2.3 MW

BONUS®
Energy A/S

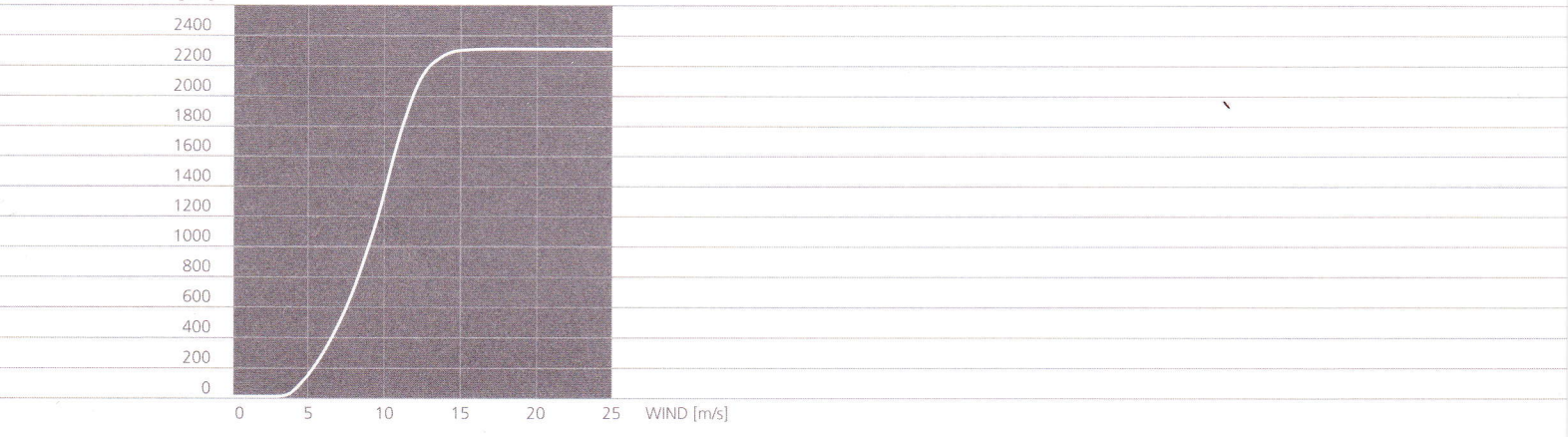
Trust in the wind

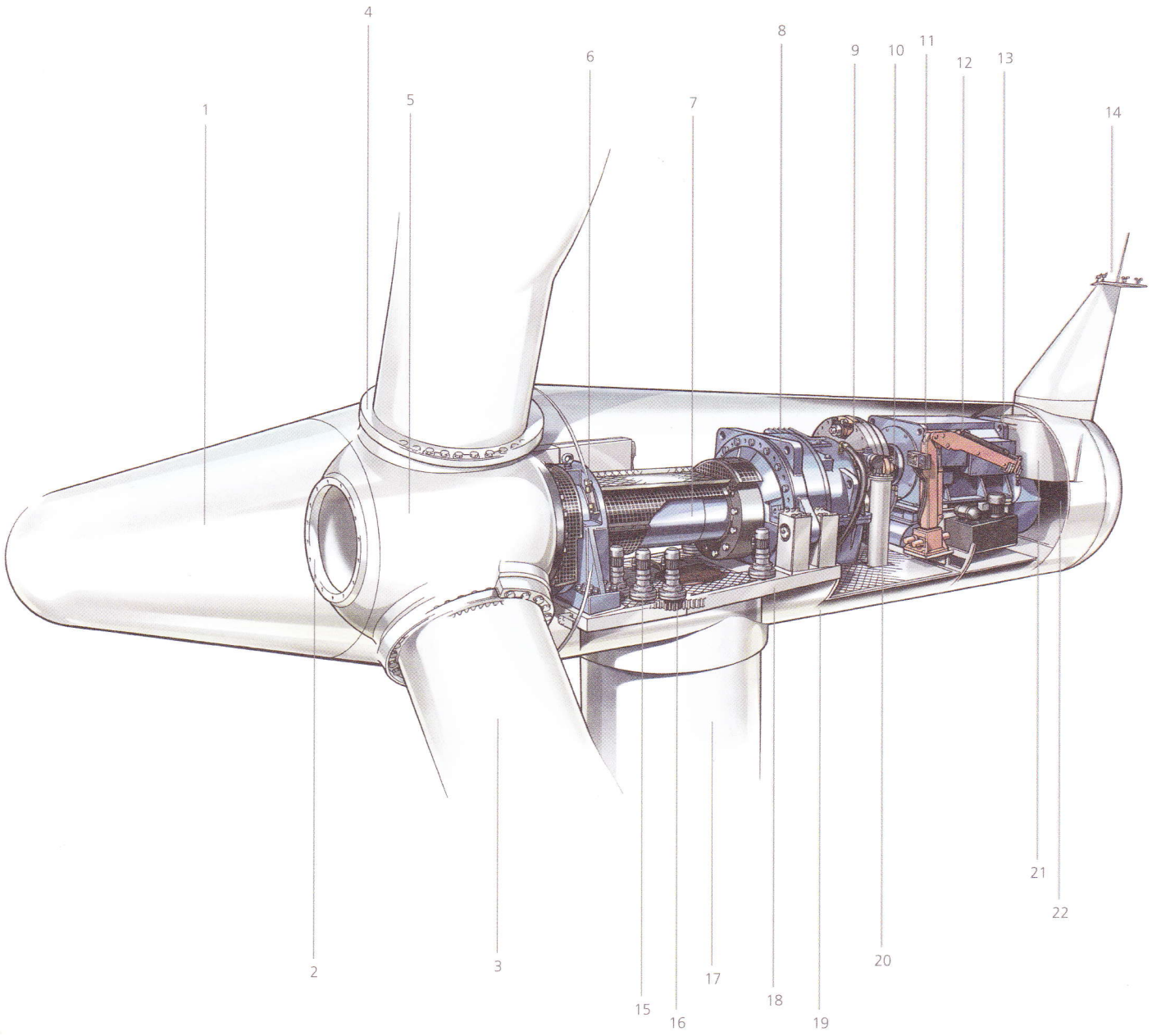
TECHNICAL SPECIFICATIONS

Rotor	
Diameter	82.4 m
Swept area	5300 m^2
Synchronous rotor speed	17 / 11 rpm
Power regulation	CombiStall®
Blades	
Type	Self-supporting, B40
Blade length	40 m
Aerodynamic brake	
Type	Full span pitching
Activation	Active, fail-safe
Transmission system	
Gearbox type	3-stage planetary/helical
Mechanical brake	
Type	Fail-safe disc brake
Generator	
Type	Asynchronous
Nominal power	2300 / 400 kW
Synchronous speed	1500 / 1000 rpm
Voltage	690 V
Yaw system	
Type	Active
Controller	
Type	Microprocessor
Tower	
Type	Tapered tubular
Hub height	60 m, 80 m or site-specific
Operational data	
Cut in windspeed	3 m/s
Nominal power at	15 m/s
Cut out windspeed	25 m/s

SALES POWER CURVE

Note: The calculated power curve data are valid for standard conditions of 15 degrees Celsius air temperature, 1013 mBar air pressure and 1.225 kg/m^3air density, clean rotor blades, and horizontal, undisturbed air flow.





NACELLE ARRENGEMENT

1. Spinner
2. Spinner bracket
3. Blade
4. Pitch bearing
5. Rotor hub
6. Main bearing
7. Main shaft
8. Gearbox
9. Disc brake
10. Coupling
11. Service crane
12. Generator
13. Automatic monitoring system
14. Meteorological sensors
15. Yaw gear
16. Yaw ring
17. Tower
18. Nacelle bedplate
19. Canopy
20. Oil filter
21. Generator fan
22. Oli cooler

72 BONUS 2.3 MW turbines at Nysted Offshore as yet another proof of the trustworthiness that has been Bonus's trademark from the very start.

The BONUS 2.3 MW wind turbine is the largest and most powerful model in the Bonus product range. The up-scaling means greater yield with maximum safety - and a competitive price.

The design of the 2.3 MW turbine is similar to, and is based upon earlier MW models and draws on the extensive operational experience of these turbines as well as of earlier 600 kW versions.

GENERAL DESIGN

The overall design of all Bonus wind turbines is based on the so-called "Danish Concept", characterised by:

- An induction generator directly connected to and on-line with the electric grid
- Several independent fail-safe operating systems including automatic air brakes and hydraulic disc brakes.

Even though many other manufacturers use this concept, specific design features distinguish Bonus turbines from the rest - features which have characterised all Bonus models during the last decade.

The 2.3 MW has a separate non-integral gearbox, with a separate main shaft, thereby providing greater flexibility in design and maintenance. Major components such as the rotor hub, main shaft, gearbox, and nacelle yaw systems are robustly engineered.

ROTOR

The 2.3 MW turbine has CombiStall® power regulation. The blades can be pitched 80 degrees and during operation in high winds, the pitch setting is continuously adjusted to maintain an average output of 2.3 MW, irrespective of the weather conditions. The blade adjustment is also used for optimising the output at low wind speeds. When the turbine is shut down, the blades act as aerodynamic brakes, turning 80 degrees from the normal operational setting. Each blade has its own independent actuating system.

BLADES

The B40 blades are made of fibreglass reinforced epoxy. Their aerodynamic design represents state-of-the-art wind turbine technology, and the structural design is based on the experiences of the Bonus B30 blade type.

MACHINE DESIGN

The Bonus 2.3 MW has the most recent type of machine arrangement developed by Bonus. The nacelle bedplate is a massive non-welded steel construction, providing optimal strength.

The main shaft is long and the path of load transfer is designed to act symmetrically around the tower axis for an optimum transfer of bending moments to the yaw system and tower. The result is a simple, rugged, and attractive machine structure, enclosed in a steel canopy.

TRANSMISSION

The transmission system consists of gearbox, coupling and generator. The gearbox is a three-stage planetary/helical design. A flexible coupling transfers the power to the generator. The gearbox and the generator have independent cooling systems both located in the rear end of the nacelle, exhausting through an efficient silencer. Both generator windings are optimised to provide maximum efficiency at low and medium power levels.

SAFETY SYSTEMS

The turbine has two independent safety systems, the aerodynamic brakes and a mechanical disc brake. Both systems are fail-safe and each system is capable of shutting down the turbine even in the unlikely situation that the other system should fail. The wind turbine has a two-stage braking system, applying reduced torque during normal shutdown, with full torque availability in possible emergency situations.

CONTROLLLER

The turbine has a microprocessor control with a portable hand terminal. All controller activities for operation, service and statistics are provided both at the tower base and in the nacelle. Optional remote monitoring is Windows-based and offers operational status, statistics and changes of operating parameters from the owner's facilities.

TOWER

The 2.3 MW turbine is mounted on a tubular steel tower. The tower has internal ascent and direct access to the yaw system and nacelle. It is equipped with electric lighting and can optionally be fitted with internal personnel hoist.

CHARACTERISTICS

Features which have been characteristic of Bonus for years are also applied to the 2.3 MW turbine: Consistent attention to noise control, a heavy-duty structure with ample design margins and a uniform high level of quality maintained throughout the machine, from the overall concept to the last details.

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