Jeffrey Petersen
Sales Director, Goldwind USA

What is Goldwind USA, Inc.?

Top Tier Chinese Company

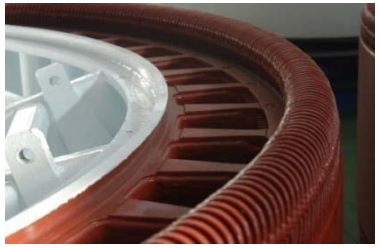
- Over 20 year history in wind energy research, development, manufacturing, and operations
- Excellent financial performance, order book, & customer base
- Bankable products, with certification, testing, & QA/QC to international standards
- Total Installations of over **6,000** wind turbines worldwide
- 2nd largest wind turbine manufacturer by 2009 market share

Field-Proven, German-Designed Technology

- 7 years of operating history
- >12,000 PMDD machines in operation
- >97% fleetwide availability

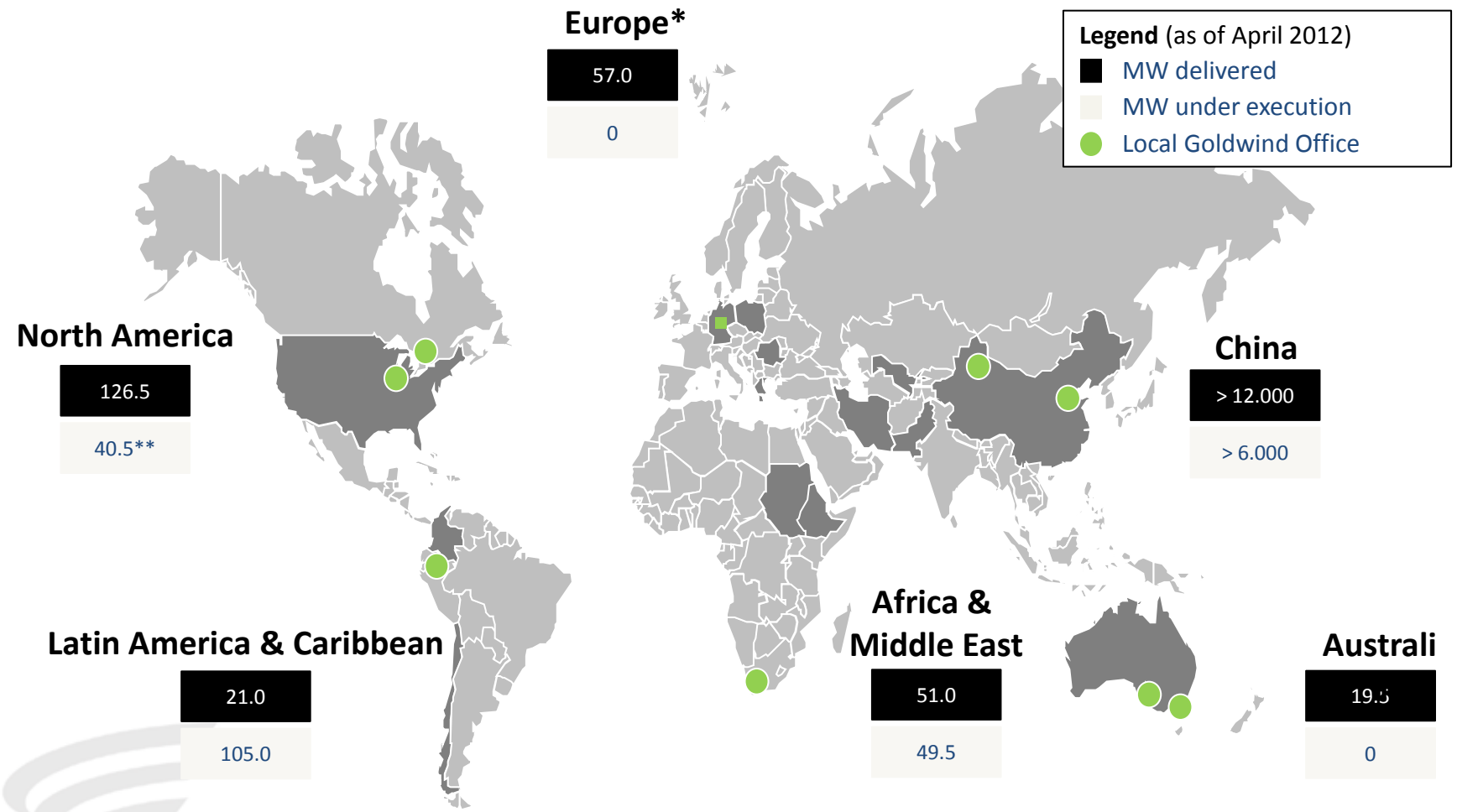
Experienced US Management Team

- Executive team with extensive background in US wind industry
- Management level all former wind professionals (GE, Gamesa, Clipper)



Committed to Expansion: Increasing our global footprint

Goldwind's active markets cover six continents.



- Vensys.
- ** Includes project acquisition deals

Engineering in The Wind Turbine

Engineering in The Wind Turbine

Aerodynamics and Fluid Dynamics: Blade design is crucial to effectively harness the wind's energy

Mechanical Engineering/Computer Science: Yaw, Pitch, Gearbox (if applicable), and Generator all make a dynamic system that transfers the wind's energy into rotational energy, controlled through detailed computer programming

Electrical Engineering: Generators convert the rotational energy into electromagnetic fields creating electrical energy

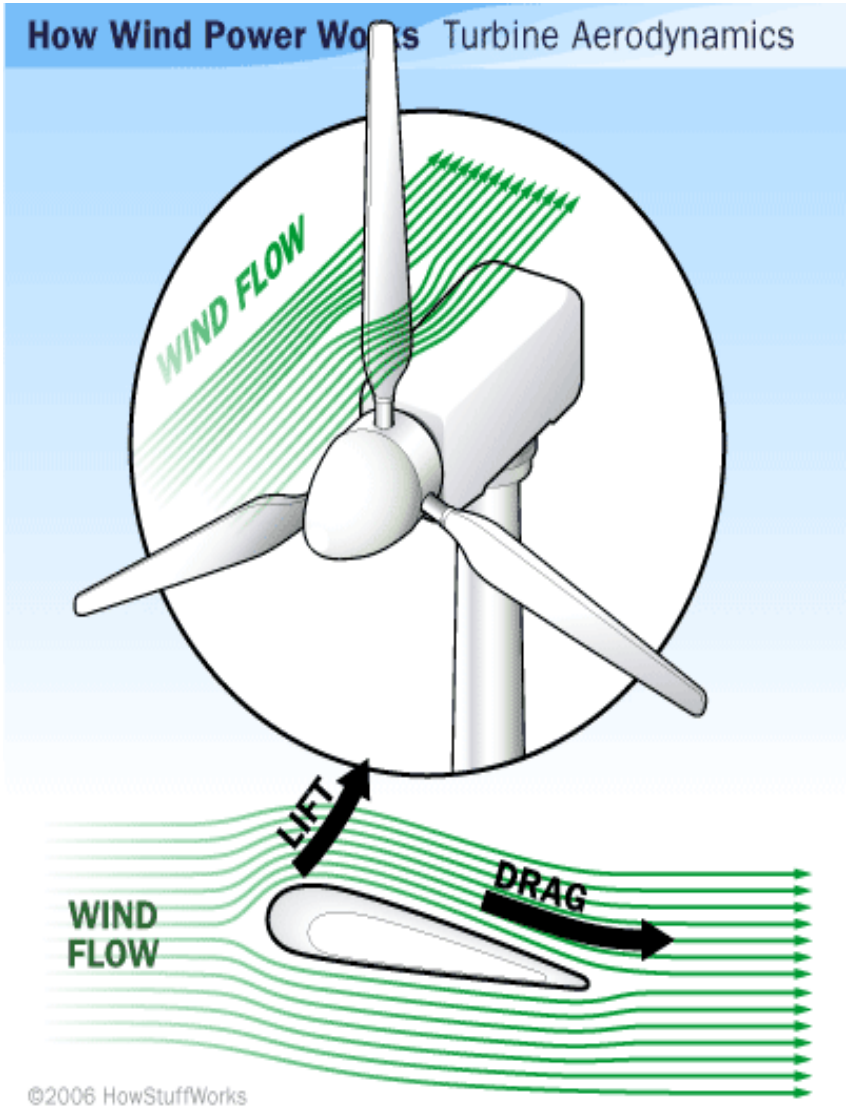
Thermodynamics: Heat loss during power generation is loss of efficiency, but a reality and must be dealt with to preserve delicate electrical components

Civil Engineering: Towers and foundations that can support heavy loads.

Computer Science and Control Systems: Downtower converters change variable frequency electricity into usable 60 Hz AC electricity

Systems Engineering: The entire electromechanical power generating system of the turbine must work in unison with the electrical grid in order to successfully convert wind to energy

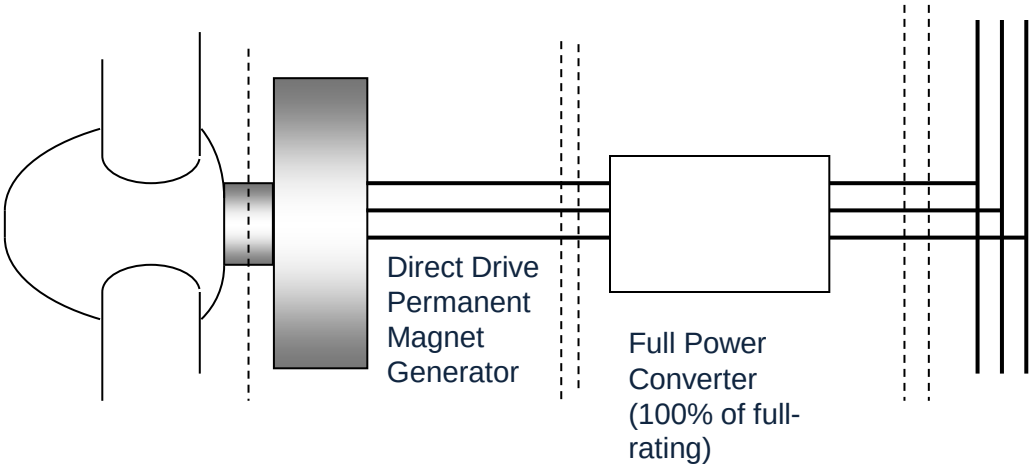
Aerodynamics



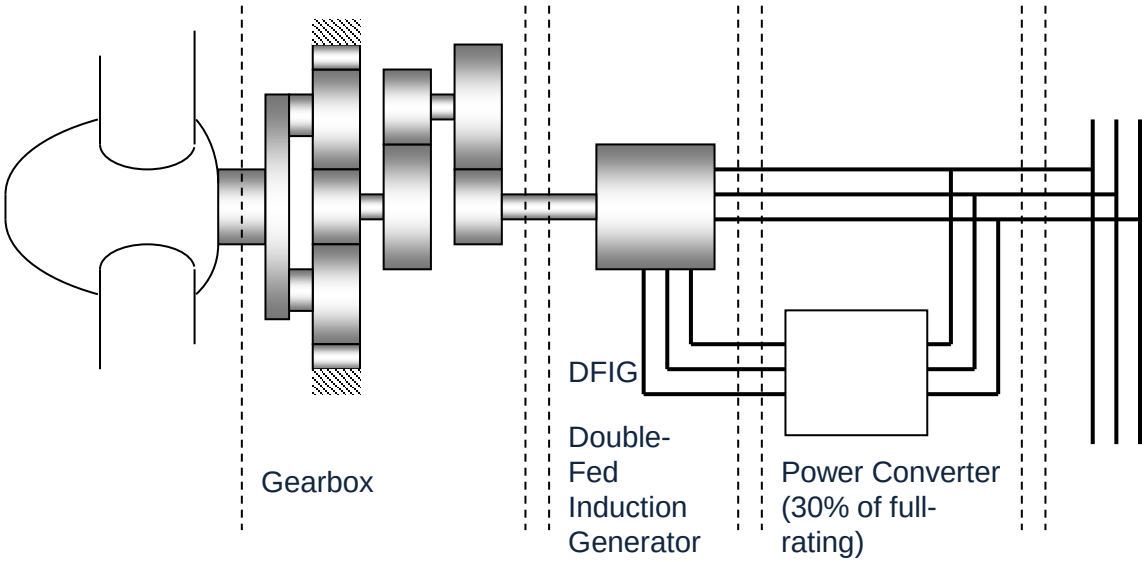
- Blades are designed like airplane wings to power rotations.
- Air traveling over the rounded, downwind face of the blade has to move faster than the wind travelling over the flat, upwind face of the blade. Faster moving air rises creating a low-pressure area above the wing.
- The low-pressure area sucks the blade in the downwind direction, an effect known as "lift." On the upwind side of the blade, the wind is moving slower and creating an area of higher pressure that pushes on the blade.

Mechanical Engineering
Gear Box vs. PMDD

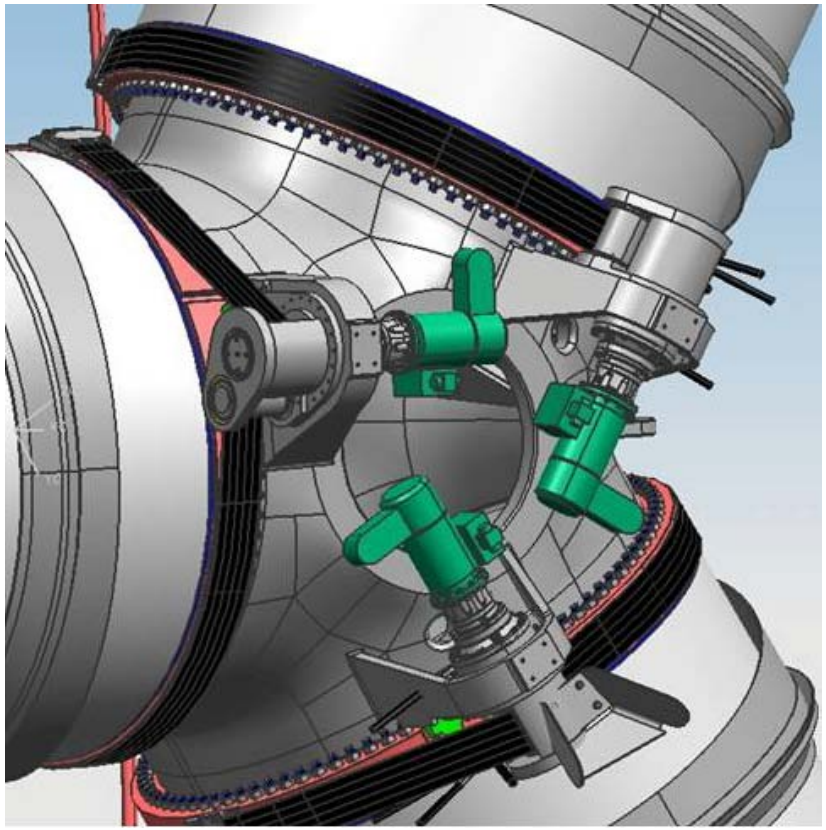
Direct Drive Permanent Magnet Technology – Forward Trend for Wind Industry



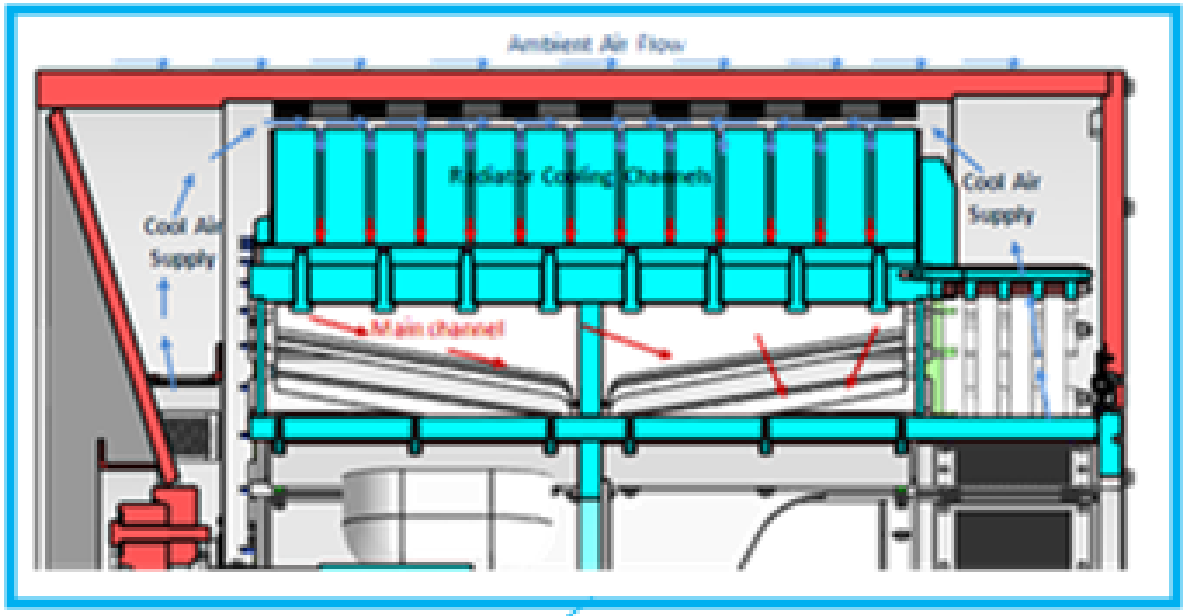
Gearbox Doubly Fed Induction Technology– Incumbent Technology



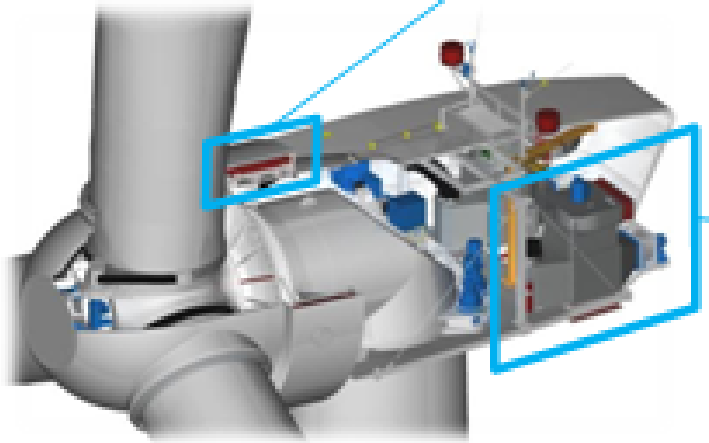
Mechanical Engineering

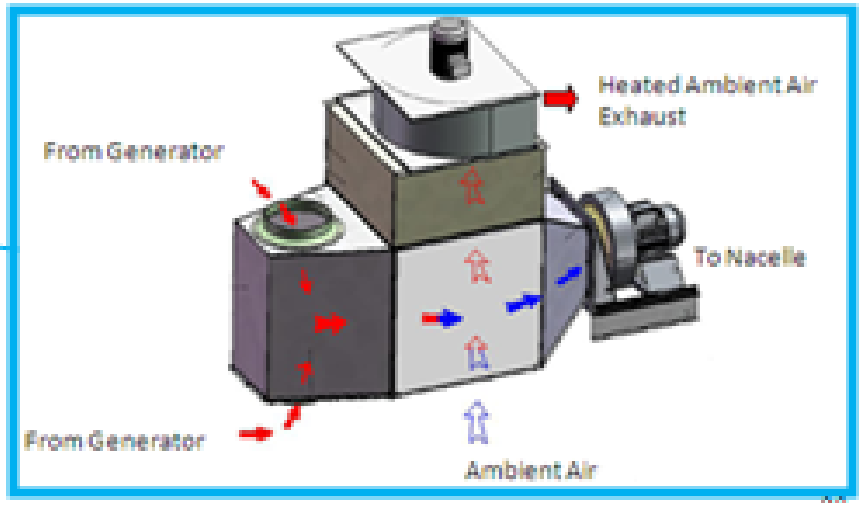


Thermodynamics

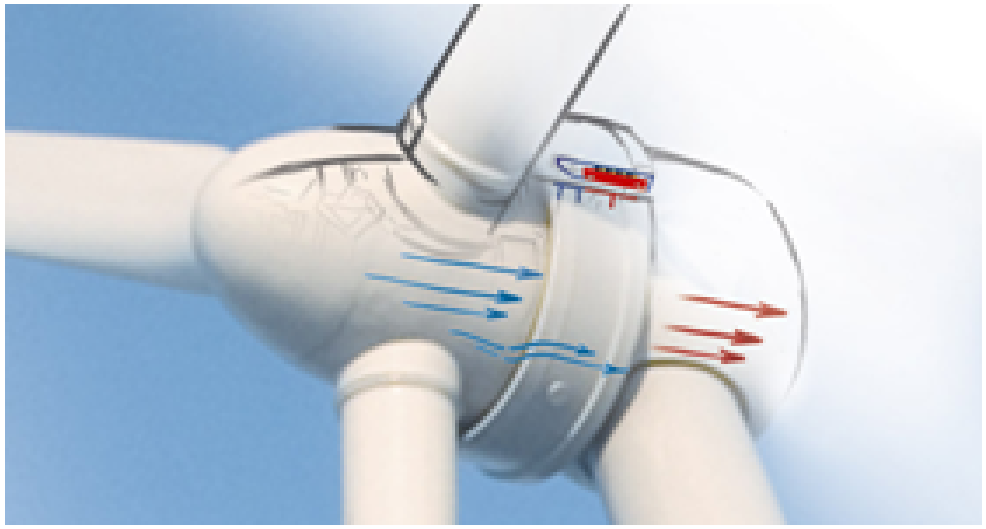


- Goldwind's 2.5 MW has an active cooling system that draws cold air through the generator stator coils
- The system is "closed loop" and uses an air to air heat exchanger prior to re-circulation

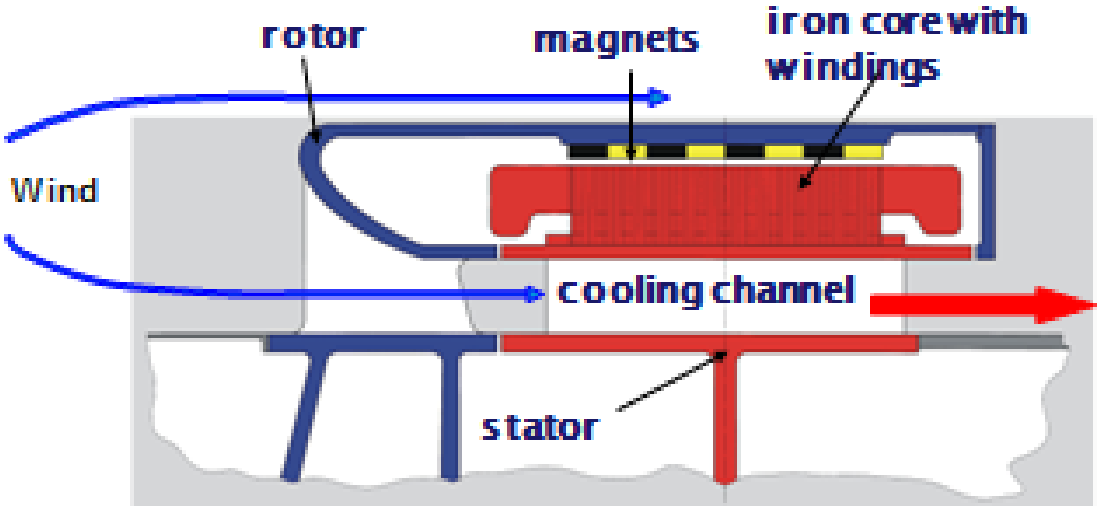




Thermodynamics



Enclosed generator, passive cooling by the wind



Outstanding generator cooling performance

Systems Engineering

1 Rotor blade

2 Cast hub

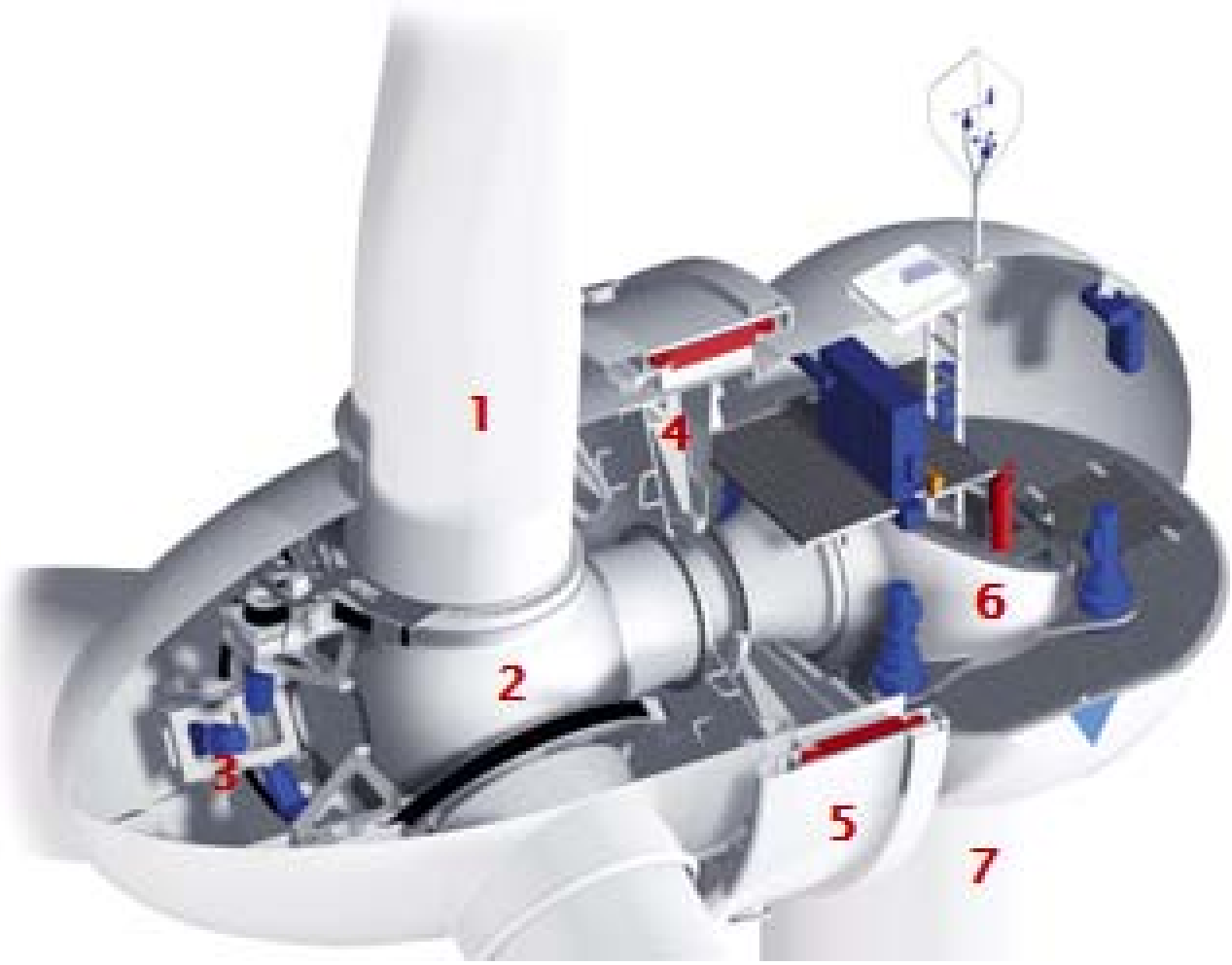
3 Pitch drives

4 Generator stator

5 Generator PM rotor

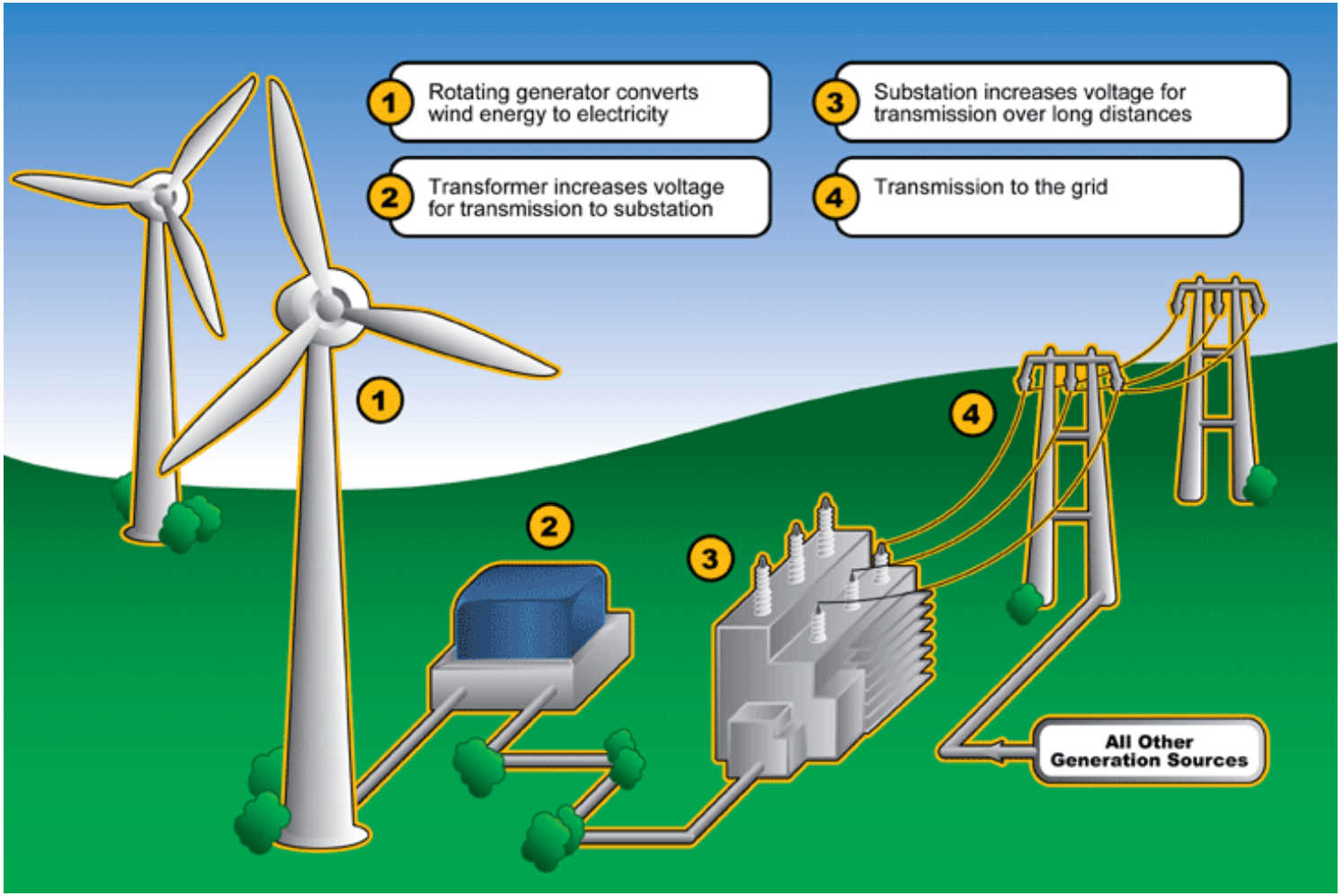
6 Base frame

7 Tower



Electrical/Systems Engineering

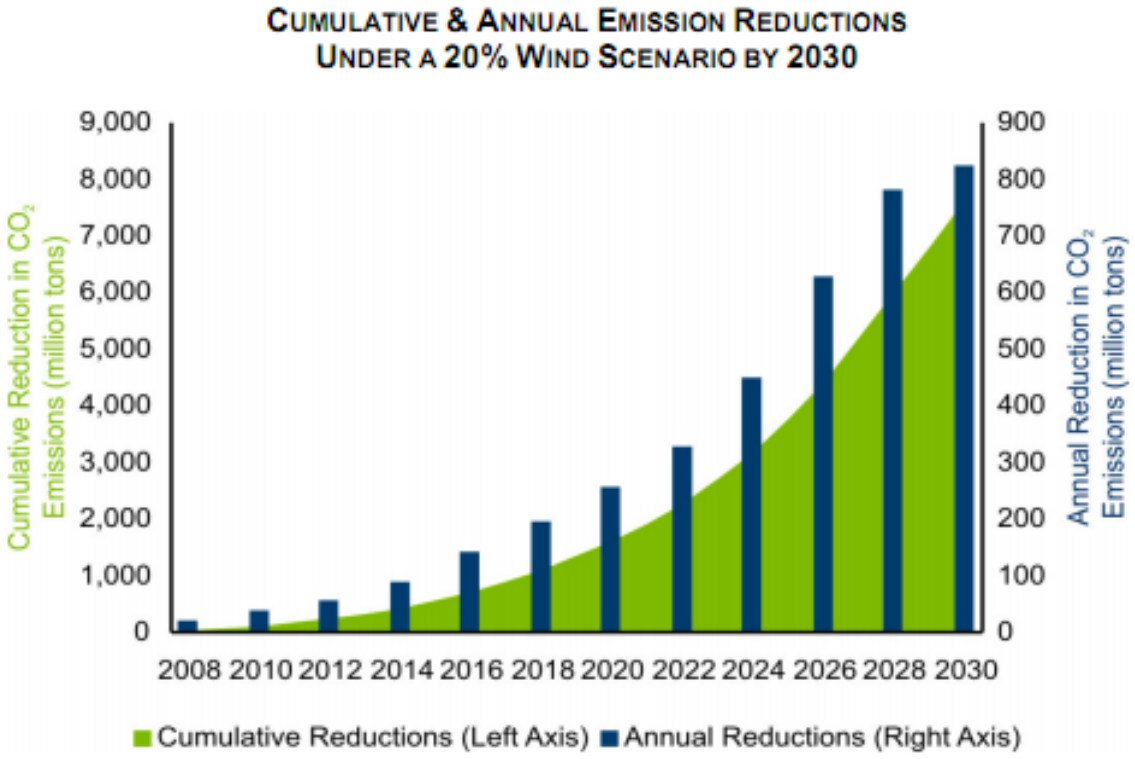
- **Intermediate transformers and substations increase voltage for travel.**



Environmental Benefits

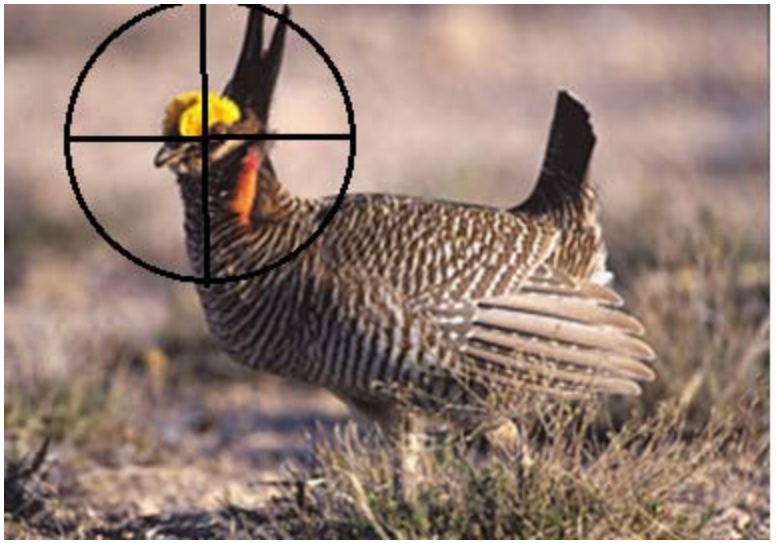
- One megawatt-hour (MWh) of wind energy produced reduces CO2 emissions by roughly 1,200 pounds each hour.
- 40,181 MW of total installed wind reduces 24,000 tons of CO2 emissions each hour.

- If we reach 20% wind energy by 2030, the DOE reports that wind energy could avoid 825 million tons of CO2 annually by 2030, cutting expected electric sector emissions by 20-25%.
- This is equivalent to taking 140 million vehicles off the road.



Why doesn't everyone love wind?

- Acquiring support of ~~an irrational~~ local population
  - NIMBY
  - Flicker
  - Wind turbine syndrome



- Sensitive, protected land
  - Animal habitats
  - Animal migration zones
  - Protected wetlands

What if everyone loved wind?

- Wind load is far from Wind Resource:
  - Areas of strong winds are far away from large cities, making delivery of wind a very difficult process

- Electrical Transmission Congestion:
  - If too much energy is already flowing to cities through limited infrastructure, harnessed energy will go unused and unpaid for.

- Financial: Requires huge amounts of capital to fund. Must find a financial institution willing to take on risk.
  - 20MW = $40M

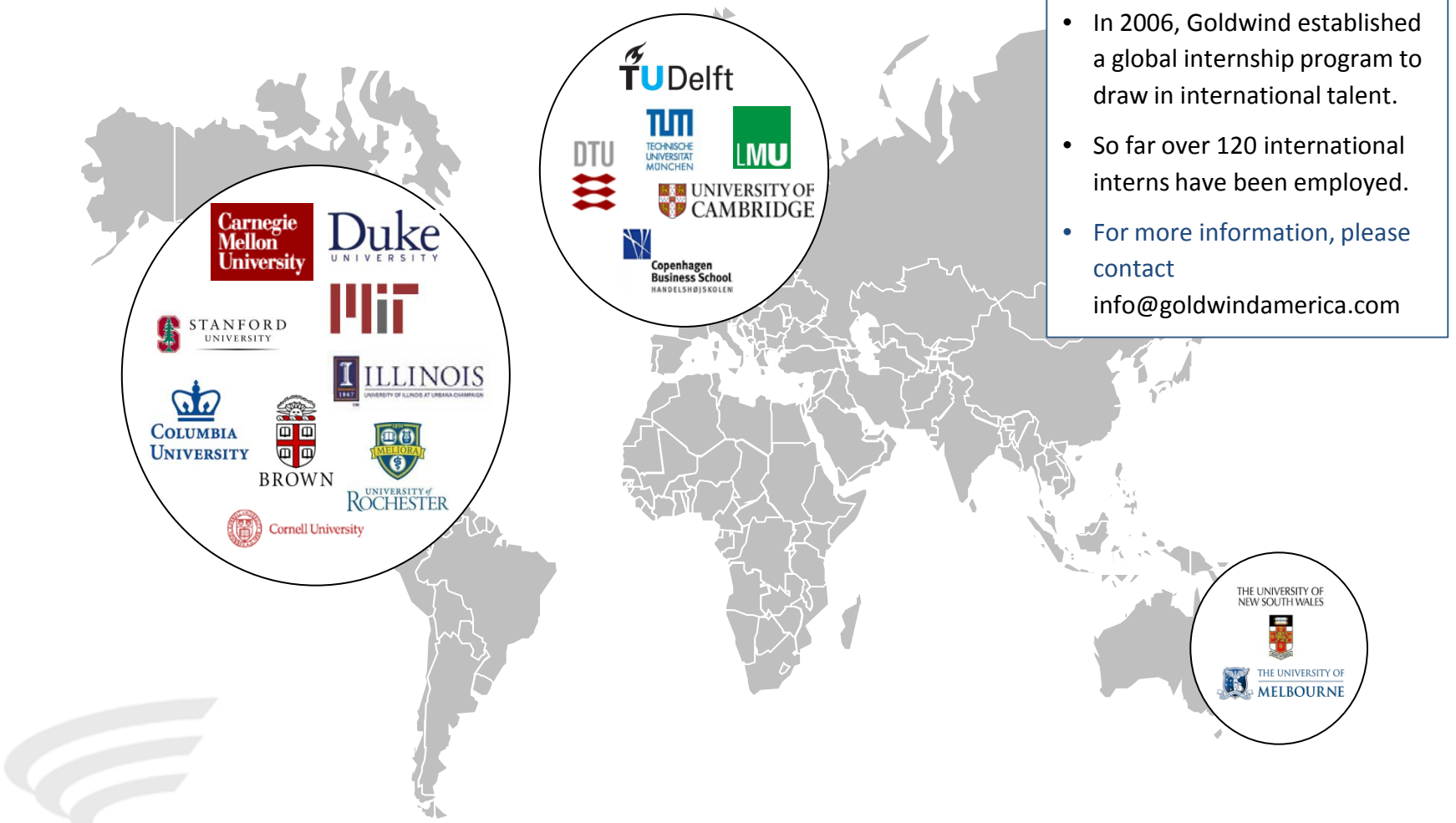
Goldwind University (GWU)

In September 2011, Goldwind launched the first corporate university within China's wind turbine manufacturing industry.

- Goldwind provides outstanding benefits to its employees.
- This includes a wide range of activities, a sports club that includes a swimming pool, a basketball court and a tennis court.
- With the establishment of Goldwind University, Goldwind also continuously enhances the knowledge base of its employees, focused on but not limited to renewable energy.
- GWU partners with leading universities globally.

Talent Recruitment: Global Internship Program

Goldwind established a network with prestigious universities around the world.



- In 2006, Goldwind established a global internship program to draw in international talent.
- So far over 120 international interns have been employed.
- For more information, please contact info@goldwindamerica.com

Final Thoughts and Questions