VENSYS

VENSYS ENERGY AG

MORE ENERGY FOR OUR FUTURE

www.vensys.de

"The spirit of innovative development has been a permanent feature of VENSYS for three decades. Consistently optimized technology is the basis for high efficiency, operating safety and availability".

Dipl.-Ing. Jürgen Rinck, CEO

CONTENT

Genius lies in simple things.

J.W. v. Goethe

THE IDEA
Brilliantly simple

Fewer components, higher wind energy yield, reliable operation

VENSYS Energy AG with its head office in Neunkirchen, Germany, develops and manufactures gearless wind turbines, whose high-performance capability using a permanently magnet-excited multi-polar generator is the trademark of our company. Other distinctive features are the low-maintenance toothed-belt drive for the rotor blade adjustment, a simple generator cooling and the full power converter system which allows for a wide range of grid requirements to be met.

The special design of the turbines is based on a minimum number of high-quality and long-lasting components, with enhanced efficiency, low maintenance as well as the compact design and the advantages provided by the absence of any kind of wear ensuring higher yields.

We deliver the complete range: from the tower base to the tip of the rotor blade

All the core components of VENSYS wind turbines are designed by our experienced engineers and manufactured in different production facilities of the VENSYS Group. While the **full power converter** and the special electrical **pitch system** are produced at Vensys Elektrotechnik in Diepholz, the **multi-polar generator** is assembled in Neunkirchen. Production of our **rotor blades** for different power classes is carried out by E-Blades, our subsidiary in Spain.

It is this interaction of perfectly-coordinated key components paired with our own **turbine control system** which guarantees reliable engine technology – made by VENSYS.

COMPANY HISTORY

Technological success through innovations

Decades of experience in permanent magnet technology

As a spin-off of the University of Applied Sciences of the Saarland, VENSYS revolutionized the technology of generating electricity through wind energy, using a completely new concept. Right from the start, we focused on development of gearless wind turbines.

The establishment of VENSYS Elektrotechnik GmbH in 2008 enabled us to step up efforts to design and manufacture tailor-made converter and blade pitch systems. Our own rotor blade production facility in Spain – Eblades Technology, founded in 2016 – further enhances vertical integration with ever more core components produced by VENSYS.

A wellspring of state-of-the-art wind energy generation worldwide

International licensees have been driving the expansion in the growth markets of the wind energy sector since 2002. VENSYS technology has thus stood the test of time – over and over again under different environmental conditions. The global expertise thus gained is harnessed to steadily improve design and optimize yields.

Proximity to research and development strength make VENSYS a popular partner when it comes to pilot projects, with a wooden tower from TimberTower, which was realized using a VENSYS 1.5 MW turbine, a prime example.

VENSYS corporate head office in Neunkirchen/Germany.

Research, development, production ...

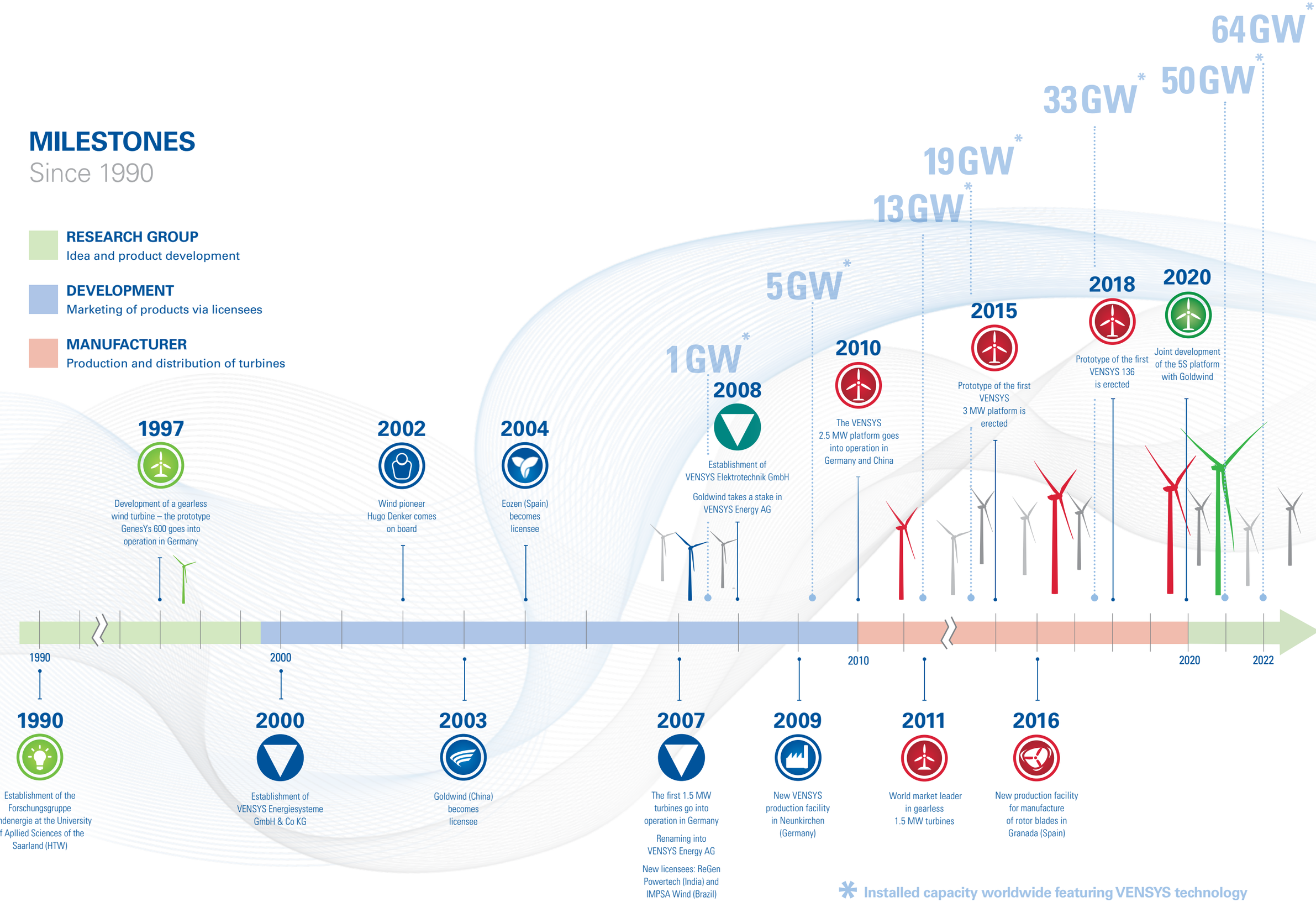
... everything under one roof, at the company head office in Neunkirchen/Germany.

MILESTONES
Since 1990

RESEARCH GROUP
Idea and product development

DEVELOPMENT
Marketing of products via licensees

MANUFACTURER
Production and distribution of turbines



1990
Establishment of the Forschungsgruppe Windenergie at the University of Apllied Sciences of the Saarland (HTW)

1997
Development of a gearless wind turbine – the prototype GenesYs 600 goes into operation in Germany

2000
Establishment of VENSYS Energiesysteme GmbH & Co KG

2002
Wind pioneer Hugo Denker comes on board

2003
Goldwind (China) becomes licensee

2004
Eozen (Spain) becomes licensee

2007
The first 1.5 MW turbines go into operation in Germany

Renaming into VENSYS Energy AG

New licensees: ReGen Powertech (India) and IMPSA Wind (Brazil)

2008
Establishment of VENSYS Elektrotechnik GmbH

Goldwind takes a stake in VENSYS Energy AG

2009
New VENSYS production facility in Neunkirchen (Germany)

2010
The VENSYS 2.5 MW platform goes into operation in Germany and China

2011
World market leader in gearless 1.5 MW turbines

2015
Prototype of the first VENSYS 3 MW platform is erected

2016
New production facility for manufacture of rotor blades in Granada (Spain)

2018
Prototype of the first VENSYS 136 is erected

2020
Joint development of the 5S platform with Goldwind

* Installed capacity worldwide featuring VENSYS technology

OUR SERVICES

Development, production, optimization

Products with the quality seal of German engineering

Our own engineering in our head office in Germany provides the interface between permanent development work and the quick transfer of its results into VENSYS products. The production in serieses follows the concept of craftsmanship. We value high-quality, durable parts, solid workmanship and elaborate quality management. Our production philosophy also gives us the flexibility for project-specific adaptations and short delivery times geared to the needs of our customers.

Wind turbines from our German production facilities are connected to the grid in Germany, Poland, France, the UK, Ireland, Spain, Cyprus, Egypt, the USA, Canada and Belarus. Additional markets are being developed.

Added value through individual project management

Customer orientation is a pervasive feature of VENSYS wind energy projects – be it planning processes geared to individual requirements, tailor-made turbine configurations, or support extending over a project´s complete operating life. We deliver product variants for every environment and facilitate project-specific adaptations to complex location requirements.

Individual project support is where our strength lies, ranging from the small wind park and supply solutions for companies all the way to the incorporation of local interests into Community Scales. The end of the process invariably sees technically sophisticated solutions in close cooperation with our know-how carriers and decision makers.

Production of VENSYS platforms at the company head office in Neunkirchen/Germany.

Project management – Individual, worldwide.

Flexible manufacturing in small series – always close to the customer and new developments. Shown here is a VENSYS 77 featuring a wooden tower from TimberTower.

THE VENSYS CORPORATE FAMILY

A strong alliance

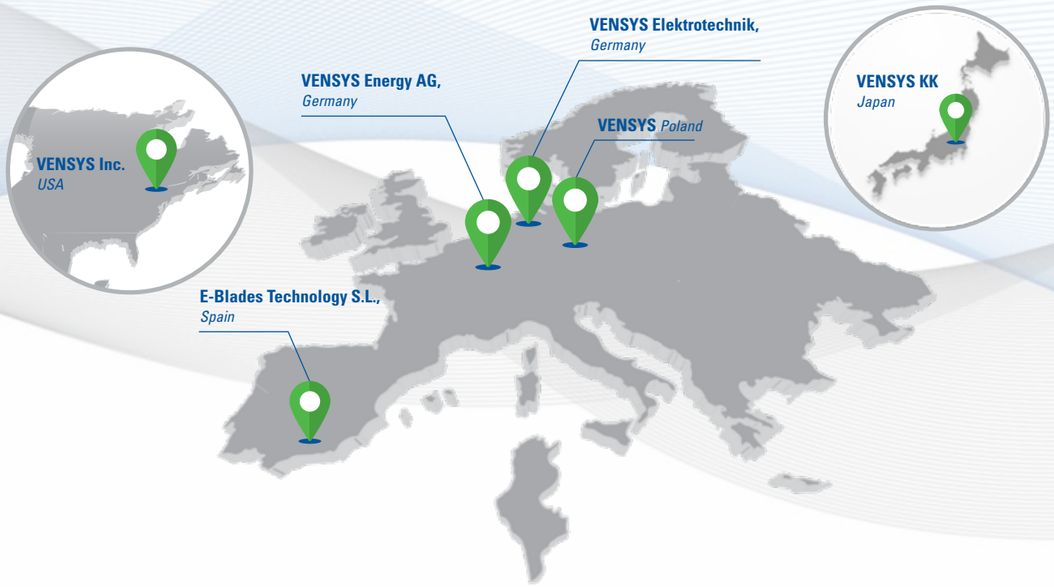
Integrated solutions with a high level of added value

The companies in the VENSYS corporate family perfectly interact to provide all the expertise necessary to deliver integrated wind energy systems. Our subsidiaries complement our core portfolio for project-specific comprehensive solutions that feature a high level of functionality. The know-how of different specialists is pooled to provide fully-optimized wind turbines with flexible options.

Growing vertical integration means that VENSYS can further develop key turbine components in close cooperation with all parties involved, facilitating adaptations for individual turbines as part of a project management that is always geared to the customer´s needs as well as groundbreaking hybrid solutions.

Advantages extending over the complete supply chain

We constantly monitor our standards of high quality, reliable availability and high efficiency – over the complete supply chain and for the duration of a turbine´s life cycle. Production in our own facilities makes sure we can deliver reliably and on time. The biggest advantage for our customers lies in the seamless interaction of all performance-related components, right from the appropriate planning process and the commissioning of turbines all the way down to our reliable service.



VENSYS Energy AG (Germany)
Company head office and interface of the VENSYS Group: research, development and production all incorporated in one location | ***Established:*** *2000*

VENSYS Elektrotechnik GmbH (Germany)
Production of full power converters, pitch systems and all other electrical system components | ***Established:*** *2008*

E-Blades Technology S.L. (Spain)
Production of rotor blades, adapted to the different VENSYS platform types | ***Established:*** *2016*

VENSYS Inc. (USA / North America)
Distribution and service point for the USA and Canada; erection of and service for VENSYS wind turbines | ***Established:*** *2015*

VENSYS Energy AG (branch office Poland)
Distribution and service point for Poland and Eastern Europe; erection of and service for VENSYS wind turbines | ***Established:*** *2015*

VENSYS Energy AG (branch office Japan)
„VENSYS Japan Inc.“ was founded especially for Japan to guarantee all-round service
Established: *2021*

OUR PARTNERS
VENSYS licensees

Technology “made in Germany” – used all over the world

Our most important licensees Goldwind and ReGen Powertech are global players in the world´s wind energy markets. As multipliers they manufacture VENSYS turbines for international demand. Goldwind, which boasts many production facilities in China, erects wind parks in Asia, the USA, South America, Australia and Africa. ReGen Powertech is developing a sustainable wind energy supply in India and Sri Lanka, using VENSYS turbines in the process.

VENSYS wind turbines are successfully connected to the grid in 25 countries on five continents, even under the severest climate conditions and in regions with poor infrastructure. Wherever they stand, our turbines are supported by regionally adapted service provisions and customer-oriented logistics.

Synergies of a strong partnership

Our successful licensing model combines the technological advantage of a German company led by engineers with worldwide production and global marketing.

As a center of excellence, VENSYS supplies innovative technology, know-how and comprehensive technical support for a global company network.

The capacities of our partners in industrial manufacturing and their potential when it comes to market penetration and logistics enhance our resources, enabling us to implement our own major projects even on a global scale.


China

Proven time and time again – The 1.5 MW platform made by Goldwind in China, under licence from VENSYS.


India

As of today, ReGen Powertech has erected more than 7200 turbines – all of them featuring VENSYS technology.

Project management – individual, worldwide.

Shipping of tower segments for a wind park project with ten VENSYS 82 turbines in Rhode Island, USA.

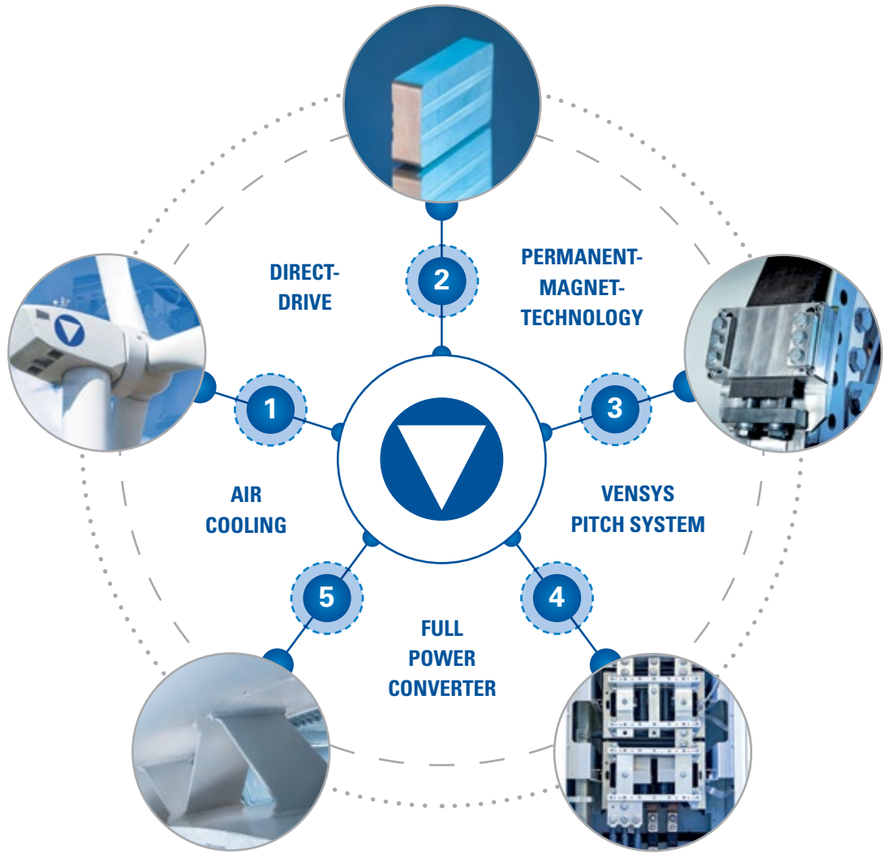
TECHNOLOGY
Five key features

Maximum yield

VENSYS technology is based on the idea of generating a maximum amount of energy while minimizing losses at the same time. Distinctly higher efficiency with increased yields and enhanced economy due to maximum availability are characteristic of this approach.

Few low-maintenance components

VENSYS has simplified wind turbines in a revolutionary way. A small number of remaining parts have been consistently improved in terms of performance, service life and durability, resulting in extra quality in addition to savings in manufacturing, assembly and operation.



Proven time and time again

What counts on the island of Cyprus is simple, high-quality technology with low maintenance requirements.

Important and robust

View of the generator winding: It is perfectly suited to use in virtually all regions.

TECHNOLOGY 1

The generator

All the advantages of gearless machines

Wind turbines designed by VENSYS work without gear boxes that require a lot of maintenance and are prone to wear. They save on elaborate technology and do not require environmentally hazardous lubricants or consumables, making safe and economical operation going hand in hand.

VENSYS combines the advantages of gearless technology with the generator concept of a synchronous machine with permanent magnet excitation. The rotor speed is transferred directly to the multi-polar generator – without any excitation losses. The gearless technology design concept used by VENSYS thus leads to high wind yields and high returns.

High performance in spite of a low tower head mass

VENSYS turbines are equipped with a directly driven, permanently magnet-excited synchronous generator. The high-quality permanent magnets are fitted on the inside of the cover of the rotor, reducing heat losses in the generator and providing for simple and efficient cooling.

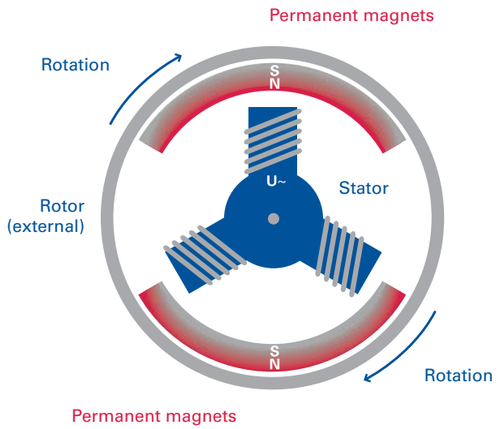
The shape of the external rotor supports a compact design, making the best possible use of the tower head volume. A maximum generator diameter can be achieved on a reduced surface – yet another aspect why VENSYS is synonymous with enhanced efficiency.

Direct drive technology without compromises. The power of the rotor is directly transferred to the generator – there is no need for gear boxes that are prone to wear.

Gearless VENSYS wind turbines are now produced on several continents – shown here is the ReGen facility in India.

TECHNOLOGY 2

Permanent magnet technology



Simplified illustration of the working principle of a permanent magnet generator
Permanent magnets fixed alternately to the (external) rotor rotate around a stator (shown here with three windings). All VENSYS wind turbines are designed according to this basic principle.

High efficiency = higher yield

VENSYS utilizes permanent magnet technology known from electric drives in navigation and electric vehicles with a tailor-made turbine design concept for wind energy purposes.

The robust VENSYS generators bring together three decades worth of know-how in independent research work on permanent magnet technology. The generators of the 3.5–5.8 MW platforms are performance-optimized enhancements with an even larger diameter and greater length yet lower speed.

No excitation losses = even higher yield

Unlike electrical excitation, permanent magnet technology does not have the disadvantage of excitation losses. The savings in excitation power are thus fully available as additional energy yield in VENSYS wind turbines.

This leads to improved efficiency, in particular in the low or partial-load range. In addition, there is no need to transfer the excitation power by means of slip rings, which saves on complex turbine components and reduces production and operation costs.

Neodymium-iron-boron

This magnet in the VENSYS rotor saves excitation power and tower head mass.

Blade pitch system

VENSYS components are durable and display a high level of workmanship – shown here is the blade adjustment system using a toothed-belt drive.

TECHNOLOGY 3
The blade pitch system

Low-wear and low-maintenance toothed-belt drive

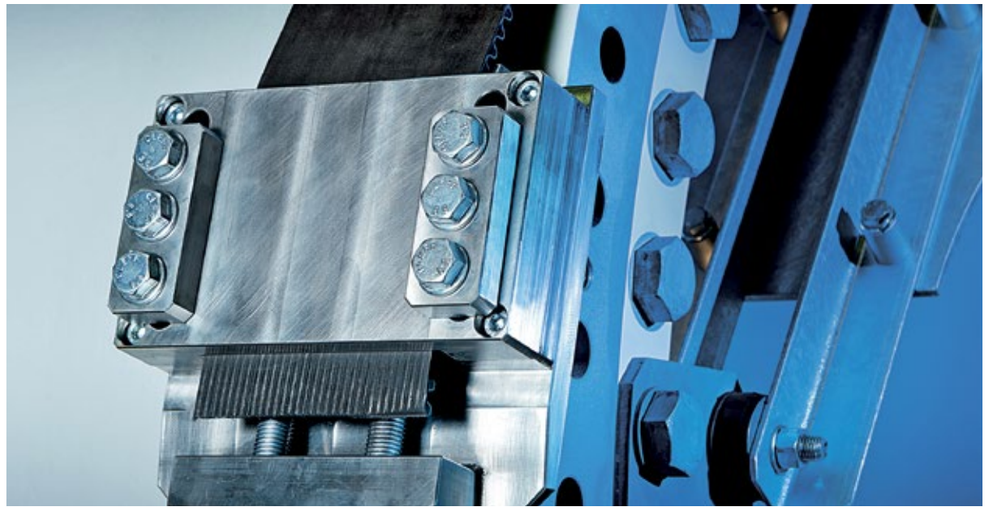
One special technical feature of VENSYS wind turbines is the lubrication-free toothed belt for transmitting the force between the pitch drive and the rotor blade. Our extremely durable drive system thus prevents wear as a result of corrosion or pitting.

The pitch system works virtually maintenance-free. The toothed belt is also impervious to shock thanks to integrated special carbon fiber which can be easily exchanged if the need arises. The variable-speed rotor blade drive ensures very good incident flow even in the partial-load range.

Increased safety and long-term cost advantages

Triple redundancy increases safety. Additionally, the drive of each rotor blade comes with an energy storage device (capacitor) to ensure that in the event of power failure the rotor blades can safely be driven into braking position. The long-life capacitors deliver the required power even in low temperatures.

Our patented toothed-belt drive for the blade pitch system has stood the test of time: for more than twenty years it has been used reliably in the most diverse locations: impervious to moisture, dirt and ever-changing temperatures as well as constant exposure in areas with strong and turbulent winds.



The triple redundant VENSYS blade pitch system is operated via the low-wear and low-maintenance toothed-belt drive.

TECHNOLOGY 4

The full power converter system

High flexibility and adaptability

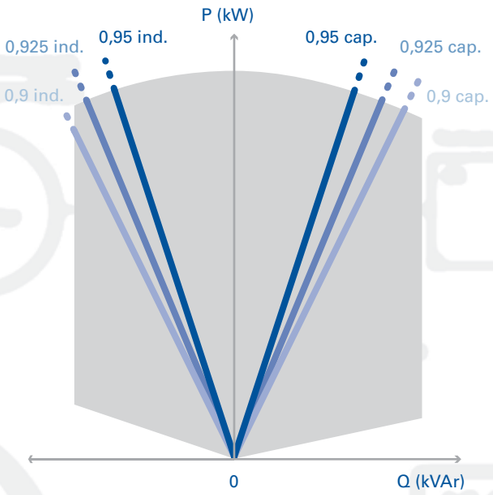
Feeding in short-circuit current, quick separation from the grid, and bridging short-term voltage drops and sudden voltage rises in the grid: All these are power plant properties that distinguish VENSYS converter systems, making them suitable for universal grid connections.

The total power produced is directed via the VENSYS converter, which makes it possible to decouple the generator effectively from the grid. Power network disturbances and voltage fluctuations thus do not affect the control behavior of VENSYS wind turbines. The converter can even support weak grids.

Meeting all grid requirements

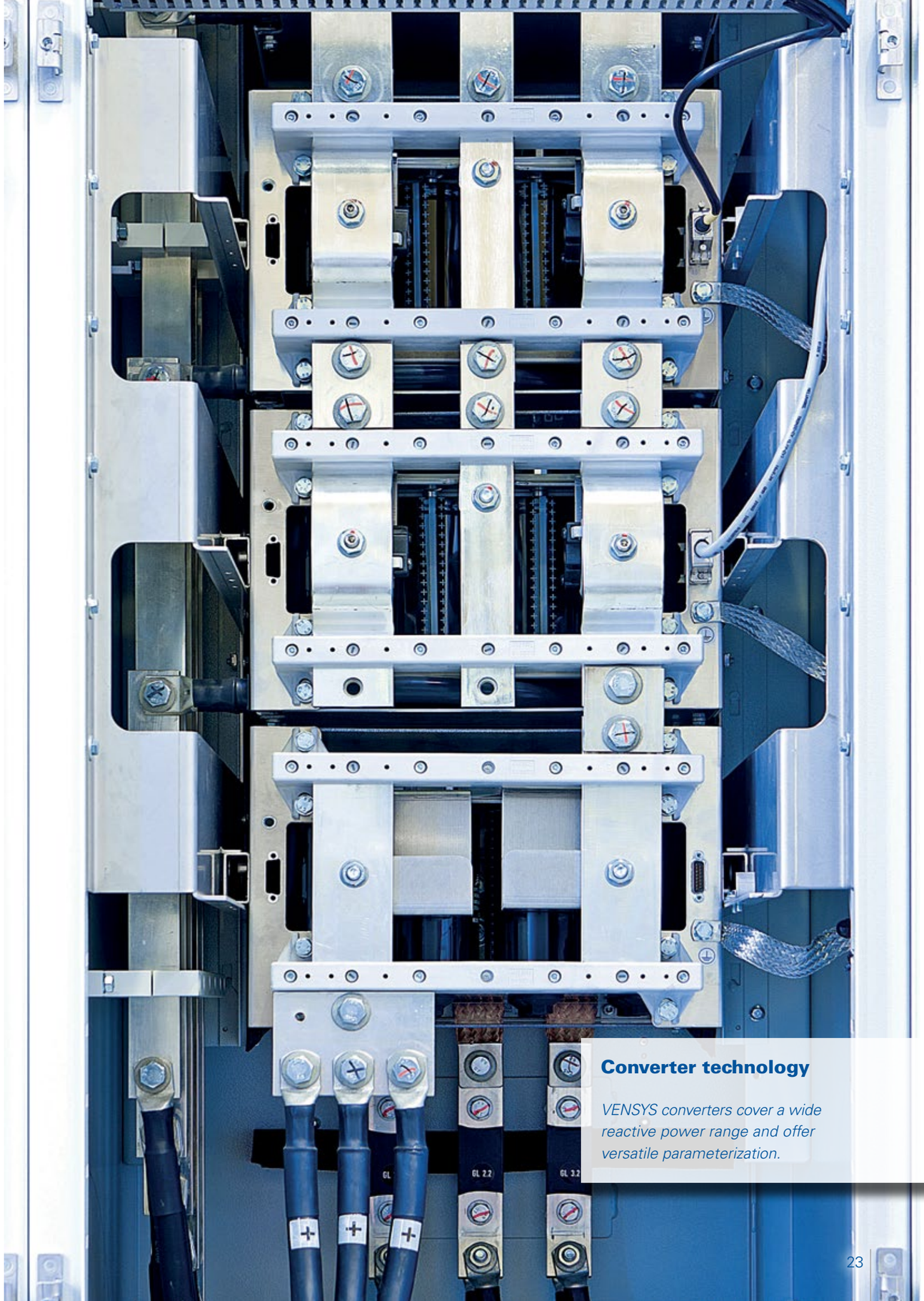
The converter technology designed by VENSYS is an all-in-one system which can be parameterized individually, which means that it adapts flexibly to the most diverse requirements and guidelines. The regulations of grid operators or direct marketers are complied with under the widest possible range of grid requirements. The converters have stood the test of time all over the world, even in grids with poor infrastructure.

The whole power electronics system, including the converter and the transformers, is housed in the tower base where it can be easily maintained and does not take up too much space.



Active power and reactive power

Depending on the areas shown, reactive powers (Q) can be requested through external specifications (P) (qualitative presentation)



Converter technology

VENSYS converters cover a wide reactive power range and offer versatile parameterization.

TECHNOLOGY 5
The generator cooling

Air cooling: simple, clean, easy to maintain

The generator is one of the core elements in the nacelle of any wind turbine. Generating electricity always entails heat losses, causing the copper windings to heat up. To prevent damage to the generator, the heat must be dissipated. To do so, VENSYS relies on a simple and efficient air cooling method. The generators of the 1.5 MW platform are cooled using a passive, maintenance-free air circulation system without any moving parts.

Fully encapsulated and innovatively cooled

The cooling concept has been taken to an even more sophisticated level to suit the needs of the 3.5–5.8 MW turbines. The result: An active air cooling system fully encapsulated from the external environment featuring an air-to-air heat exchanger. In a closed circuit clean air flows through the stator winding and dissipates the heat where the highest temperatures occur. Full encapsulation protects the winding as well as the interior of the generator from outer influences such as salty and humid air, dust and dirt.

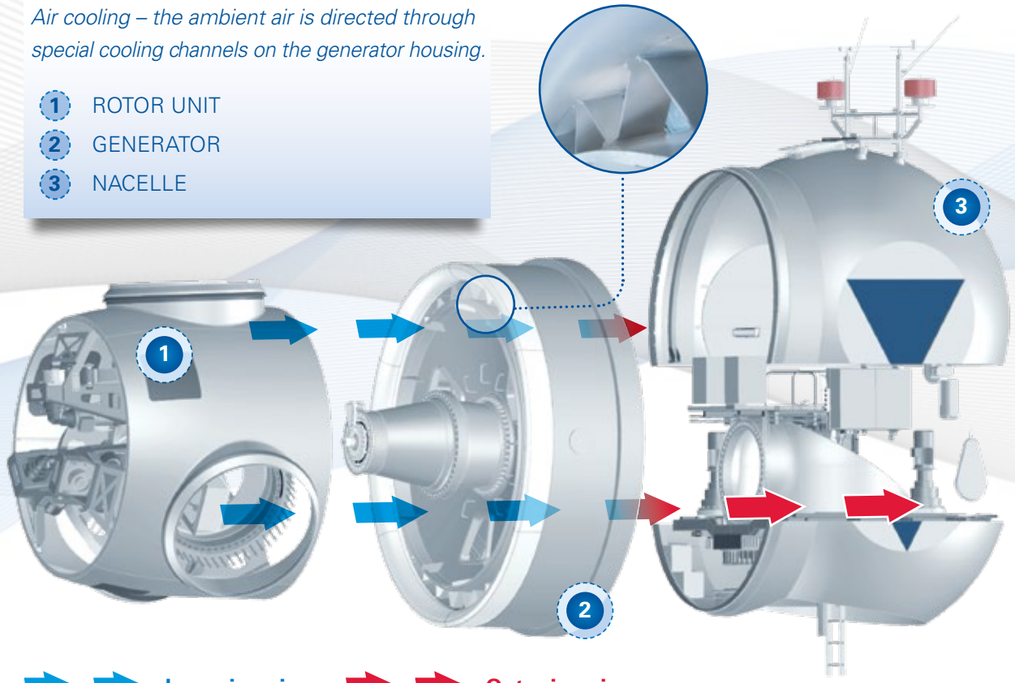
Uncompromisingly eco-friendly

An equally robust and effective system which completely dispenses with additional working materials such as cooling liquids or oils. The frequency converter is also air-cooled, making VENSYS turbines suitable for ecologically sensitive locations.

1.5 MW PLATFORM

Air cooling – the ambient air is directed through special cooling channels on the generator housing.

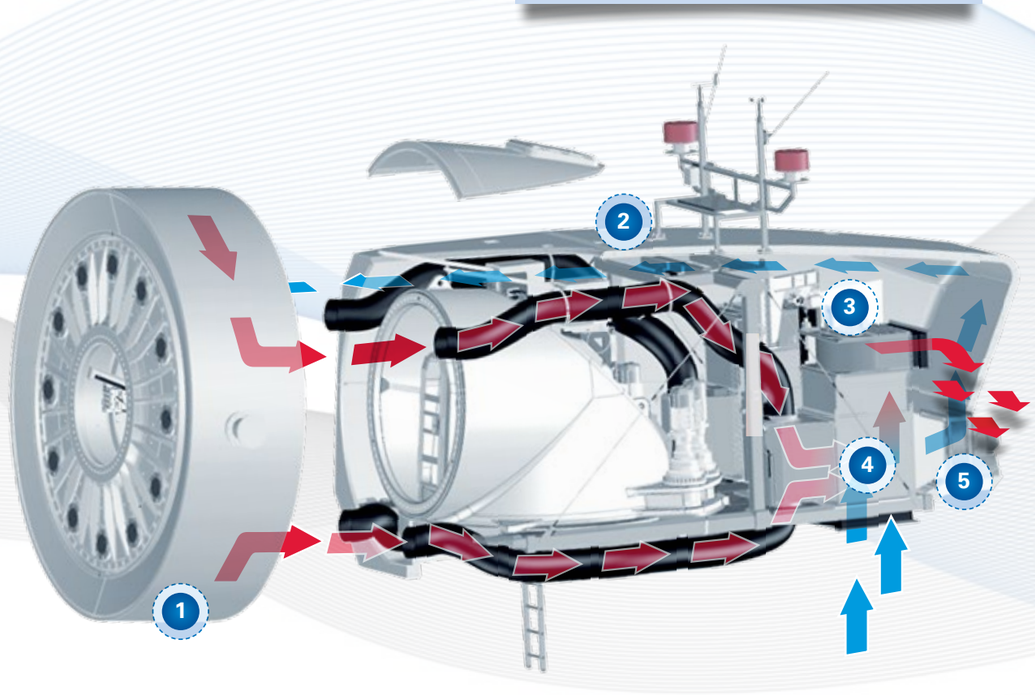
1. ROTOR UNIT
2. GENERATOR
3. NACELLE



3.5 – 5.8 MW PLATFORM

Air cooling for the VENSYS 3.5 – 5.8 MW platform with two circuits.

1. GENERATOR
2. NACELLE
3. MOTOR EXTERNAL COOLING CIRCUIT
4. HEAT EXCHANGER
5. MOTOR INTERNAL COOLING CIRCUIT



THE VENSYS PRODUCT RANGE

A tailor-made solution for every requirement

High yields in every location

Two platforms featuring variable tower heights and rotor diameters as well as generators that come with different performance ratings provide for configurations that are always perfectly geared to the site-specific requirements, making the best possible use of wind yield potentials for all wind classes even in areas with poor wind conditions.

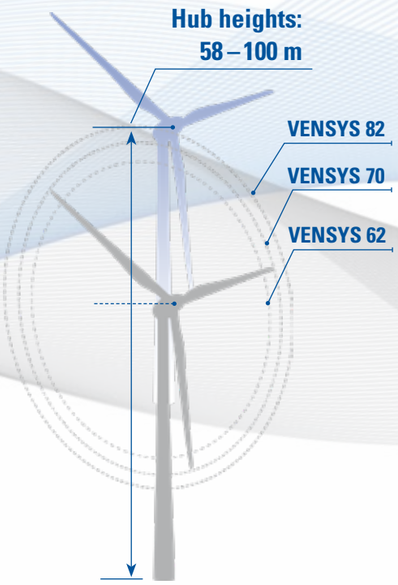
In addition, VENSYS erects a variety of tower systems and has extensive experience of up to 160-meter hybrid towers and single-blade assembly in a demanding construction environment. Another location advantage is the low level of sound emissions.

Optimized to meet project requirements

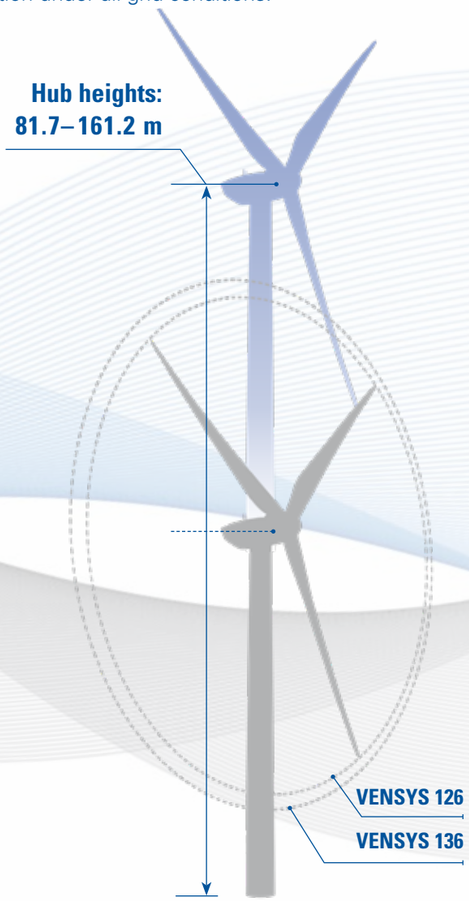
Our robust turbines have stood the test of time all over the world, not only in extreme climates and where infrastructure is poor. The parameterizable VENSYS full power converters ensure safe operation under all grid conditions.

Individually planned

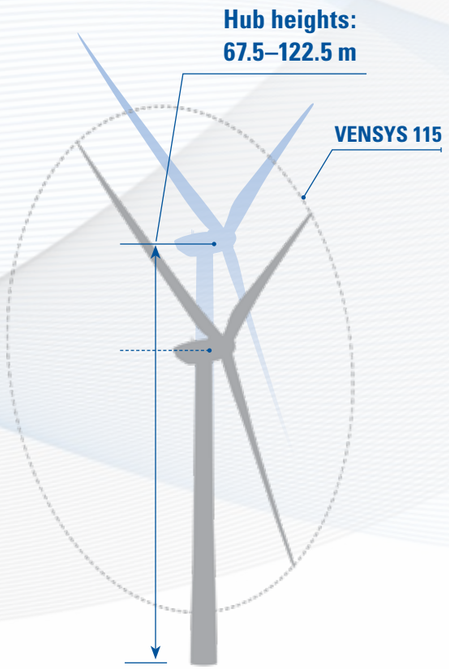
Municipalities, industry and investors can rely on VENSYS as a service-orientated project partner, which includes individual adjustments and technical adaptations.



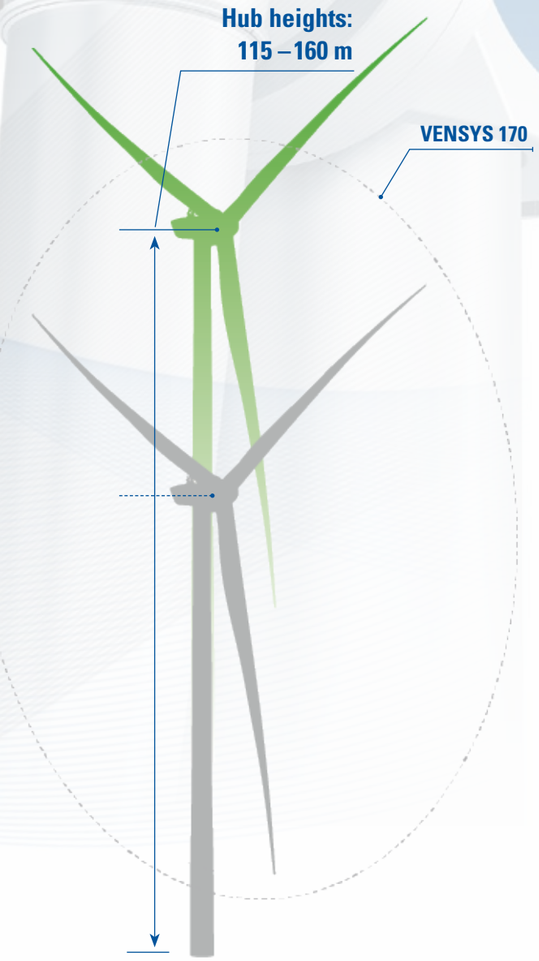
VENSYS 1.5 MW
Wind classes IA, IIA, IIIA



VENSYS 3.5–3.8 MW
Wind classes IIA, IIIA



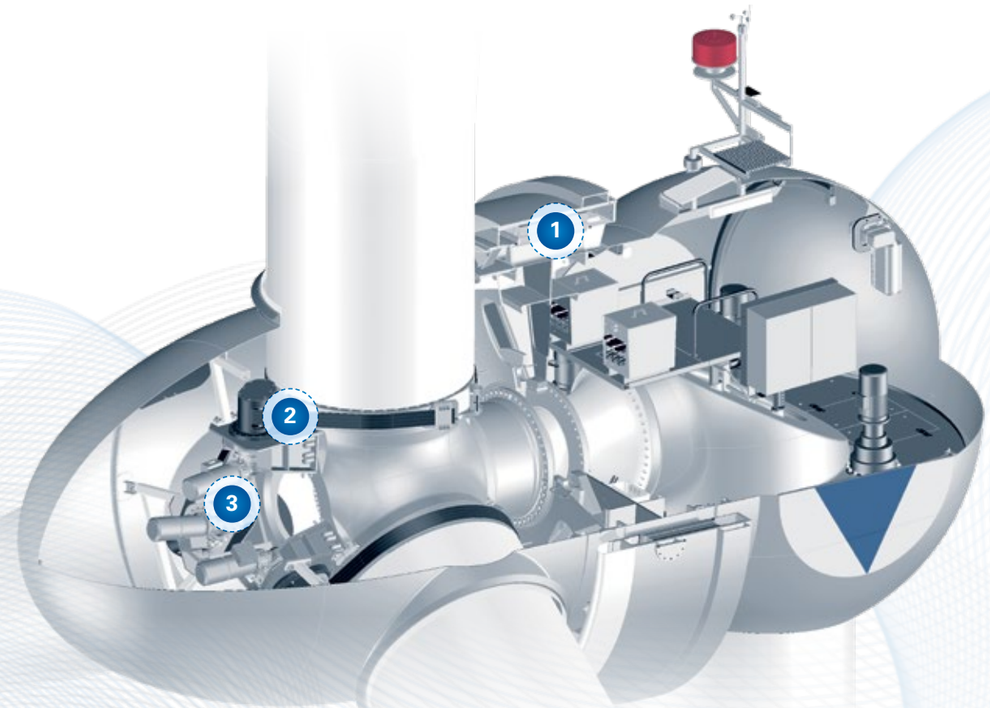
VENSYS 4.1 MW
Wind class IIA



VENSYS 5S (5.8 MW)
Wind class IIIA

VENSYS 1.5 MW PLATFORM

The successful one



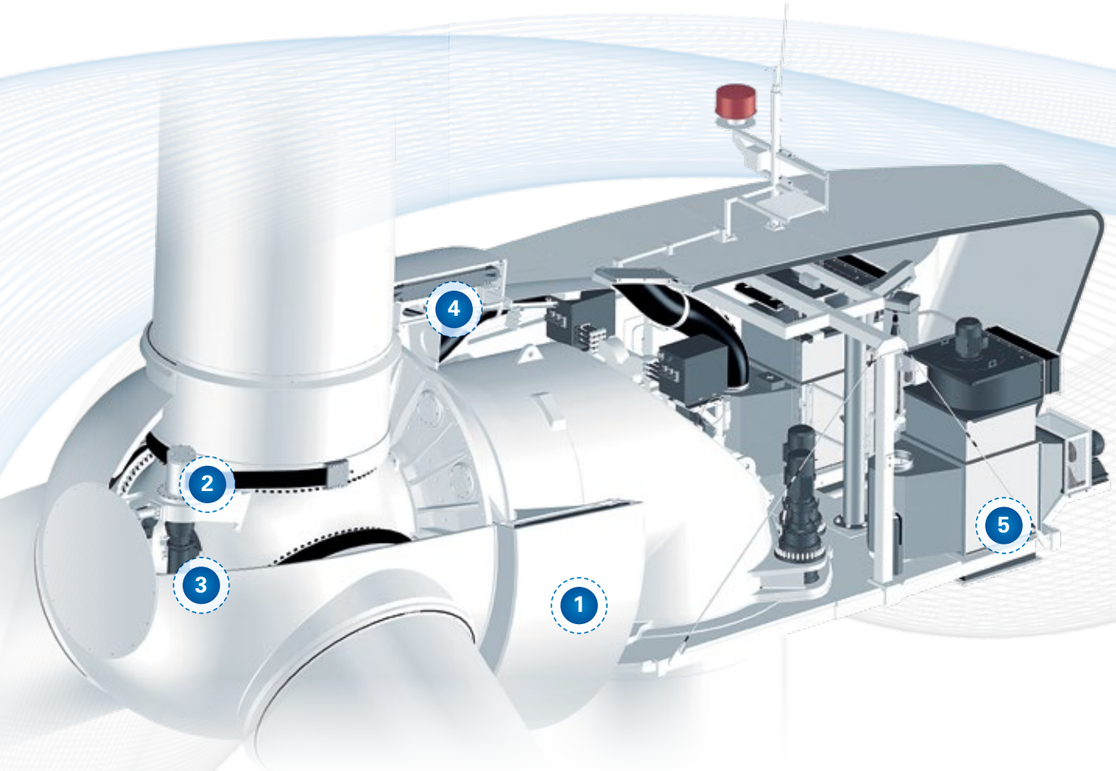
1 PM generator
- High efficiency through permanent magnet technology
- No power loss through separate excitation; a particular advantage in the partial-load range
- Low-maintenance
- Low-voltage-ride-through technology
- **1.5 MW:** passive cooling – no power loss resulting from an active cooling system
- **3.5 MW–5.8 MW:** closed generator cooling system (air-to-air heat exchanger)

2 Rotor blade adjustment drive with toothed belt
- Compact and efficient design
- No lubrication necessary
- Impervious to humidity and dirt
- Low-maintenance and durable
- Can be easily exchanged

3 Pitch drive
- Capacitors for emergency power supply
- Temperature-insensitive
- Long service life

VENSYS 3.5–5.8 MW PLATFORM

The favorite for the multi-megawatt class



4 Integrated rotor bearing
- Grease-lubricated double-row tapered roller bearing
- Specifically light supporting structure
- Compact design, easy access to the rotor area

5 Air-to-air heat exchanger
- Simple and robust design of the cooling system – no additional cooling agents necessary

Simply better technology

The VENSYS 1.5 MW platform is the world´s best-selling 1.5 MW turbine of our time. All around the globe with far more than 11.000 installations. Innovative and proven time and time again.

Despite a remarkable increase in performance, the VENSYS 3.5 – 5.8 MW platforms remains a very compact design. Featuring rotor diameters of 115 to 170 meters, VENSYS wind turbines can be used in virtually all strong and weak wind zones.

The most diverse assembly techniques ...

... are used by VENSYS to meet the demands of a wide range of different locations.

SERVICE

Our comprehensive care-free package

From the planning stage to reliable operation

Customer-oriented project management aims at trouble-free operation right from the start. We offer our customers location-adapted wind energy converters as part of an all-inclusive package which contains delivery and erection plus comprehensive service with guaranteed availability. We master all assembly techniques, all tower variants as well as the whole range of sophisticated logistics.

All over the world, VENSYS service staff and partners ensure the professional set-up, grid connection and consistently profitable operation of our customers´ turbines. The reliability that comes as a result of our construction principle and the low maintenance requirements of our product enable us to offer attractive service agreements: simple, transparent, customer-friendly and at a reasonable price – typically VENSYS.

Reliability and availability – around the clock

Harvesting the wind at full capacity for many decades – that is what the VENSYS service concept is all about: permanent monitoring keeps a close eye on the operating states of the turbine and generates the data for systematic optimization. It allows us to actively intervene via a remote maintenance system to guarantee availability – any time and at any location in the world.

Operators can also keep up to speed on the operating state and productivity of their turbine – whenever they like and with a maximum of available data.

The service center is the competent place to turn to for all technical questions. Servicing is coordinated here, with cooperation partners worldwide carrying out maintenance work on site if the need arises.

Our full maintenance agreement includes constant operational control, all inspections, preventive maintenance, repair work and a availability guarantee.

Our competence center in Neunkirchen is the place where we train and qualify our staff and partners, making sure that service and technical support are always of the highest quality.

VENSYS TECHNOLOGY

Worldwide

Overall installed power: more than 65,000 MW

VENSYS wind turbines in MW*
according to countries or regions

*Last updated: 05/2022

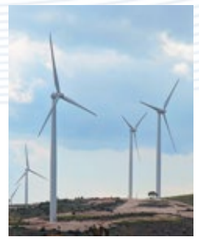
Egypt

Brazil

China

Germany

India



Cyprus

2009 Mongolia

2012 Egypt, Safaran

2011 Brazil

2011 India

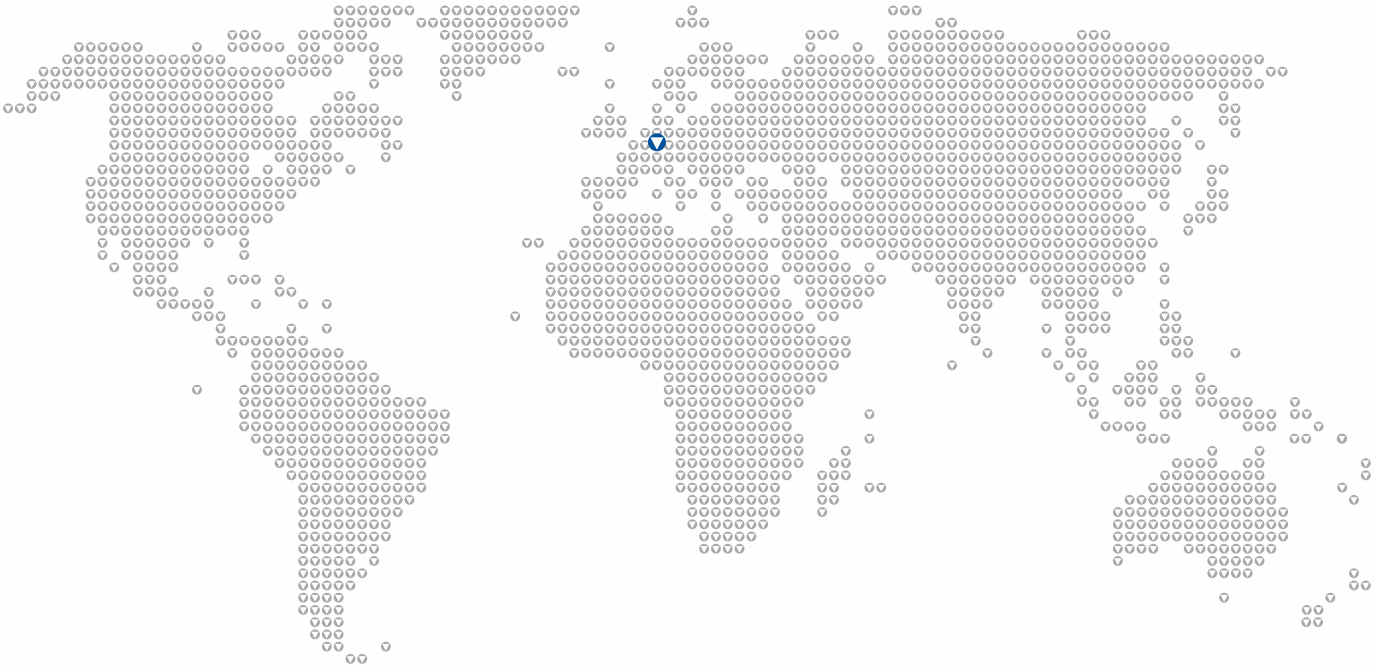
2014 UK, Quarrendon

2013 Germany,
Titting, Bavaria

2011 Cyprus, Alexigros

2014 Germany,
Losheim, Saarland

2011 China



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