



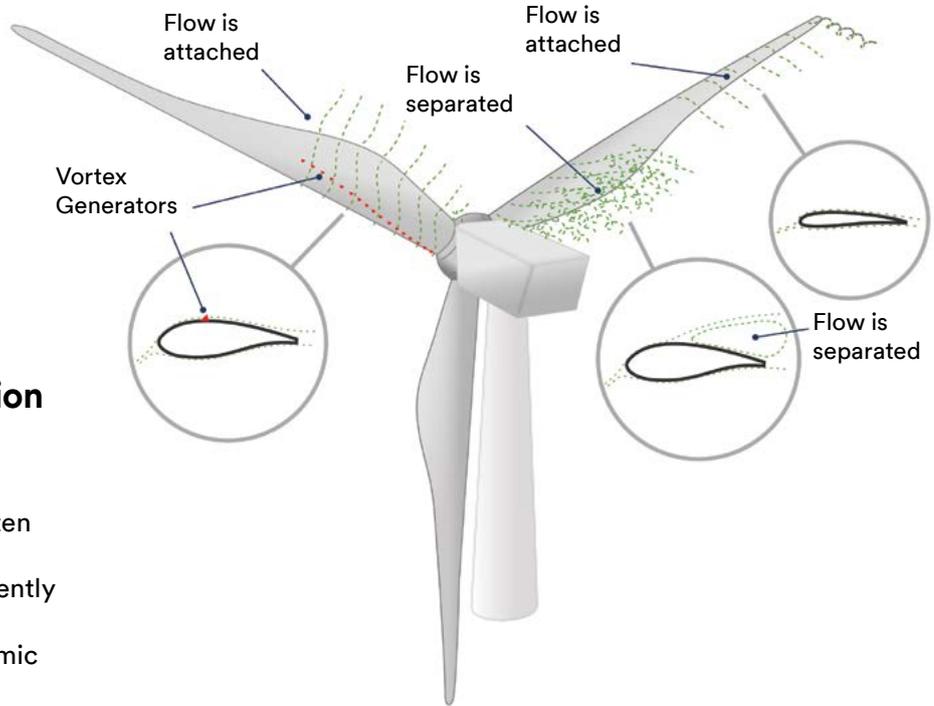
Science.  
Applied to Life.™

3M™ Wind Vortex Generators

Improved  
aerodynamics.  
Made easy.



# Enhancing efficiency at every turn.



## A simple, reliable way to increase energy production

Due to shape and operation limitations, the blades of large pitch-regulated wind turbines often have suboptimal aerodynamic properties at the root. This frequently leads to an undesired airflow separation – known as aerodynamic stall – and can have a significant negative impact on wind turbine efficiency. Surface roughness and leading edge erosion can increase the problem.

Now, 3M™ Wind Vortex Generators give you a simple, easy to install and highly reliable way to improve aerodynamic efficiency – helping to enable annual energy production increases of up to 1% or more!



## The science

3M Wind Vortex Generators are attached to the root section of a wind turbine blade on spots that are determined using a proprietary analysis process. They help improve performance by energizing flow around the surface. This helps reduce flow separation and increases the performance of the entire turbine, in terms of power, loads and service life.

## Developed in cooperation with some of the world's leading wind technology experts



### Maximum Performance

Physics research and wind tunnel testing were performed by Smart Blade, a German engineering company with expertise in wind turbine aerodynamics.



### Quick and Accurate Installation

The installation can be performed by EDF Renewable Services, the leading third-party provider of O&M and performance services in North America.



### High Reliability

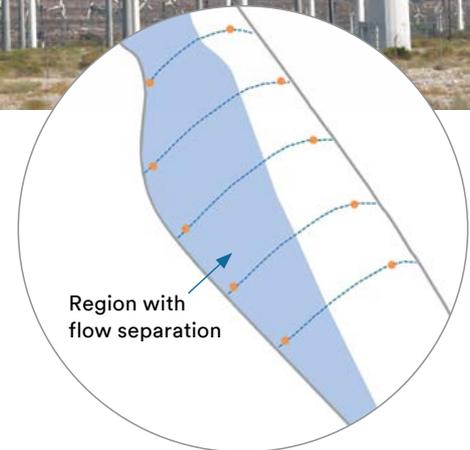
The product design and supply are ensured by 3M Company, a global technologies company with key competencies in material science, bonding technologies and long-term outdoor weathering experience.



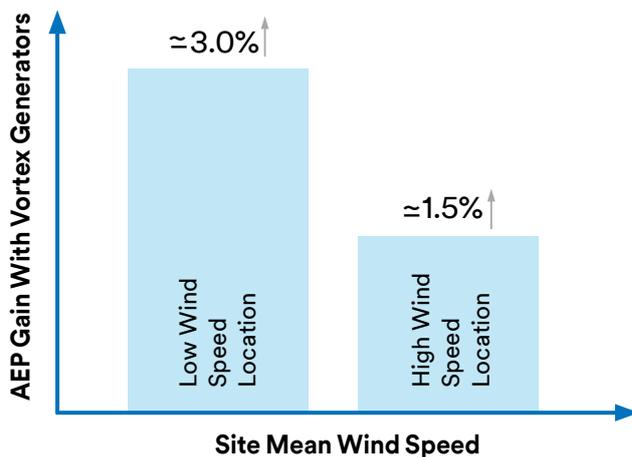
## Designed for increased efficiency and peace-of-mind

The use of 3M™ Wind Vortex Generators gives you a fast, economical way to address aerodynamic blade issues caused by limited twist and chord length at blade root.

- ▶ Increased annual energy production, typically of 2 to 3%, has been confirmed in different case studies
- ▶ Stabilized aerodynamics help balance load effects of unsteady wind conditions
- ▶ Reduced noise due to less stall



Example of a flow separation region for a specific blade type. Its border corresponds with the 3M Wind Vortex Generator installation line.



Optimizing blade aerodynamics helps achieve a significantly higher energy yield, for higher profitability. The increase is dependent upon the turbine site, the turbine type and the turbine condition. Long-term field tests show increases in annual energy production of 2.0% or more.

## An easy-to-install upgrade with a fast payback

- ▶ Designed for higher reliability and fast roll-out to wind parks
- ▶ Global network of qualified installation specialists
- ▶ Adaptable to different blade types independent of turbine OEM
- ▶ Proven in hundreds of existing installations and backed by case studies about actual performance improvement
- ▶ Payback time of approximately 1 to 2 years including installation, materials and downtime

## Putting 3M science to work to protect your investment

The reliability of your materials of construction plays a vital role in achieving long-term profitability. That's where 3M's expertise in polymers, bonding and weathering technologies can work to your benefit. 3M Wind Vortex Generators are made of a highly durable thermoplastic with dimensional stability and strength which has a proven track record of weathering resistance. Furthermore, our Vortex Generators are equipped with 3M™ Acrylic Foam Tape die-cuts that provide excellent long-term durability and holding power while treating the blade surface with care.

# Connecting you to a world of 3M resources.

## Your reliable supplier of technologies for wind energy

When you're being challenged to find new ways to make wind and other forms of sustainable energy more reliable and cost efficient, you need people on your side who have the industry experience and technical know-how to make that happen. With 3M, you have the advantage of an experienced, reliable partner, with the resources and expertise to help you develop applications, provide technical support and supply products almost anywhere in the world.

From tapes and adhesives used in blade manufacturing to electrical splices and terminations for connecting to the grid, 3M is ready to help you build the next generation of wind energy systems – with products designed to enhance reliability, improve performance and provide protection against weathering and harsh environments.

Working with a single, dedicated supplier like 3M gives you one contact for many issues. And as a global company with operations in 70 countries, and laboratories in 36 countries, we have the ability to connect you with local 3M personnel to provide expert technical and business support almost anywhere in the world. Contact us today to see how 3M's renewable energy expertise can help you meet the challenges of today's marketplace.

### 3M Global Footprint



<b>United States</b> 800 676 8381	<b>Spain</b> 34 91 3216000	<b>Italy</b> 39 02 70351	<b>South Korea</b> 82 2 3771 4043	<b>Brazil</b> 0800 13 23 33	<b>Japan</b> 81 3 3709 8283
<b>Germany</b> 49 2131 144450	<b>France</b> 33 1 30316161	<b>Singapore</b> 65 6450 8888	<b>India</b> 91 80 22231444	<b>Mexico</b> 52 55 52702250	<b>Malaysia</b> 603 78062888
<b>Denmark</b> 45 43 480100	<b>United Kingdom</b> 44 1344 858000	<b>China</b> 86 2162753535	<b>Canada</b> 800 364 3577	<b>Taiwan</b> 886 933 896752	<b>Other Areas</b> 800 755 2654

For more information on our wind energy product line, contact 3M Renewable Energy at 800 676 8281 or visit us at [3M.com/Wind](http://3M.com/Wind)

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