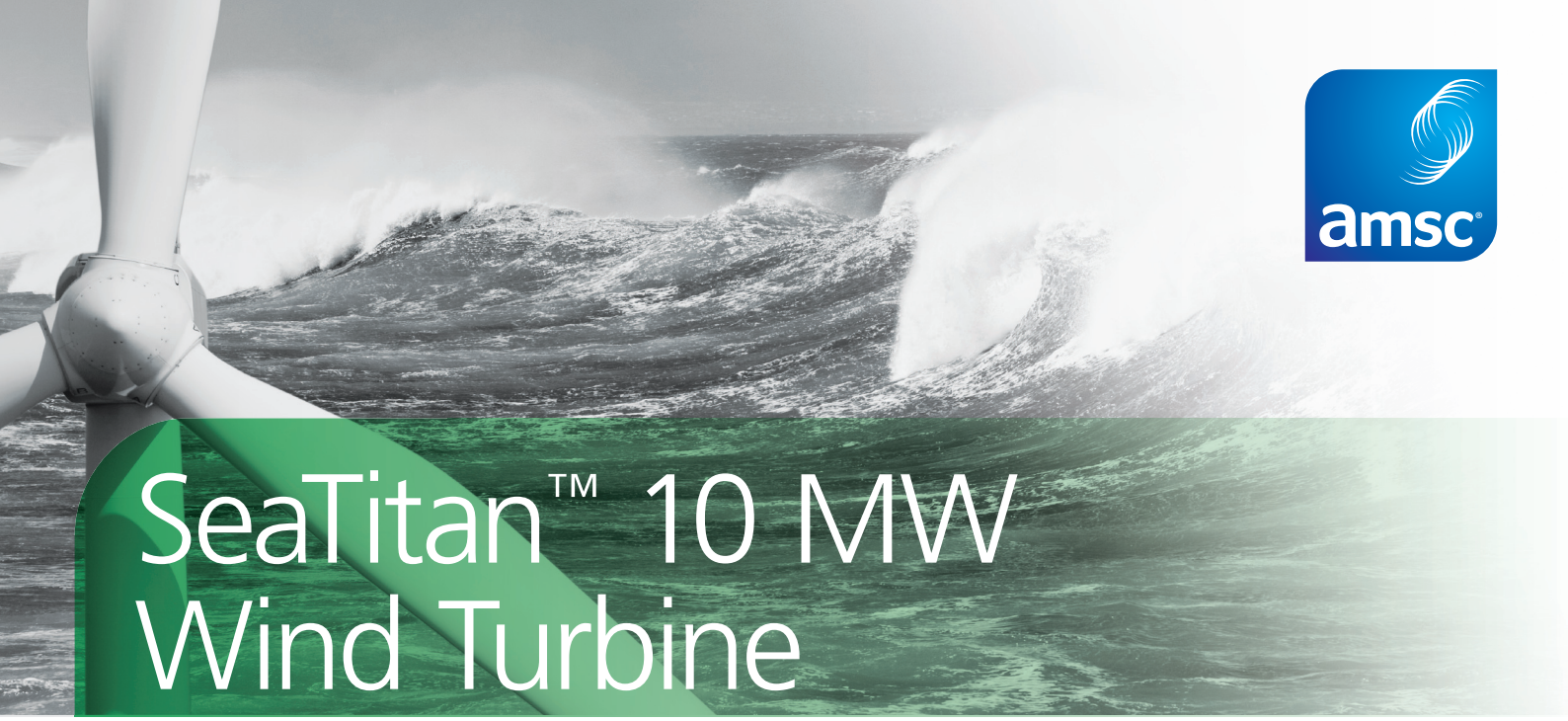


SeaTitan™ 10 MW Wind Turbine

Maximum power per tower for offshore environment

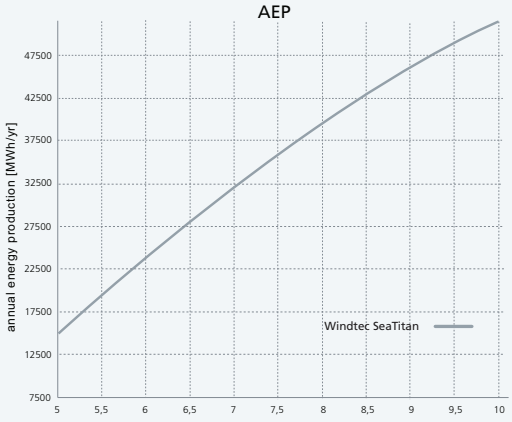
AMSC's Windtec Solutions include wind turbine designs that enable our partners to launch best-in-class wind turbines quickly, effectively and profitably. Providing a path to significantly lower the cost of offshore wind power, AMSC is developing the SeaTitan wind turbine to maximize "power per tower." With the ability to produce 10 MW of power or more, the SeaTitan model promises to be the world's most powerful turbine. It is based on a lighter weight and highly reliable direct drive design, ensuring a perfect fit for the harsh offshore operational conditions.

Superconductor generator eliminates tolerance and deformation issues
The SeaTitan wind turbine design employs a high temperature superconductor (HTS) generator, which is significantly smaller and lighter than a generator using conventional technologies. The superconductor generator has a large air gap to eliminate issues with tolerance, deformation and rare earth material availability. The generator is integrated as part of the turbine and decoupled from the load-carrying components. Generator torque is transferred directly from the stator to the mainframe.

Amperium® wire is key to low cost and light weight
AMSC's Amperium wire is used for the HTS rotors instead of copper wire. These wires can carry over 100 times more power than copper wires of the same dimensions. Therefore, the generator is much smaller, lighter and more efficient than conventional large-scale wind turbine generators and produces the highest known power-to-weight ratio. This reduces the costs associated with the supporting mast structure, foundations, floatation systems and installation.

Direct drive lowers maintenance need
The direct drive model does not use a gearbox, which is one of the most maintenance-intensive wind turbine components and extremely costly with breakdowns at sea. In addition, no couplings are needed with the direct drive.

High efficiency for offshore generation
The SeaTitan turbine connects the superconductor generator to the grid with a full-scale converter. The IGBT-based converter with advanced power electronics ensures that the generator works with high efficiency over the entire speed range.



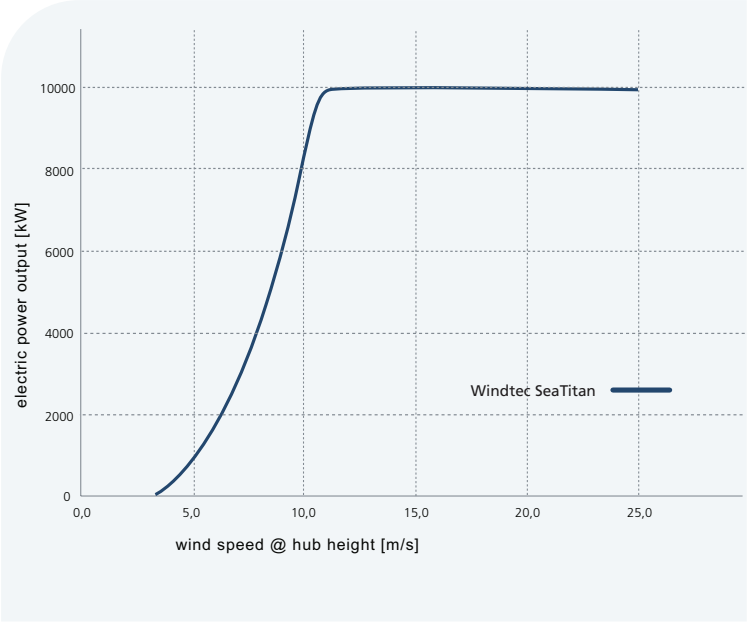
Windtec Solutions™

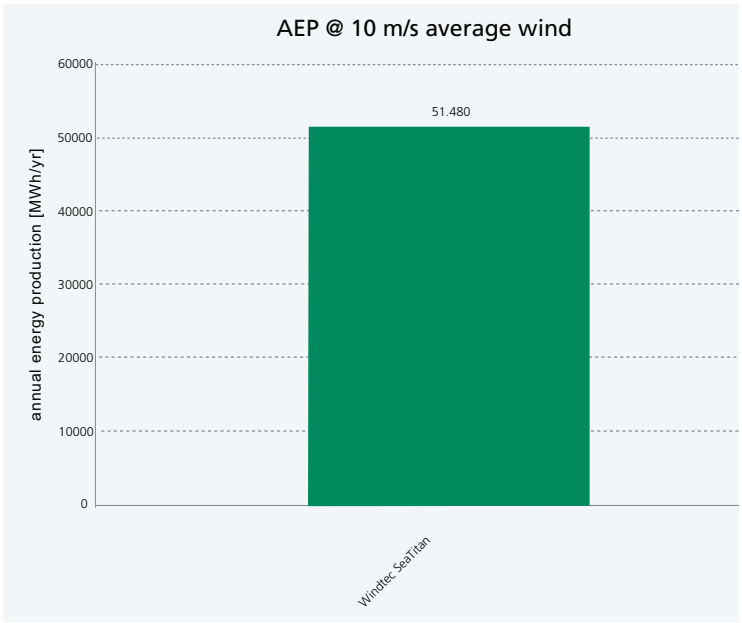
- HTS generator offers efficiencies of up to 96%; 94% with converter
- Direct drive eliminates gearbox
- Air core for lightest weight
- No iron rotor or stator teeth
- HTS windings generate high ampere-turns and flux density without iron pole faces
- 190 m rotor diameter for TC1 conditions

AMSC® intends to license SeaTitan wind turbines and generators to qualified manufacturers around the world.

Wind Turbine Designs – 10 MW

Windtec Solutions™





The SeaTitan turbine uses an advanced electrical individual pitch control system design. It is available in 50 Hz or 60 Hz.

Compliance with international grid codes
The SeaTitan turbine fulfills the most demanding international grid code requirements and has low voltage ride-through (LVRT) capability.

Real-time information with continuous monitoring and alarm handling
AMSC's advanced wtCMS condition monitoring system provides continuous monitoring of the key system components. This gives operators real-time information about the turbine status as well as detailed and comprehensive analysis tools to optimize maintenance activities. The fully integrated system allows intelligent measurement, turbine control interaction, and the analysis of monitoring and performance data. In addition, wtSCADA remote operation and wtDataCenter analyzing packages are available to provide a harmonized control system with supervisory control and data acquisition to actively monitor, analyze and operate entire wind farms.

TECHNICAL DATA	
Type:	wt10000dd
Grid frequency:	50 Hz / 60 Hz
Tilt angle rotor axis:	5°
Hub height:	125 m
Hub type / material:	cast iron
Mainframe type:	cast iron
Type of tower construction:	conical tubular steel tower
Rotor diameter:	190 m
Lightning conductor:	integrated

OPERATING DATA	
Cut-in wind speed:	4 m/s
Rated wind speed:	11.5 m/s
Cut-out wind speed:	30 m/s

GENERATOR AND POWER ELECTRONICS	
Generator type:	HTS synchronous
Rated driving power:	12,000 kVA
Rated generator speed:	10 rpm
Number of poles:	multi-pole
Cooling:	cryogenic and water cooling
Converter type:	IGBT, 4-quadrant
Generator rated power	0.95 inductive to 0.95 capacitive at 690V ph-ph

DRIVETRAIN SPECIFICATION	
Type of gearing:	direct drive
Gear lubrication:	-
Connection gear / generator:	-

BRAKING SYSTEM	
Operational brake:	individual blade pitching
Type of construction:	gear/servomotor
Mechanical brake:	disc brake

YAW SYSTEM	
Type of yaw bearing:	ball bearing
Drive unit:	gear motor
Number of drive units:	tbd
Brake:	active brake plus motor brake

AMBIENT TEMPERATURE RANGE		
Normal:	During operation:	-10°C to 40°C
	Survival range:	-20°C to 50°C

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...better energy

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