

# TILTING AT WINDMILLS



## **brief**

Design, build and test a windmill for maximum power and efficiency in an urban environment

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## **aim**

create a windmill which can be placed in high-rise buildings which will use the created wind tunnel from these buildings to generate green energy to help reduce energy bills in urban areas.

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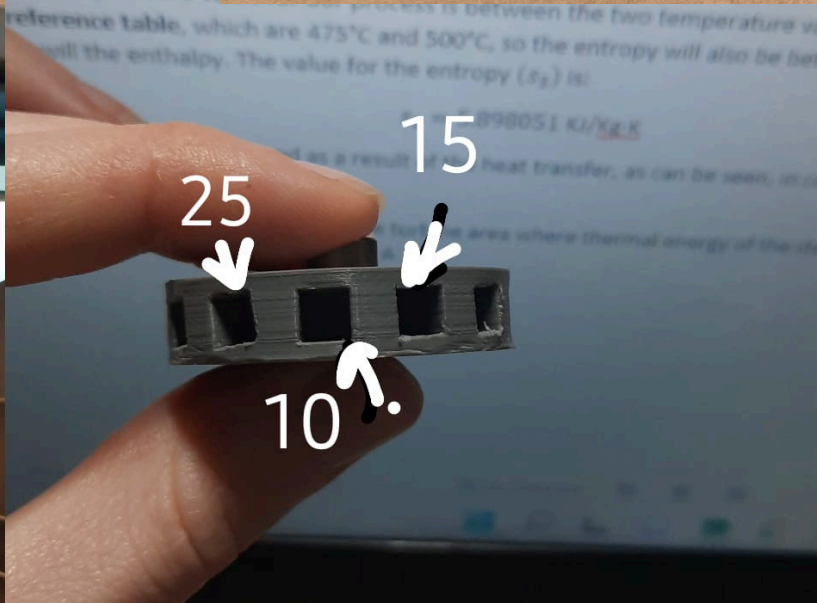
## **idea**

Use a venturi on the windmill to direct wind flow towards the turbines, creating higher velocity wind speeds due to the narrowing of space available to the flow, increasing the velocity at which the turbines will spin at which will generate a higher power output.



## testing

Throughout the design process, all prototypes were tested in a wind tunnel (pictured below) where we set the resistance and recorded the power to calculate the power output. This allowed us to test changes in our design so to optimise the design.



## prototyping

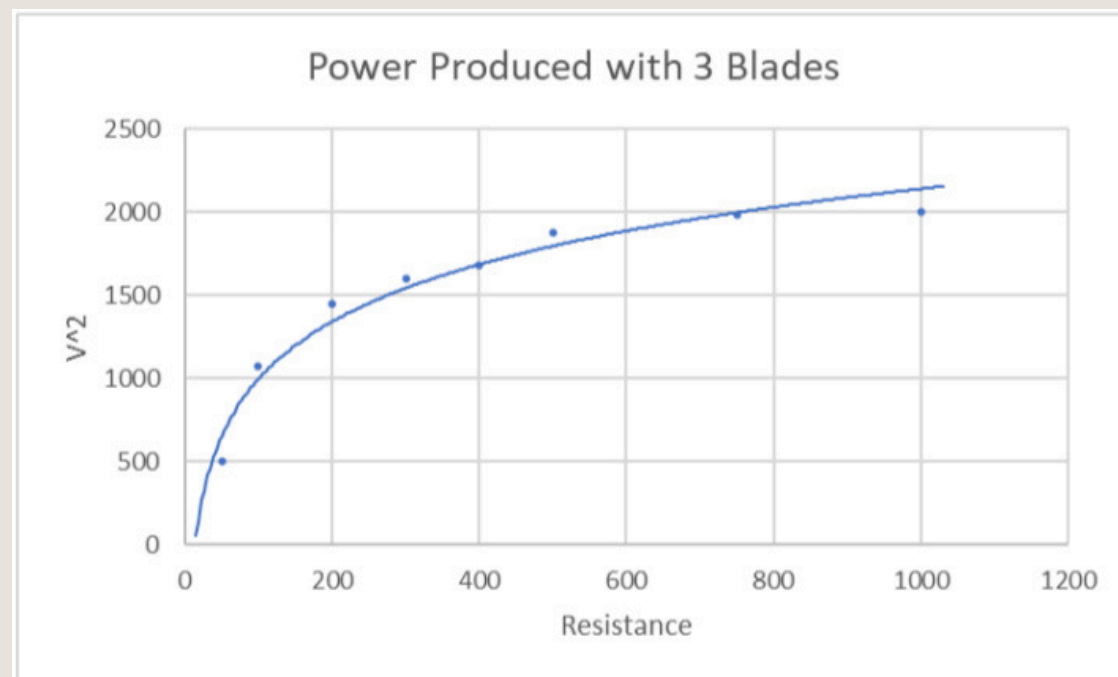
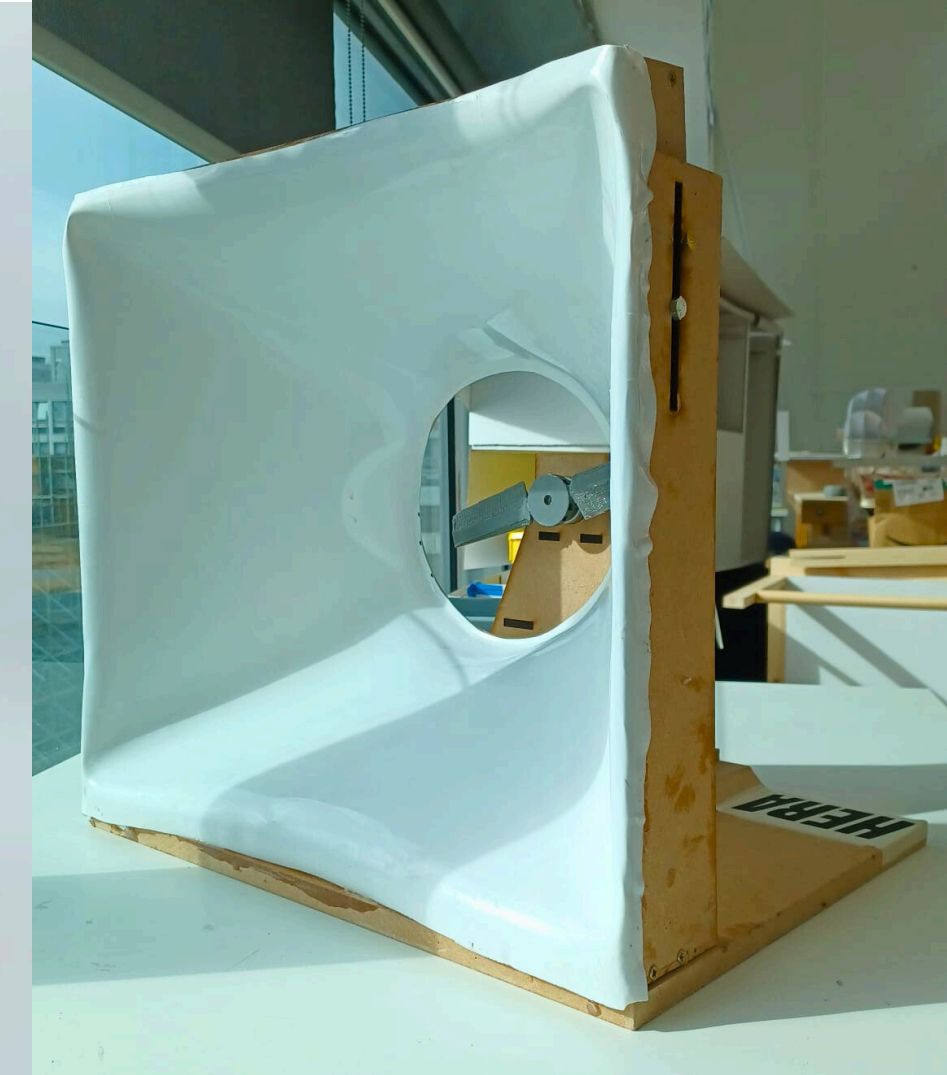
During the project, a range of prototyping methods were used, from cardboard modelling to laser cutting to 3D printing. Alongside optimising the venturi, we use prototyping to optimise the size and angle for the turbine blades.



## final design

The final design was created by vacuum forming an acrylic sheet for the venturi which was nailed to the frame. The design also used a 3 blade turbine on a horizontal axis.

This design and use of the venturi effect meant that the wind was accelerated and streamlined onto the blades, resulting in a faster flow of air around the turbine and therefore increased power output.



| Resistance/ohms | Voltage/Volts | V <sup>2</sup> /volts <sup>2</sup> | Power output/Watts |
|-----------------|---------------|------------------------------------|--------------------|
| 50              | 22.5          | 506.25                             | 10.125             |
| 100             | 32.7          | 1069.29                            | 10.690             |
| 200             | 38.0          | 1444.00                            | 7.220              |
| 300             | 40.0          | 1600.00                            | 5.330              |
| 400             | 41.0          | 1681.00                            | 4.200              |
| 500             | 43.3          | 1874.89                            | 3.750              |
| 750             | 44.5          | 1980.25                            | 2.640              |

## result

We reached a maximum power output of 10.69 Watts. This result meant that our design was the most efficient in the class and this power output was the highest output in the history of the project.

