# Method and Case Study for Wind Power Assessment in Cyprus

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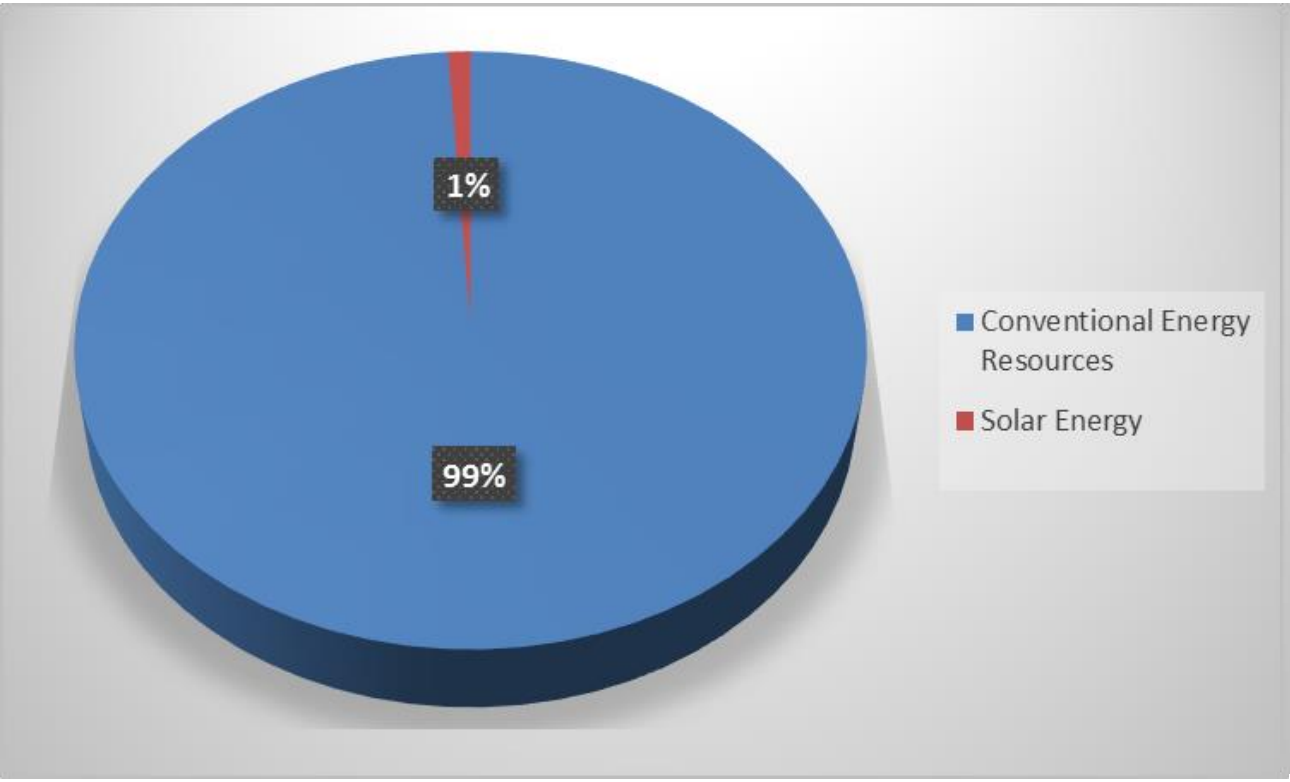
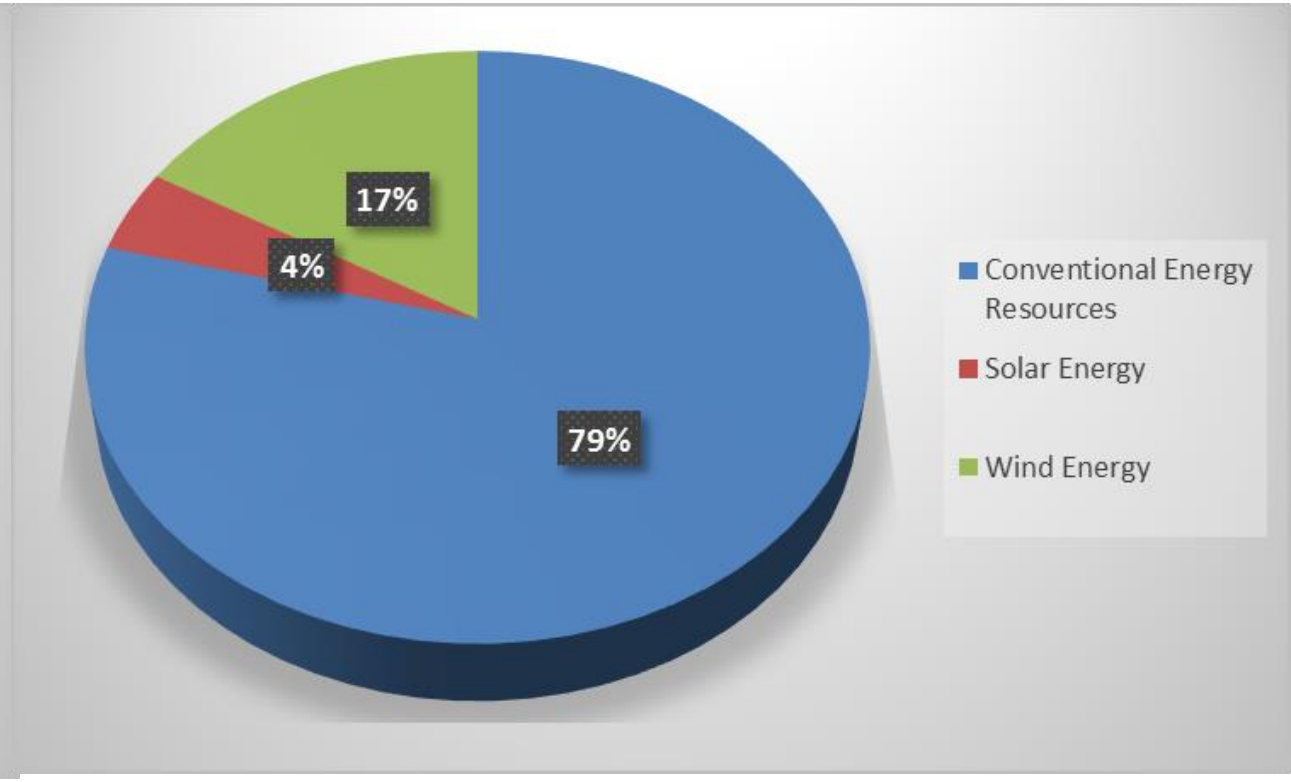
# Introduction

- Northern Cyprus




- Southern Cyprus

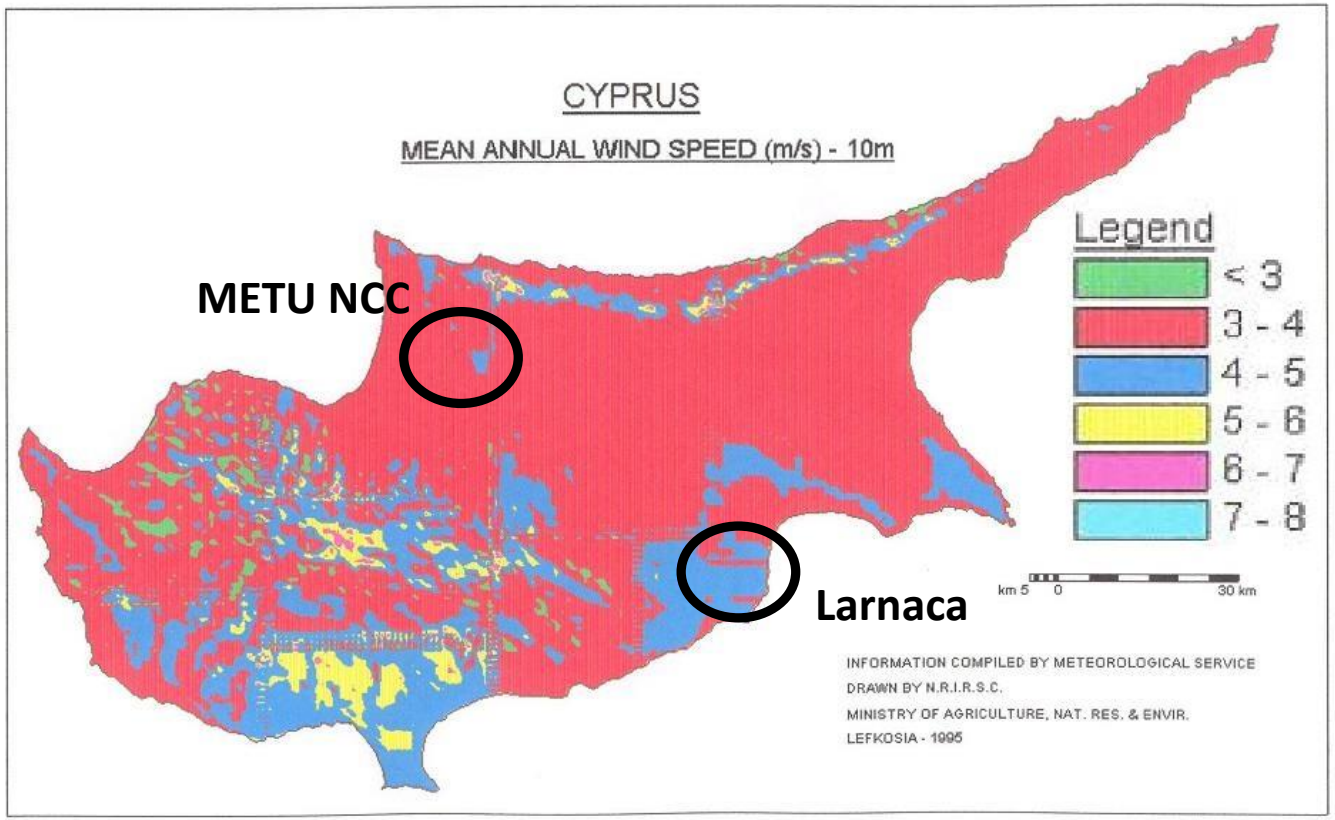


# Focus of this work

- Wind power generation opportunity
- Available data from SE coast (Larnaca region)
- Useful wind speed analysis along with angular direction
- Analysis will be carried out to NW Cyprus (METU NCC)

# Wind profile of Cyprus

Average wind speed of 4-5 m/s. (Larnaca)



# Related work

- Koroneos et al.
  - Wind and solar power → Northern Cyprus → Larnaca
  - Weibull distribution, several critical regions.
- Pashardes et al.
  - Statistical approach for wind direction and speed over the island
  - Wind rose map
- Jacovides et al.
  - Possible (promising) wind power plant (WPP) spots on the island including Larnaca

# Wind power generation theory

- Kinetic energy → Electrical energy

$$P(v) = \frac{1}{2} C_p \rho A v^3$$

- $C_p$ – power coefficient (const.)
- A – area of blades (const.)
- ρ – wind density (atmospheric pressure, average temperature) (~const.)
- v – wind speed

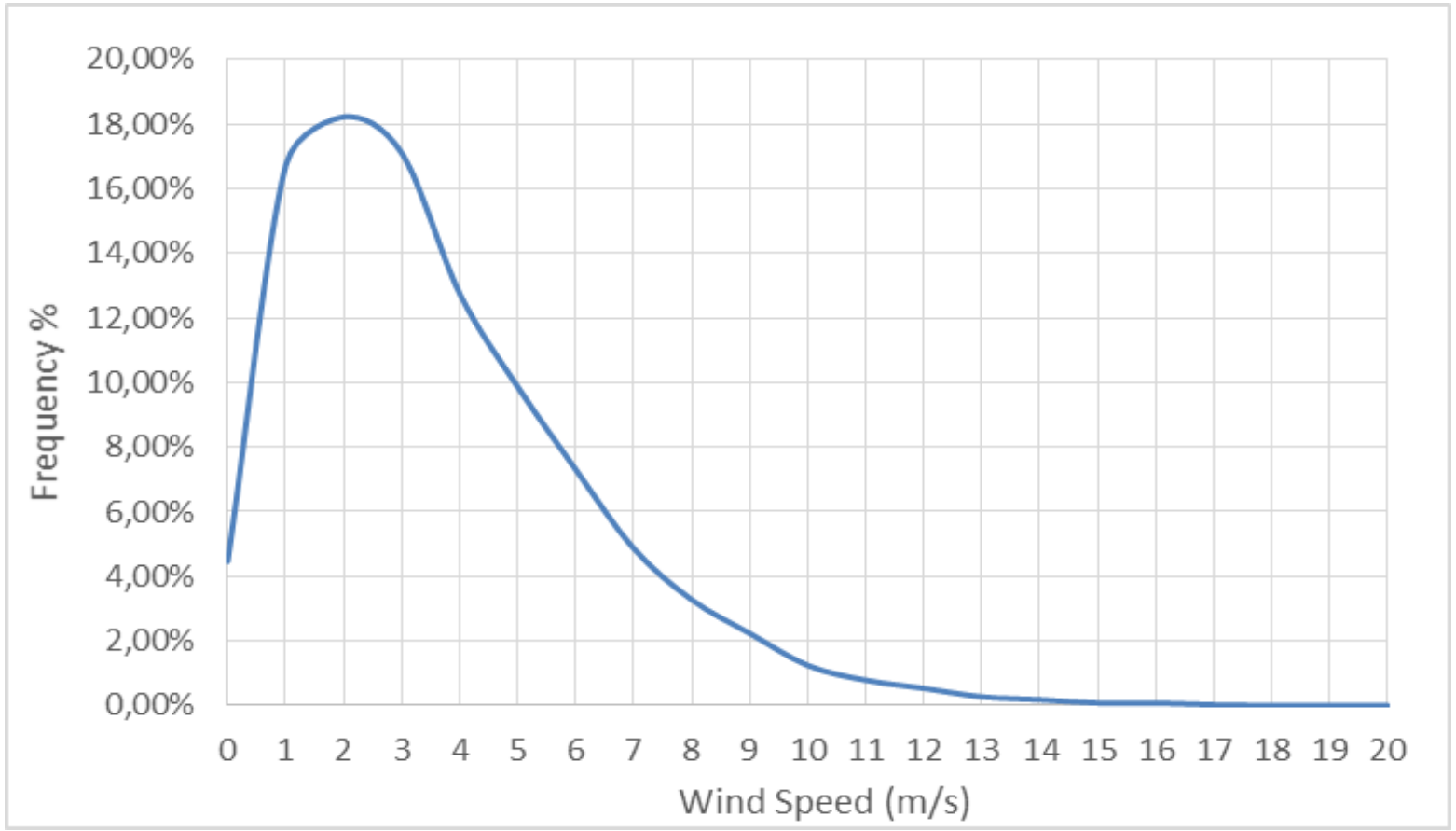
# Wind profile power law (WPPL)

- Project measured speed to desired heights
- Measurement at 2m, possible wind power plant at 60m

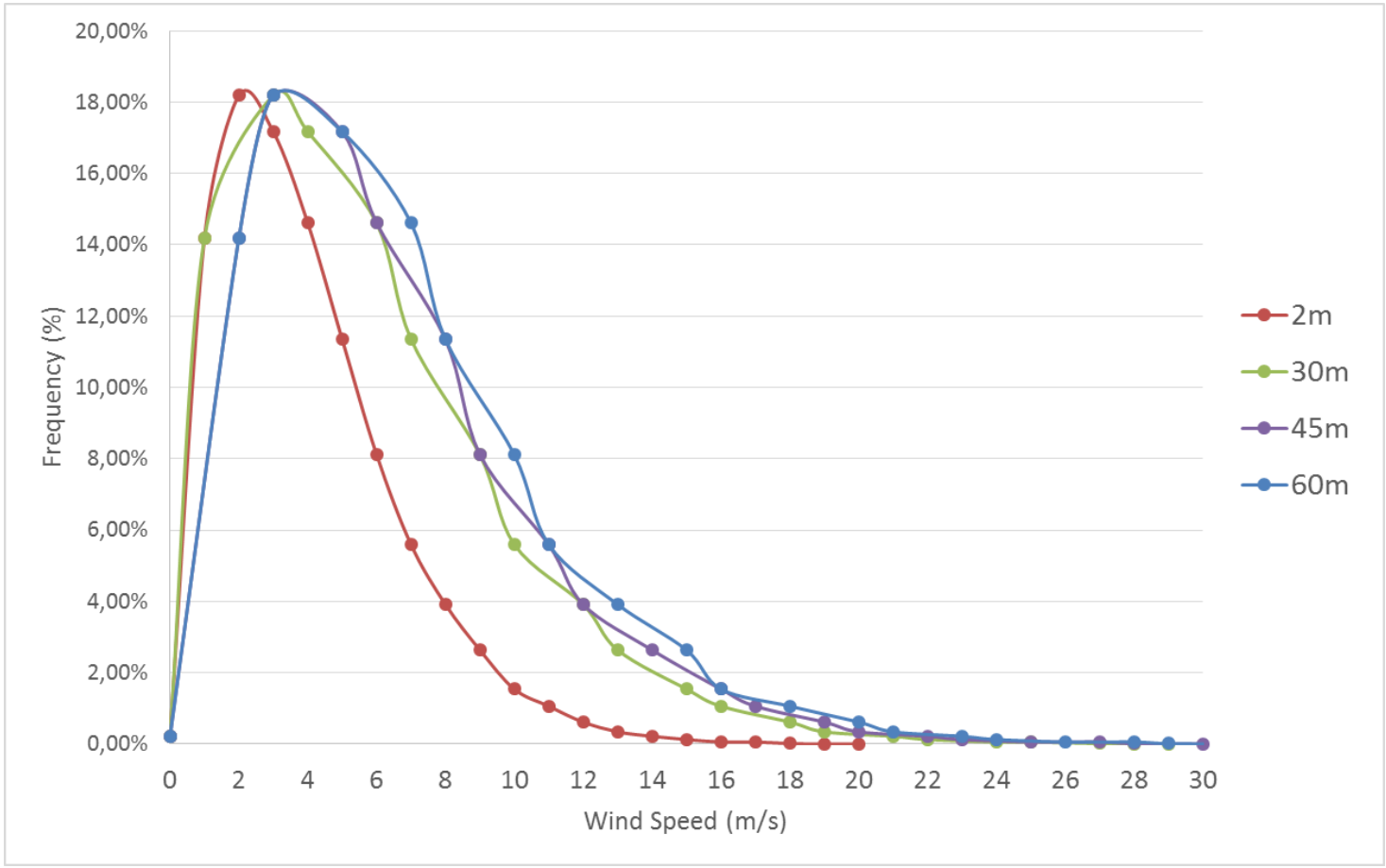
$$u/u_r = (z/z_r)^{\alpha}$$

- Also called 1/7$^{th}$ law
- u – wind speed
- z - height

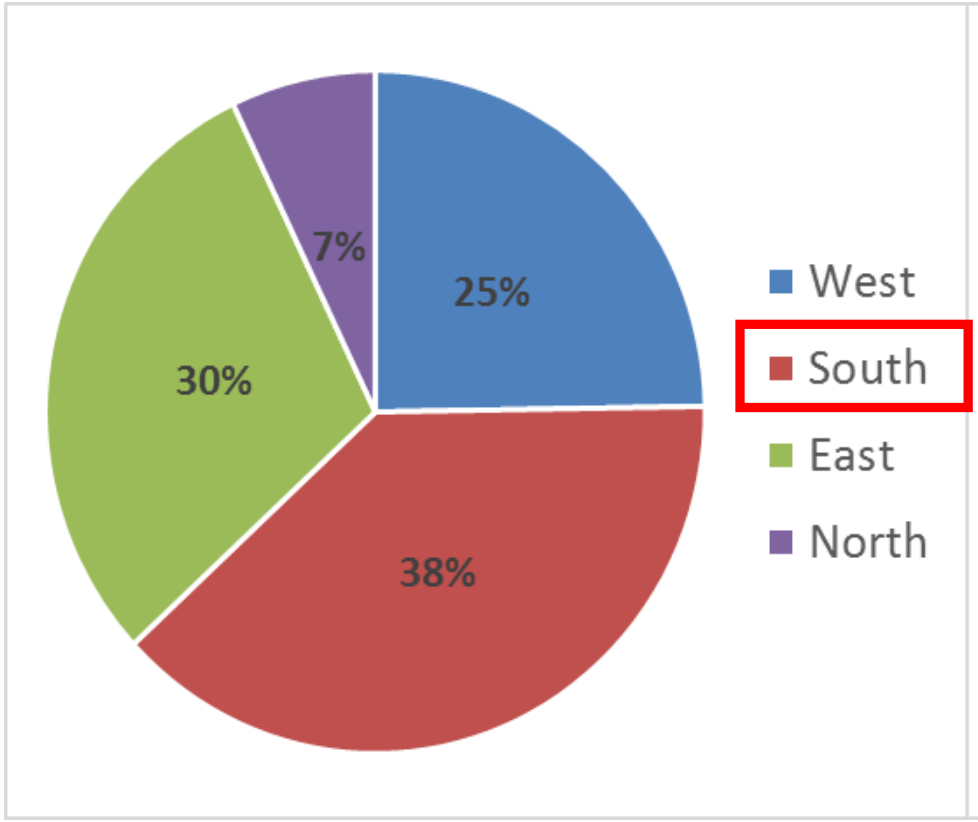
# Weibull distribution of wind speed (Larnaca, 2 meters height)



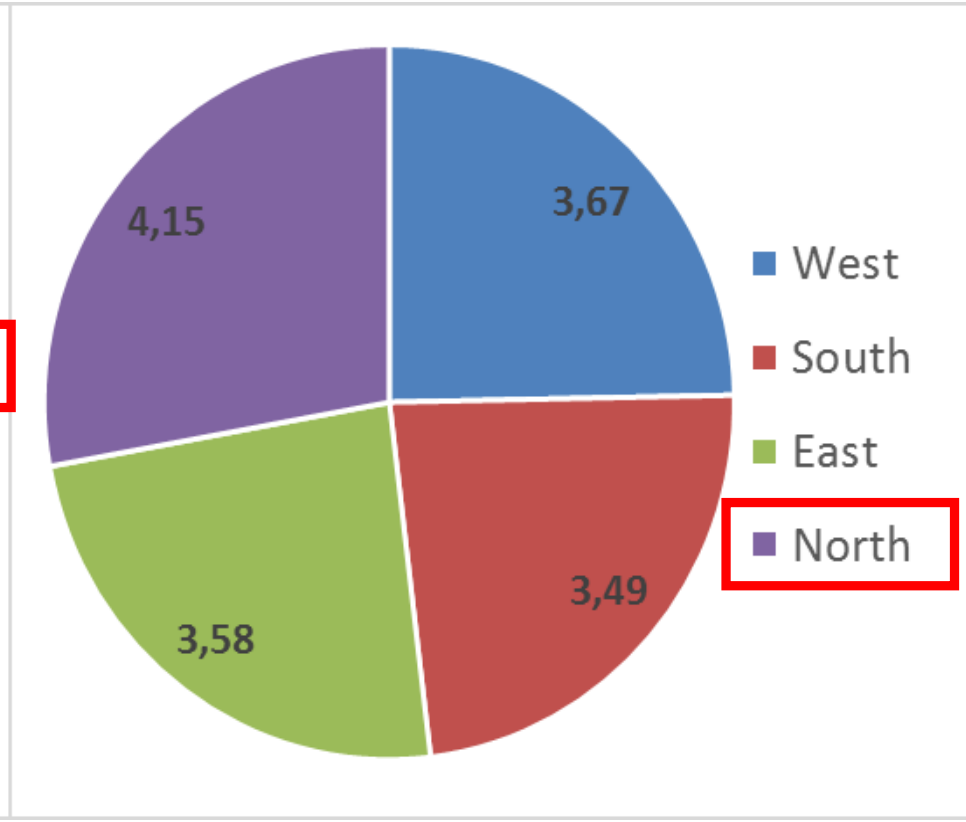
# Projecting wind speed profile by WPPL



# Direction analysis: North or South?

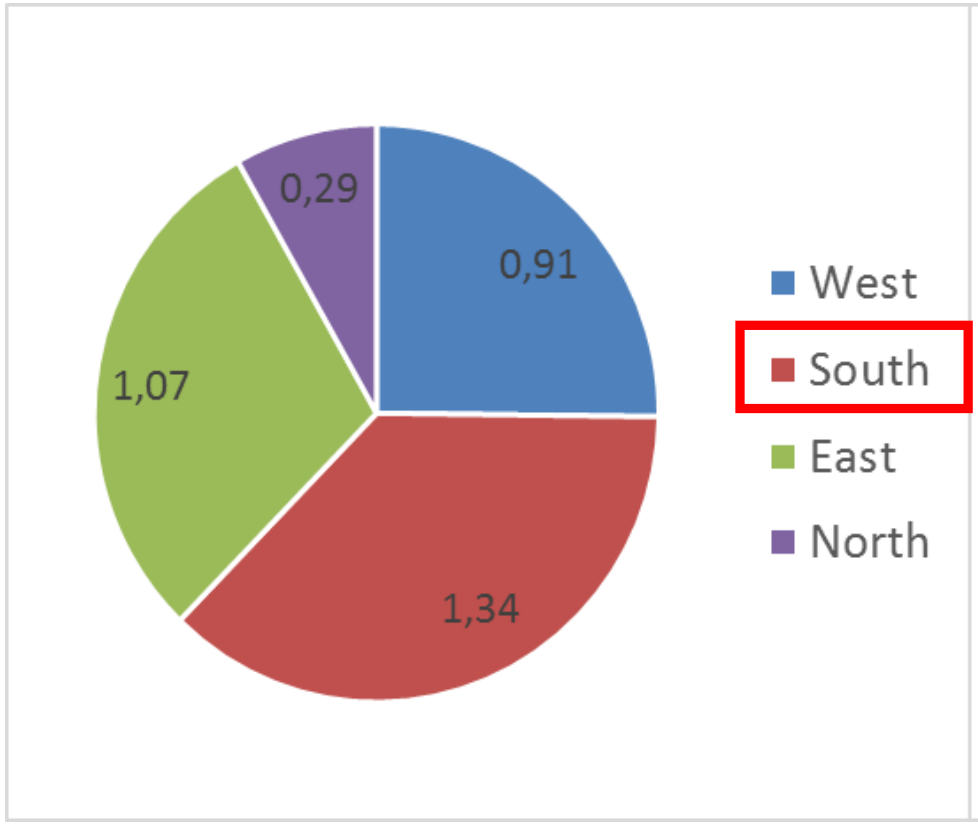



Wind directions from the obtained data



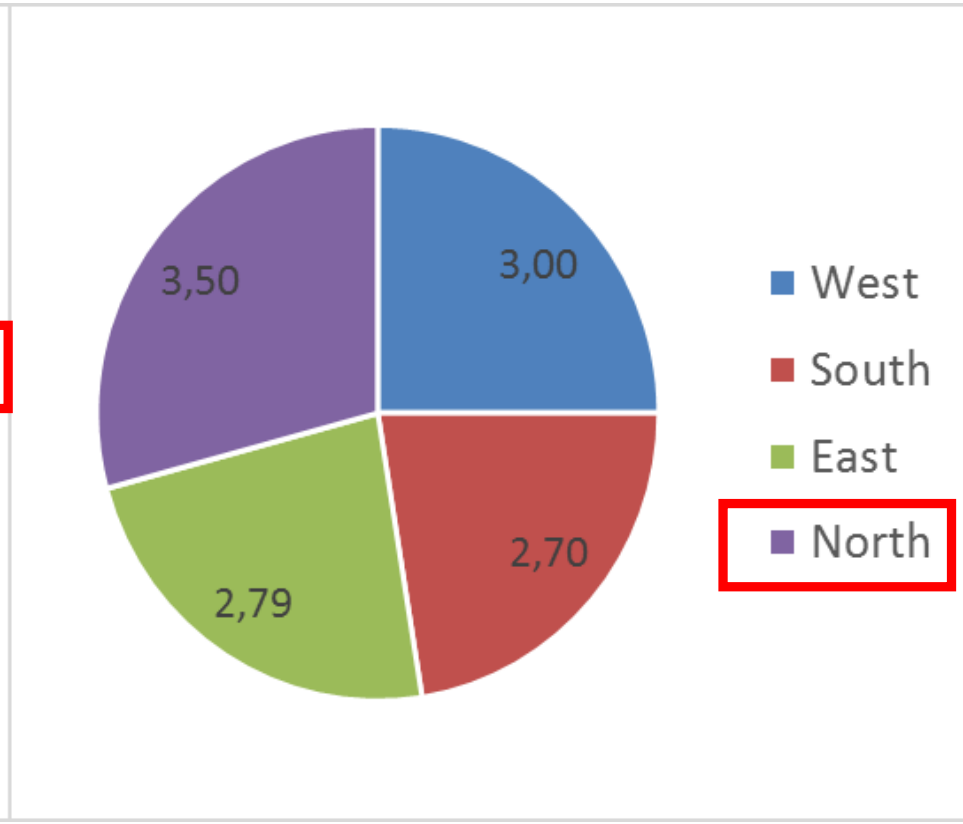

Average wind speed from each direction

# Power Analysis:
# North or South?



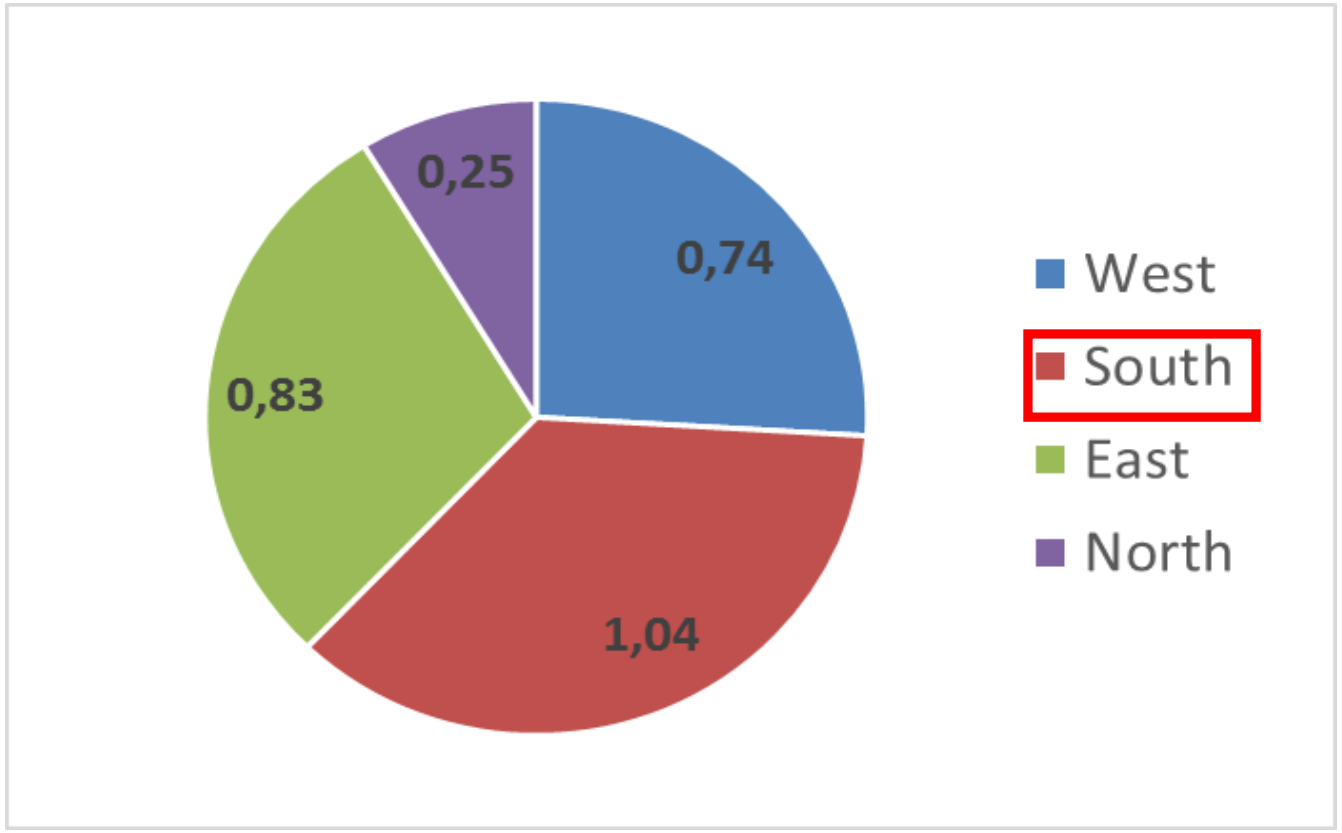

Direction weighted with speed*

*Unit: m/s times %direction



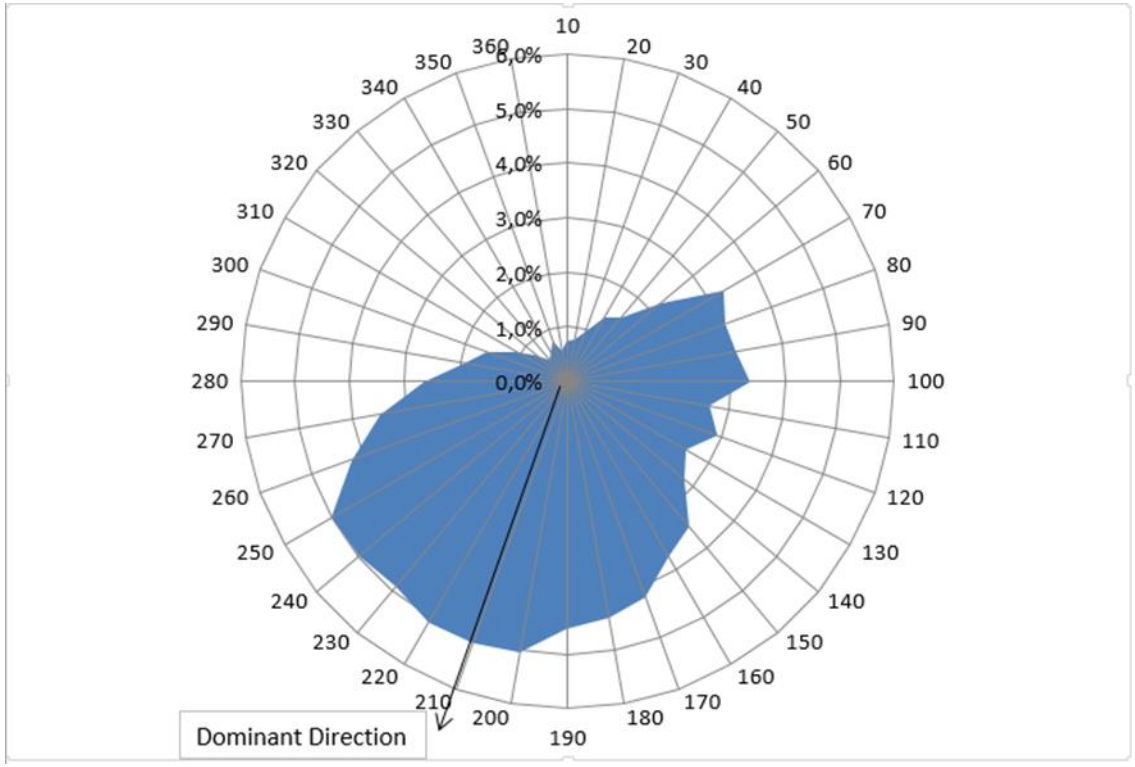

‘Useful’ average wind speed

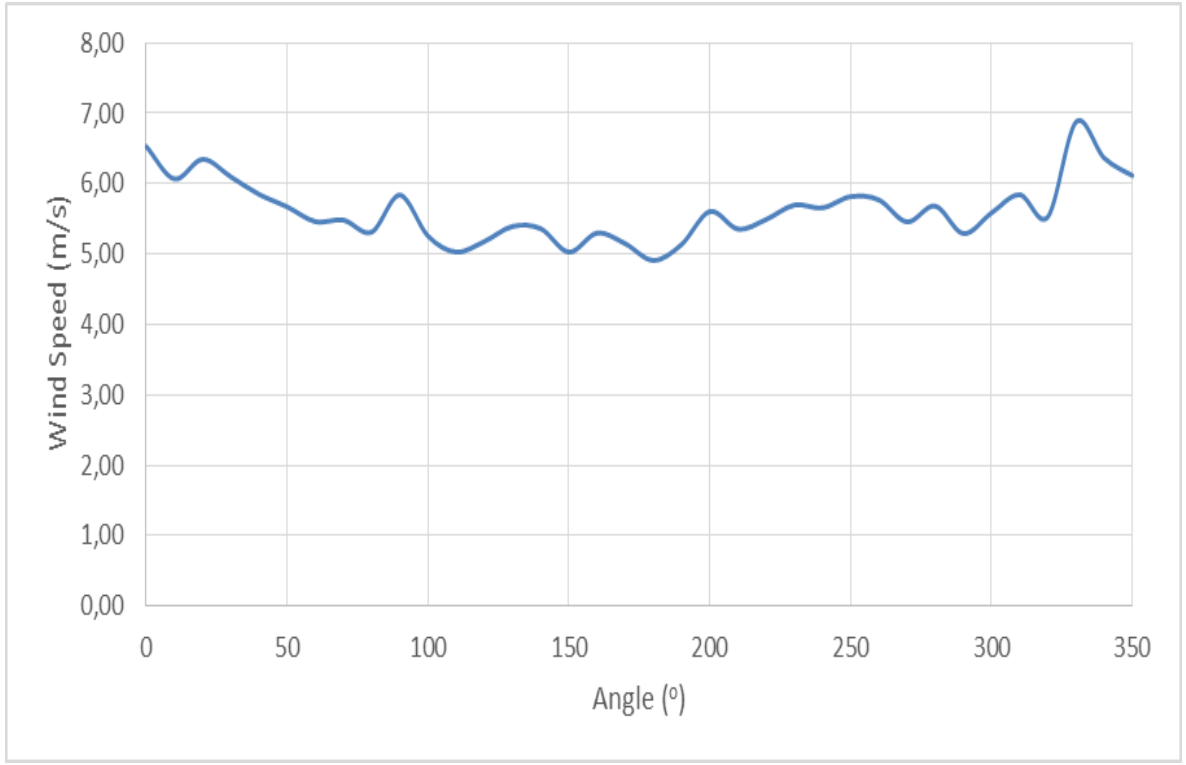
# Optimum Direction:
# North or South?



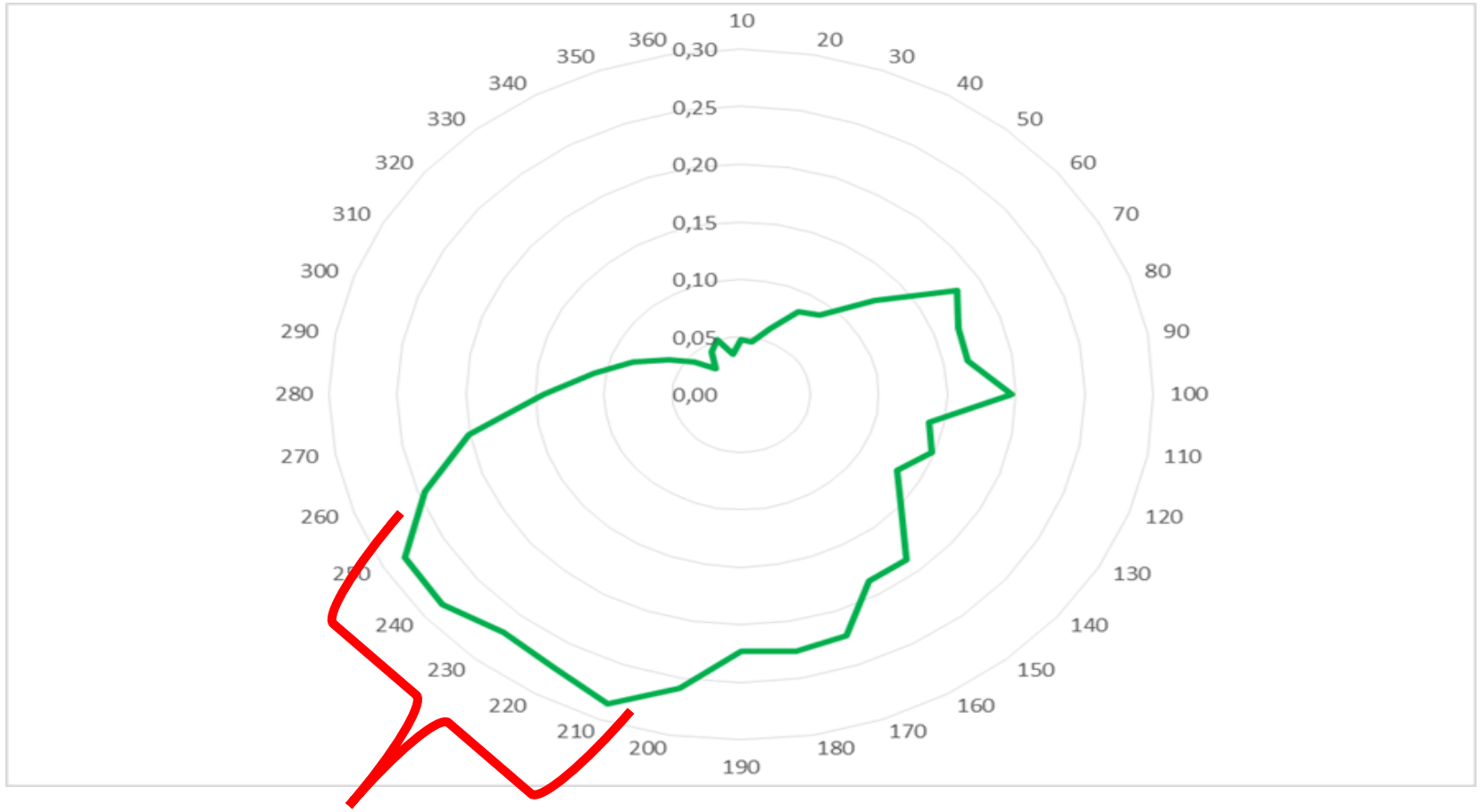

Wind direction weighted with useful speed

# Detailed angle/speed analysis



# Best angle for wind energy generation




Best angle for wind energy generation

# Conclusion

- Average wind speed of 5 m/s in Larnaca
  - Suitable for wind power generation
- SW is the best direction for energy generation
- For the best outcome, a wind turbine with cut in speed of 3 m/s should be preferred
- Further analysis shall be made for specific wind turbine models
- Different regions in Cyprus shall enhance quality of this work
  - Such measurements are currently being made in METU NCC

# Thank you