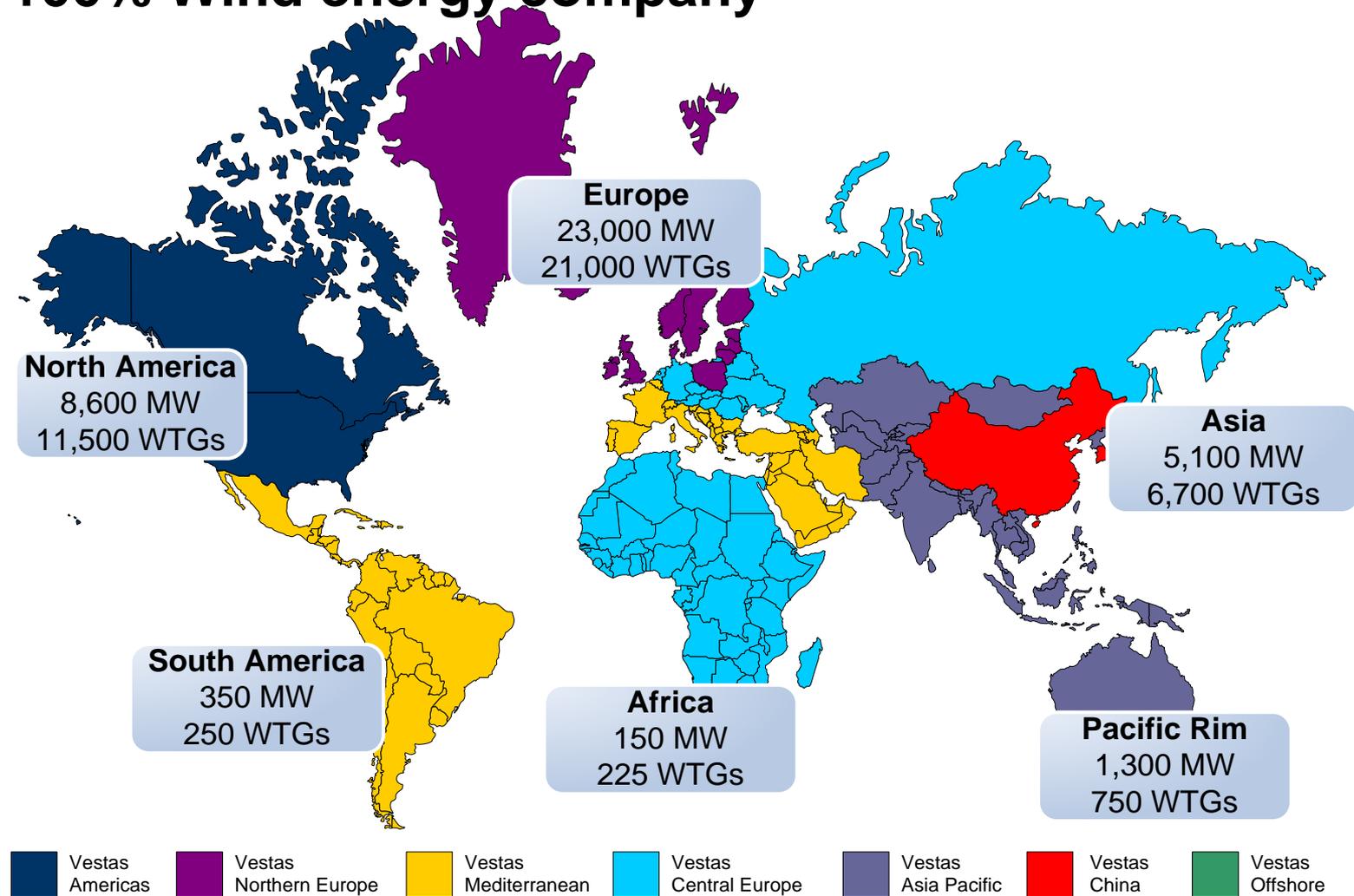




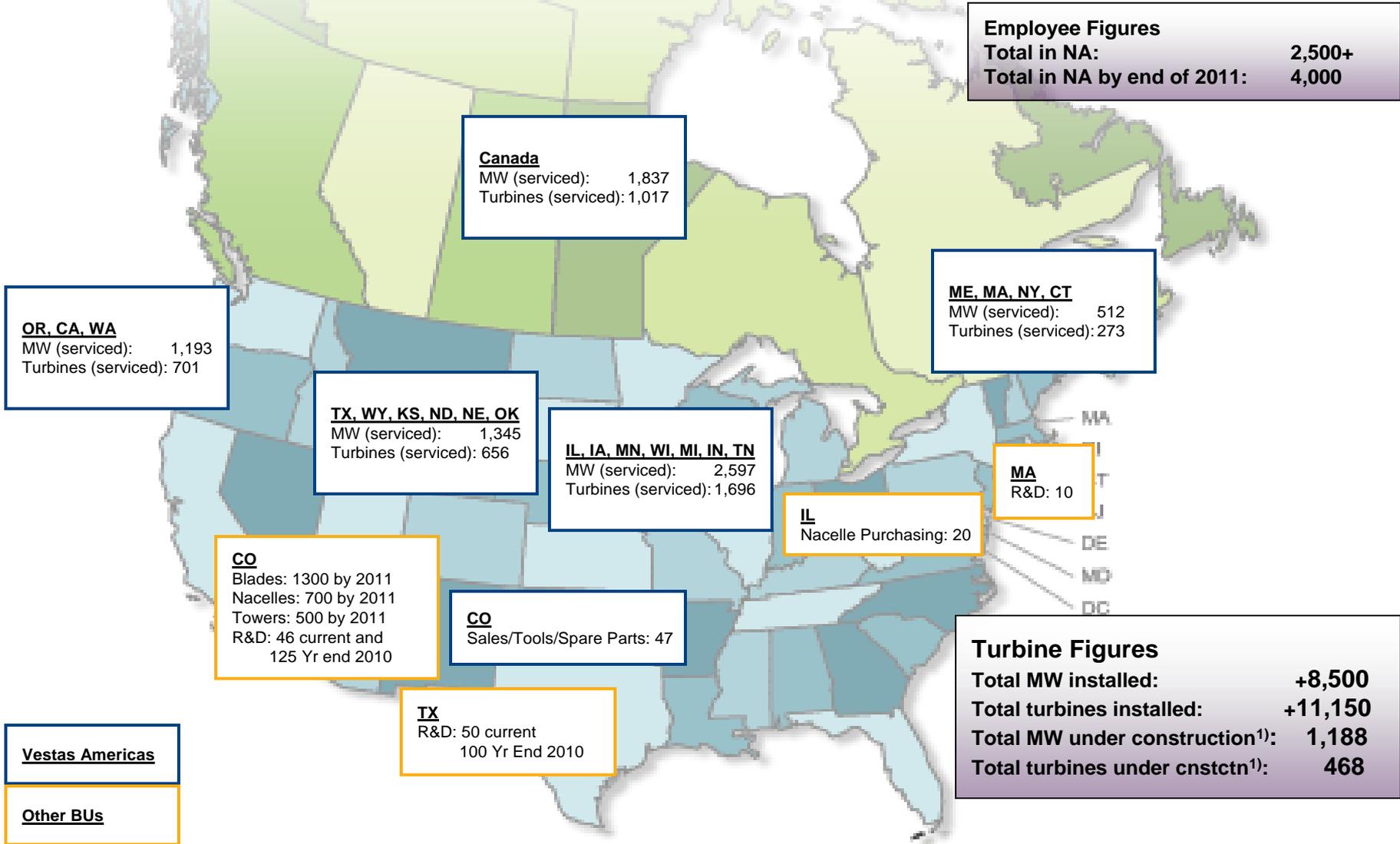
Vestas Wind Turbine Technology, BLM Training – NREL Colorado, September 2010

Vestas turbines around the world...

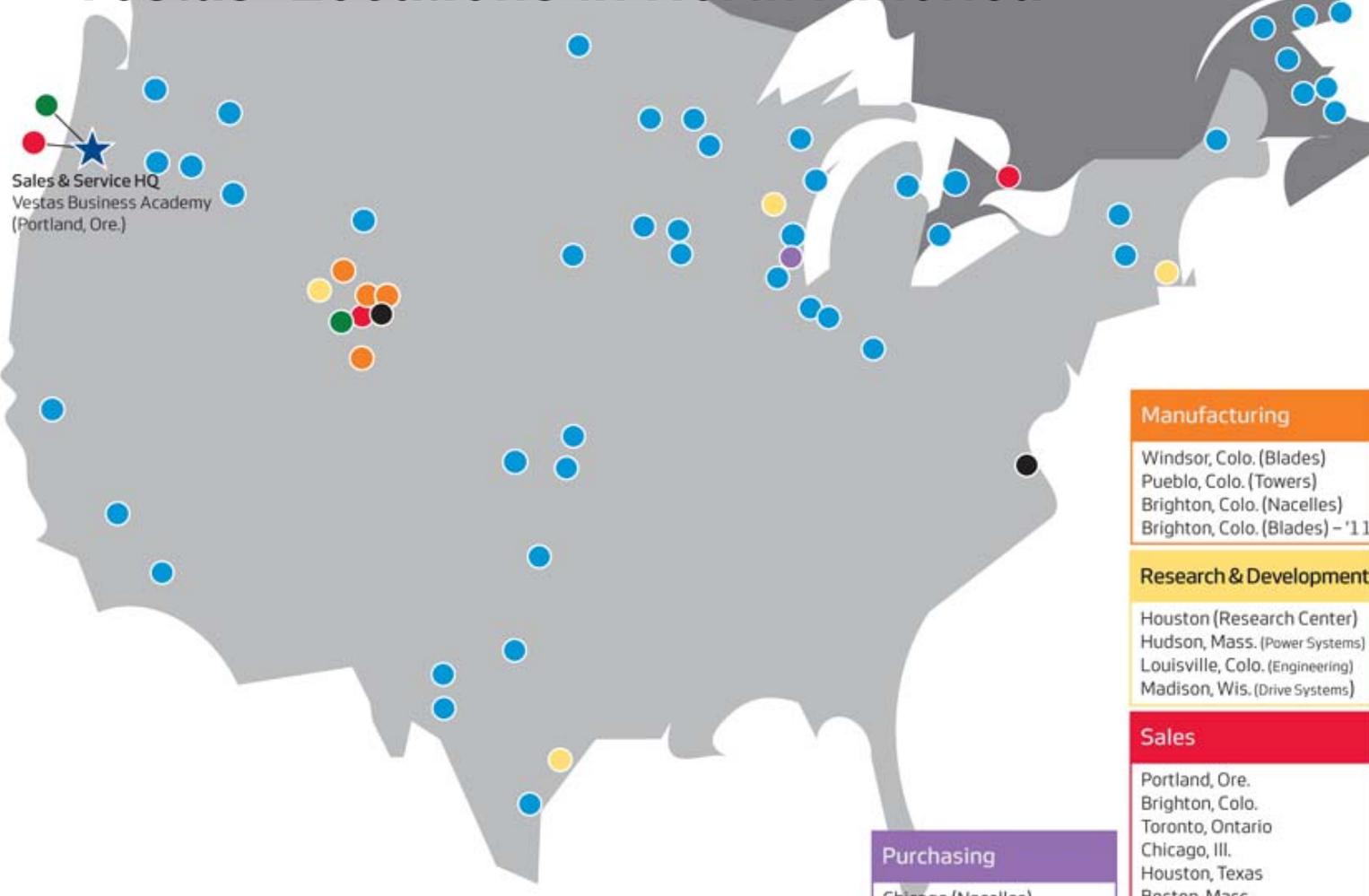
100% Wind energy company



Vestas – North American Business



Vestas' Locations in North America



Sales & Service HQ
Vestas Business Academy
(Portland, Ore.)

Onsite Service Offices

- United States**
- Bad Axe, Mich.
 - Carnegie, Okla.
 - Cheyenne, Wyo.
 - Concordia, Kan.
 - Crofton, Neb.
 - Dayton, Wash.
 - Dodge Center, Minn.
 - Ellensburg, Wash.
 - Ellsworth, Ill.
 - Eustis, Maine
 - Fon du Lac, Wis.
 - Fort Stockton, Texas
 - Fowler, Ind.
 - Goldsmith, Texas
 - Hampton, Iowa
 - Hermiston, Ore.
 - Kermit, Texas
 - Lake Park, Iowa
 - LeRoy, Minn.
 - Lowville, N.Y.
 - Luxemburg, Wis.
 - Marienthal, Kan.
 - Madison, N.Y.
 - Malone, Wis.
 - Merkel, Texas
 - North Palm Springs, Calif.
 - Rio Vista, Calif.
 - Salina, Kan.
 - Taft, Texas
 - Tehachapi, Calif.
 - Tiskilwa, Ill.
 - Tyler, Minn.
 - Union, Ore.
 - Velva, N.D.
 - Ventura, Iowa
 - Wasco, Ore.
 - Wolcott, Ind.

Manufacturing

- Windsor, Colo. (Blades)
- Pueblo, Colo. (Towers)
- Brighton, Colo. (Nacelles)
- Brighton, Colo. (Blades) - '11

Research & Development

- Houston (Research Center)
- Hudson, Mass. (Power Systems)
- Louisville, Colo. (Engineering)
- Madison, Wis. (Drive Systems)

Sales

- Portland, Ore.
- Brighton, Colo.
- Toronto, Ontario
- Chicago, Ill.
- Houston, Texas
- Boston, Mass.

Purchasing

- Chicago (Nacelles)

Government Relations

- Washington, D.C.
- Brighton, Colo.

Spare Parts & Repair

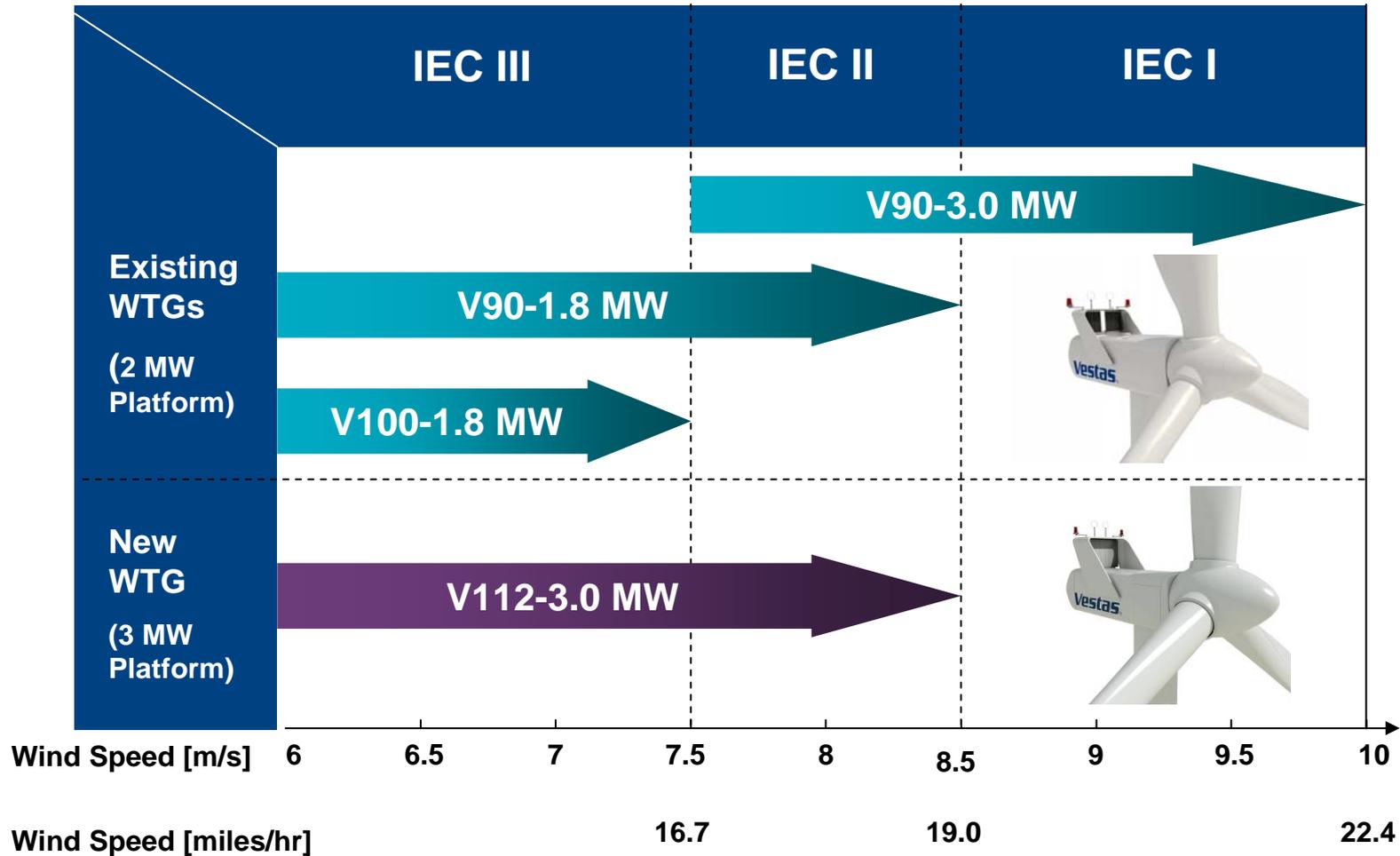
- Portland, Ore.
- Denver, Colo.

Canada

- Bathurst, New Brunswick
- Elmira, PEI
- Fermeuse, NL
- Moncton, New Brunswick
- Murdochville, Quebec
- Pincher Creek, Alberta
- Springfield, PEI
- St. Lawrence, NL
- St. Leon, Manitoba
- Swift Current, Saskatchewan
- Tiverton, Ontario

Locations in the U.S. and Canada

Vestas North American Turbine Range



Vestas - Environmentally Responsible Design Based on Proven Technology

Blade and Nacelle

- 100% recyclable fibreglass/carbon fibre
- Used to make Railroad Ties and other building products.

Recyclable Metals

- Tower, bed frame and gearbox all steel. Copper cables and steel all recyclable.

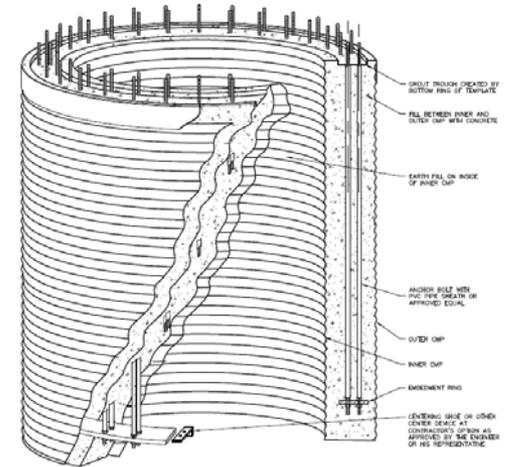
No External Transformer:

- Vestas turbines have no pad mounted transformer. The transformer is integrated into the nacelle



Dry Transformer

- Oil free transformer to remove possibility of leaks.



Tubular Foundation Design

- Tubular design saves 80-90% of the cement when compared to a traditional spread footing, reducing truck traffic and extent of excavation.
- Easily removed to 3ft below grade at end of life

Vestas - Environmentally Responsible Design Based on Proven Technology

On-demand Aviation Lighting

- Small RADAR systems on outer turbines pan for Aircraft and activate the lighting when an aircraft is approaching. Minimizes visual impact.

Pitch System

- Double feeding pump system ensuring redundancy and reliability. In the event of pitch system failure, an individual blade pitched to feather can stop the machine.

Blade

- Fibre glass shell bonded to a carbon fibre spar
- Lightning protection system capable of handling 200kA minimizes fire risk.

Vestas CoolerTop™

- Water/glycol cooler
- No external valves to minimize leak potential.

Conventional drive train

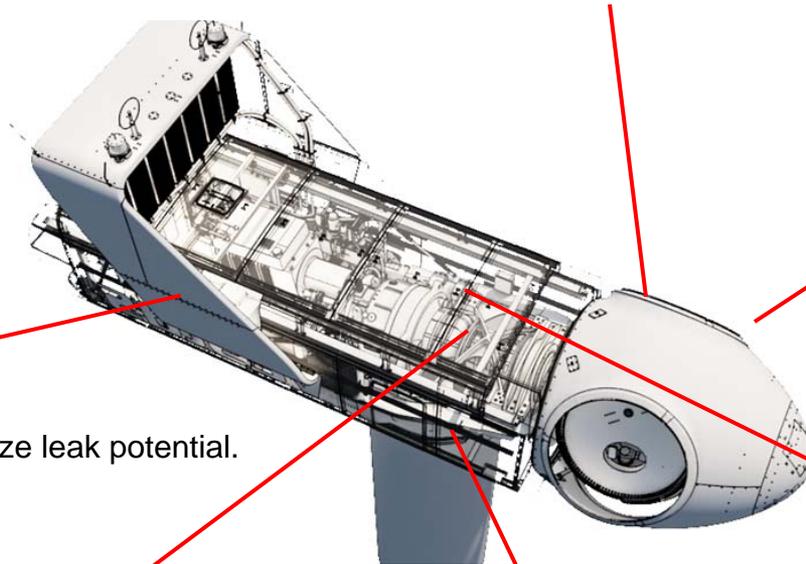
- Drive train based on prior WTG's with traditional main shaft and dampening
- All main components able to be replaced with internal or tower climbing crane

Oil Capture

- Internal bunding system: Should a gear fracture occur, turbine basement has bunding capacity greater than gearbox oil content.

Onboard Fire Protection

- Arc detection and auto stop standard
- Smoke detection an option
- Fire suppression an option



Vestas Tower Climbing Crane

Capable Of All Major Component Change out:

- Gearbox
- Generator
- Blades

Reduced Truck Traffic

- Transported on 1 flat bed truck Vs 15 flat beds for a conventional boom crane.
- No permanent crane pad required (access road sufficient)

Reduced Downtime

- Faster response means minimized down time and no unsightly non-operating turbines.
- Reduced visual impact when compared to component replacement with a conventional boom crane



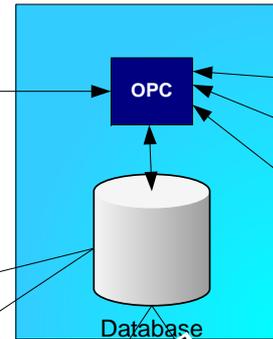
Vestas SCADA and Service Management limit turbine downtime and turbine visits

Vestas 24/7 Turbine Surveillance Center



Monitoring and control data

SCADA Server



Customer reporting center



Direct read-only access to database

FTP and email containing turbine operational data

Production and availability PDF reports via email

Email and SMS with turbine events

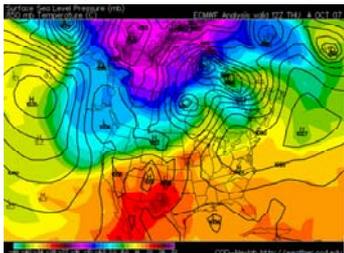
Service personnel



Customer management

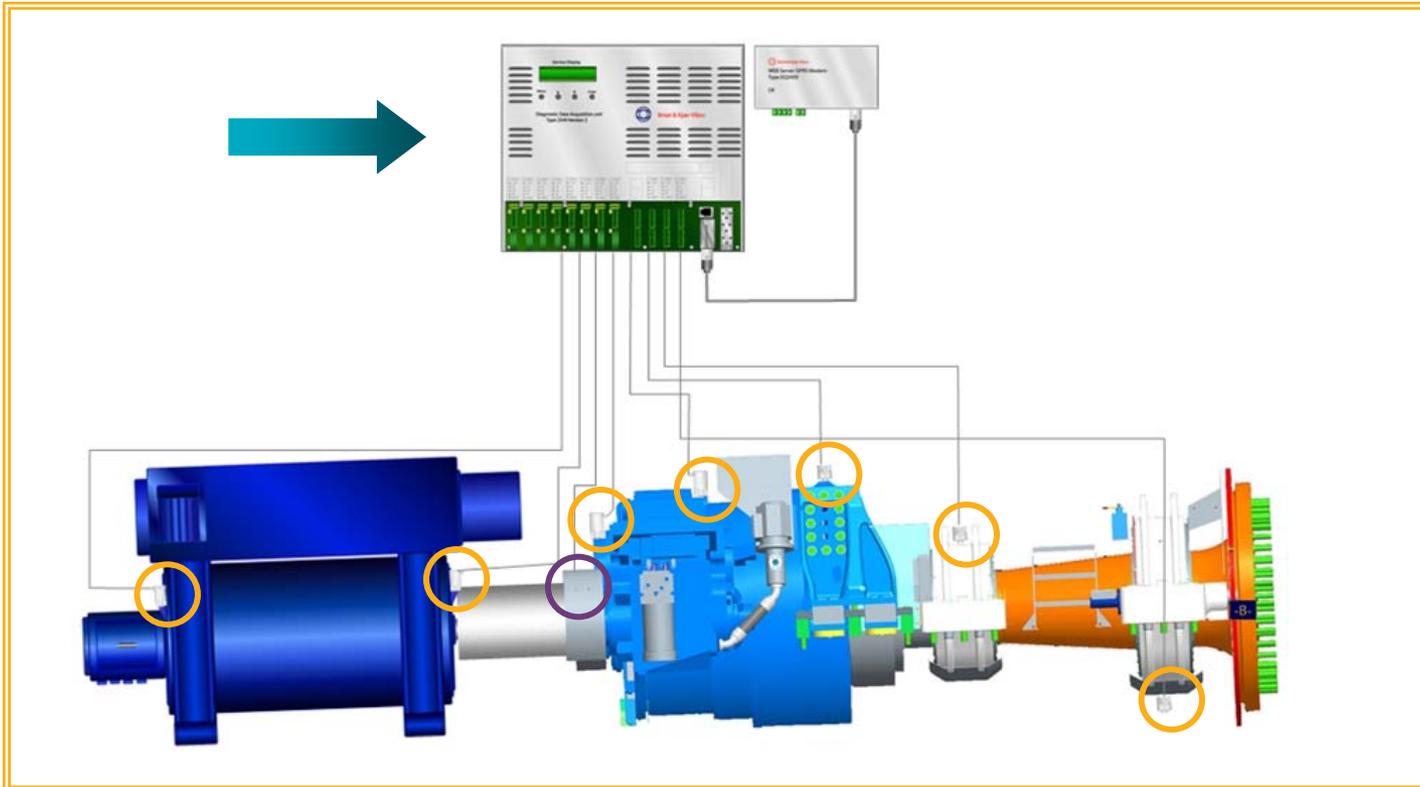


Meteorological forecasting center



Vestas Condition Monitoring

- Assessment of the "health" of a machine by analysis of measured signals (vibration/temperature etc)
- Estimation of time of failure → optimised **planning** of maintenance activities
- **Minimizes unnecessary service visits through remote monitoring and bundled service visits.**



Flexible Operation

Intelligent strategies for minimizing Bird and Bat Impact:

- Ability to increase cut in speeds for during specific times of day for the duration of bat migration season.

Ability to vary the sound output of the turbine

- Variable rotor speed allows for reduced sound output if required.

Shadow Control

- Onboard light detection system in conjunction with predetermined solar tracking allows the turbine to be curtailed and minimize shadow flicker impact with minimal production impact.

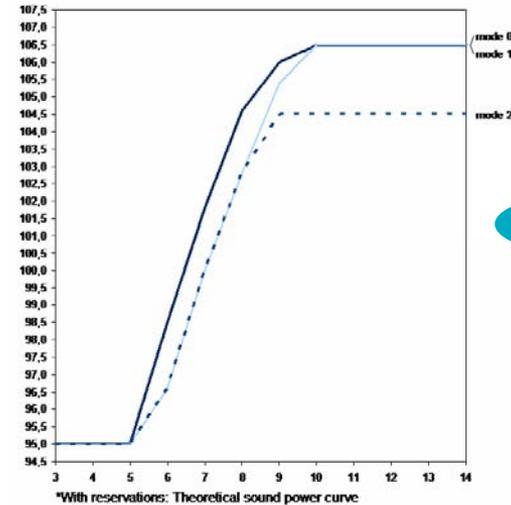
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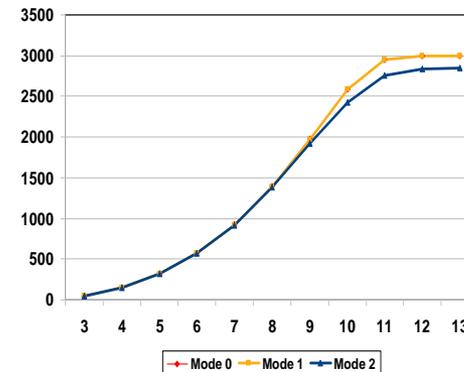
Production Impact

- All deviations from an optimized solution will have an impact on the annual energy output and profitability of the project, so it is important that these are applied only where necessary.

Sound power* level mode 0,1 and 2



Noise Curve



Power Curve

Questions?

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