Low-noise wind turbine design using DinoTails® Next Generation

Rob Kuilboer, NSG bijeenkomst, Oktober 2018
Value of low-noise wind turbine design

- Many onshore wind turbines must be curtailed to stay within noise limits.
- This results in lost energy production: roughly 2-4% AEP per dB.
- Quiet wind turbines can produce more power → lower cost of energy.
Wind turbine noise sources

Dominant source is aerodynamic noise from blades:

- Noise caused by turbulent air flow over blade surface.
- Most noise produced by outer part of blades.
- Noise generated at trailing edge of the blade.
SGRE noise reduction technologies

Low-noise turbine control settings:

- Minimize energy loss by tailored RPM and pitch curves.

Blade design optimized for performance and noise.

Low-noise blade add-ons:

- Applied to new turbines and existing fleet (retrofit).
- Can reduce noise and increase power output.
SGRE DinoTails® Next Generation

Trailing edge serrations:
- Introduced by SGRE around 2000, now industry standard.
- Different types to optimize noise and aerodynamic performance.

In 2016 SGRE introduced DinoTails® Next Generation:
- “Owl technology” for even larger noise reduction.
- Small combs between teeth create small vortices: less noise.
Design and performance

**DinoTails® Next Generation** now applied to most onshore SGRE turbines:

- DinoTails® Next Generation lay-out optimized for each turbine type.
- Optimized for acoustics, aerodynamics, and structure: minimize LCoE.

**Advanced design and validation** methods:

- Various computational aerodynamics/acoustics methods.
- State-of-the-art wind tunnel and field testing.
Robust performance on all platforms

Optimized DinoTails® Next Generation design for different blades:
- Tooth angle, length, aspect ratio, radial lay-out, etc.

Proven performance using different methods:
- Computational Fluid Dynamics and Aeroacoustics.
- Acoustic and aerodynamic wind tunnel testing.
- Structure: highly accelerated lifetime tests (UV, vibrations).
- Power and noise curve validation in IEC field tests.
Application of DinoTails® Next Generation in SGRE portfolio

DinoTails® now offered for most onshore SGRE platforms:

- **New turbines and existing fleet** (retrofit).

Substantial improvements to sales noise levels:

- Focus on noise reduction for same AEP.
- Siemens Gamesa 2.X platform: -2.0 dB.
- Siemens Gamesa 3.X platform: -2.3 dB.
- Siemens Gamesa 4.X platform: -2.3 dB.
- Legacy Gamesa (G90-2.0 MW and G97-2.0 MW): -1.5 dB.
- Direct Drive Platform: AEP & noise optimized.

→ **Lower LCOE** for noise constrained sites.
Conclusion

DinoTails® Next Generation offer the best noise reduction performance in industry.

DinoTails® Next Generation are now offered for complete onshore SGRE product portfolio.

DinoTails® Next Generation lay-out tailored for each turbine type to maximize performance.

Robust performance thanks to state-of-the-art design and validation methods.

SGRE will continue to develop world-leading noise reduction technology.
Thank you