



WIND TURBINES

Under Supervision of :

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HEADLINES

- Background on wind turbines
- Problem definition
- Data description
- Methods of solution
- Analysis of the results
- Suggestions for future work
- Conclusion

Background

- The use of wind energy goes far back in history.
- There's some claims that it goes back to ancient Egyptians .
- The first known windmill was built by the Hero of Alexandria around the first century A.D.

Problem definition

- Energy Challenges
- Wind farms and investors worries
- Diverse nature of design parameters

Data Description

- Power density

$$P_d = 0.5 * \rho * V^3$$

The wind climate in Egypt may be utilized favorably for electricity production. Like, Hurguda in the Red Sea coast.

Data Description

- Efficiencies.
 - Betz's limit (59.3%)
 - Components' considerations

- Wind Farm Land-Use

Methods of solution-equations

◉ Diameter of Turbine

$$D = 2.6065 * \left(\frac{p_t}{p_{Dg}}\right)^{\frac{1}{2.8}} \text{ "Equation 1"}$$

$$40 < D < 160$$

- p_t : Annual power produced by turbine
- p_{Dg} : Power density of air at 10m height from the ground

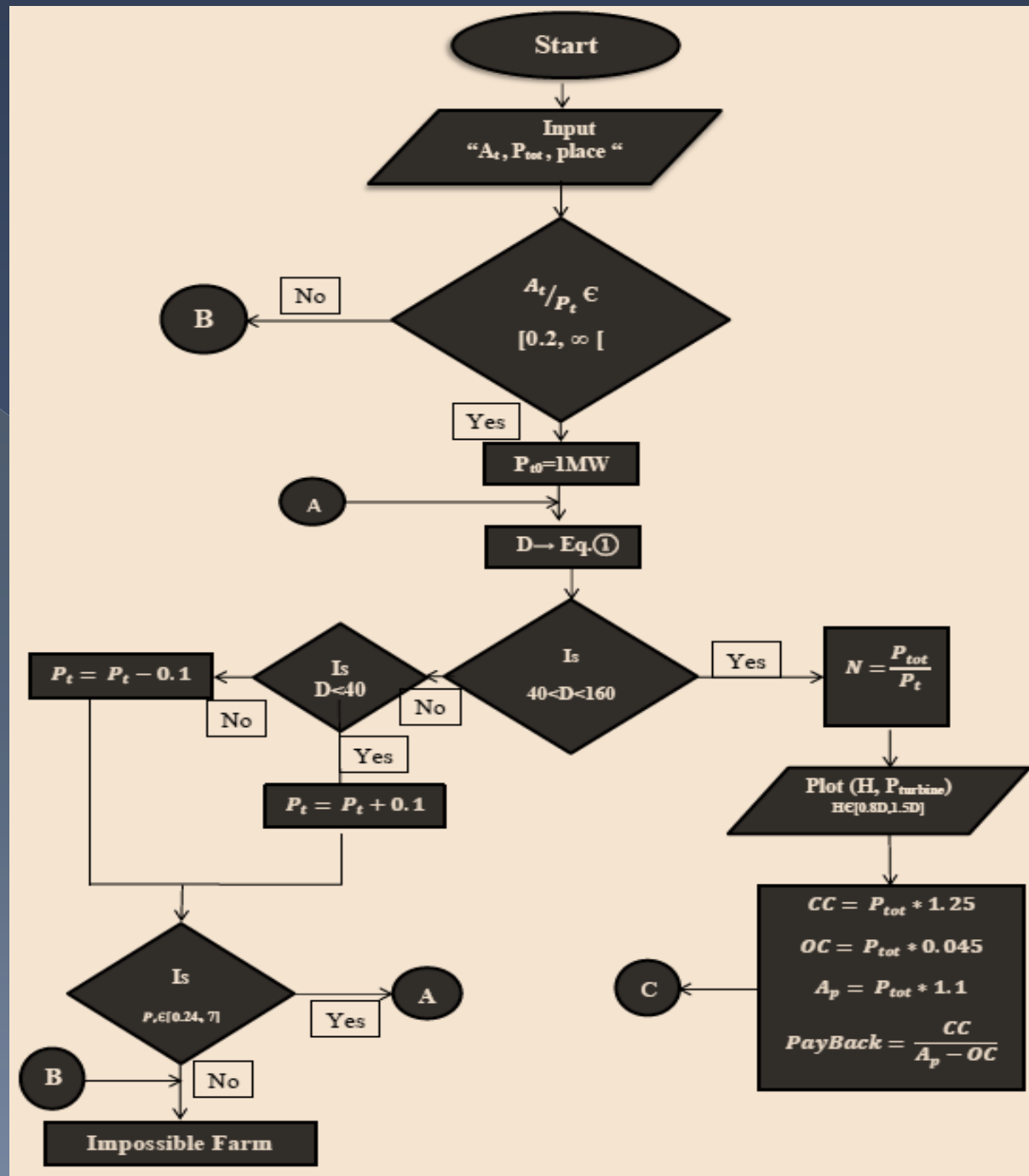
- To derive the previous equation

$$p_t = \text{Power density} * A_t * C_p$$

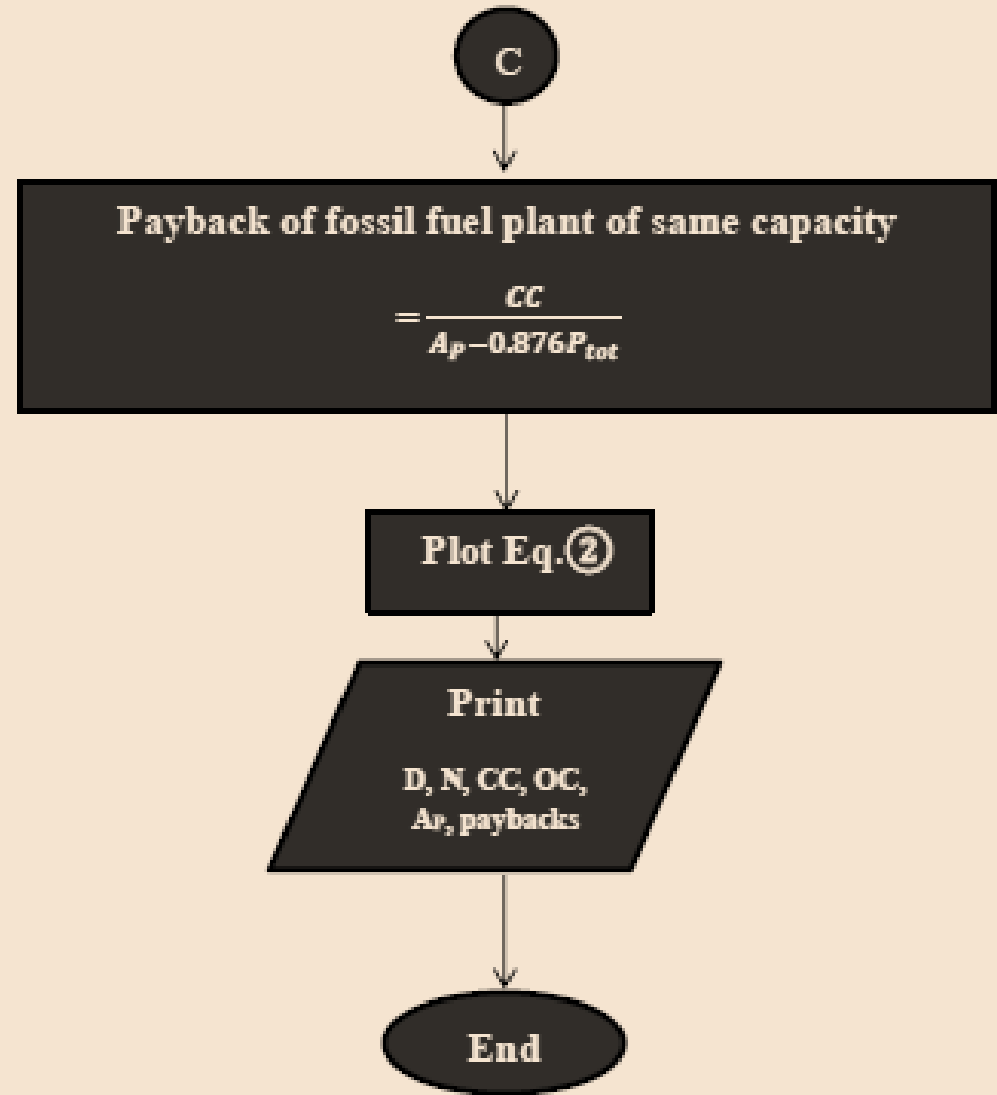
C_p : Modified Betz's coefficient

$$\frac{P_{Dh}}{P_{Dr}} = \left(\frac{h}{h_{ref}} \right)^\alpha$$

Flowchart

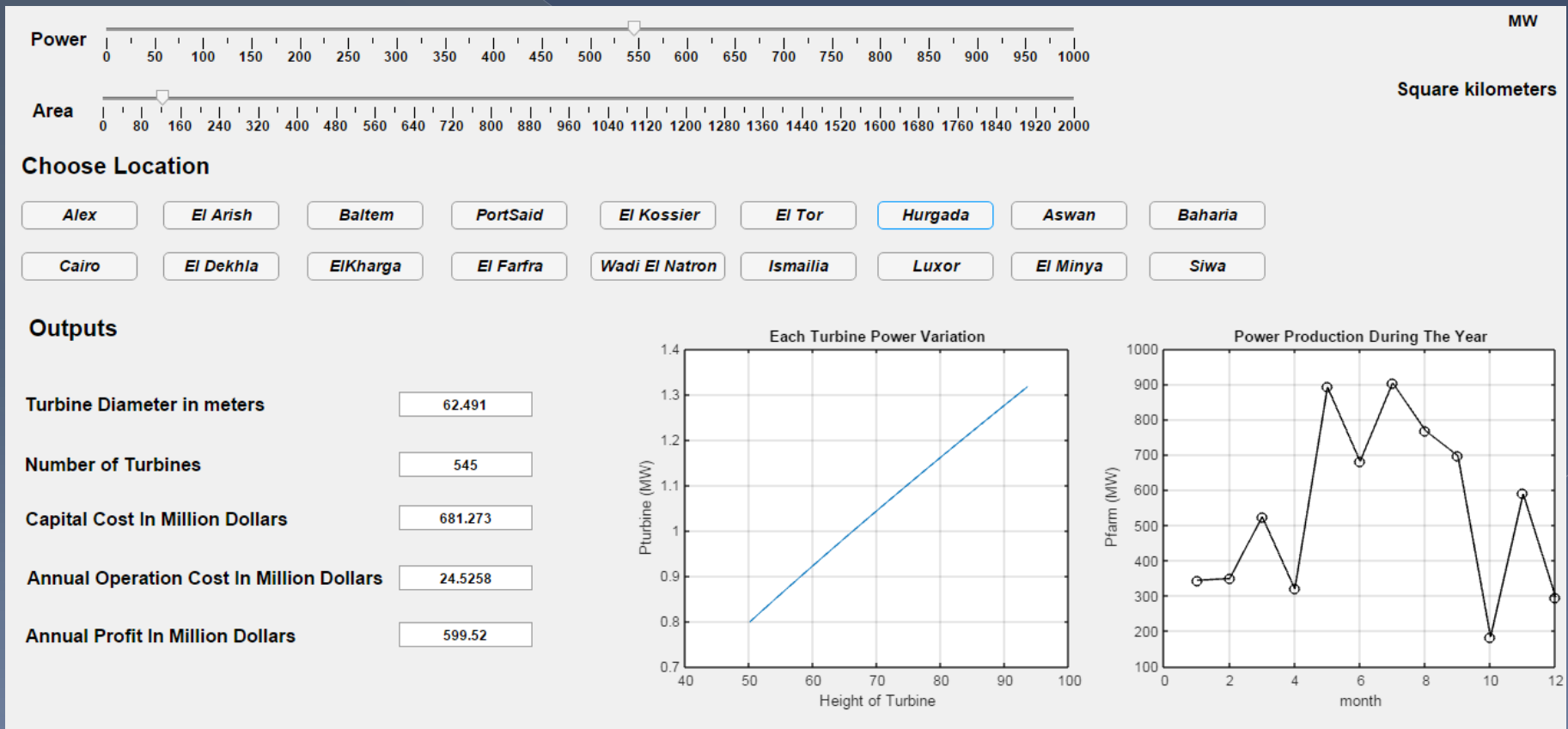


Flowchart



Analysis to the results

- Zafarana farm contains about 700 turbines of different power outputs (600KW-660KW-850KW)



We guarantee you that the PayBack time of farm will be 1 year and 3 months compared to the PayBack time for a fossile fuel plant with similar power output which is 5 years and 7 months

Recommendations for future work

- ◉ Effect of terrain
- ◉ Noise and annoyance
- ◉ Blade design
- ◉ Stress Analysis

Conclusion

- Our program provides rough numbers and pre-feasibility analysis to the investor so he can decide if it's worth it to continue the steps of research and analysis to his project or not.

For more information:



Thanks for your attention