modules, which powers elevators, lighting and ticket machines.

2. A new section of the A16 being built near Rotterdam will be the world's first enery-neutral motorway with a tunnel. Solar panels will generate all the electriicty needed for over 50 tunnel installations.

3. In the province of Noord Brabant, a 400-metre-long solar noise barrier with integrated bifacial panels has been installed. Its yield is 20% higher than expected, and the integrated design can lower the cost of installing future solar noise barriers by 20% (compared to fitting panels to existing noise barriers).

Floating solar

If land becomes scarce, there is always water. Floating solar farms are not new, but Dutch companies are at the forefront of refining the technology, assessing its potential yield and ecological impact – and adapting the concept into new and ever more challenging environments.

Water management and offshore construction are successful export products for the Netherlands: throughout the world, Dutch expertise plays a key role in many challenging marine engineering projects. It is therefore not surprising that the Netherlands has enthusiastically embraced the concept of floating solar farms. It has a highly developed domestic market, thanks in part to the Dutch government's active role as a 'launching customer' and the availability of the right policy frameworks, permit systems and opportunities for subsidies. Floating solar farms with good yields have already been built at a variety of locations, including sand extraction lakes, water treatment plants and water reservoirs. And government agency Rijkswaterstaat, responsible for water management and infrastructure, is investing in floating solar farms on dredging depots or next to inland waterway locks.

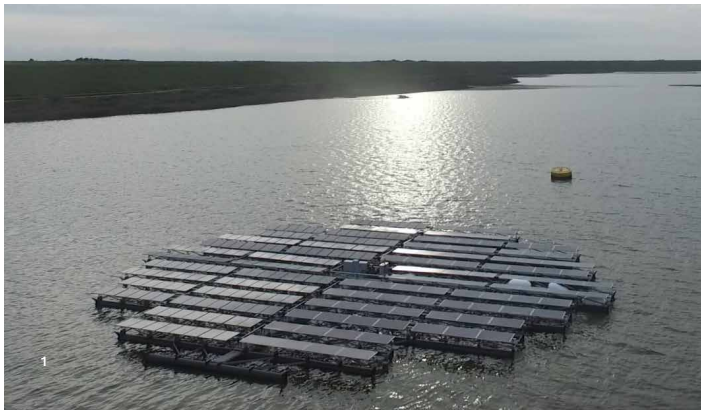
Reliability and ecological impact

Technological innovations by Dutch companies focus on the quality and reliability of the required technology, which becomes even more crucial as the scale of floating solar farms throughout the world increases. In addition, the Netherlands leads the way in researching the ecological impact of floating solar farms, for example, on water quality and biodiversity. Such insights make it easier to identify locations where solar energy can be harvested for years to come, without adverse effects on the environment.

Robust solutions

Possibly the most crucial factor in the long term is that Dutch companies are exploring the opportunities for floating solar farms beyond the relatively easy, calm inland water bodies. Urbanised areas with a high energy demand are often located on the coast or in river deltas, where there is a large amount of useable space but where wind, waves and the tides combine to create a very challenging environment. However, through joint research and ambitious pilot projects, the Dutch have been able to to come up with robust solutions. Around the periphery of the Rotterdam Port area, experiments have taken place with floating (and in some cases sun-tracking) solar farms, at a location with waves of up to a metre high. At the same location, preparations are underway for the construction of a floating solar farm that is expected to cover 100 hectares. Elsewhere in the Netherlands, preliminary research is focusing on large inland water bodies (also with waves of more than a metre in height). And in recent years Dutch companies have led the way in successfully building offshore floating solar farms, which can withstand even severe conditions. This technology has matured rapidly and has already reached the stage at which Gigawatt-scale solar farms can be developed.

On a former sand extraction lake near the city of Zwolle, a floating solar farm was built which upon completion was Europe's largest, with 72,000 panels producing 24 GWh of electricity. The project was designed to withstand the relatively strong wind and wave conditions and to preserve and boost the lake's biodiversity.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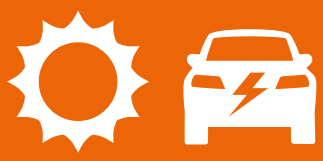
1. Based on extensive experience with floating solar modules near Rotterdam harbour, Floating Solar is developing the world's largest solar-tracking PV system in a reservoir next to a water purification plant. To minimise ecological impact, the 73,500 solar panels will be arranged to form 15 individual islands. The islands' design and construction has a transparency factor of 80%, ensuring that plenty of light reaches the water's surface. Special Weather Risk Management technology will minimise the risk of damage by automatically repositioning solar panels during storms.

2. Oceans of Energy installed the world's first offshore solar farm in 2019, which has since been operated successfully under severe weather conditions. The technology has since been employed on several other offshore locations,a nd recently the company announced a collaboration with 15 leading European partners, aimed at scaling up offshore solar farms to Gigawatt scale.

3. SolarDuck has built the world's largest hybrid floating solar plant, as well as the first offshore floating solar farm in Japan and is working on another project in Malaysia. The company has a pipeline of over 3.5GWp.



Solar mobility

Imagine your car not just as a mode of transportation, but as a self-sustaining powerhouse on wheels. That's the promise of vehicle-integrated photovoltaics (VIPV). Dutch companies and researchers are rapidly developing the technology to power not just cars, but trucks, ships and even airplanes.

The advantages of VIPV are obvious. In an ideal world, energy is consumed as close as possible to the place where it's generated. By enabling solar power to be generated by vehicles themselves, VIPV technology can boost the large-scale electrification of our transport system. It can extend the range of electric vehicles and reduce their reliance on charging infrastructure.

For example, research by Dutch knowledge institute TNO indicates that solar roofs on cars could reduce the need to charge these by 25 to 40%. The same institute has joined forces with other European expertise centres to launch an extensive pilot programma in which cars, trucks, vans and buses will be fitted with solar panels and monitored during tests under real-world conditions across Europe.

Powering trucks and buses

The inclusion of trucks and buses makes sense, since these vehicles have more substantial surface area for solar panels (provided these do not restrict load capacity). Current technology developed in the Netherlands is already able to generate 20% of the energy needed to power electric trucks. Which means a 20% reduction of charging times and electricity bills. Current research focuses on efficient production and installation methods for integrating PV in larger vehicles such as trucks and buses, to create a compelling business proposition.

Lightweight solar foil

Of course, there are challenges as well. While there are already commercially successful examples of smaller solar-powered vehicles, from delivery bikes to city cars and tuk-tuks, powering larger cars and trucks with self-generated solar electricity requires further technological innovation. For example, Dutch companies are at the forefront of developing solar roofs for cars. Which require flexible, lightweight and highly efficient foils.

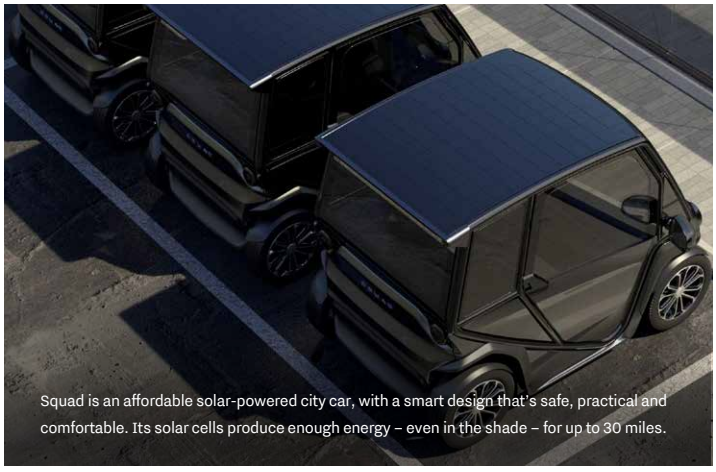
And what about modes of transport that so far have been heavily dependent on fossil fuels, such as ships and airplanes? Promising research is underway in these areas as well, from solar hatches on inland shipping barges to solar skins for lightweight airplanes.

To achieve breakthroughs in these and other areas, and in particular to make the leap from proof of concept to commercially feasible solutions, close cooperation is required. The Dutch are a driving force behind the Alliance for Solar Mobility (www.asom.solar), in which almost 30 companies and knowledge institutes (with dozens of patents) are working to establish and scale up a complete value chain for efficient, convenient and eco-friendly transportation.

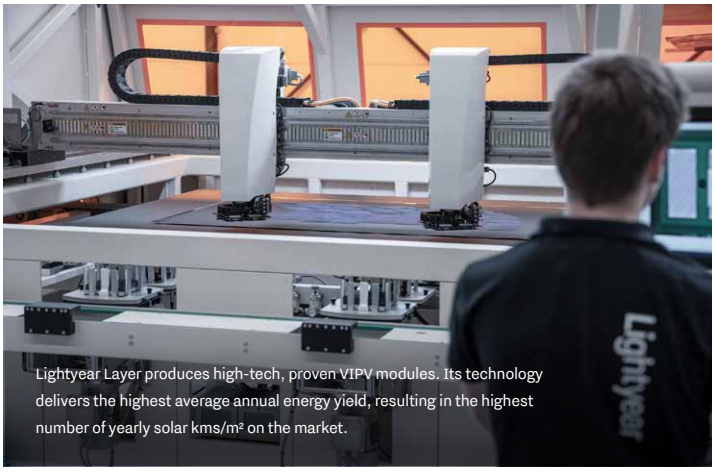
MitoSolar produces produce high-end solar modules and prototypes new solar lamination materials for VIPV applications. For example, their panels were used in this solar-powered camper van, developed by a student team at the Technical University of Eindhoven. These panels weigh only 1.5 kg/m2 and have an efficiency of 23.7%.

IM Efficiency has retrofitted over 100 lorries throughout Europe with its SolarOnTop technology. The solar panels reduce overall fuel consumption by up to 6%, lowering CO_2 emissions per truck by 3.8 tonnes per year.

Wattlab produces Solar hatches for inland shipping vessels, aiming for a 10 to 15% fuel reduction and significantly reducing the required number of onboard generator hours.



Squad is an affordable solar-powered city car, with a smart design that's safe, practical and comfortable. Its solar cells produce enough energy – even in the shade – for up to 30 miles.



Lightyear Layer produces high-tech, proven VIPV modules. Its technology delivers the highest average annual energy yield, resulting in the highest number of yearly solar kms/m² on the market.

Balancing solar energy: storage solutions

Alfen's storage solutions include a compact, modular battery system ranging from 1 MW to more than 100MW, which can be used to optimize solar and wind farms, as well as an energy management system that integrates local infrastructure with solar panels, wind turbines, power storage, grid connections and more.

The rapid growth of solar energy is good news for our climate. However, its intermittent nature poses new questions as well. How can we incorporate vast amounts of solar power into existing grids and ensure a stable energy supply at times when solar yields are low? This will require new, innovative, and cost-effective ways of storing and buffering energy, and of balancing supply and demand – and the Dutch have developed a wide range of technologies to do just that.

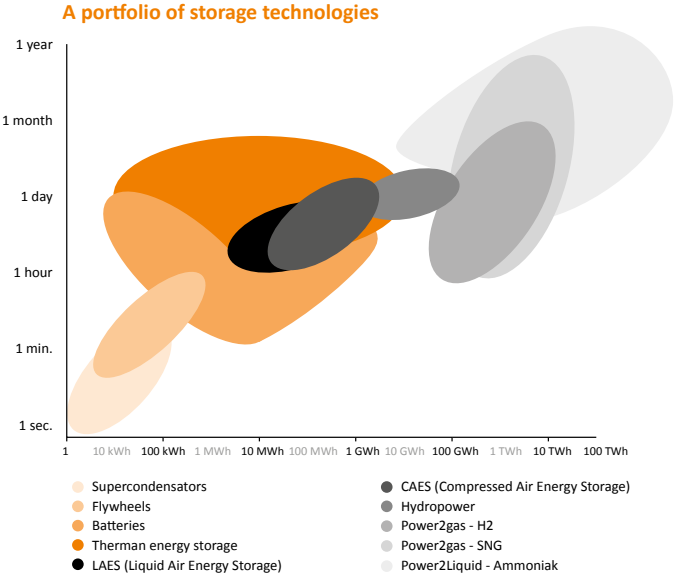
Storage is increasingly recognized as an integral part of a sustainable energy system. In order to match supply and demand, it is crucial to have substantial buffer capacity.

The global energy storage market is experiencing unprecedented growth, triggered by a sharp drop in the price of lithium-ion battery systems. And the cost of battery storage looks set to fall even further, potentially halving over the next decade. It is estimated that by 2030, the global installed capacity of battery storage systems will have increased tenfold, to over 400GWh.

Yet batteries are not the only way of storing solar energy. Solar power can also be converted into 'molecules', through energy carriers such as hydrogen, methane or ammonia. It can also be stored as heat. Each type of storage technology has its particular strengths and limitations (see the graph on this page), and a whole range of innovative technologies is needed to ensure a stable energy supply across different timeframes, from (milli)seconds to hours, days, weeks or even seasons.

In all these areas, Dutch companies and researchers have already come up with innovative technologies and proven solutions, or ways of making existing technologies more efficient, sustainable, and future-proof.

A portfolio of storage technologies



Each storage technology has its particular strengths and limitations in terms or the amounts of energy it can store and across what timescales it can be deployed efficiently and economically.

Energy Storage NL (part of FME) is a rapidly growing network of Dutch companies, research institutes, grid operators, and insurance companies, whose expertise covers the entire energy storage value chain and all types of energy storage.

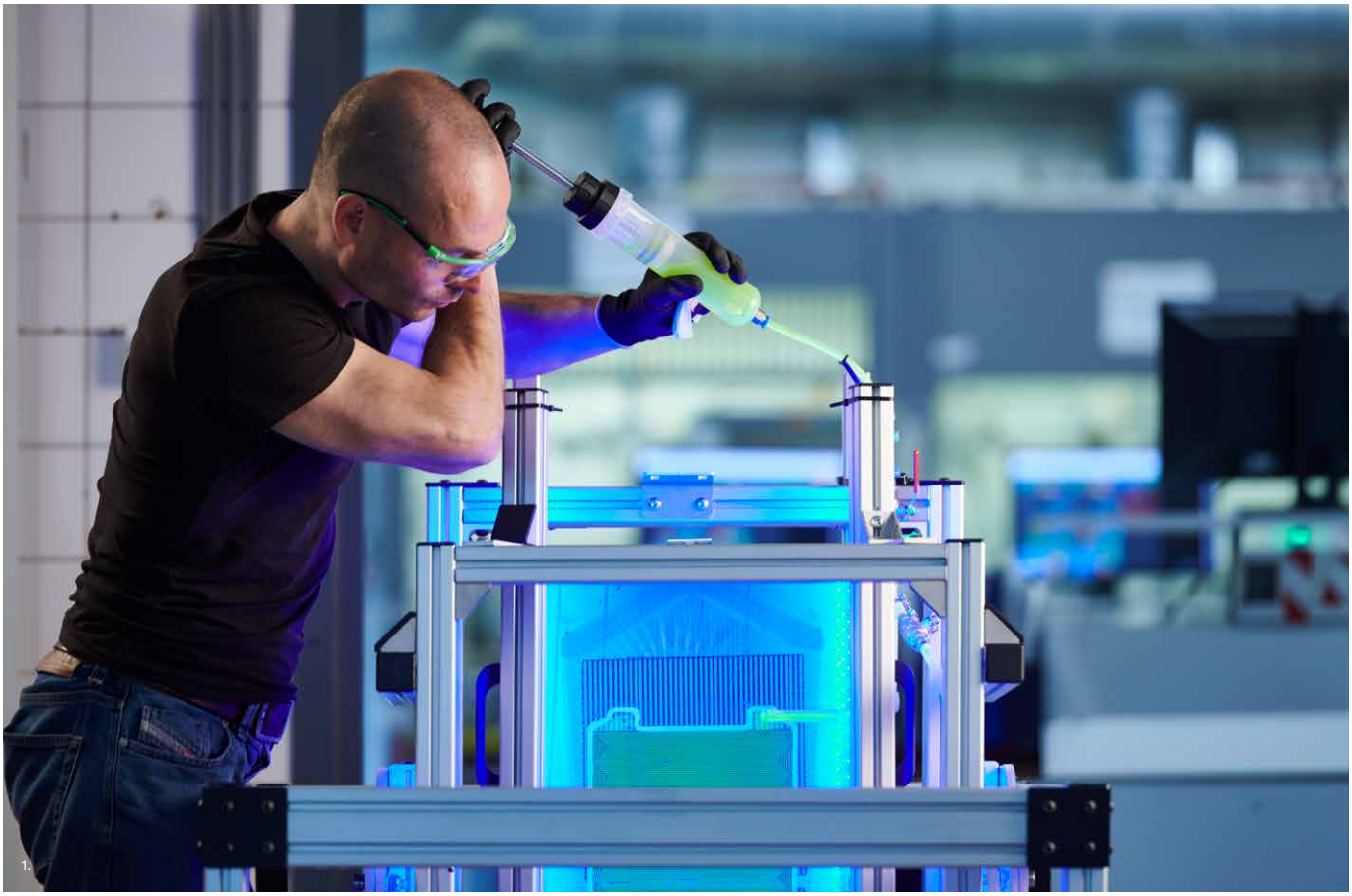
ENERGY STORAGE NL

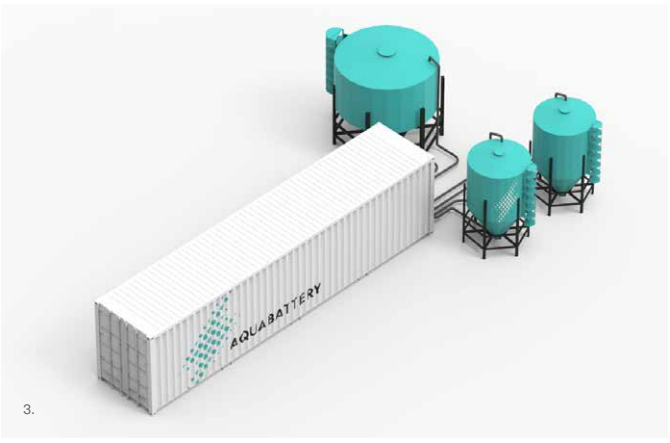
FME POWERED BY DUTCH TECHNOLOGY

Next-generation electricity storage

Battery storage systems play a crucial role in ensuring a stable energy supply, and their impact will only increase over the next few years. In the Netherlands alone, 9 GW of battery storage capacity will be needed by 2030, according to the national grid operator TenneT. And these investments will be worthwhile: they are expected to save 2 billion euros per year in damage from power outages.

The Netherlands is home to several companies with an excellent track record in developing large-scale battery storage facilities for grid operators, energy producers, and traders. Examples include the largest battery storage facility in Europe, currently being developed just across the border in Belgium, and a new hybrid storage facility that combines the advantages of battery storage with those of kinetic storage, using advanced flywheel technology. Other Dutch companies have developed mobile battery solutions with ever higher capacities, which – in combination with the electricity grid or other energy sources – provide a clean alternative to diesel generators on construction or event sites.





Meanwhile, the Dutch are also working on new technologies that boost the capacity and energy density of lithium-ion batteries. Or that address some of the short and long-term concerns around this type of batteries, such as the scarcity, cost price, and environmental impact of raw materials. A Battery Competence Cluster has been set up: an innovation program in which companies and knowledge institutions are developing new materials, more sustainable production methods as well as reuse and recycling capacity. The development of new technologies, such as sodium chloride batteries, is gathering pace and many of these innovations are on the threshold of commercial viability.

One emerging alternative to lithium-ion, especially for use on (micro)grid level, are flow batteries, which store energy in electrolyte solutions housed in external tanks. Flow batteries are safer, more flexible, and have a much longer lifespan. Crucially, they use materials that are much more readily available than lithium. For example, Dutch companies have developed flow batteries using a combination of hydrogen and bromine, or table salt and water.

1. Elestor's flow battery, using abundant active materials, has an extremely long lifespan: it can be charged and discharged up to 20,000 times.

2. LeydenJar has developed a pure silicon anode for lithium-ion batteries, which paves the way for batteries with extremely high energy density.

3. The Aquabattery flow battery uses water and table salt and has been named "one of Europe's breakthrough technologies and game-changing innovations" by the European Innovation Council.

Storing heat

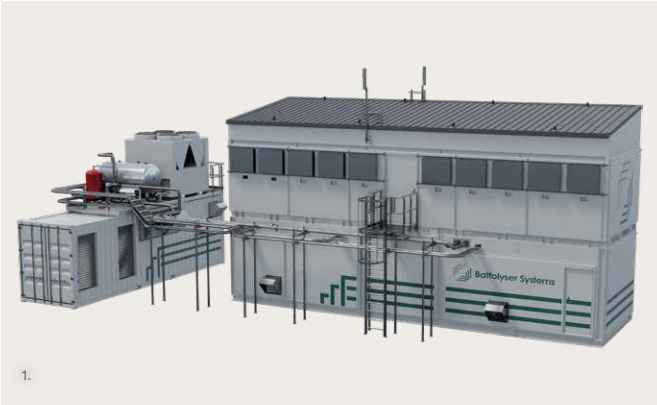
Solar energy can be stored as heat either directly (thermally, for example using solar collectors), or indirectly, using solar electricity to produce heat. The second option may seem a very roundabout way of doing things but can be a highly efficient method for long-term storage of solar energy. For example, Dutch companies have developed a system in which electricity is used to charge steel pipes encased in volcanic rock. The core of this 'heat battery' can reach temperatures of 450-500 degrees Celsius – and can be stored for months.

Other Dutch companies have refined various types of thermal energy storage, in which the heat absorbed by solar collectors can be stored in large, insulated underground water tanks, or in a 'salt battery'. Such solutions can provide year-round heat to industrial facilities, offices, or residential areas – currently the third-largest solar thermal project is being built in the North of the country, with over 37MW worth of solar collectors providing enough heat for over 2,500 homes and offices.

1. Cesar's technology allows solar electricity to be stored in steel slag concrete, achieving an effective heat capacity four times that of water. Each 10 m3 module can store around 3,000 KWh.

2. Cellsius has developed a battery that stores heat without any loss, through a chemical reaction between water vapor and a carefully selected salt hydrate.

3. HoCoSto has developed a new, simple, and space-saving way of building underground storage facilities, where heat generated in summer can be stored for use in the winter.



1.

2.

3.

Storing molecules

In addition to storing solar energy chemically or thermally, a wide range of other storage technologies is being developed or rolled out in the Netherlands. In a country that for decades derived much of its energy from its own natural gas fields, it's not surprising to see much activity around the conversion of energy into hydrogen or methane through electrolysis. Such initiatives have been given added impetus by the fact that over the next few decades, natural gas will be completely phased out from the country's built environment. Other ways of storing energy in molecules is in the form of ammonia, green gas or compressed air.

Kinetic storage

Kinetic storage is yet another method that the Dutch have been investing in: from large flywheels to an ambitious plan to build an energy storage lake in the country's southwestern delta, where a combination of electric pumps and turbines would allow the Dutch to generate hydropower - in the flattest of landscapes.

1. The Battolyser combines two storage techniques in one innovative solution: it's a 'classic' battery that, once full, automatically converts surplus electricity into hydrogen using a built-in electrolyzer.

2. S4 Energy has built several hybrid storage installations, consisting of batteries and its proprietary KINEXT flywheel technology, for a range of applications including grid stabilization and a charging station for inland shipping vessels.

3. The Delta21 plan encompasses a lake that can store vast amounts of energy. Using renewable energy, 400 million cubic metres of sea water can be pumped into the lake. By releasing the water, turbines can generate vast amounts of energy. The estimnated capacity of the lake is 1.8GW.

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 PV and energy storage technology, global players in semi-conductor 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 solar and energy storage expertise into national consortia. These networks offer fast and easy access to the right technology providers, researchers or combination of specialists. They pursue a common goal: solving global challenges together.

Dutch solar and storage expertise in brief

R&D

AMOLF / University of Amsterdam
Delft University of Technology
Eindhoven University of Technology
Solliance
TNO Energy Transition
University of Groningen
University of Twente
Utrecht University
Amsterdam University of Applied Sciences
Hanze University of Applied Sciences
Radboud University
Saxion University of Applied Sciences
SolarBEAT
SolarLab
Zuyd University of Applied Sciences

MATERIALS

C-Coatings
Endurans
Sabic
SPG Prints
Yparex

PRODUCTION EQUIPMENT

ASM
Besi / Meco
Demcon
Eurotron
Lamers HTS
Levitech
Maan Group
Morphotonics
Rimas
Smit Thermal Solutions
Tempress
VDL ETG

CELLS, FILMS AND (INTEGRATED) MODULES

BEAUSolar
Compact Solar
Energyra
HydroPV Technologies
HyET Solar
Kameleon Solar
MC PV
Solarge
Solinso
Studio Solarix
TULiPPS
Wellsun

INTEGRATED SYSTEMS

Ecoplant
IMefficiency
Lightyear Layer
Oceans of Energy
SPIRIT solar lighting
Solar Duck
Wattlab

Dutch expertise covers virtually the entire chain, from fundamental research into next-generation PV technology to the construction and management of large-scale solar farms and a wide range of energy storage technologies. Below you will find a summary of some of the country's key players by type of expertise.

To find out more about the latest developments in Dutch solar and storage technology and the right partners for your particular requirements, please contact info@tki-urbanenergy.nl, internationaal@fme.nl and/or redesk@rvo.nl.

For companies and research institutes highlighted in orange, short profiles and portfolio descriptions have been included in the following pages.

TEST AND MEASURING EQUIPMENT

Eternal Sun
Hielkema Test Equipment
XYZTEC
ReRa Solutions
Celsian
Kipp & Zonen

COMPONENTS

ATB Motors
Bosch Rexroth
Esdec
Femtogrid
Heliox
Taylor Technologies
Van der Valk Solar Systems
Victron Energy
ZigZagSolar

STORAGE

Accuselect
Alius
Ampowr
Anesco
Aquabattery
Batenburg
Blauhoff
Brabetech
Bredenoord
Cellsius
Covolt
Delta21
Edmij
EnergyKoNneX
EnergyNest
Eurotronic
Exergy Storage
Friday Energy
GIGA Storage
GivEnergy
Greener
Greeny Energy
Groendus
H2Storage
Indutec
iwell
JP Energy Systems
Konka Energy
Metalot
Novar
Perdix
Pondera
POWERWATT
QuinteQ Energy
Renset
Rolls-Royce Solutions Benelux
Solarwatt
Solyx Energy
Straightforward
Watts In Store
Zwart Techniek

PROJECT DEVELOPMENT, ENGINEERING & CONSULTANCY

BIPV
DNV
Chint Solar
CMS
Eneco
Green IPP
GroenLeven
KiesZon
Klimaatfonds
LC Energy
LightsourceBP
Naga Solar
Powerfield
Pure Energie
Royal Haskoning DHV
Royal Dutch Shell
Solartechno
Statkraft
Stratergy
Sunprojects
Sunrock
Tomorrow Energy
TP Solar
Vattenfall

Energy as a global necessity and the Dutch response

As global demand for energy rapidly increases, the necessity for sustainable energy solutions with reduced environmental impact becomes ever more pressing. To meet this challenge, we must unify the growing energy demand with a transition to renewable sources. Developing new systems and solutions for a sustainable supply of clean energy, particularly solar energy, is crucial in this transition.

The Dutch focus on solar-PV and energy storage

In the Netherlands, the high demand for solar-PV systems drives our commitment to ensuring a sufficient and safe supply chain. This extends beyond our robust solar ecosystem, incorporating energy storage as a key component for enhancing efficiency and stabilising the grid through peak shaving. Energy storage plays an essential role in maximising the efficiency of our installed solar fields and in maintaining grid stability.

Unique approach to energy solutions

The Dutch energy sector holds a strong global position in energy applications, largely due to a unique collaborative approach. This success stems from our typical Dutch model of cooperation: forming public-private alliances, and sharing knowledge among industry, research institutes, NGOs, and government organisations. Such cooperation fosters innovative solutions that are rooted in the latest scientific knowledge, tailored to the specific needs of our private partners and policy makers. This collaborative model enhances the deployment of innovative solutions, effectively addresses societal challenges, and generates substantial revenue.

Investment in future technologies

To enhance strategic independence for the future, the Netherlands is deeply invested in next-generation technologies, ensuring their development and preservation for Dutch and European markets. In pursuit of this goal, the Netherlands will invest 412 million euros in next-generation solar-PV and 296 million euros in advanced energy storage technologies, further strengthening our position in these sectors.

International cooperation and partnerships

Recognising that strategic international cooperation is essential in the global solar-PV and energy storage markets, the Dutch energy sector emerges as an ideal partner. With extensive experience, knowledge, products, and services in the solar energy and energy storage fields, Dutch solutions adeptly handle complex energy systems in both developed and developing countries. Partnering with the Netherlands means investing in a win-win solution for all involved parties.

Showcasing Dutch innovation

The Solar Energy & Storage Guide not only showcases innovative Dutch organisations in the solar and storage sectors but also reflects our nation's commitment to leading a sustainable energy future. It is with immense pride that we present these pioneering organisations to the global community.

Peter Molengraaf
Chair, Energy Innovation NL

tki urban energy
topsector energie

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At Accuselect, we make home batteries more accessible for consumers in the Netherlands. We do this with our 'Energy simulation software', enabling us to calculate which home battery suits specific home-owner situations. We provide consumers with tailor-made advice for which home battery suits their specific situation, deliver these home batteries, and install these all over the Netherlands with our network of installers.

Furthermore, with our Energy Management System, we enable home owners to participate in the Day Ahead Market with their home battery, making them more financially attractive for those who have a dynamic energy contract.

We now have installed over 1 MWh of home batteries all over the Netherlands, and we do this with European home battery brands only, such as Sonnen and GivEnergy.

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Alius offers a complete range of solutions in the field of sustainable energy generation, energy savings, heat recovery and battery storage. We are a reliable partner in the sustainable energy solutions since 2007. Founded by Wil van der Meijden, Alius started as an installer of PV-systems for the residential market and is nowadays grown to an advising wholesaler and the biggest SolarEdge distributor and specialist in the Benelux. We offer the beautiful Aelex inlay mounting system and the safe and fire resistant Aesthetica in-roof mounting system. Since 2014 we expanded our business with different climate applications. With these applications we focus on healthy, comfortable and sustainable solutions in the Industrial sector. Our PVT-system, Volthera, is a two-in-one solution for electricity and thermic energy. The PVT-panels replace the ground source or outdoor unit needed for the heat pump. With Volthera you have a quiet and invisible source.

In short, Alius develops, produces and distributes products that provide the world with sustainable energy. Our motto is 'energy for each other'. These four simple words tell us what we do, for whom we're doing it and why we do what we do. We love to invest our energy in you!

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AMPOWR™

We create next-generation energy storage systems, transforming the energy landscape with Smart Battery Energy Storage Solutions. We are here to Switch the Flick, turning the conventional energy landscape 180° to the new future of energy by creating and configuring your systems from batteries, cabinets, and containerised solutions. The future of energy is going to be driven from Behind-the-Meter with Utilities being the back-up.

We provide cutting-edge battery systems integrated with our proprietary Energy Optimisation Platform, Cosmos. Our holistic solution autonomously optimises your energy assets for peak performance, leveraging the synergy of advanced hardware and intelligent software.

We provide a unified energy ecosystem with Ampowr's all-in-one solution. Our Battery Energy Storage Systems and Cosmos software seamlessly integrate with your assets.

Our holistic approach simplifies energy management across the board from battery storage and renewable generation to facility operations, grid integration, and even EV charging. We engineer ecosystems that are not only sustainable and efficient but also revenue-generating.

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Anesco™ AMAZING ENERGY

At Anesco we develop, design, construct, operate, maintain and optimise high performing grid scale renewable energy assets. Our main focus is on solar farms and large scale grid batteries. We provide services to investors that enable investments in low carbon technologies.

From identifying and securing land, to feasibility and technical design, the project development team at Anesco plays a critical part in the success of every project. The team is behind more than 100 high performing ground mounted solar farms and over 250MW of the UK's connected battery storage, forming part of the company's end to end lifecycle services.

With over 1.5GW of clean energy across 25,000 assets, Anesco has become the asset manager and O&M provider of choice for blue-chip clients, city investors and banks with large portfolios and individual portfolio owners. The company is entrusted to manage and maintain thousands of systems across the UK.

All Anesco staff are direct employees with health and safety being of vital importance and central to the company's values and activities. In the meantime offices have been opened in the Netherlands, Germany and Denmark and more countries are to follow.

Our mission is to accelerate the energy transition as fast as we can!

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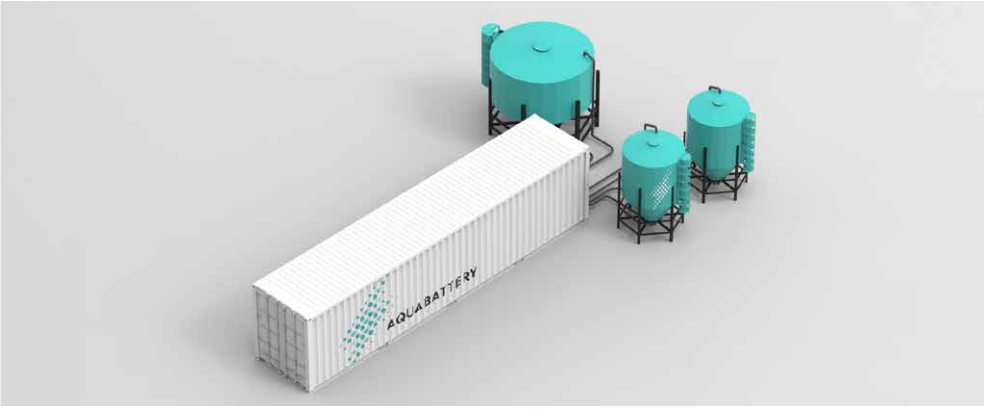

AQUABATTERY

The world is pushing for a net-zero power system by increasing installed capacity of solar and wind. This means a reduction in security of power supply as sun and wind are not always available. Moreover, renewables' intermittency causes grid congestion. AquaBattery's unique flow battery technology in which excess electricity is stored in table salt and water, shifts energy to enable supply even if the sun does not shine or the wind does not blow. The long duration energy storage solution also enables energy producers, grid operators and energy-offtakers deal with grid congestion.

Using just saltwater as core ingredients makes this flow battery highly affordable, safe, and sustainable. Salt and water are some of the world's most abundantly available materials that are cheap and accessible everywhere. They are non-flammable, non-explosive and non-toxic, enabling deployment of the storage system in inhabited and naturally sensitive areas. Salt and water do not require energy intensive or socially undesirable extraction processes. And along with its other battery components, they are recyclable. As such, AquaBattery is dedicated to equally serve customers' profits, people and planet.

With its fourth pilot in the making, AquaBattery partners with multiple international renewable energy producers and commercial and industrial parties to scale up its solution. Keen to know more? Reach out to empower net zero together.

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ATB
WOLONG *company*

ATB Motors B.V., founded in 1982, is part of the Wolong-ATB Group. The ATB Business Group, founded in 1919 by Gottlob Bauknecht, is part of the Wolong Group and is a leading Power Drive System Solution manufacturer in Europe, with several well-known brands such as Brook Crompton, Morley, Laurence Scott, OLI, SIR and Schorch.

The Wolong Group is founded in 1984, employs more than 16,000 employees worldwide, is the world's 3rd largest electric motor manufacturer with total 39 manufacturing plants. In Europe the group employs more than 3,000 and has production bases in Germany, UK, Poland, Italy and Serbia.

The Wolong Business Group Renewable Energy has more than 10 years history not only for manufacturing products for residential, commercial, industrial and utility projects but also act as EPC or EPC-F for Renewable Energy projects. In November 2023 the Wolong Group opened the first full automised factory for ESS within a New Energy Industrial Park in Shaoxing City, China. In this park Wolong will start to build more new factories to produce Energy Storage Converters and products for PV, Hydrogen and Wind Energy. The Wolong-ATB group is committed to develop Renewable Energy business in Europe and will invest in resources and facilities needed to support our vision to continuously contribute to carbon neutrality and create a clean energy world.

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batenburg energietechniek

Batenburg Energietechniek supplies components and systems that are used in the electricity distribution network: from power generation to local connection. We supply our energy-technical solutions to Transmission (TSO) and Distribution (DSO) grid companies and clients in several markets. Our products undergo heavy type testing to ensure they comply with the latest applicable standards. Technical innovations are developed in collaboration with our clients and implemented into a new standard. This is our contribution to enabling clients to take the next step in the energy transition.

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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'.

BIPV Projects and BIPV.world
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BIPV.world
Creating self-powered buildings

BIPV.world is a platform for inspiration, design and supply chain collaboration in the field of building-integrated solar panels. It is intended for architects, designers, facade builders and construction professionals. We enable every architect and designer to quickly create a custom facade design with integrated solar panels according to the most recent BIM standards. Another outcome of the process is the real-time insight into the costs, yields and ROI of the sustainable solar energy-generating facade in function of the design choices made.

In addition, our ventilated Click&Go solar facade panels can also be combined with traditional facade materials (stone, composites materials, aluminium cassettes, aluminium composite cassettes, non-active tempered glass, etc.).

We utilise glass-glass solar panels from multiple leading European manufacturers for provide freedom of choice for the architect and developer. Also, all other components are sourced from European manufacturers only.

BIPV Projects BV is the supplier of prefab produced facade systems designed with BIPV. world. BIPV project supplies to professional facade contractors and construction companies. BIPV projects can deliver turn-key facade projects, such as the Van Caem Transporten project BV in Waalwijk. This is the largest BIPV facade on an industrial building in the Netherlands. Photos of this project and other projects can be found on our website: https://bipv.world/projecten.

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BlauHoff

www.storeyourownpower.com is a web shop specialising in home batteries of all brands and small industry solutions for storage of power. The master company is www.blauhoff.com which is our own brand with high voltage solutions and low voltage solutions from 5kWh till 2 megawatts. With storeyourownpower.com you can immediately start reducing your energy costs. By storing power at home you can now decide where and when you want to use the energy. We sell home batteries from famous brands like BYD, Sungrow, LG, Solaredge, Pylontech, Huawei and BlauHoff. High voltage and Low voltage.

Storeyourownpower.com is specialised in battery solar panels. We also call these powerwalls. These powerwalls can store solar energy, allowing you to control from home where and when you use the stored solar energy. The stored solar energy can be controlled with a home battery solar panels. Your home battery is a kind of buffer that allows you to retain energy when there is a lot of sun, or instead release it to the public grid or your own home when there is no sun. You can buy home batteries in different sizes. On average, 5-20 kWh is sufficient.

Often you can also connect them in parallel to achieve more kWh per hour. The home battery or 'solar panel battery' can be mounted inside or outside, depending on the type you choose. Storeyourownpower.com supplies home batteries and inverters to both individuals and installers.

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BRABETECH
Technical solutions & innovations

Brabetech develops innovative heat storage and transfer systems for industrial processes using molten salt technology. Twenty percent of all energy is used for industrial heat, and this heat is mainly generated with fossil sources. Brabetech believes in a future where we can generate, store, and use 100% renewable heat in industrial processes.

The mismatch in the supply of renewable energy and the demand for process heat means that heat storage is required to make industrial heat fully renewable. Brabetech has developed the ThermalPod system that converts renewable energy into heat and stores it in molten salt.

The system allows flexible offtake of energy so that it can be used when it is in ample supply and thus cheap. It can also be used as a flexible asset for net balancing purposes, providing asset owners with an extra revenue stream.

The ThermalPod can store large amounts of energy, up to 100 MWh, and deliver heat by means of thermal oil or steam, depending on the use case. It provides savings in heat costs for industrial processes with operating temperatures between 90 and 400 degrees Celsius, such as food processing, drying, and the chemical industry.

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Bredenoord

Bredenoord is the specialist in temporary and mobile power solutions. Throughout the world, we ensure that businesses, institutions and governmental organisations can work as they wish to. In a clean, efficient and responsible way. Together with our clients, we work on appropriate solutions for sustainable energy security.

Every energy demand is unique. You can rely on the best solution for your situation. Smart combinations of various technologies deliver optimal reliability, minimal emissions, and high efficiency. Emission-free batteries take centre stage in hybrid systems, connecting to the grid or local energy sources. We offer Battery Boxes ranging from 15 to 600 kW to suit your specific needs, expertly guided by our professionals.

Alternative fuels like biogas, HVO, methanol, and hydrogen are also available. With a comprehensive fleet of battery systems, generators, and skilled professionals, Bredenoord is ready 24/7.

With almost 85 years of experience, Bredenoord operates globally in rental, sales, and maintenance, with facilities in the Netherlands, Germany, and Denmark, along with worldwide partners. Prioritising quality, reliability, and safety, we maintain an extensive safety, health, and environmental policy. Certified according to ISO 9001, ISO 14001, and VCA**, Bredenoord consistently strives for a secure and healthy work environment.

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[cellcius]

A core challenge in the energy transition is to move away from natural gas to sustainable heating solutions. Cellcius Heat Battery Technology helps accelerate this transition. By capturing waste heat or electricity from industry, data centres and horticulture. And releasing it at any given time or location, without loss of energy. In the Netherlands alone there is enough residual energy available to supply 3 million homes with all the warmth needed. Cellcius makes it happen, fast, CO_2-neutral and affordable.

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CMS
law·tax·future

CMS is one of the largest commercial full-service law firms in the world. We are the esteemed sparring partner of leading energy companies, regulators, public entities, project developers, large buyers, lenders and investors. Our expertise and experience comprise legal counselling on projects and transactions in all fields of energy – particularly renewable energy, varying from the development and financing of solar and (onshore and offshore) wind farms, biomass and biofuel plants to LNG terminals and interconnectors. CMS is deeply involved in the development of energy transition technologies, such as hydrogen, carbon capture and storage (CCS) and carbon capture and utilisation (CCU), battery energy storage and electric vehicle (EV) infrastructure.

Our recent experience in the Netherlands includes:
Aroundtown | Advised on the regulatory aspects involved in the measures to achieve sustainability for its Dutch real estate portfolio, including the generation of renewable electricity for use by its tenants through rooftop solar photovoltaic (PV) installations.
Susi Partners | Advised on the acquisition of a portfolio of solar PV projects, with an aggregated capacity of 76.1 MWp, including one of largest operational solar parks at the time in the Netherlands.
Delin Capital Asset Management | Advised on the development and operation of one of the largest single roof solar plants in the Netherlands, the 57,000 m^2 roof of DCAM's warehouse facility in Born.

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Covolt is your Asset Manager and Aggregator for renewable Energy Installations.

Covolt is the expert in management and optimisation of renewable energy installations where intelligent systems and processes ensure greater efficiency, safety and reliability.

To get the maximum efficiency from a renewable energy installation, you need to push the right buttons. We don't just manage and optimise your installation; we make the entire energy chain work in your favour.

Trough smart software, a complete range of services and a team of energy experts, together we ensure maximum efficiency, safety and reliability for your Battery Energy Storage and PV-installation.

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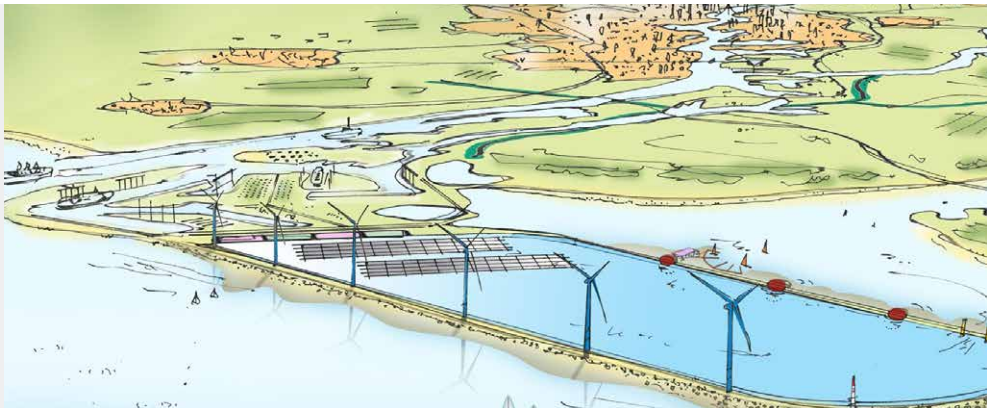

Delta21bv has developed an energy storage concept. It has also developed an application of that concept in the Netherlands for a 40 km^2 Energy Storage Lake in which salt water can pumped out with the surplus of solar and wind energy at any time and can function as a power plant when the demand for electrical power increases. The Lake's pump capacity is more than 2 GW and the volume is 34 GWh and yearly it can generate about 5 TWh of 'clean' energy. With this large storage capacity, the port of Rotterdam can strengthen its strong energy position.

The supply of energy is supplemented with electricity from a 30 km^2 large floating solar park inside the lake and some offshore wind parks. Due to its strategic location at the landing of the BritNed cable, a mega socket can also be added.

A row of natural dunes encloses the Energy Storage Lake. The European Water Framework Directive has urged that this plan be used optimally for nature restoration at the same time. Delta21 is therefore based on the principle that the natural values. As a result of the spatial intervention, these values will be generously compensated. During a severe storm in combination with high river discharge, the surplus of river water can also be discharged directly via the pump turbines into the North Sea.

The design exploration shows how Delta21 would fit in perfectly with the original landscape with plenty of estuarine dynamics and experience. This will give the area back its original quality of dynamic channels, banks and dune system.

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DNV is the independent expert in risk management and quality assurance, operating in more than 100 countries. Through its broad experience and deep expertise DNV advances safety and sustainable performance, sets industry benchmarks, and inspires and invents solutions. Whether assessing a new ship design, optimising the performance of a wind farm, analysing sensor data from a gas pipeline or certifying a food company's supply chain, DNV enables its customers and their stakeholders to manage technological and regulatory complexity with confidence. Driven by its purpose, to safeguard life, property, and the environment, DNV helps tackle the challenges and global transformations facing its customers and the world today and is a trusted voice for many of the world's most successful and forward-thinking companies.

DNV provides assurance to the entire energy value chain through its advisory, monitoring, verification, and certification services. As the world's leading resource of independent energy experts and technical advisors, the assurance provider helps industries and governments to navigate the many complex, interrelated transitions taking place globally and regionally, in the energy industry. DNV is committed to realising the goals of the Paris Agreement, and supports customers to transition faster to a deeply decarbonised energy system.

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The Ecoplant stands as an exceptionally efficient power generator harnessing energy through Bi-Facial solar panels. It integrates a multitude of functions, encompassing both On-Off grid capabilities, energy charging, and convenient energy delivery for electric bicycles and cars, while ensuring protection for personal property. This innovative solution combines safety cameras, street lighting, and a charging station into one comprehensive unit, promoting an environment of stunning and sustainable energy provision. Operating autonomously, the Ecoplant continuously aligns with the sun, maximising the utilisation of available solar power round the clock. Its freestanding, sun-tracing design allows for versatile placement – be it near residences, in gardens, business parks, or any preferred location – boasting a hassle-free setup.

Moreover, the Ecoplant's mobility factor enables both On-Grid and Off-Grid energy solutions, ensuring flexibility and ease of use while remaining license-friendly. Leveraging patented technologies like Nano Clean Coating, 4G communication, and state-of-the-art sun tracing, it guarantees an exceptionally high energy yield. Our goal is to seamlessly connect the investment in solar energy to substantial energy savings while providing on-site assistance and additional services. This concept of mobile energy empowers users to access energy wherever needed, fostering adaptability and convenience. Additionally, the Ecoplant serves as a captivating centrepiece, customisable with your company logo or corporate identity, enhancing its visual appeal and aligning with your brand aesthetic.

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Dutch electricity supplier and EPEX member Edmij enables companies to react quickly to power prices and therefore helps them to save costs and lower emissions.

At the same time, Edmij as aggregator balances the grid (BSP) and reduces congestion for grid operators.

Assets under management: 500 MW (batteries, solar, wind, diesel generators, and many more).

Investors: bootstrapped by the founders Jeffrey Bartels en Heine Prins (truly a Dutch SME).

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Endurans Solar is a leading manufacturer of innovative material solutions for solar panel manufacturers worldwide, on a mission to enable clean, affordable solar energy for all. We believe that the solar industry plays a key role in creating a more sustainable future for our planet. With our expertise in polymer materials, co-extrusion, and solar technology, Endurans Solar helps make this future a reality by boosting the performance of photovoltaic modules and developing solutions that protect both solar module and planet. Endurans has production and R&D facilities in the USA and Europe and representative offices in India and China.

Products: Our fully recyclable, high-performance polyolefin Endurans HP back sheet series feature the strongest water resistant core layer in the industry, while our conductive back sheets (Endurans CB) enable flexible designs and highly efficient, aesthetically pleasing solar modules based on leading-edge, back-contact technology.

Our development products are all based on co-extruded polyolefins with circular design in mind and include rear perforated insulators, transparent back sheets and encapsulants.

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At EnergyKoNneX, we redefine the energy landscape, offering energy savings and operational reliability through cutting-edge energy measurement-, management-, and storage solutions. Our mission is to provide intelligent energy designs where users and the climate both reap the benefits.

Key Offerings:

Energy Measurement: Our advanced software empowers you with accurate insights into your energy consumption, ensuring transparency and informed decision-making.

Energy Management: Navigate towards optimal energy usage with our smart energy management solutions. We put control in your hands, making efficiency accessible and sustainable.

Energy Storage: EnergyKoNneX introduces intelligent energy storage solutions that not only enhance reliability but also contribute to a sustainable future.

Our **Projects:**

Energy storage / peakshaving: 320 kWh-110 KVA: Smart energy peak shaving solution in combination with 320 kWh energy storage system and 400 solar panels to support limited grid connection. https://energykonnex.nl/portfolio-item/accupakket-320-kwh-110-kva/

Energystorage: 80 kWh-45KVA: Smart energy solution for optimal performance enabling electric heating in combination with energy management / peakshaving software. https://energykonnex.nl/portfolio-item/accupakket-80-kwh-45kva/

International Energy Monitoring System: International system to monitor and report factory energy consumption from production facilities in different countries. https://energykonnex.nl/portfolio-item/energie_monitoring_systeem/

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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 200 Dutch companies and organisations 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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ENERGYNEST offers a flexible and cost-effective thermal energy storage (TES) system for customers in power generation, energy intensive manufacturing and renewables industries. The thermal battery solutions decarbonise energy supply by electrifying industrial heat, and by recovering and repurposing waste heat into energy on demand. ENERGYNEST also provides large-scale energy storage to solar thermal and other zero emission power plants. ENERGYNEST thermal energy storage can be combined with PV and concentrated solar production plants to electrify industry and provide grid balancing services. The technology is proven and operational on industrial scale.

Founded in 2011, the company is headquartered in Norway with offices in Hamburg, Seville and Rotterdam and is ranked #3 in Global TOP100 Carbon Reducing Innovations by Mission Innovation.

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The sun. An inexhaustible source of energy that we can quickly access. And we do that, en masse. Through the roofs of our homes and businesses. All over the world. And we believe that this can always be done smarter, faster and easier. By simply making things more thoughtful from the start. Based on that vision, we develop smart mounting systems for solar panels that create less hassle and more value for solar professionals. We have been doing this since 2004, when Esdec was founded.

Our mounting systems consist of light, sturdy components that simplify the mounting of solar panels and make it faster. With inter-changeable parts that can be attached in a safe and convenient way. With one tool or even completely tool-less. For example, we have reduced the assembly time by about 40%, and we facilitate error-free installation.

And we go further than developing innovative mounting systems. We help solar professionals in a few digital steps with a technical proposal, with smart project support, maximum insured value and education and training. Online, on location or in our Innovation Center, in Deventer. With these smart services we remove as much hassle as possible and create extra value.

With almost 20 years of experience and more than 11GW of installed solar panels, now more than 12,000 installers in more than 10 countries see Esdec as their partner in innovative mounting systems. Esdec. Building value for solar professionals.

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Eurotronic has been a distributor in the Netherlands of Outback Power since 2015.

Outback Power operates worldwide and has its headquarters in Arlington USA. They are a leading designer and manufacturer of advanced power electronics, batteries and management platform for renewable energy, backup power, maritime and mobile applications. Outback Power is part of Enersys. With more than a million installations around the world – in some of the most demanding environments imaginable – Outback products provided clean, reliable power where you need it, when you need it, and how you need it.

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Exergy Storage developed and is scaling up a novel sustainable battery technology for energy storage based on abundant raw materials such as salt, (recycled) aluminium and iron. The new battery is characterised by high energy density and safety, being deployable both in densely populated residential areas or used in large utility-scale systems. It also has a long lifespan, allowing high deep cycling numbers and it is fully recyclable, easy to refurbish and designed for closed material loops. These characteristics also make the battery suitable for electrification of transport over rivers and coastal waterways, including barges and passenger transport. At the same time, the company aims to increase consumption of home-generated renewable energy in an affordable and efficient way.

Another benefit that arises from the usage of relatively simple production processes is that the amount of energy required for production is several times lower than compared to that of Li-ion battery production.

Together with value chain partners (such as suppliers, strategic and commercial partners, scientific institutes and universities) the company is currently preparing for series production and market roll-out. In parallel the technology is being optimised and validated through prototypes and pilots.

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FME POWERED BY DUTCH TECHNOLOGY

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 including solar. FME members employ a total of 220,000 people, have a combined turnover of € 139 billion and their exports total € 59 billion. FME members therefore account for one-sixth of all Dutch exports.

FME has 23 affiliated trade associations. FME mobilises and connects partners in the technology industry to meet the big challenges society faces, both today and in the future. In doing so, we increase our members' individual and collective earning power.

Technology provides answers to some of society's most pressing questions and challenges. Our mission is to help shape those answers by mobilising and connecting technology companies with each other and society as a whole. We are committed to a future-proof world: prosperous, healthy and inclusive

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FridayEnergy

At Friday Energy, we envision a world with 100% sustainable and affordable energy accessible for everyone. To achieve this, our planet requires an increased adoption of solar and wind energy, coupled with the smartest decentralised flexibility in our energy system. As a technology company, we assist businesses, non-profit organisations and commercial real estate owners in investing in optimal smart Battery Energy Storage Systems (BESS) that cater to their specific needs while contributing to the enhancement of the local energy grid.

We provide systems equipped with safe Lithium Iron Phosphate (LFP) battery systems ranging from 15 to 2000 kilowatt hours. Our company developed an Energy Management Software (EMS) based on AI with algorithms optimising the energy usage. This algorithm integrates historical & real-time energy pricing data, forecasts, predictions of PV & Wind production, energy consumption, market trends, and local weather conditions.

Utilising a tailored model that aligns with individual business activities, power connection size, energy consumption, and onsite PV production, we remotely ensure that each battery in a system is charged and discharged at the right moment.

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The way we consume and generate electricity is changing. The energy landscape is evolving with the rise of renewable energy sources, electric vehicles, and local generation. But new developments bring new challenges. Renewable energy sources such as wind and solar energy are sufficiently available to provide us with electricity, but generating renewable energy is not fully maximised.

GIGA Storage specialises in large-scale energy storage. Investments are made in projects aimed at optimising energy supply and grid stability. GIGA Storage's goal is to become a key player in energy storage in Europe to fully harness sustainably generated energy. Energy storage is the missing link in the transition to a world powered exclusively by renewable and clean energy. When the wind is not blowing and the sun is not shining, GIGA Storage delivers renewable energy. The smart combination of hardware and software makes GIGA Storage so unique!

GIGA Storage creates large-scale renewable energy storage. Through smart use of large-scale energy storage, parties can be connected faster at lower social cost, whereby more sustainable energy is used, and the closure of fossil fuel plants can be accelerated.

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GivEnergy is a manufacturer of a complete range of inverters, cobalt free battery systems and associated software. We offer energy storage systems both for households and businesses. When used together, our products create an end-to-end ecosystem for customers to control their energy while cutting their carbon emissions. Our systems use intelligent algorithms to capture peaks and make best use of storage of excess power generated from solar, wind, etc. to maximise self-consumption. Customers can monitor, manage, and optimise their system in the GivEnergy app or portal. A complete in-house R&D team ensures the technology will continue to lead the field. Furthermore, we have an excellent customer service department to give support to our installers.

The company was founded a decade ago in the UK. Since then, the company has experienced hyper-growth and has become market leader in home energy storage in the UK. In 2022 the company expanded into Europe. The European head office and warehouse are in the Netherlands.

We are on a mission to help people save on their energy bills while also having as little impact on the environment as possible. Whether it's by making the most of your customer's solar panels, or by charging the battery using the off-peak tariff, we can guarantee that the GivEnergy system will deliver exactly what we promise, both for the domestic and the commercial market.

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Greener Power Solutions

Greener Power Solutions is a pioneering force in the temporary energy market, rapidly emerging as Europe's fastest-growing energy tech innovator. Our mission is anchored in providing emission-free energy across diverse locations, thereby accelerating the transition from fossil fuels to sustainable energy sources. We facilitate organisations to take tangible steps towards a greener future by offering the cleanest mobile power solutions available. Central to our service offering is the integration of our extensive rental battery fleet with on-site (renewable) energy sources. Our distinct edge lies in our in-house developed software, designed to optimise complex energy setups efficiently, both during planning and in real-time operations. This approach ensures our clients benefit from maximum efficiency with a minimal environmental footprint. Our comprehensive service package includes swift delivery and installation, remote monitoring, control, and dedicated 24/7 technical support. The Greener dashboard provides our clients with easy access to track their energy usage, CO_2 savings, and diesel reductions, ensuring complete transparency and control over their energy solutions and environmental impact. Our portfolio includes diverse projects across various sectors, emphasising our versatility and commitment to sustainability. For instance, we have provided energy solutions for electric vehicle (EV) charging stations, utilising our mobile batteries to manage peak energy demands efficiently. Our involvement in the construction and infrastructure sector demonstrates our ability to deliver emission-free power solutions that comply with stringent environmental regulations.

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GREENY ENERGY

Greeny Energy, a pioneering force in the Netherlands, addresses critical trends in the energy markets faced by entrepreneurs and businesses daily. These include:

- Increased electricity consumption.
- Rapid growth in renewable electricity generation.
- The inability of the distribution network to keep pace with demand growth.

These trends converge to a common issue: excessive demand for the available transport capacity, known as grid congestion.
This congestion leads to:

- Long wait times for new/temporary (construction) connections.
- Delays in upgrading existing connections.
- Loss of return on investment in green power generation due to curtailment

Greeny Energy offers a solution for both supply and demand grid congestion in the form energy storage and peak-shaving solutions. Unique in circularity, our mission is to accelerate the energy transition in the most circular way possible.
We stand out by reusing battery packs from the automotive industry, in a market where buffer storage solutions traditionally use new cells, contributing to resource scarcity.

Greeny Energy gives used battery packs a second life. Unlike 'standard' second life, which often involves dismantling existing packs down to the cell level, losing the added value of design, production, assembly and energy management components, Greeny Energy retains this value, significantly reducing the carbon footprint as well as cost.

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GroenLeven

GroenLeven is the market leader in large-scale solar energy in the Netherlands and is one of the top five largest investors in the Dutch energy transition. GroenLeven realises large scale solar energy, wind energy, battery storage and green hydrogen installations. At GroenLeven we are genuinely concerned about climate change. That is why we work passionately every day on our mission statement: providing the world with clean energy. GroenLeven develops innovative solar energy projects in multifunctional form. Think of solar energy on large roofs, as a carport, floating on water, on garbage dumps and above fruit. Based on the intrinsic motivation to further the Dutch energy transition and our innovative strength, GroenLeven develops wind energy, large-scale battery storage and green hydrogen projects in addition to large-scale solar energy. For example, SinneWetterstof from GroenLeven is one of the first green hydrogen factories in the Netherlands and our first large-scale battery storage system that has been realised and many more are planned. In this way we make a substantial contribution to the energy transition in the Netherlands and work together with companies, governments, grid operators, residents and NGOs to create a cleaner, better world for future generations.

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Denk vooruit.
Doe groendus

Groendus: an integrated energy solution. Groendus is the one-stop-shop sustainable energy partner for businesses in the Netherlands. 225 Groendus employees are constantly working towards our mission: clean and affordable energy for all. To date, there are more than 350 Groendus solar plants across the Netherlands. We install smart meters, charging stations and batteries. We help companies save energy and consume it smartly, with the help of our insights, energy monitoring and innovative energy management.

Additionally, the Groendus Energy Marketplace constitutes a sustainable energy platform, which facilitates direct and local trade in renewable energy between producers and consumers. This trade is entirely independent of traditional energy suppliers. Together with our 5,000 customers, we are creating a future-proof energy system where sustainable energy generation and consumption are in perfect harmony. Think ahead. Act today.

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(Local) Storage & Transport (Road, Rail and Sea)

Off-grid power source

Automotive & Mobile filing station

H2Storage is a 100% Dutch company with experienced executives (from the energy, composites, aviation and automotive sectors) as the driving force behind this successful start-up. By combining our years of experience gained from the aforementioned sectors we developed a viable solution for long term energy storage. We have fulfilled an essential step towards a hydrogen economy by introducing the use of high pressure lightweight composite storage tanks from recyclable material to store hydrogen. Now we have an alternative solution to store more hydrogen under high pressure in the whole supply chain, from production all the way till the end user. This can be realised by type 4 composite cylinders with NWP of 700 bar.

Portfolio of H2Storage consists of single light-weight composite cylinders, double, triple or quadruple bundles and standard 10-45ft container containing tenfold(s) of these cylinders including the essential appendages for hydrogen storage. The solution to store locally, transport and use locally (e.g. an off-grid (emergency)generator) large quantities of hydro-gen. These products are developed according to the International (ISO/ADR/ADN/TPED) and European standards (R134) for the automotive, shipping, stationary and transportation industry. Currently we are fully involved in, among other things, the SHIP2DRIVE consortium, the realisation of a sustainable inland vessel and the realisation of a sustainable excavator. Naturally, our role is to realise the most efficient storage and transport of hydrogen systems.

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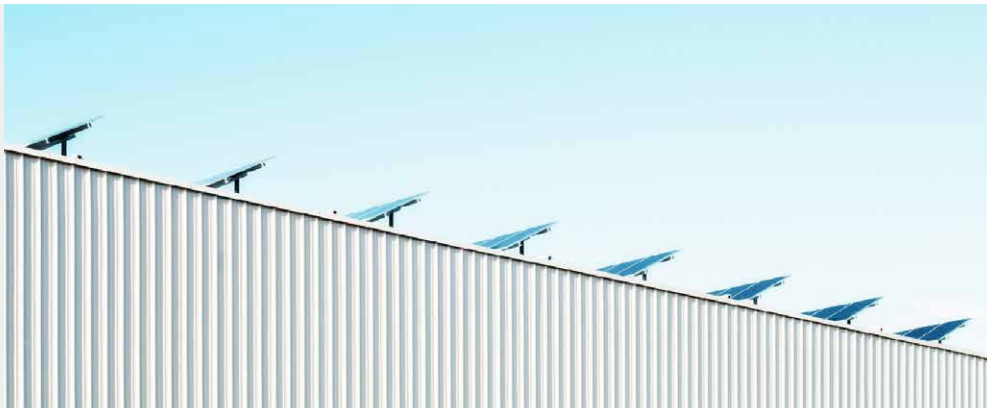

Holland Solar, founded in 1983, is the key organisation for professional solar energy experts, companies and institutions in the Netherlands. Members are active in both solar thermal energy and solar photovoltaics, comprising the complete chain from R&D and production until consultancy and installation. 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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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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IM Efficiency is at the forefront of bringing disruptive and sustainable solar energy technologies to the transportation industry. With a focus on renewable energy sources within the vehicles, such as solar power, we can immediately reduce fuel usage in trucks while enhancing overall reliability. At the heart of our innovation lies SolarOnTop, an onboard solar technology that's revolutionising fleet operations and fostering greater sustainability in commercial transportation. Designed specifically for trucks and trailers, SolarOnTop offers a cost-effective and sustainable solution, cutting annual fuel consumption by 1,000 to 3,000+ liters and reducing carbon emissions by 3 to 9 tonnes of CO_2, all while offering a rapid payback period. Our comprehensive technology comprises a lithium battery, an advanced energy management system, and lightweight, flexible solar panels. With SolarOnTop, experience clean, reliable solar power day and night, regardless of the weather conditions.

IM Efficiency is a key participant and actively contributes to the Solar Moves project, Solar NL project, and plays a crucial role on the board of ASOM: Alliance for Solar Mobility. Additionally, we are part of the GTD-E project:

- The SolarNL project is a collaboration between a large consortium of Dutch solar companies, research organisations, and institutes. The project aims to bring back and stimulate photovoltaic (PV) manufacturing in the Netherlands and Europe.
- Within the SolarMoves consortium, we explore the potential of solar-powered vehicles.

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Indutecc RENEWABLE SOLUTIONS

Indutecc Renewable Solutions is the specialist in the field of Sustainable Energy issues. We combine energy storage with solar power and EV charging and bring them together in a smart energy management system.

The use of batteries within the energy transition requires a smart approach where a battery is just a part of the solution. In addition to batteries, we add BMS (battery management systems), an inverter and an EMS (energy management system). We offer this combination as an integral solution in which we also make solar power part of the whole.

With our three-step plan: Measuring, Phase Balancing and Peak shaving, we offer a scalable solution in which we step by step arrive at a meaningful system to optimize grid connections.

In doing so, we work with European manufacturers who have been able to seamlessly coordinate their systems. We don't depend on one brand of energy storage but chose for every case the best possible solution, from scalable systems till containerised projects.

Problems with grid congestion and/or achieving maximum grid connection values require innovative solutions that relieve the grid as much as possible and allow the user to use his energy as efficiently as possible. Especially now that we are also driving more and more electrically. This is the terrain that Indutecc is in; innovative solutions for energetic problems. From phase balancing to power sharing and smartly controlled batteries in combination with, for example, solar power and EV charging.

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iwell
Saving nature's energy

At iwell, we want clean and affordable energy for all; one of the biggest challenges of our time. Cleaner air, cleaner water and a healthier planet. A sustainable power supply is needed to achieve these goals.

We combine sustainable goals with business models. We believe that if you enable business as a force for good, you will accelerate and have a bigger impact on slowing down climate change. With our smart energy storage solutions, we rebuild the European energy infrastructure. From centrally managed, fossil and predictable towards local, clean and dynamic. Building by building.

By utilising our smart battery systems, you can increase the reliability and efficiency of your energy supply, and also gain more certainty about your energy costs. Moreover, we enable you to use more renewable energy in your premises, contributing to a cleaner and greener future while utilising a strong business case. What sets us apart is our unique combination of hardware and self-developed software. As pioneers in the industry, we have developed our own energy management system.

We've now installed a total of over 70 MWh of battery capacity at around 250 organisations in multiple countries in Europe. We help a variety of businesses, from transport and logistics to commercial and industrial companies, to manage their energy locally, without being dependent on the unstable grid.

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JP ENERGIE SYSTEMEN

JP Energy Systems is specialised in combined hydrogen and battery solutions and is agent of the French company Powidian. We help customers with the generation, storage and reuse of sustainably generated energy. In this way we help to make your location more sustainable and make it partially or completely energy independent. Our intelligent systems make very efficient and effective use of renewable energy sources.

JP Energy Systems is a reliable partner with many years of experience in the energy sector. We know our technologies very well and work closely together with our customers, partners and suppliers.

We work with proven technologies and reliable and experienced partners who value quality. We deliver turn-key projects and provide the complete package needed to realise the project, including project management, commissioning, service, training and aftercare.

The energy transition needs acceleration and requires new types of technical solutions and new ways of working together. We believe in having the guts to execute projects quickly and well. This not only makes the energy transition visible and tangible, but follow-up projects can be realised better and faster thanks to learnings from the experience gained.

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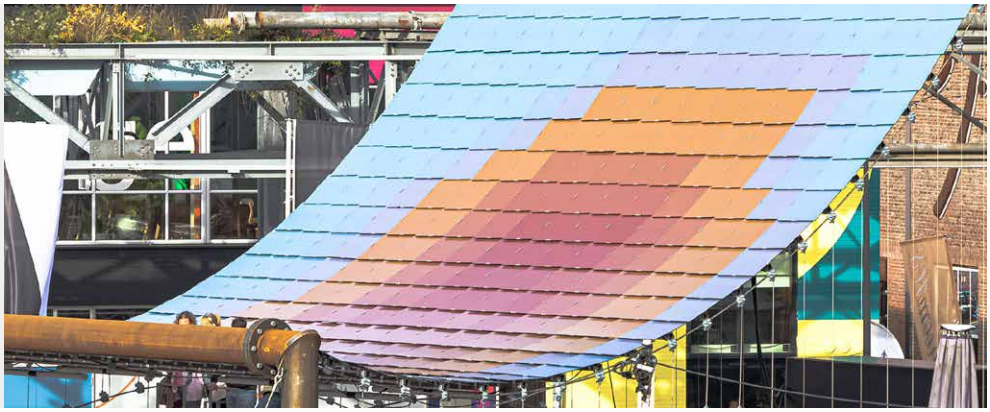

KameleonSolar

Kameleon Solar designs and manufactures custom-made coloured solar panels for solar facades and BIPV (building-integrated photovoltaics). Our solar elements seamlessly integrate into buildings, for beautiful and more sustainable cities. We are experts in matching colours, customising colour, shape, and size, and optimising power throughout our coloured and designed solar panels.

Our ColorBlast technology offers aesthetically pleasing energy solutions. ColorBlast provides a myriad of colours for stunning and active solar applications lasting over 50 years and allows multiple colours or images on a module. Our services encompass expert project guidance, colour matching, design advice, graphic design customisation and module design, yield calculation, samples and prototyping, and the manufacturing of tailored solar solutions.

Our portfolio includes successful projects, such as the Solar Pavilion at Dutch Design Week 2022, a collaboration showcasing a visually stunning wave effect with 376 custom-coloured and tiled elements, and the restoration of De Volharding, a national monument in ARTIS zoo in Amsterdam featuring BAPV (building-applied photovoltaics) on the roof – a historic breakthrough for sustainable energy on protected zinc roofs.

Explore an innovative urban environment where solar panels are functional design elements on building skins. With Kameleon Solar, architecture becomes a canvas for sustainable and artistic expression – the art of solar.

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KiesZon

At KiesZon we respond to today's energy issues in a sustainable and innovative way. Being part of the Greenchoice Group, we believe in a sustainable world, where we make smart use of renewable energy.

The demand for sustainably generated electricity is increasing. But generating more solar and wind energy creates new challenges, with congestion being the biggest obstacle. Technological innovations, such as smart storage techniques, demand-side management and electrification of mobility present themselves as solutions.

KiesZon integrates these and other innovations into smart energy systems, with solar energy as its foundation. We engineer and apply innovative solutions for complex energy issues. As part of the Greenchoice Group, KiesZon has access to expertise and knowledge regarding every element of the renewable energy supply chain. We guarantee the supply of green electricity, with our focus being on seamless business continuity and operations for our partners.

This way we build the electrical infrastructure of the future and make real estate not only more valuable, but also sustainable for generations to come.

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KLIMAATFONDS NL

Klimaatfonds is a Dutch investment platform for large-scale sustainable energy projects. We take care of the complete financing and construction and are the long-term asset owner of the projects.

Since its establishment in 2018, Klimaatfonds Nederland has realised many solar parks. Recently, we have expanded our focus to include large battery storage and hydrogen projects.

Our mission is to increase the realisation rate of Dutch large-scale sustainable energy projects through knowledge and capital in order to realise 1,450+ MW of projects (total investment value approximately €1.4 billion).

Klimaatfonds Nederland believes in long-term collaborations that listen to the wishes and requirements of initiators and developers in order to jointly achieve successful realisation with the highest production and lowest cost of energy.

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At KonkaEnergy, we are at the forefront of revolutionising the energy landscape with our cutting-edge energy storage solutions. As a pioneering force in the energy storage industry, we pride ourselves on delivering innovative, sustainable, and efficient Battery Energy Storage Systems (BESS) that cater to the diverse needs of businesses and communities. Key Strengths:

- Innovative Technology: KonkaEnergy is synonymous with innovation. Our BESS systems leverage state-of-the-art technology, incorporating the latest advancements in energy storage to ensure optimal performance and reliability.
- Sustainability at the Core: Committed to environmental stewardship, we embed sustainable practices in our solutions. Our BESS systems not only enhance energy efficiency but also contribute to a greener and cleaner future.
- Customisable Solutions: Recognising that every energy need is unique, we offer customisable BESS solutions. From capacity to configuration, we tailor our systems to match the specific requirements of our clients, ensuring maximum flexibility.
- Competitive Edge: KonkaEnergy stands out in the market with a competitive edge. Our commitment to delivering high-quality products is unwavering, and our pricing reflects our dedication to making advanced energy storage accessible.
- Proven Track Record: With a track record of successful implementations, we have earned the trust of businesses seeking reliable and efficient energy storage 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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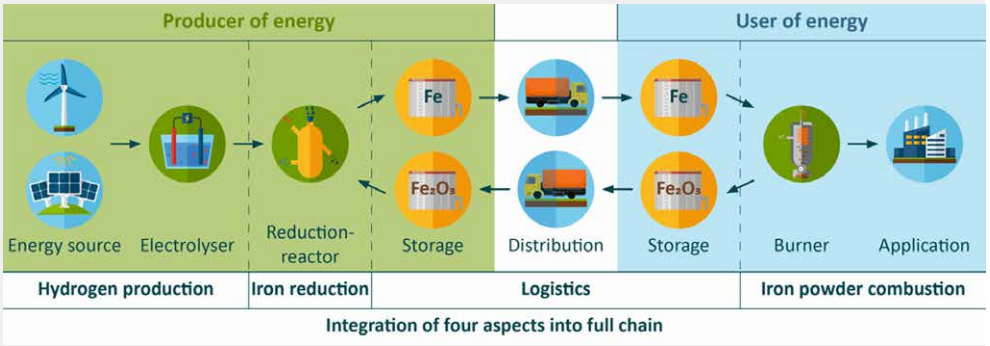

The Metalot Future Energy Lab builds the eco-system around the Iron Power technology and application. The technology is a CO_2 free, low NO_x and circular process to capture green energy (wind, water, solar) and store it in iron powder (limitless) for later usage. Bridging seasons? No problem. Iron powder storage and transport is safe, non-toxic, non-explosive and non-corrosive. Metalot is a neutral party aiming to install Iron Power as an accepted energy carrier. Metalot operates a membership model, organises community events, publicises vision and benchmark documents and facilitates, stimulates and initiates projects that drive the state of the art in Iron Power technology and application. The IronPower technology concept is based on a circular process of combustion and regeneration of iron powder. When iron powder is burned, it releases energy and the iron powder is transformed into iron oxide. Iron oxide can be turned back into iron powder again by reducing it with green hydrogen.

The Metalot Future Energy Lab provides services such as:

1. Business case assessments for implementing:
   - iron power (incl. storage) into your processes
   - high temp heat or electricity generation using Iron Power
   - reduction of iron oxide to iron installations
   - (balanced decentralised) energy hub designs (green energy IN, heat or electricity OUT)
2. Test services and benchmarking on:
   - equipment used for reduction and oxidation of iron powders

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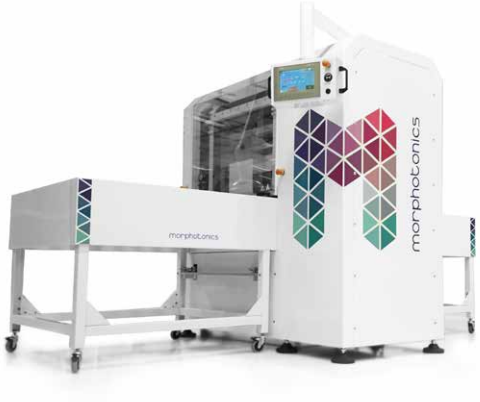

Morphotonics B.V. (www.morphotonics.com) develops and sells roll-to-plate (R2P) OEM production technology for imprinting nano- or microstructures on large area substrates. Our cutting-edge technology and machines have unique features that radically improve our customers' products in the display and solar 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 optimisation which can even be customised for a certain panel type or mounting system.

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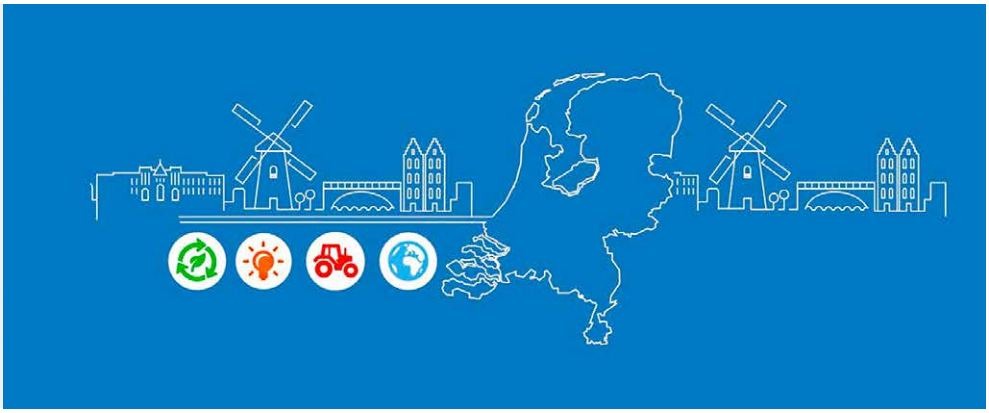

Netherlands Enterprise Agency

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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novar
Getting new energy done.

We are Novar. We develop green energy systems for the corporate market, including generation, storage, distribution and management. We realise major turn-key projects. Every asset we deliver contributes to your green energy system – from clean generation and storage to smart delivery and management. From A to Zero.

We feel the urgency to take steps toward a sustainable world now. We are taking the lead in this. To realise our ambitions, we are coming up with solutions that have never been available before. We will not let a 'full power grid' stop us, and we realised the largest solar carport in the world and the first large-scale solar thermal park in the Netherlands. Because can't, doesn't exist.
Generating: We believe that sustainable energy makes the world a better place. That's why we realise projects to generate more energy from green sources.

Optimal Management: Every solar farm, wind farm or solar roof should generate the maximum returns. We manage energy projects and keep them in good technical and financial health.
Smart Storage: Waste not, want not. We realise major sustainable energy storage projects with batteries, green hydrogen and heat so clients can reap the maximum benefits from the green energy we generate together.
Efficient Energy Use: Novar supplies PPAs, corporate PPAs and GOs, so you can be certain the electricity you use, has been sustainably generated. The systems and services we supply are integrated smartly and adapted to your user profile.

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Perdix is a boutique renewable energy consultancy and co-developer. We make the energy transition happen. Perdix offers project management, (co-)development, and market entries for foreign investors that are interested in the Dutch energy sector.

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Pondera's main goal is to leverage natural resources to meet our energy needs. The elements – earth, wind, water and sun – are abundant and renewable energy sources. Fortunately, they are everywhere. Since the start of our company in 2007, we have helped realise sustainable energy projects for our customers.
In the field of solar and onshore wind, we have developed large-scale projects in challenging environments with many stakeholders. However, small-scale projects and so-called hybrid projects – for example solar PV and batteries – are also becoming increasingly important. Pondera has been involved in the development of more than 10 GW of renewable energy projects, of which approximately 1 GW is installed and operational. More specific, we have realised more then 50 solar projects that vary from feasibility studies for (floating) solar up to developing whole energy parks where we combine solar farms with wind turbines.

Our experience in project development enables us to advise policymakers in drawing up sustainable energy policies that are in line with daily practice.

With all our services and projects we challenge ourselves to continuously improve, based on the following core values:
- Commitment to the needs of our customers and partners
- Creative solutions using reliable and proven techniques
- High service level
- Long-term professional relationships

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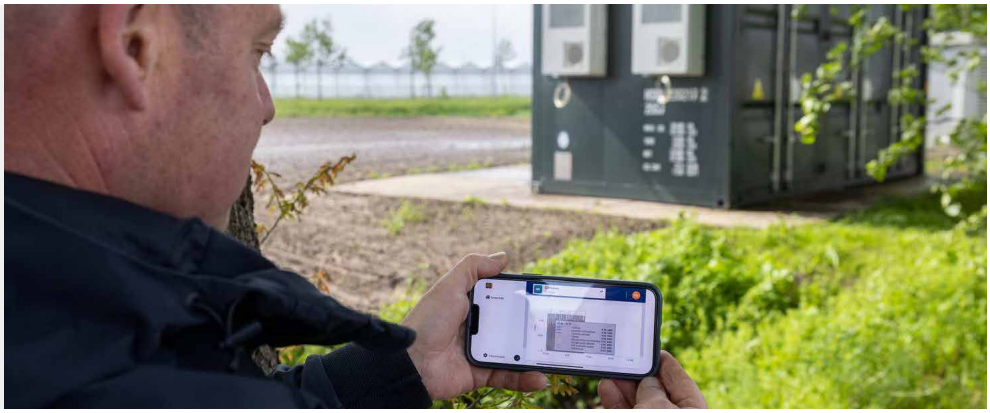

POWERWATT

POWERWATT BV, a leading energy storage company, has successfully completed a wide range of projects ranging from small vacation homes with 5 kWh capacity to impressive container batteries with 2 MW capacity and 2208 kWh storage capacity. Each of these projects is unique and driven by specific needs and goals for implementing battery storage. The motivations behind installing these battery systems are varied. For some projects, the goal is to store solar and wind energy so that the electricity generated can be utilised at times when energy production is lower. This contributes to a more efficient and sustainable energy supply. In addition, POWERWATT has also implemented projects in which the batteries serve as backup supplies, providing crucial power during peak loads or emergencies, thus ensuring a reliable power supply. Another innovative aspect of POWERWATT's projects is its cooperation with grid operators. By making the batteries available to the grid operator, they can help to stabilise and balance the electricity grid. This not only provides a valuable service to society, but can also result in a lucrative revenue model for POWERWATT.

While the benefits of battery storage are obvious, it is important to note that battery placement is still a relatively new concept. This means that its implementation can be complex. However, POWERWATT has established its reputation as an expert in this field, with a team of highly qualified professionals who ensure that each project is carried out with the utmost care and precision.

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QuinteQ energy storage

Introducing the world's most advanced flywheel energy storage technology, developed by the Boeing company, brought to the market by QuinteQ, made in the Netherlands. QuinteQ Energy is the shock absorber in Energy Transition, operating where power peaks are most challenging. The QuinteQ system is the perfect peak-shaver for frequent power peaks lasting seconds to minutes. It can deliver power in places where infrastructure is insufficient to do so.

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renset
Portable Renewable Energy

Renset is a robust and mobile battery system for sustainable energy on building sites. Thanks to the use of interchangeable batteries, a fully green, uninterrupted power supply becomes possible. With silent operation, no fuel consumption, and low maintenance costs, Renset offers a versatile and environmentally friendly solution for professionals.

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mtu A Rolls-Royce solution

Rolls-Royce Power Systems presents MTU Energy Packs for the dynamic Dutch and Belgian markets, offering capacities from 150kVA to 2000kVA and energy storage ranging from 178kWh to 2200kWh. Our QGRID solutions redefine power capabilities, providing turn-key systems from 1MW to several GW for a new era of energy excellence. As a global industry leader, Rolls-Royce Power Systems boasts 40,000 employees across 30+ subsidiaries and a network spanning 1200 locations in 130 countries. Our commitment to excellence is unwavering, ensuring worldwide support for our customers.
In the heart of this transformative energy landscape lies Rolls-Royce Solutions Benelux, a proud subsidiary of Rolls-Royce Friedrichshafen. Anchored by a team of over 70 adept professionals, our presence in the Benelux region encompasses a spectrum of services, including engineering provisions, parts supply, logistics, sales, and project management. Strategically based in Dordrecht, we not only provide state-of-the-art systems but also turnkey projects, operating as a full-spectrum partner. From product supply and finance solutions to performance guarantees, EPC, and project operations, we tailor our offerings to your unique needs. Experience the assurance of our 24/7 field service, ensuring peace-of-mind wherever you are. Rolls-Royce Solutions Benelux is your trusted ally, leading the charge in innovative energy solutions.

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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 maximise throughput while minimising 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.
- Selenisation and crystallisation for CIGSe layers in S2S and R2R.
- Drying and sintering for printed electronics and Perovskites.

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SolarBEAT
SOLAR OUTDOOR RESEARCH FACILITY
TNO innovation for life
TU/e

SolarBEAT (Solar Building Elements Application Testing) is an internationally renowned research facility where innovative solar systems or products are tested and monitored in real life conditions, facilitating product development. Both solar thermal and solar electricity are within the scope of this test facility at the roof of the TU Eindhoven since its founding in 2014 by TNO and the TU/e.

At the facility, researchers, in collaboration with companies, conduct research into the functioning of complete systems and the individual components such as new solar panels, thermal collectors, combinations of these (usually abbreviated as PVT), (micro) inverters, smart PV windows, power optimisers, batteries and more in any stage of the product development. Typical research partners are product developers, architects, construction companies and installers. To do this research SolarBEAT uses flexible mounting options, highly accurate and calibrated measuring equipment, taking high-quality measurements 24/7.

The testing result and analysis can be used as input for performance models that are essential for the final business case and are crucial before market introduction. Besides, it can also be a showcase for potential customers of new solar energy systems on or in buildings.

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Solartechno is a specialist in producing battery energy storage systems (BESS) for residential as well as commercial clients. These systems can be used to store excess solar energy for later use. This can help to reduce reliance on the grid and lower the cost of solar energy. We make BESS from off the shelf components, as well as custom made turn-key components. Right now, we are exclusively using LFP battery cells in the BESS, ranging from 20 kWh to 250 kWh. For the smaller systems, we use outdoor cabinets for the batteries as well as the invertors. This makes it possible to have the whole BESS in one compartment.

For the bigger systems, we use 20ft containers where the batteries as well as the inverters are placed in, just like the smaller cabinets.

Most of our systems are preassembled at our facility in Zaandam, the Netherlands. This is an easy and fast way to install the BESS on the final location.

All our BESS are being made to be certified for PGS37-1 norm, which is the highest quality norm in the Netherlands. This means that the BESS are excellent protected right now, but also in the future.

Solartechno Europe also offers engineering and consultancy. We can handle the entire project lifecycle, from the technical-financial feasibility study, through to the definition of the technical specifications and system installation. In addition to building and installing BESS, we can also provide consulting services to investors.

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Solarwatt is the European market leader in glass-glass solar panels and the pioneer in residential electricity storage. The company was founded in 1993 and has its headquarters in Germany. Solarwatt has more than 800 employees worldwide employed and works with international organisations such as BMW and E.ON. In addition to the factory in Germany, Solarwatt has production sites worldwide where our products are made with Solarwatt's high quality standards.

Solarwatt is almost 100% owned by Stefan Quandt, also a major shareholder of BMW.

Through close cooperation with BMWi, Solarwatt has one of the most automated and innovative factories in the world. The entire production is carried out by smart robots that ensure constant high-quality production.

Solarwatt's product range consists of solutions to generate, manage and store renewable energy. This provides our customers with a perfectly aligned system that allows to take maximum advantage of solar energy, worry-free, and links the Solarwatt system to other renewable energy technologies.

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SOLYX ENERGY

Solyx Energy aims to help users of solar panels with better utilising their produced energy. Our products measure solar electricity sent to the grid via the P1 port or via a clamp connected to a sender placed in the fuse box. The measured excess energy is then used to heat tap water in an electric boiler, allowing for simple short-term energy storage. Not only does this reduce the need for gas, but the system also lessens the amount of electricity sent to the grid to lower the chance of congestion. Furthermore, by continuously measuring if electricity is sent to the grid, our products ensure that the boiler is heated with exactly the amount of excess electricity available. The system can also be utilised to heat water at specific times to make use of dynamic energy prices. Combining our products with heat-pumps is possible via special electric boilers and separate heating elements. A combination with city heating is also possible via a three-way valve and a temperature sensor. We primarily focus on delivery and distribution of our products rather than installations. Instead, we work with a network of technicians throughout the Netherlands and Belgium to take care of installations.

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SPIRIT
solar lighting

SPIRIT solar lighting is a pioneering force in the domain of public lighting, dedicated to deliver stand-alone products, powered by solar energy. With a mission deeply rooted in environmental responsibility, the company seeks to reduce carbon footprints and contribute to a cleaner planet. Their commitment to innovation, quality, and social responsibility defines their values.
The core of SPIRIT solar lighting's expertise lies in cutting-edge solar lighting technology – managing solar energy, battery technology with the result of lighting the precise area at the exact time as needed. The integration of solar panels in the vertical surfaces, energy-efficient LED lighting, and advanced energy storage systems forms the backbone of their solutions. This technological competence ensures optimal energy capture, storage, and utilisation, positioning SPIRIT solar lighting as an industry leader.
The product portfolio reflects versatility and adaptability, ranging from solar street lights to garden and pathway lighting. Noteworthy is the modular design, allowing scalability for projects of various scales. Beyond functionality, the company places emphasis on design aesthetics, ensuring their solutions seamlessly integrate with urban landscapes.
The impact of SPIRIT solar lighting extends beyond environmental conservation, reaching into community development. By reducing reliance on traditional grid-powered systems, the company enhances safety, promotes economic activities, and fosters educational opportunities, especially in off-grid or remote areas.

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Straightforward is an independent technical consultancy for photovoltaic (PV) projects, working for leading stakeholders in PV since 2008. Straightforward helps developers, investors, owners and lenders to realise successful solar energy projects. Straightforward strives to enter into long-term partnerships with its clients to help them realise bankable, reliable and safe solar PV installations.

The team consists of dedicated professionals: experienced, committed, objective and independent. Straightforward combines knowledge of basic functional principles, regulations, standards and best practices with extensive practical know-how. The in-depth expertise of Straightforward in all technical aspects of solar power helps its clients realise reliable and safe PV plants on rooftops, fields and water.

Elbert-Jan Achterberg, founder and director of Straightforward, is Member of the National standards Committee for solar energy systems, NEC 82 and of the international working group IEC TC64 / TC 82 Joint working group 32 electrical safety of PV system installations. On behalf of the industry association Holland Solar, he is a Member of the Scios Committee of experts (Scope 12 is a certified inspection system for solar PV plants).

Straightforward is SCIOS Scope 12 and VCA* approved. Straightforward is member of industry associations Holland Solar and Storage NL.

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Stratergy is an advisory firm that provides counsel on developing, financing, and operating sustainable energy projects, greening real estate, and the buying and selling of sustainable energy. Stratergy has extensive experience in developing battery projects, both stand-alone and in cable pooling, as well as behind-the-meter. At Stratergy, we organise training sessions on battery revenue models, both for in-house teams and through open enrolment. Stratergy's founder, Jan Willem Zwang, authored the 'Handbook on Battery Revenue Models' in 2022. This handbook can be downloaded for free from the Stratergy website.

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With nearly 20 years of experience in the PV industry, we have dedicated ourselves to shaping a sustainable future by providing progressive energy solutions.

With a team of dedicated experts, we go beyond technological expertise. Whether realising solar power projects for large-scale energy production or customised solutions for local businesses. Our focus is on making an accelerated contribution to the energy transition.

Our successful track record is the result of close collaborations with clients, partners and stake-holders. A collaboration with Sunprojects, means a partner who shares your vision and is committed to achieving your business goals.

Whether you are a business owner looking to reduce your carbon footprint ecological footprint, an investor looking for profitable sustainable projects, or a community striving for energy independence – Sunprojects is here for you.

Sunprojects has installed more than 500MWp of systems in the Benelux region. These projects range from rooftop, field, greenhouse, facade, carport and floating projects. In addition, we not only deliver your project but also take responsibility for maintenance and monitoring.

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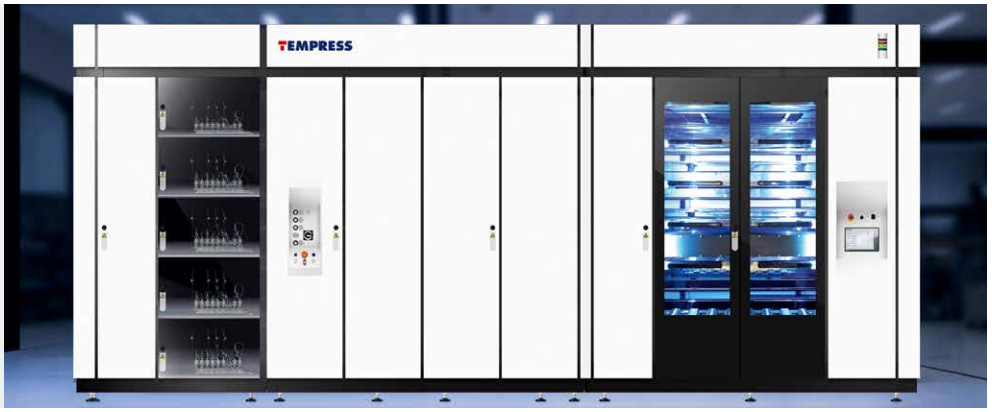

Tempress: The expert source in horizontal diffusion – and CVD furnace equipment. Ranging from small batch laboratory systems up to fully automated high volume manufacturing equipment. Besides the furnace equipment, we develop state of the art PV Cell Technology in order to provide our customers with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

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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 idenytify and access the right people with the right expertise.

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TNO innovation for life

TNO Energy & Materials Transition is a unit of the Applied Research & Technology institute TNO, its Solar Energy research group has been world leading since its start in 1990. TNO works with companies and universities to develop new technology for solar cells and applications, ranging from advanced cell technology (perovskites, tandem) to production technologies that can address the need for mass customised solar based solutions for building, infrastructural and transport domains. TNO's focus is to realise further cost reductions, performance increases and improved integration of PV in our living environment. With its research partners, TNO is exploring the possibilities for completely new, highly efficient solar cells architectures and module designs, and facilitating new applications for solar energy.

The unit Energy Transition of TNO covers research and innovation on a wide range of topics related to the energy transition, in our joint route towards a sustainable energy system. We are always eager to work together with companies, other institutes or governmental bodies, in innovation projects or studies:

- Scenario's for the future energy system
- Application forms of solar energy, such as building integrated PV or offshore solar
- Various forms of energy storage and their role in the energy system
- Advanced PV technologies, such as perovskites and tandem technology
- Circularity challenges

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VAN DER VALK
SOLAR SYSTEMS

Van der Valk Solar Systems is since 2009 one of the fastest growing companies in the solar industry and focuses entirely on the development and production of solar mounting systems for pitched roofs, flat roofs and open fields. Van der Valk Solar Systems is specialised in commercial and residential projects. Its customers are mostly wholesalers and major installers (EPC). Van der Valk Solar Systems also has an office and warehouse in the UK, offices in Sweden and Spain and is currently active in 13 countries.

Our mounting systems are developed and produced in our own factory in The Netherlands and stand out thanks to their broad area of application, the very short time in which they can be installed, and the high quality. They are developed according to the latest Eurocodes and therefore comply with the requirements defined for solar systems by banks and insurance companies.

Innovation is our passion and our strength. Innovation is a continuous process in our product development, but also in our business processes in general. By looking ahead and anticipating developments, we can maintain our strong position and always offer our customers more than they expect.

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VDL

VDL ETG Projects has a recognised track record in the design, realisation and turnkey delivery of prototypes, R&D equipment and first-of-a-kind production lines in various industries. For the solar business, VDL ETG Projects designed and built machinery for c-Si, a-Si, OPV, CIGS, perovskite technologies.

VDL ETG Projects is part of VDL Enabling Technologies Group (VDL ETG), which is a tier-1 contract manufacturer with more than 4,500 employees and worldwide operations. The main customers of VDL ETG are leading original equipment manufacturers (OEMs) and users of advanced production lines in many high-tech markets: semiconductors, analytical instruments, medical systems, aerospace, defence. VDL ETG manufactures complex parts, subsystems and fully-integrated equipment in six large factories located in The Netherlands, Switzerland, Suzhou (China) and Singapore, and has strong design and engineering capabilities to support customers throughout the entire lifetime of their products.

VDL ETG itself is part of VDL Groep, a Dutch industrial conglomerate with more than 100 companies, 16,000 employees and a combined annual turnover exceeding €5.7 billion. VDL Groep is a trusty and financially-healthy partner that also designs and builds its own electrical busses, provides contract manufacturing for automotive OEMs and automotive battery assembly, and manufactures a broad range of parts and products.

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Our extensive product range includes sine wave inverters, sine wave inverter/chargers, battery chargers, DC/DC converters, transfer switches, battery monitors, batteries, solar panels, solar charge regulators and many more. Victron Energy's innovative products play key roles in recreational and commercial boating, overland transportation, land-based off-grid energy systems, and industrial settings.

Our goal is always to marry technology to customer needs, and our experience allows us to look at the broad picture – as well as the details. Because we design new system solutions and all parts of the system, we can control quality and performance at every step. Our technological leadership is evident, including the PowerAssist functionality of our MultiPlus inverter/chargers and in the 4-stage adaptive charge curve of our Chargers.

Our sales managers and distributors are technically inclined. That foundation of knowledge and experience is our customers' assurance that we will be fully capable of helping them with any system or installation issue and provide first-line repair assistance. In the rare instance that a product must be returned to our premises for repair, it is usually shipped back to the customer within two working days.

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Established in 2019, Watts In Store stands out as a leading B2B battery solutions provider in the Netherlands, serving clients across the EU. With a team rooted in the battery and solar industry, Watts In Store has transformed into a comprehensive 'one-stop-shop', offering more than just batteries. their services encompass thorough analysis and proactive advisory support, EV charging solutions, Energy Management Software, and maintenance and monitoring for their batteries. Watts In Store's main mark focus is on Small and Medium-sized Enterprises (SMEs), logistics companies, and the real estate sector.

Their proactive approach addresses issues like strained power grids, surging energy prices, and the growing demand for sustainable, self-produced energy. At the core of their services is a commitment to simplicity and accessibility. This is exemplified by their commitment to providing customers with fully financed systems, eliminating the need for upfront investments, ensuring that the transition to sustainable energy solutions is within reach for all customers. Their main goal is to provide a seamless experience, making the journey towards sustainable energy solutions straightforward and efficient.

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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 facades, 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 facade is activated by the brilliant transparent solar panels, enabling the building to generate and save energy. At night, the facade 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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ZIGZAGSOLAR

ZigZagSolar stands for a patented technology that will revolutionise the global facade markets. Based on this technology, and the proprietary software, our licensed partners can offer special kits for installing high performance solar facades. Team ZigZagSolar sells products and offers engineering services, training and guidance. We support in architecture, facade technology, building physics, thermal insulation, energy efficiency and quality. We have an international presence. We support you in the design and realisation of superb solar facades. Thanks to the proven solar-trap-functionality the yield is up to 28% better. ZigZagSolar: Guaranteed – Affordable – Economic – Elegant – Energy. Our mission: make cities a better place to live in. We sell products and services with a clear focus on technical perfection and flawless execution. ZigZagSolar works on 8 different SDG's.

Our main benefits are:
- We bring affordable clean energy to cities with financially attractive solutions.
- We fight air pollution, climate change, power cuts and grid congestion.
- We save energy and create circular solutions for energy efficient buildings.

ZigZagSolar offers technologies for all types of facades. We offer matching add-ons and advise for a complete one-stop-shop experience. ZigZagSolar is integrated in the largest solar facade in the Netherlands. ZigZagSolar gives hard guarantees on the performance of its products. ZigZagSolar is preparing for a launch in international markets. We aim at local production. ZigZagSolar invites investors, distributors, partners and launching customers to contact us for getting acquainted.

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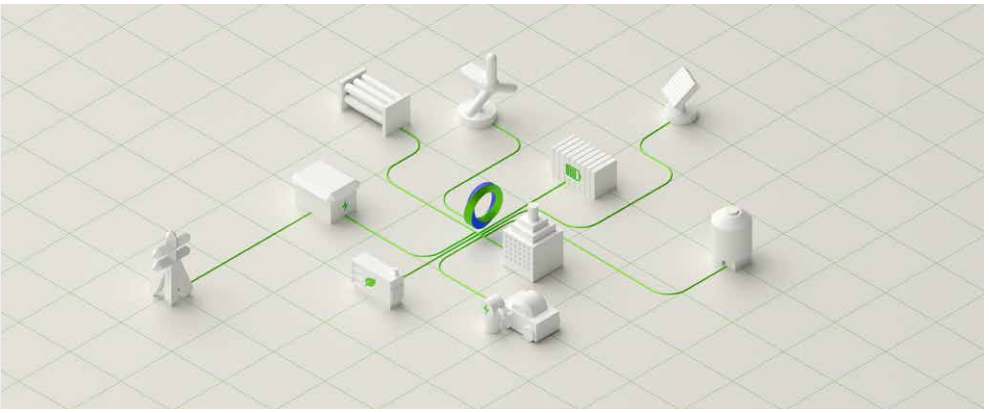

ZWART
When it matters most

Zwart makes energy self-evident. Due to the increasing energy demand and the unpredictable availability of solar and wind energy, the energy grid is under pressure. As a result, thousands of entrepreneurs are on the waiting list for a power connection to realise their ambitions. As an entrepreneur, that is the last thing you want. You want control over your ambitions, whether you aim to grow or become more sustainable. That's why Zwart develops smart energy systems that intelligently connect energy generation, storage, and management, giving you 99.999% energy security and putting you at the forefront of the energy transition.

Zwart has been ensuring energy security since 1930. We provide comprehensive energy systems for organisations and businesses where power outage is not an option, such as distribution centres, hospitals, and datacentres. Whoever you are, we think from A to Z with you. We assess your current and future needs and propose customised energy solutions. This allows us to accelerate energy availability by setting up a decentralised energy system. Peaks in consumption are managed, costs are saved by trading surplus generated energy, and your continuity is guaranteed by using a battery as an energy buffer.

For every challenge, we have the solution in-house. We not only come up with the concept and design for your energy system, but we also build and maintain it for an extra-long lifespan. Only in this way can we guarantee our Zwart quality, down to the last bolt.

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b=bottom, m=middle, t=top, l=left, r=right

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Holland Solar

Netherlands Enterprise Agency

ENERGY STORAGE NL

FME POWERED BY DUTCH TECHNOLOGY

Netherlands

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