

REROTORING



INTRODUCTION

Nabla wind hub provides different **Rerotoring** solutions to improve the Power Output of the wind turbines.

On the one side, the **reblading** developed by nabla is based on the replacement of former blades with new longer, lighter and aerodynamically more advanced blades.

On the other, **retipping** consists of installing a Tip Extender at the blade end, using lightweight carbon structures bonded to the solid laminates of existing blades.

Both solutions are produced at nabla's facility in Fano, Italy, with a track record of more than 2000 blades manufactured.

CONCEPT

Turbine wind design conditions are very conservative compared to reality of sites. Each wind farm has a huge potential to be unlocked and the rotor diameter is key for energy production. The blades are key elements for creating loads on the structures and for fatigue life spectra, so acting in the blades with tailored designs or addons can maximize energy production and life expectancy, targeting maximum energy production as long as:

- real site specific loads are kept inside turbine margins of safety and reserve factors
- ensuring a safe long term operation
- winglet: to suppress tip from being dominant source for aeroacoustic noise
- using independent aeroelastic models for design and certification: full non-OEM independency
- designed to be plug&play on the turbine (no need to change the controller)

Reblading, Blade design main characteristics:

- lighter: made of carbon to reduce gravitational fatigue, especially in mainframes (linked to an ageing management plan)
- slender: advanced aerodynamics to reduce sensitivity to turbulence
- winglet: to suppress tip from being dominant source for aeroacoustic noise
- using independent aeroelastic models for design and certification: full non-OEM independency

Retipping, Tip Extension design main characteristics:

- flexible solution: optimal aep upgrade adapted to each site
- minimal impact on the turbine
- base blade tip is kept intact inside the tip extensions: up-tower installation without cranes or installed and ready to use in 8h.

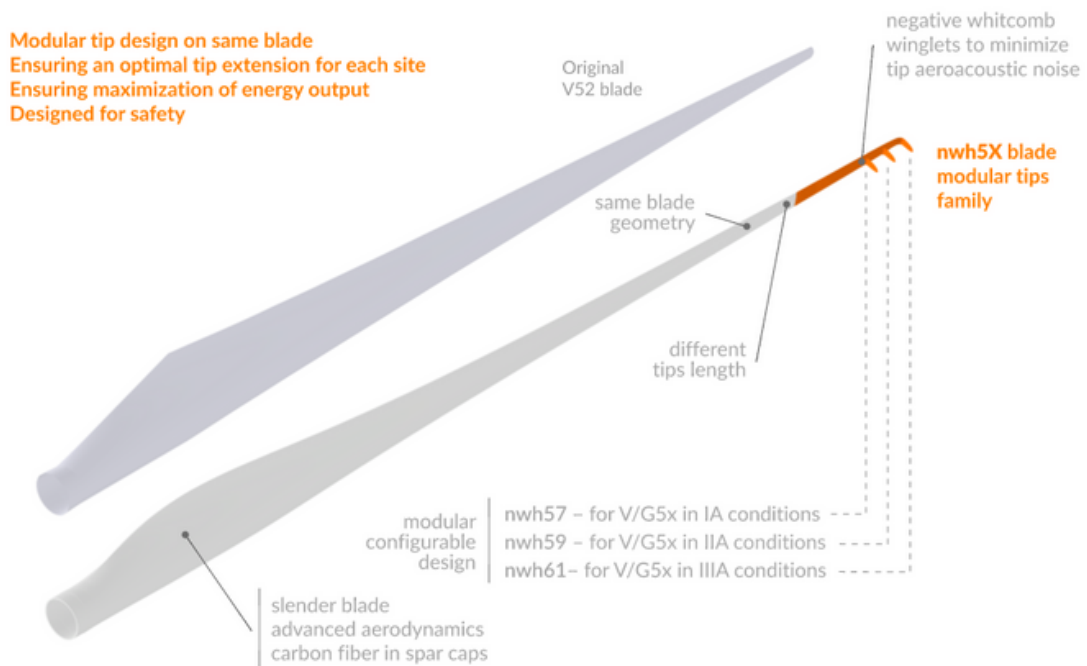
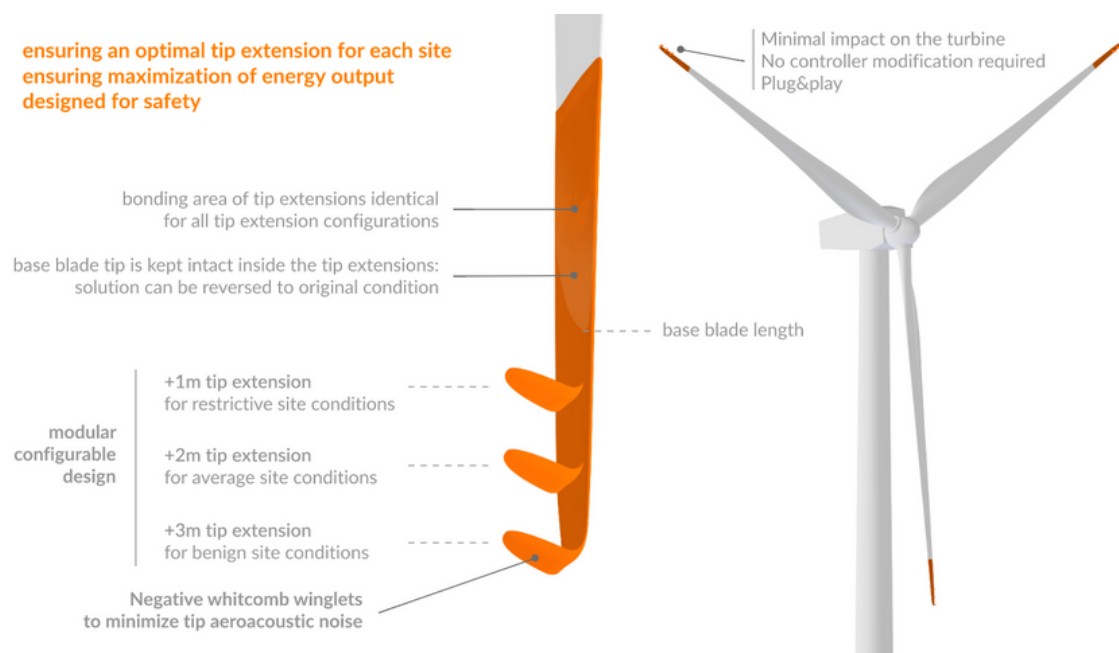


Figure ANNEX II 13-C: Reblading concept in Vestas/Gamesa V/G52 and Gamesa G58



METHODOLOGY

Nabra wind hub offers full end-to-end solution for Rerotoring, including:

- **Assessment** of the performance improvement potential, offered both **at P80 Exploratory Level**.
- **Site Suitability Analysis**, identifying and configuring optimal rerotoring solution, **at P90 Level, suitable for Certification, including:**
 - **Extreme Loads:** ensuring that the solutions provided never exceed design loads (e.g. Vortex Generators increase maximum loads under gusts).

- **Blade deflections:** ensuring there is no risk of blade impact to tower surface (e.g. with longer blades or with controller modifications for higher nominal power).
- **Fatigue Life Consumption:** ensuring that new Life Expectancies with Power Upgrade solutions are inside Target for LCOE minimization (IRR Maximization).
- **Dynamic Power Curve:** showing the effect of the solution in the performance (Dynamic Power Curves are calculated and integrated to show Power comparison per wind speed and overall AEP).
- **Manufacturing,** supply logistics and installation, from nabla wind hub Composites Plant in Fano, Italy.
- Solutions and turbine **Health Monitoring** via **nabla analytics**.
- **Certification of full solution with SGS.**

OUTCOMES

Nabla wind hub provides a full technical report providing all the information required by the client to fill their Business Case. From the effect in Long Term Maintenance Optimization to the AEP increase.

The processes for manufacturing and installation of both Rerotoring solutions, is managed by nabla's team.

REFERENCES

nabla wind hub is an independent technology platform that delivers asset redevelopment projects for the wind industry worldwide. End-to-end & one-stop-shop partner for SPVs and Portfolios revaluation, through Life Extension, Performance Improvement and Maintenance Optimisation; based on state of the art technologies, such as top-accuracy aeroelastic models, in-house rerotoring components, and advanced monitoring solutions.



600 wind farms assessed



1200 sensors installed



2000 blades installed



+250 Wind Turbines monitored

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