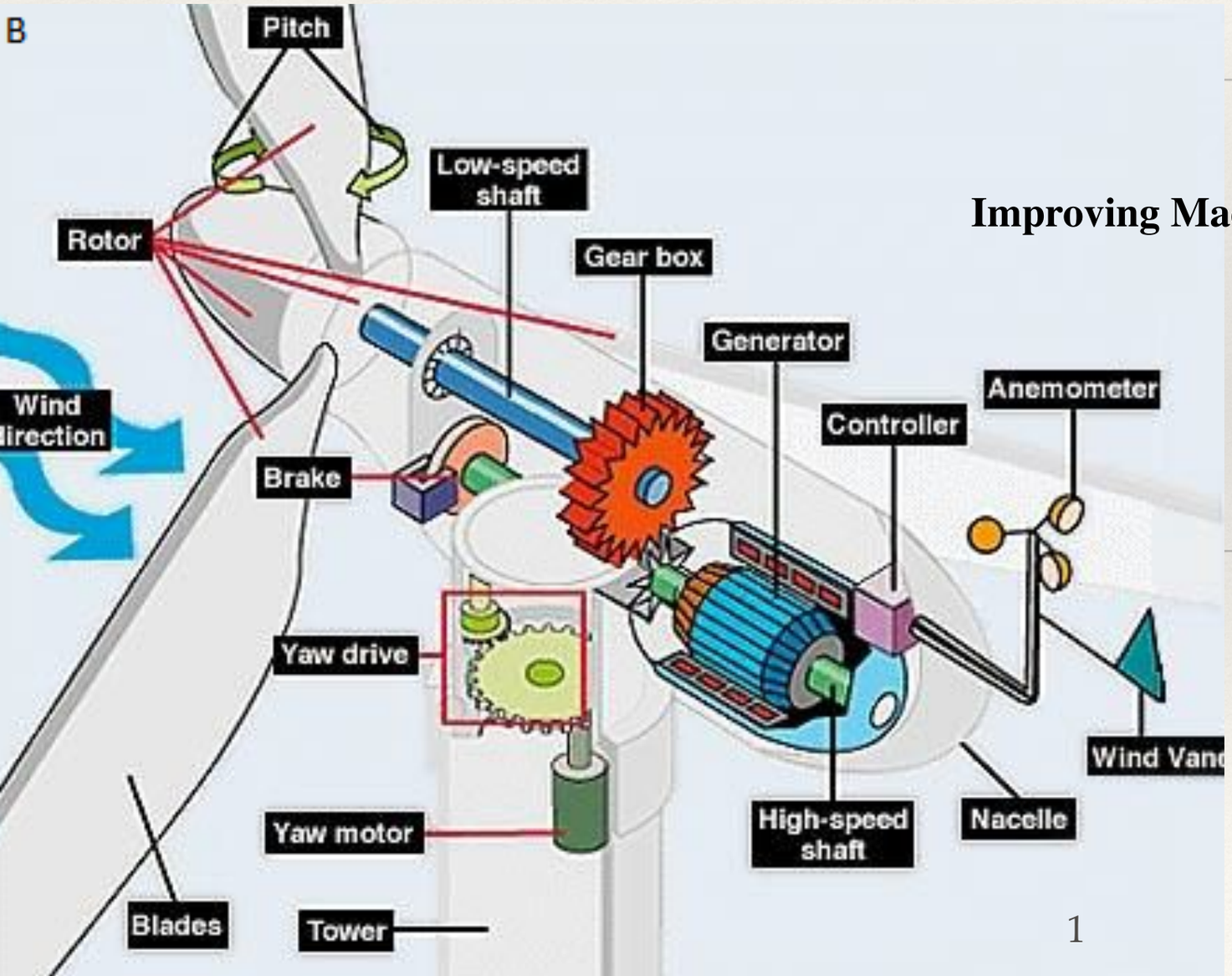
Heat stress in operation and maintenance (O&M) of wind energy turbines



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*"**Design: many of the OSH risks in the wind energy sector come from the design stage.** Design is a critical stage in minimising the potential for OSH issues throughout the life cycle of wind turbines.*

With prevention through design, OSH will be incorporated into the design at the very earliest stages of a wind farm project and this will allow the 'designing out' of hazards and risks and help to prevent or minimise work-related accidents and ill health in the sector.

The industry should be designing systems to be safe, not adapting a design to make it safe." (*EU-OSHA E-FACTS-79*)

Hazards in wind turbines O&M - a shortened list of what is included in risk assessments docs:

- **Security hazards:** work at heigh, electricity, rural road transport, fire, cuts, etc.
- **Toxic** substances are used or created. Several areas are or became **confined spaces**: such as nacelles, blades, rotor hub, tower, tower basement and pad mount transformer vaults, depending on the substances present, the work to be carried out, and the level of ventilation: use of solvents, flammable gases, epoxi resins, bisphenol, sulphur hexafluoride (SF6), dust (fiberglass and other), fumes, toxic gases, etc.
- Turbines contain **confined spaces** and spaces with **short ventilation apertures**, specially in newer models.
- Exposure to noise, **sunlight, (UV …),**
- "**Meteorological** risks" designate **winter events**: electrical storms, snowstorms, winds, ice failing from blades, ice on rural ways, etc.
- **Poor ergonomics and physical efforts:** carrying materials, ladder climbing, static awkward postures, repetitive work, etc. But exertion demand is assessed as "moderate" as O/M technicians are considered acclimatized
- Heat stress exposition is evaluated in relation to PPE, detached of other aspects, and considered not a problem
- High ambient temperatures is viewed at as a"**confort issue**" - (weighted out as a minor problem compared to "security", hazards). WGTB measurement are usually done during "a representative day"

Practices that increase **heat stress** risks

- Outside Europe, lifts are not a requirement but an option.
- Turbines can become unbearable heated ambients: the machinery is shut down by the team, *in situ*, + external ambient heat and sun radiation
- PPE are a requirement for several hazards: toxicants, oxygen depletion risk; noise, security risks (falls from heigh, electricity, fire, ….)
- No easy exit from the nacelle; Emergency rescue is a problem
- No in-areas shielded from heat, to allow for interruption of the exposition to ambient heat, or to rests to make possible hyperthermia reduction.

Hazards emerge also from the work organization and the business model

- O&M is an outsourced production process: after the guarantee period ends, the owner of the towers choose an "O&M" provider considering cost effectiveness, based mainly on a guarantee of highest "availability" (often of 95%)
- O&M companies operate in a global market - under high "productive" pressure in a globalized market
- O/M companies as subcontractors cannot do much to reduce the need of protective clothes /PPE, improve access, to reduce physical effort and to ease first aid, emergency aid, and rescue provisions.
- Inter-regional and "global" displacements of O/M technicians. (1) Equipments installed in other countries don't meet all the EU H&S requirements. (2) Displacement poses a frequent thermal acclimation challenge for technicians.
- O/M technicians are considered to be "autonomous"- When the ambient is extremely hot, **instead of working slower, technicians hurry up, to ensure they can finish and go out of the tower before the middle of the day**

Improvements, by design

- **Reduce visits to turbines, both scheduled and unscheduled; remote control maintenance, etc., specially during extreme events**
- **Reduction of the demand of physical exertion, not only regarding the way up into the nacelle**
- **Reduction of ambiental heat:**
  - **Better ventilation - reduction of inner humidity and temperature buildup, to improve the quality of air, to eliminate confined spaces, less need of PPE, etc.**
  - **Allow the switch off of the equipment, with anticipation**
  - **Shielding of radiant heat sources**
  - **Air conditioning of working areas**
- **Creation of a rest conditioned area inside the tower, and an easy access to it**
- **Elimination/reduction of toxicant and confined spaces**
- **Security improvements to reduce the need of PPE or special clothes for electrical, fire, etc. risks**
- **Evacuation and rescue solutions (emergency descenders, etc.)**
- **Lifts, mandatory**