3D Printed Dimpled Wind Turbine Blade Designs

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With the current global energy crisis, renewable energy technologies are being developed as alternatives to fossil fuels. One technology is wind energy, and many countries are implementing wind turbines to harness energy. Dimples can be placed on wind turbine blades to create a disturbance in air particles. This experiment tested the effects of different sized 3D printed wind turbine blades. The 3D printed blades were scaled down to 58% of the height and width, and approximately 25% of the weight, compared to the commercial blades. The blades were manipulated with dimpling and texture, to determine the effect on the voltage, amperage, and wattage produced in a custom-built wind tunnel. The null hypothesis was rejected and the alternative supported. Overall, the smaller 3D printed blades performed significantly better than the larger commercial blades ($p<0.05$). The 3D printed smooth dimpled blades performed significantly better than the commercial dimpled blades ($p<0.05$). The commercial dimpled blades performed significantly better than the commercial smooth blades ($p<0.05$). The 3D printed blades with a smooth surface performed significantly better than those with a rough surface ($p<0.05$). Dimpling on the 3D printed smooth blades did not change the performance compared to 3D blades with no dimples. The next step will be to isolate the length or weight to determine which factor improves energy production. This smaller blade design could also be scaled up and tested with larger generators. Dimple size, shape, or depth could also be altered to produce more efficient and effective wind turbine blades.