CHAVA Windleaf2500

CHAVA WIND –
THE ART OF WINDPOWER

... energy in harmony with nature

... the convergence of economics,
solid engineering and aesthetics

WWW.CHAVAWIND.COM

CHAVA Windleaf2500
Our Mission

Providing the world with a point-of-use wind generator that finally finds widespread acceptance by combining functionality and economics with aesthetics and art.

Hagen Ruff
Founder and CEO CHAVA WIND

ELEGANT ENGINEERING

CHAVA WIND'S innovative engineering solution for a Vertical Axis Wind Turbine combines German Engineering and American Innovation. It avoids premature bearing failure by spreading both horizontal and vertical bearing forces along the entire length of its axis, causing lower vibrations, greater durability, increased safety and a lift system not found in other Vertical Axis Wind Turbines.

With a length of 30 meters, including the mast, and a roughly 9 meter turbine diameter, CHAVA WIND enables economic success for investors and developers, combining up to 44% peak efficiency with competitive pricing.

The fundamental advantage of a Troposkein airfoil shape is the fact that it is only subject to tension forces during rotational motion and hardly any bending forces.

THE BEST ROI

CHAVA's VAWT (Vertical Axis Wind Turbine) Troposkein design is fine-tuned to enable the long-awaited commercial viability of VAWTs.

With the latest advances in composite materials and fabrication methods, CHAVA WIND has overcome key challenges and achieved a highly efficient, robust design at low cost and high structural reliability.

This combines classical advantages of VAWTs (much lower noise and bird kill, no yaw system by taking wind from all directions, and better aesthetics) with the efficiency and reliability of common HAWT systems.

In good wind areas a return on investment (ROI) can be achieved in as little as 6 to 8 years.

FUTURE GREEN DECENTRALIZED ENERGY PRODUCTION

Small" Wind turbines are an investment in the preservation of planet earth's natural resources and beauty while creating some "independence" from central energy providers.

The "point-of-use" deployment allows for customers to save on expensive retail cost of electricity (or even more expensive off-grid fossil generator production) compared to whole-sale pricing of large 'grid-tied' wind-turbines which require long term power purchase agreements to sell their output to utilities.

We believe that clean energy doesn't have to sacrifice the beauty of nature and that wind turbines can be integrated into our landscape as innovative landmarks.

In some regions of the world people have been pushing back on excessive deployments of large HAWT Wind turbines. It is our mission to provide future generations with grid-independent clean power, without invasive impact on the beauty and erenity of nature.

Quick installation, superior design and efficiency

DIFFERENTIATORS OF CHAVA WIND TO OTHER VAWTs IN THE MARKET

- First ever VAWT in this class to obtain the industry's 'gold standard' Type certification by the international IEC 61400-2 standard.
- Lift-Design VAWTs are the most efficient VAWT design but they will only operate well with sophisticated speed control. CHAVA WIND is the first VAWT with permanent computer controlled speed monitoring and adjustment to maintain optimal efficiency.
- Rotor blades inspired by nature according to the geometric troposkein shape, which support centrifugal forces only with tension, avoiding the problematic bending and shear forces that have plagued most Lift-Design VAWTs in the past.
- Aesthetic design, which optimally integrates into the environment. Small Wind Turbines in this class are still visible and customers want to make a statement.
- CHAVA WIND offers an integrated micro-grid solution with batteries and added solar for complete independence from the electric grid.

Aesthetic Design

Hybrid Technology

With higher swept area VAWT can be spaced closer to each other

Roof Top Installation

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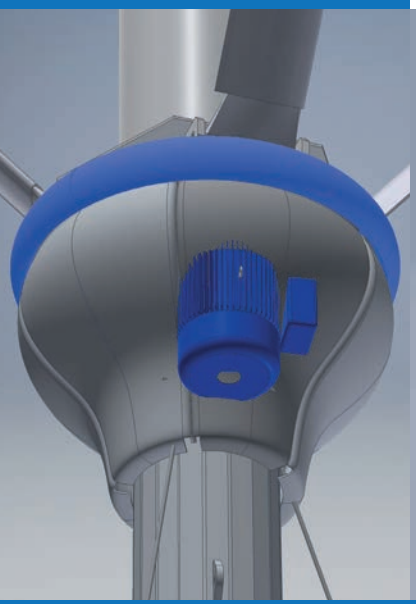
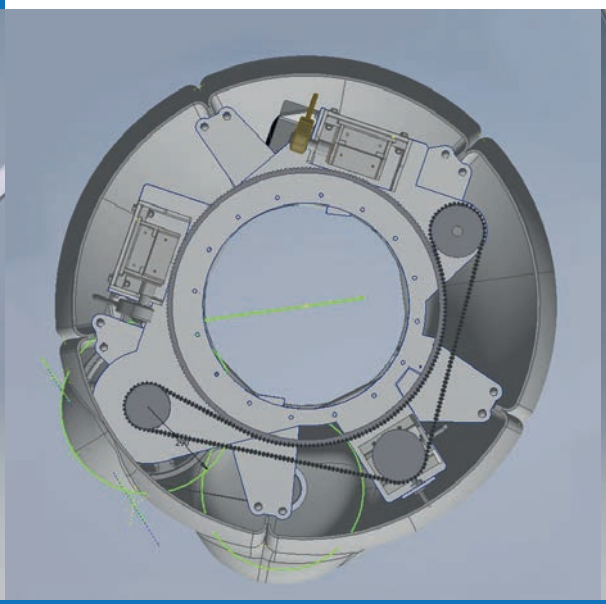
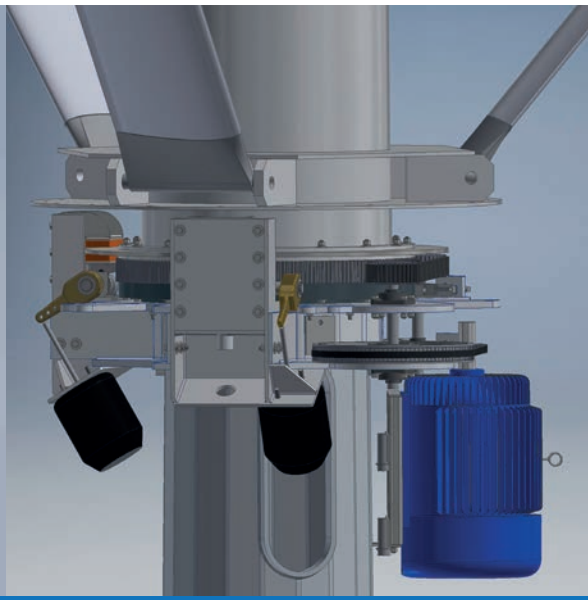
Competetive Analysis

BIG HAWT WIND VERSUS SMALL VAWT WIND

- The predominantly large wind-farms are facing challenges with missing or overloaded grid-connections and with the difficulties in balancing electricity demand with such highly concentrated and highly intermittent power sources.
- Small- to medium wind technologies will be deployed in a more decentralized fashion and most of the power will be used directly by consumers. Therefore, the buyer (or investor) will be much less dependent on unpredictable policy changes regarding regional feed-in rates and regulations.
- The smaller and mid-sized VAWTs can be grid-interactive but not grid-dependent (i.e. in events of grid failure they can operate stand-alone). This allows for a much wider range of deployments world-wide!
- The installation of large HAWTs (Horizontal Axis Wind Turbines) requires large, complicated, expensive and specialized transport equipment (very long trucks), material handling equipment (i.e. cranes). The maintenance of large HAWTs also requires complicated processes and special equipment, and – most importantly highly trained and specialized technicians who are expensive and not widely available in remote areas and less developed regions or countries.
- Large Wind competes with utility-grid wholesale cost of power.
- Small Wind competes with retail cost of power!

WHY SMALL VAWT WIND

- Small- to medium wind technologies will be deployed in a more decentralized fashion and most of the power will be used directly by consumers. Therefore, the buyer (or investor) will be much less dependent on unpredictable policy changes regarding electric power prices, regional feed-in rates and regulations.
- High ROI and easy to installation/maintenance of the VAWT (no cranes or climbing required).
- VAWTs will take wind from any direction and will therefore not have the need to turn into the wind. This eliminates the need for an active or passive yaw-system.
- On the same footprint, VAWTs can achieve a higher swept area than HAWTs. Furthermore, VAWTs can be spaced much closer to each other, which reduces the overall land-use when multiple turbines are installed on the same site. VAWT wind farms will require up to 8 times less land compared to HAWTs.
- Small Wind Turbines are by definition closer to civilization and therefore subject to more scrutiny by neighboring property owners. Most VAWTs (particularly the curved Troposkein shape) are aesthetically much more pleasing and are therefore subject to much less objections by neighbors.
- In densely populated Japan, we have experienced first-hand that people are very excited about our VAWT (which is viewed as a sculpture or even a sustainability status symbol), whereas we have heard many objections against traditional HAWT propellers.
- In addition to aesthetics, VAWTs are quieter by principle than comparable HAWTs due to its lower blade-tip speed.
- That lower blade tip speed also leads a naturally low-to no bird kill rate with VAWTs and are therefore more suitable in natural preserves with protected species.

CHAVA WINDLEAF2500
ANNUAL PROJECTED ELECTRICITY SAVINGS (OR REVENUE) / (USD/€)

Annual average Windspeed (m/s)	Electricity Production im MWh per year in MWh	LCOE* over 25 years Cost per KWh USD	€	LCOE* over 50 years Cost per KWh USD	€
4,0	15,8	0,2748	0,2390	0,2195	0,1909
4,5	23,3	0,1870	0,1626	0,1495	0,1299
5,0	30,2	0,1441	0,1253	0,1151	0,1001
5,5	38,0	0,1145	0,0996	0,0915	0,0795
6,0	45,9	0,0948	0,0824	0,0757	0,0659
7,0	60,6	0,0718	0,0624	0,0574	0,0499
7,5	67,0	0,0650	0,0565	0,0519	0,0451
8,0	72,5	0,0600	0,0522	0,0479	0,0417
8,5	77,0	0,0565	0,0491	0,0451	0,0393
9,0	80,7	0,0539	0,0469	0,0431	0,0375

* Levelized Cost Of Energy

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The convergence of economics, solid engineering and aesthetics

CHAVA WIND Vertical Axis Wind Turbine combines energy generation with futuristic aesthetics.

CHAVA WIND KEY INVESTMENT FACTS

DECENTRAL

Decentral „point of use" energy production at the consumer and for the consumer

AESTHETIC

Aesthetic design combined with reliability

CERTIFIED

First international certified wind turbine according to IEC 61400-2

INDEPENDENT

Independent from unpredictable price increases and grid connection

SUSTAINABLE

Massive CO2 reduction

QUALITATIVE

6 years of high qualified R&D

EFFICIENT

High efficiencies and economics

PROMOTED

EU will promote and support reusable energy production for end users

TECHNICAL SPECIFICATION

- Troposkein blade design. Inspired by nature, forming a tension-only shaped Troposkein to manifest the dominating centripetal forces on blades as tension only
- Blade profile is derived from NACA0018 (modified) and airfoils supported at both ends (strength)
- Rated at 25 KW @11m/s wind-speed
- Maximum rotational speed: 81 rpm
- Efficiency of 44% peak
- Optimal Tip Speed Ratio (TSR): 4.4
- AEP at 7m/s: 65 MWh/year
- Proprietary airfoil mass fabrication process
- Designed to withstand winds of up to 280 km/h
- Mast Height: 15.7 m (to bottom of turbine)
- Total Height: 29.9m (to top of turbine)
- Blade Chord length: 40.67 cm
- Turbine Diameter: 9.6m
- Needed ground area 115 qm
- International Certification IEC 61400-2 in process of completion
- Low level of noise
- No ultra and infra sound
- Electronically controlled stabilizing of rotation speed
- Best customer value and lowest long-term LevelizedCost of Electricity (LCOE)
- Long life (exp. 20 years)
- Low cost of components (many off-the-shelf commercial parts, i.e. induction generator, VFD, brakes, belts, sprockets)
- Simple installation and maintenance, especially with tilt mast.
- Omnidirectional (good in gusty, turbulent, lower elevation winds)
- Steel mast extends inside the rotor all the way to the top of the turbine allowing for rotor bearings to be placed the very ends of the rotor (very top and very bottom) to avoid the classical bearing failure of VAWTs due to high (and pulsating) bending moments.
- The top rotor bearing is an off-the shelf industrial-grade spherical roller bearing. This bearing is subject to zero bending forces and only axial load.
- The bottom rotor bearing is a German-engineered slewing bearing with large diameter, extending around the static mast. This bearings is also subject to zero bending and only radial load.
- Both rotor bearings are connected to lubrication lines, which allow for periodic lubrication from the ground or connection to standard auto-lube timer devices.

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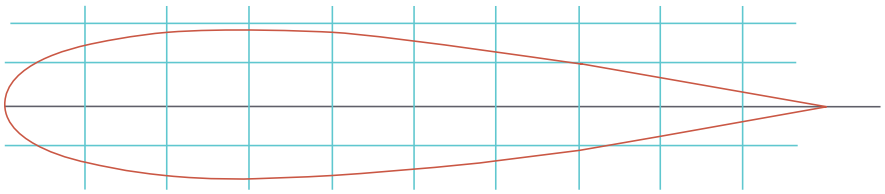
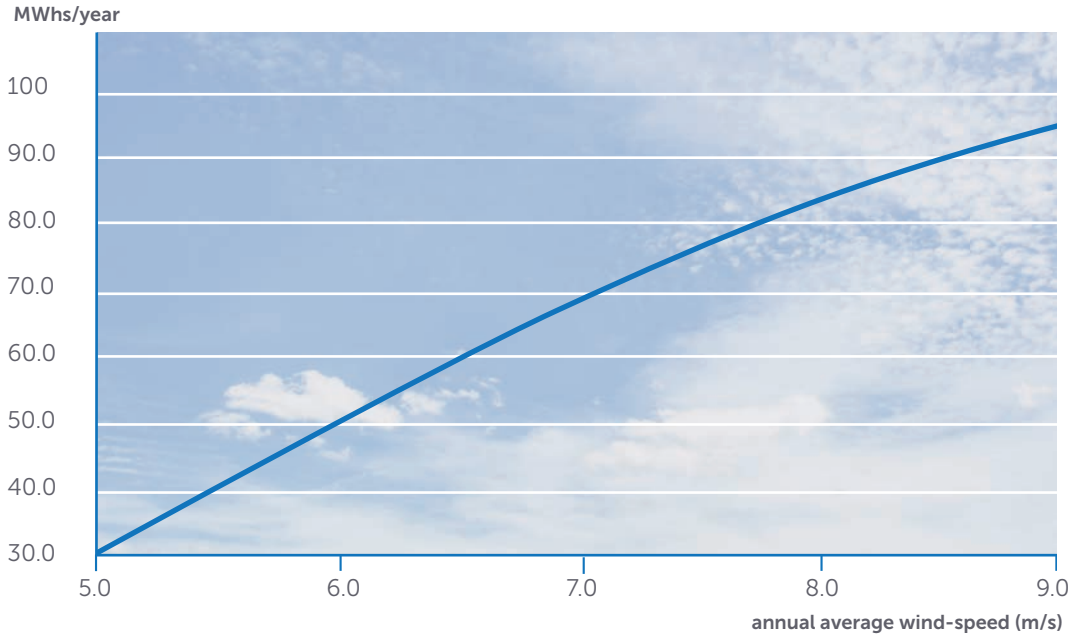
Energy in harmony with nature

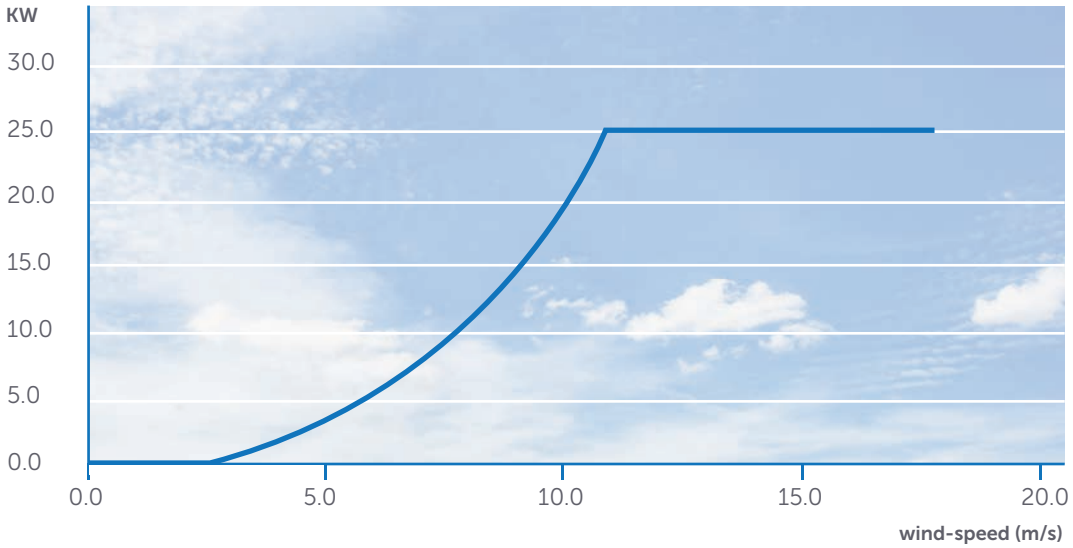


Troposkein blade

ANNUAL ENERGY PRODUCTION (MWH) VS AWG WIND SPEED (M/S)



POWER CURVE



TECHNICAL SPECIFICATION

WIND TURBINE	
Type	Vertical Axis / Troposkein-Darrieus
Total Weight	2200kg (without tower)
Number of Blades	3
Material	Carbon Composites (blades)
Weight of blades	124 kg (each)
Blade Dimensions	Height 14.1m, Length 17.3m, Diameter 9.6m Control
System	Blade speed control. No pitch or yaw
Protection Circuit	Overspeed, which determines overvoltage
Cut-in Wind Speed	4 m/s
Rated Output	25kW at 11 m/s
Annual Generating Capacity	65 MWh (Average wind speed : 7.0m/s)
Maximum Output Rotation	81 rpm
Rated Output Voltage	200-240VAC
Noise Level	low (decibel figure to be confirmed)
TOWER	
Model	Hydraulic Tilt Steel Tower
Material-Weight	Galvanized Steel - approximately 5 tons
Height	30m (total height extending to top of turbine)
INVERTER (PCS)	
Model	Chava Wind Power Inverter
Rated Output	25 kW single phase or 3-phase, 200-240V AC
Dimensions	Width 21"(54 cm), Length 24"(61 cm), Height 10"(25.4 cm)
Input Voltage Range	400VDC~800VDC
Frequency	(50HZ/60HZ)
Efficiency	96.5% (full power) | 97.7% (half power)
Environmental	Will be placed inside NEMA-4 rated waterproof enclosure
RECTIFIER	
Dimensions	included in PCS
OVER VOLTAGE REGULATION DEVICE	
Dimensions	included in PCS
OVER VOLTAGE REGULATION HEATER	
Dimensions	included in PCS

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Micro Grid Application

For more information
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