ABSTRACT

There's still around 2 to 3 million Indonesians who still don't have access to electricity, and this is not counting those who have little electricity. In order to get the power they may instead get a gas/diesel generator, but these generators are of course harmful for the environment and also expensive to maintain. Wind Turbines can be used instead as they are relatively speaking simple and easy to understand while also being cheaper compared to other alternative energy, these Turbines are also gonna be built by the users. It's gonna follow a VAWT orientation as the orientation can rotate at slower speeds while being easy to build and cheaper compared to HAWT, the other orientation. The Airfoil, which is what allows it to rotate thanks to Newton's 3rd law and Bernoulli effect, is the main subject of the analysis as it is the starting point before any calculations can be done, NACA 0021 is the recommended airfoil design as it works best with VAWT turbines. Using the Formula $P = Cp(½ \rho Av^3)$ and the ideal Power Coefficient V Tip Speed Ratio graph we can set a target goal in airfoil program Qblade, having differing Polar range from the formula $Re = (vl)/Nu$ helps with the trial and error process of finding the ideal dimensions. The finalised dimensions is simulated in the model designing program Solidworks in order to finalised the turbine design as a whole and find its Mass and Moment of Inertia, the result of designing process is a 5 kilo turbine with a moment of Inertia of 3 maximum and a surface area of (1.2x1.3x1.2) metres.

Keywords: *Turbine, VAWT, Airfoil, Polar Range, Moment of Inertia*