# Metamorphic Wind Turbine Blade Designs

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Metamorphic wind turbine technologies that respond to changes in wind strength and direction to optimise energy efficiency could pave the way for future durable and high-performance wind turbine designs, and technologies of this kind are currently being worked on in both the US and the UK.

"The idea was born from a simple observation of a fish in an aquarium", San Diego State University scientist Asfaw Beyene stated. "Many flying and swimming animals have superior efficiencies than manmade devices. The primary difference between natural motion and motion of manmade devices is lack of geometric adaptability to varying flow conditions."

"In flying and swimming creatures, the geometries morph to fit to a flow condition. In man-made devices, typically the geometry remains rigid in spite of widely varying flow conditions."

## New Wind Turbine Technology

Beyene forecasts that new wind turbine technology featuring blades able to change their shape into new angles to boost the amount of harvestable wind energy could be constructed out of plastics that resemble urethane rubber. To date, he and his colleagues in California have carried out trials with three-metre diameter turbine blade units made out a variety of substances, and yielded results described as "very promising."

In the UK, meanwhile, a group of researchers at Bristol University are also in the process of developing directable wind turbine blades. "The wind can be very harsh on blades — turbines turn off if the wind gets too much, or else the blades will break fighting the wind", university aerospace engineer Paul Weaver stated.

## Wind Turbine Efficiency

He continued: "A morphing blade uses the wind to its advantage rather than fighting it, adapting its shape to get greater performance. This has the potential to significantly relieve unwanted stresses in the blades, increasing [wind turbine] efficiency and helping to prolong their life."

Wind turbine blades are typically constructed out of a mixture of carbon fibre plastics and glass. At the manufacturing stage, the plastics are exposed to a range of temperatures in order to fuse them with the fibres and solidify the blades' structural integrity. By manipulating the fibres, the Bristol scientists say that blades able to change form can be created.

The team has already showcased morphing blade technology on a helicopter blade design and, through a new collaboration with Denmark's Vestas Wind Systems, is now looking to scale it up.

Progress in Energy Efficient Wind Turbine Design

Funding for New Wind Turbine Design