

21st Century Wind, Inc.

* The company's vision is to be an OEM of utility-sized wind turbine generators (wtg), mostly built in the US, to exclusively serve the low and moderate wind climates. 21 CW will **replace** now higher cost electricity generated by **fossil fuels**, as **21 CW wind turbines will make lower cost energy in moderate winds.**

* 21st Century Wind's **Patent 11,105,317**, on-shore wind turbine generator for the 2/3rds on earth living in the under-served moderate wind niche of the world's fastest growing market.

*Generates 30% to 60% higher annual electric production in moderate winds, & typically 35% lower installed cost when placed on ridges.

*Expecting \$4 million in grants; seeking \$5 million loan/equity for the manufacturing/ installing 21 CW's initial wind turbine plus solar and storage battery. 21 CW has been issued a Power Purchase Agreement from an electric utility. \$950K expected annual revenue from utility, plus \$600K investment tax credit.

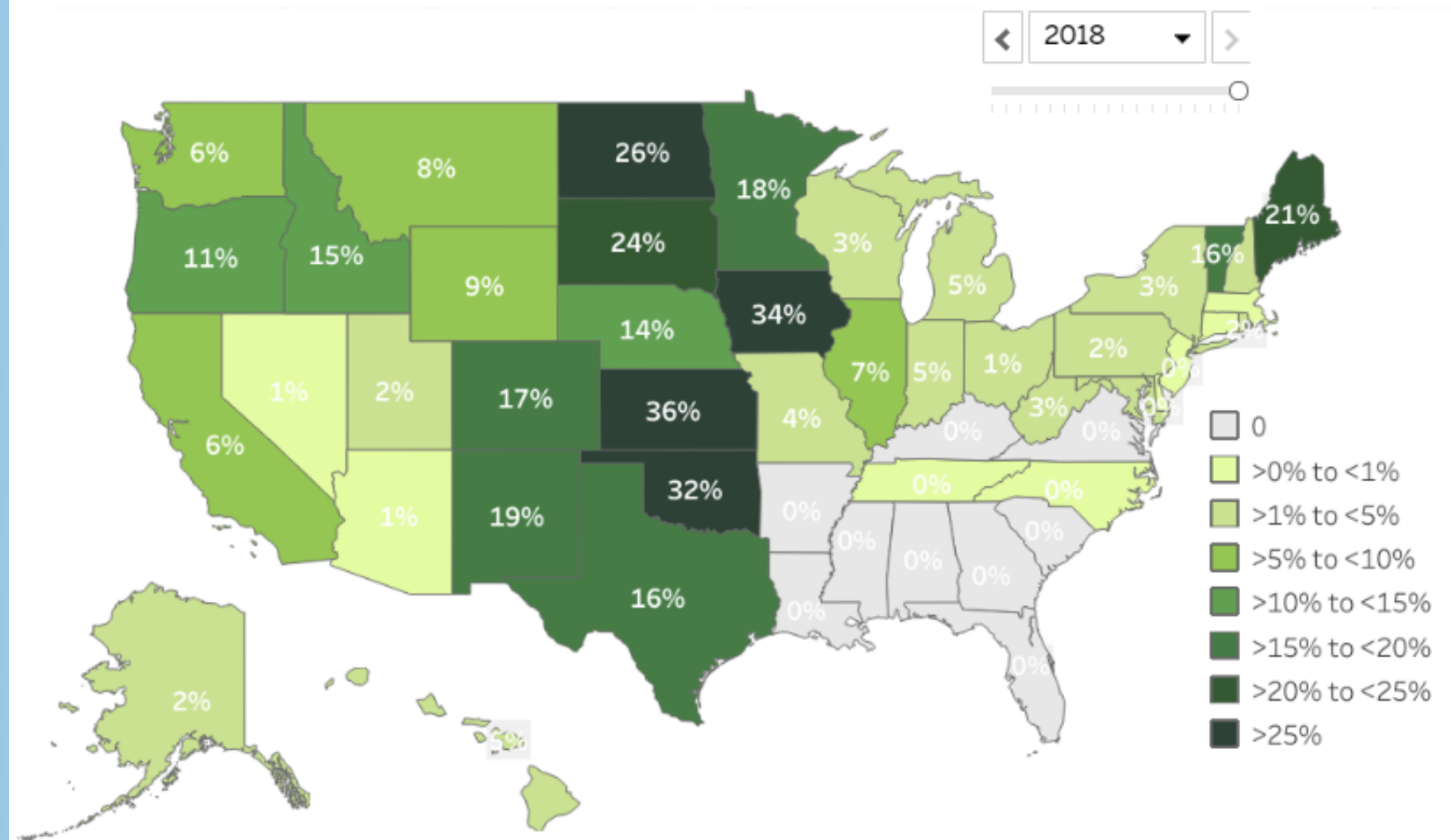
*Engineers & suppliers team ready to accomplish the manufacturing and installation of 21 CW's initial unit.

*2027 plan: \$1 billion sales of wtgs, \$120 million profit.



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Wind Energy's Share of State Electricity Generation



21st Century Wind for moderate winds

- Wind turbine generators are mostly installed in the US and abroad on high wind plains. These are heavy with deep foundations installed on flat ground, manufactured by global OEMs.
- Few wind turbines are installed in moderate wind areas, such as eastern or western US; India and Nepal. This is because the global firms' turbines output is insufficient in moderate winds to justify investment, and their installation is too expensive on ridges.

21st Century Wind offers an affordable solution in moderate winds:

- 30% -> 50% higher energy yield per invested dollar than the multinationals in moderate winds.
- Ridges in moderate wind areas have challenging, expensive terrain for installing wind turbine generators. 21CW is often 15% less investment.
- The solution is 21CW's patented, modular and high efficiency turbines.



Configuration

- **3.5MW nominal output**
 - Overturning moment is consistent with other 3+MW WTGs
 - Allowing torque and RPM to vary without, but not the tower toppling moment
- **Upwind, 3-bladed horizontal axis**
 - Integrated Gearbox and Generator reduces weight; this combined with the location of the power conditioning equipment to the ground reduces over all tower top weight and complexity significantly.
- **120m rotor diameter**
 - Rotor has a higher specific power than a rotor of greater diameter, this means more power is extracted from a given column enabling shorter blades, easier manufacturing and transportation since the blade ships in two sections.
- **80m-140m hub height**
 - By employing a rotor with greater specific power means the tower does not have to be taller to preform at low wind sites, yet reduced weight allows for a potential service height of 140 Meters

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- 21st CW is a team of dedicated and passionate wind energy experts and tier 1 suppliers with a wealth of experience ranging from new turbine design and production startup, to fleet reliability management and innovative product upgrades.
- Our background in successful technology transfer across language and cultural differences is lengthy.
- Experienced with technology development, prototyping, type certification, series manufacture, and field fleet support of a wide range of wind turbine technologies.
- Many 21st CW suppliers to be from Cumberland and Lancaster Counties, elsewhere in PA including foundation and installation.

Innovations for 21 CW

Drivetrain – high efficiency Permanent Magnet, Medium speed generator integrated with a conservative low ratio 2 stage gearbox

Rotor – Moderate wind, High Power density, site specific Customizable solutions

Tower – Taller towers with more efficient use of steel and standard truck transportation.



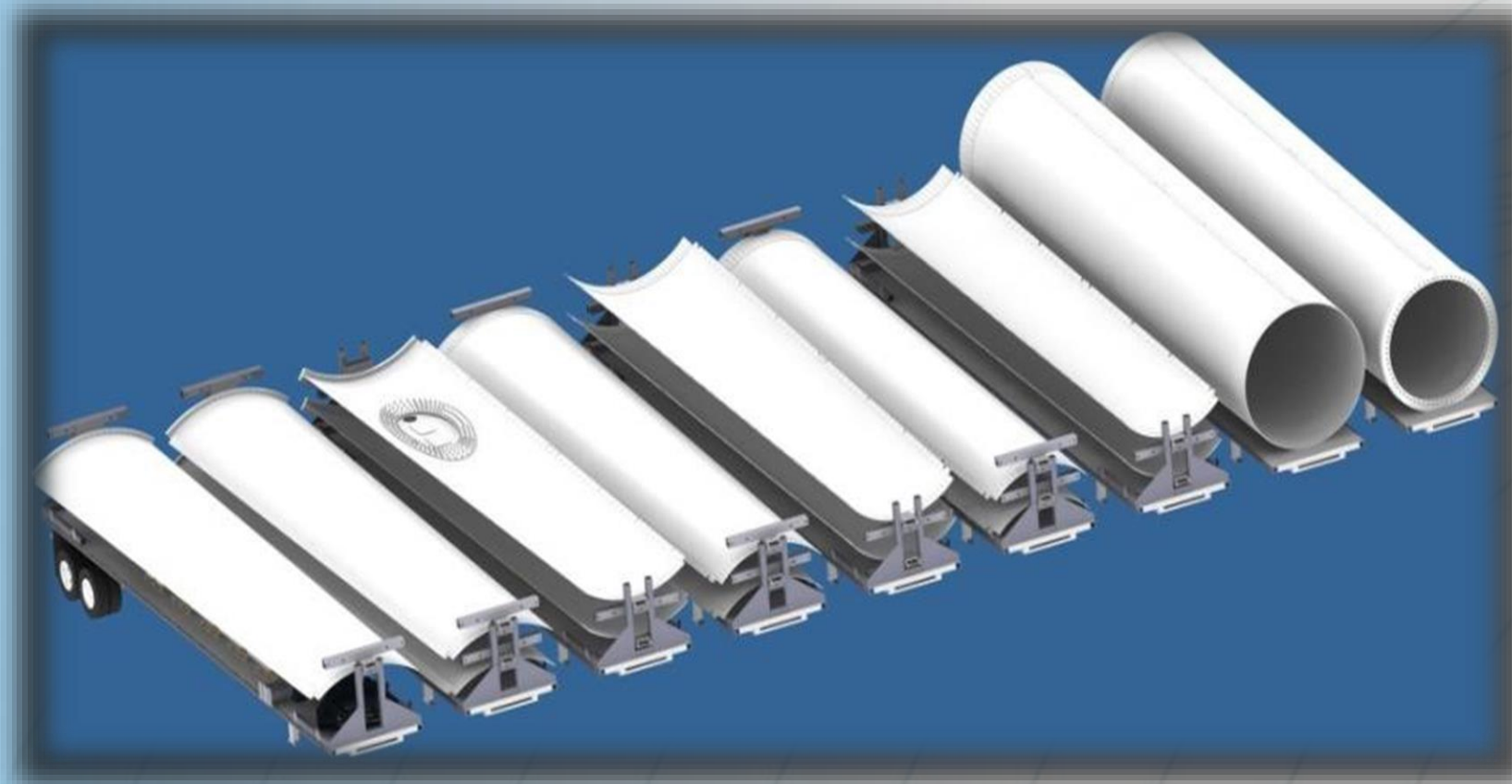
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Tower

- Modular design for local manufacturing creates more local jobs
- Modular design reduces the amount of environmental encroachment by reducing road size
- Tower and Rotor assembly staging areas are smaller
- Tower pieces transported by standard flatbed trucks, significantly lowering transportation cost. Up to 75% savings on transport.
- Larger tower base to support loads without using large expensive forged rings sourced outside of the USA. Lower load on foundation.
- Larger tower base resist tower overturning moment with Low Disturbance foundation
- 15% lighter than conventional tube tower = 15% lower cost.
- Certified by DNV, which is the certifying agency for wind.

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Tower

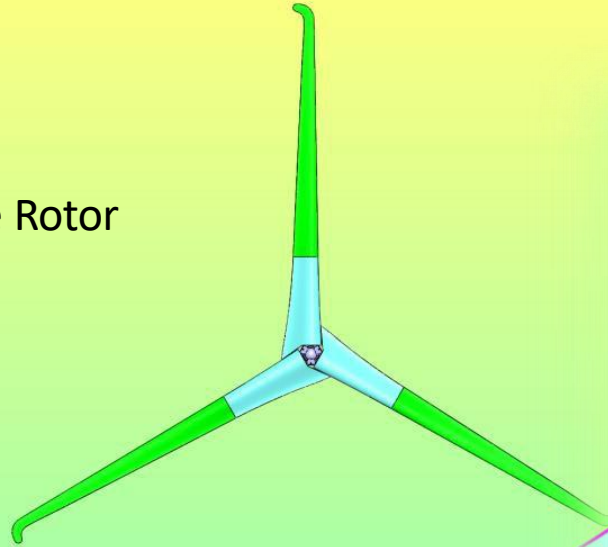


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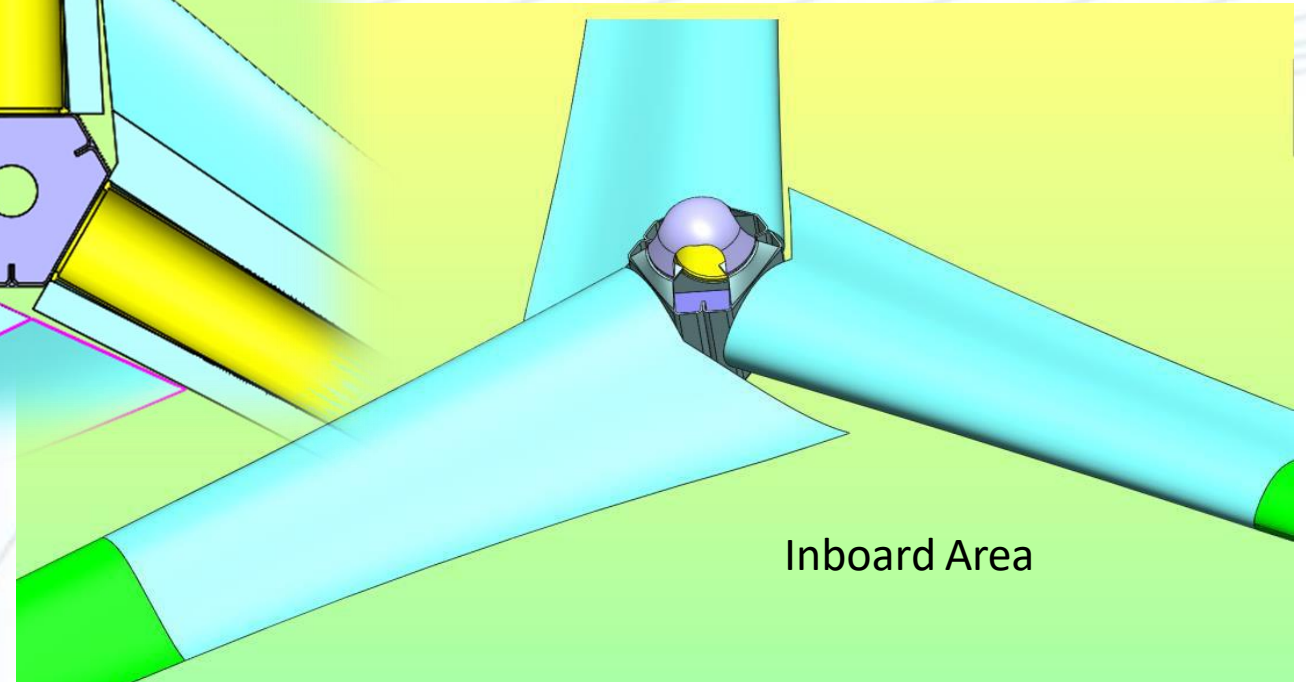
Rotor 3-D rendering

The Modular Rotor System MRS, uses a combination of elements to increase AEP while solving the manufacturing and transportation challenges of longer blades. The blade ships in two sections.

Complete Rotor



This is contrary to conventional blade design which targets a long slender shape to avoid increased loads - however this is not a constraint for a blade optimized for use at moderate wind speeds.



Inboard Area

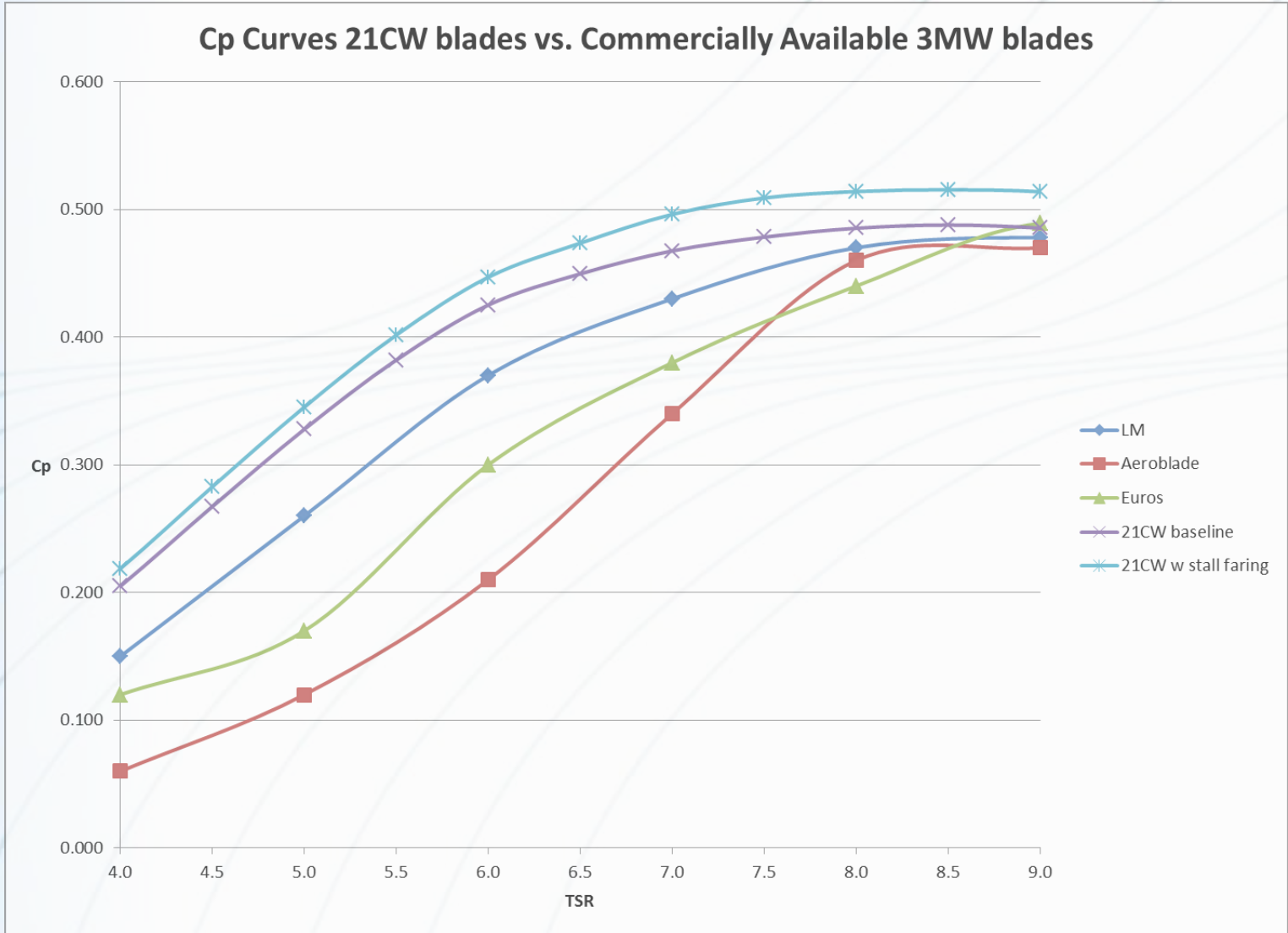
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Rotor Performance

The blade will be designed with a lower optimum tip-speed ratio, to increase power capture at low RPMs (partial power).

Therefore this rotor is especially complementary with a variable speed permanent magnet power generator which has high efficiency at partial power.

This blade is optimized for use at moderate wind speed sites (IEC class II)



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Performance Compared to Competing Technologies (3 MW used for 21 CW)

St. Francis University Results adjusted for tower height

Turbine Type	21CW Increase in AEP
GE 3.2-103m	30%
Vestas V90 3.0MW	65%
Enercon E82 3MW	82%
Gamesa G114 2.5MW	24%

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Hub

The plate hub concept eliminates the costly casting pattern, reducing start-up as well as change costs for hub manufacturing. In addition to low start-up costs, a major advantage of a plate hub is time to market, eliminating the time to engineer and build the casting pattern and first article proving process.

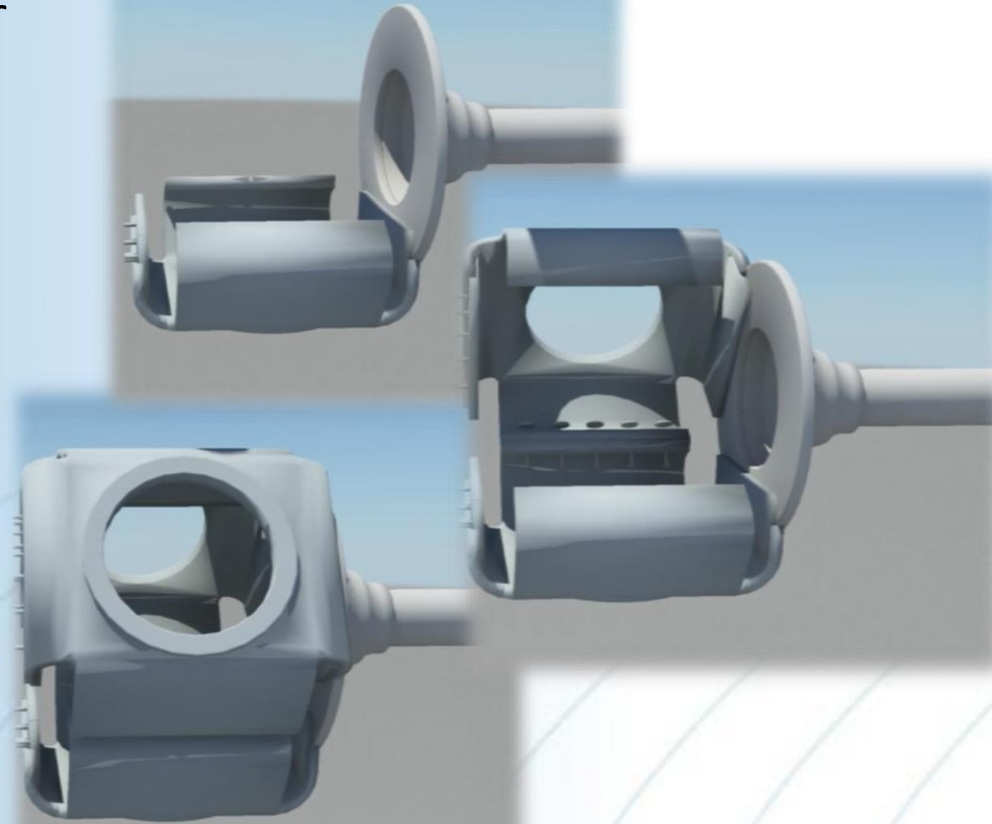
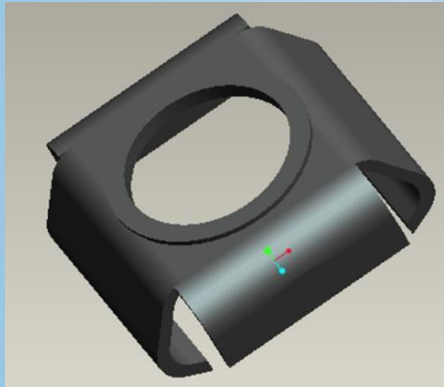
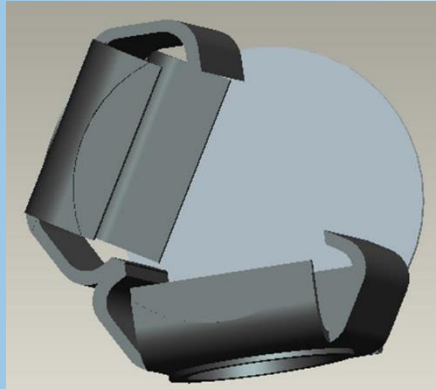
- Modular design for local manufacturing on standard equipment
- No casting mold – saves time and cost for manufacturing startup
- Fast and reliable fabrication
- Compliant structure for load reduction

Therefore risks and liability of schedule delay due to deviations in quality will be lowered and overall costs for quality control, third party monitoring, test, and evaluation will be reduced. Finally, risks of component failure due to missed defects will be mitigated.

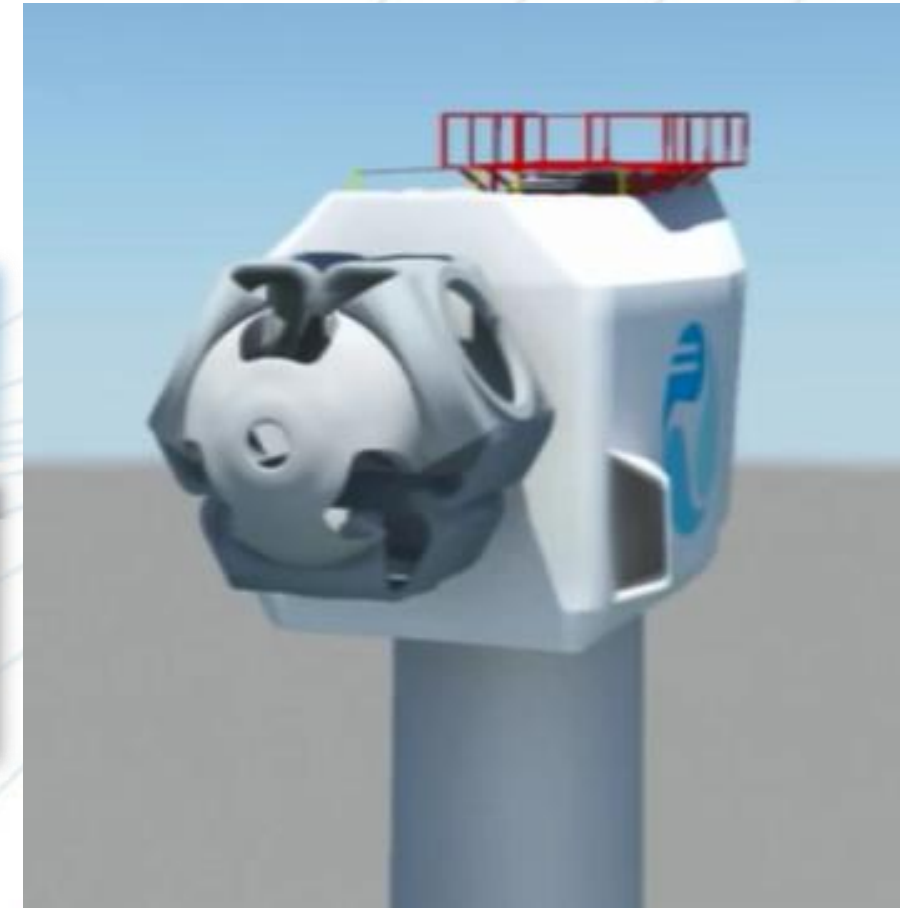
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Hub

Why bending is better



By using a readily available base material, the high part rejection rate and repair rate associated with casting will be radically lower.



Unlike the raw materials used in casting, high-strength plate steel is delivered to the fabricator with a material certificate, guaranteeing the composition, material strength, and traceability of the material.

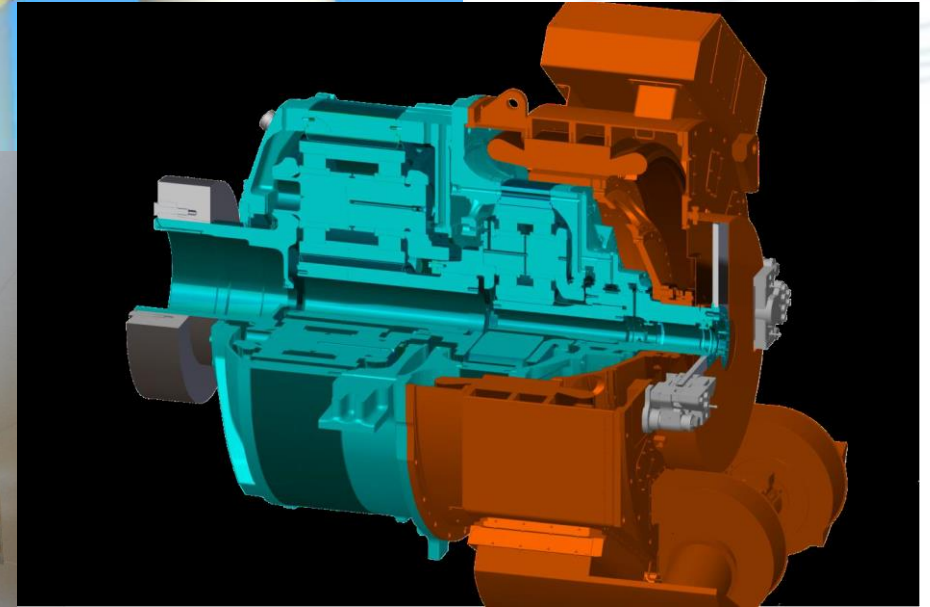
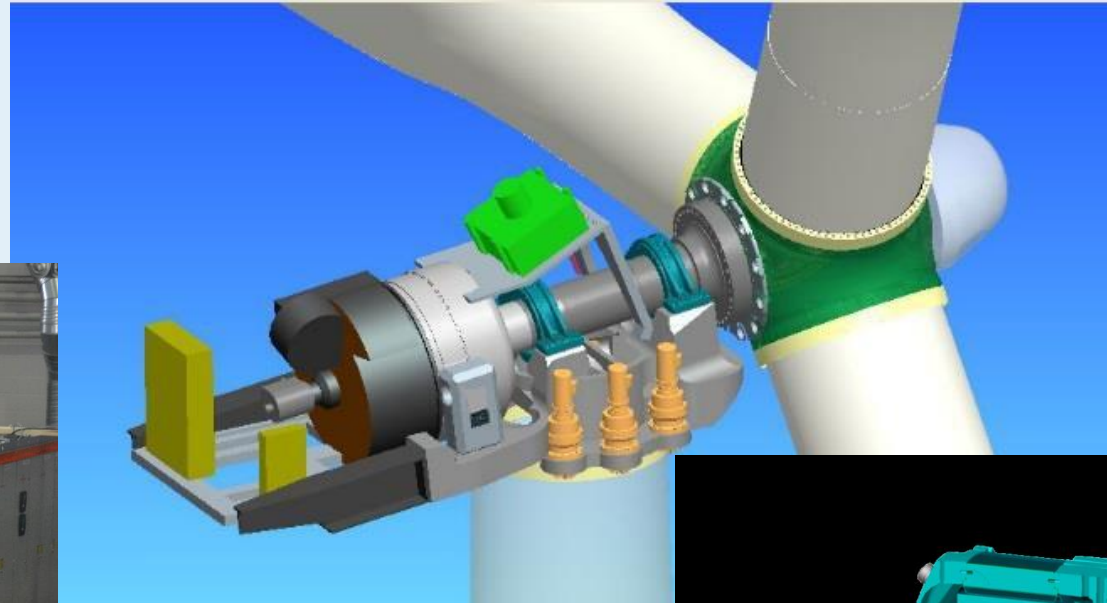
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Drivetrain and Powertrain

- Permanent Magnet Generator (PMG) selected for high energy output at low wind speeds, low maintenance
- Associated Converter offers low harmonics and grid stabilization without additional equipment
- Low ratio gearbox for reliability
- PMG and gearbox integrated into a single package to reduce weight and cost. Two are already manufactured, tested and certified.
- Two main bearings to reduce bending transferred into gearbox
- Service up tower to minimize operational cost

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Drivetrain



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- Projections, with funding in July, 2022

Item Thru	<u>2023</u>	<u>2024</u>	<u>2024</u>	<u>2025</u>	<u>2026</u>
# of blade molds	1	1	1	2	3
# of wtgs	Prototype	60	100	170	250
Revenue(millions)	\$0	\$240	\$400	\$680	\$1,000
Profits (millions)	\$0	\$28	\$48	\$82	\$120

Web site www.21stCenturyWind.com

For further information on funding please contact John West, cell 717 961 9165 John@21stCenturyWind.com
Thank you.