Cape Recife Wind Farm – Port Elizabeth

Your company is planning to submit a tender to secure a contract for erecting 30 wind turbines in the Port Elizabeth area. This is part of the South African government's Renewable Energy Independent Power Producer Procurement Programme (REIPPP). Research has shown that 30 wind turbines (under conditions similar to those of Jeffreys Bay) can generate enough renewable energy to supply more than 50 000 average South African households with power. The recent load shedding in South Africa has made it clear that Eskom cannot keep up with increasing demands. Wind power, which will feed into the national electricity grid, is a feasible option.

The company needs to complete a feasibility study before deciding to submit a tender or not. Compile a report for the director of the company using the following information as a guide:

1. Weather conditions

1.1 Identify the two prevailing wind directions and give an estimated percentage for the year (Figure 1).

1.2 On the map, indicate the prevailing wind. This will help you to determine the location of the wind farm.

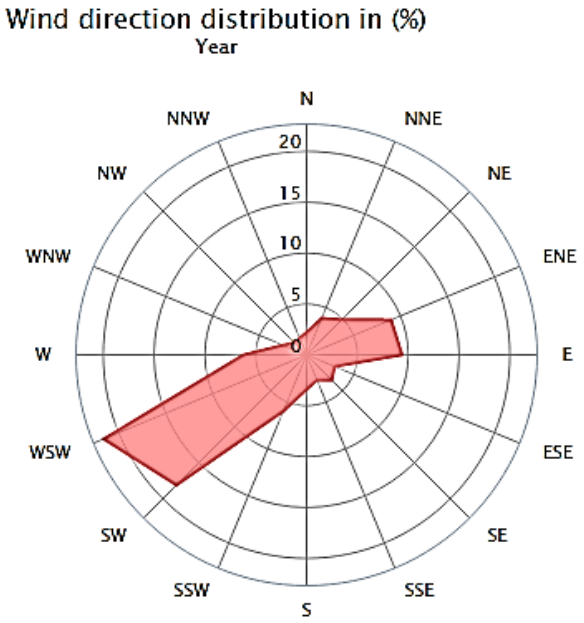

Figure 1: Wind rose for Port Elizabeth

1.3 Draw a line graph that shows the probability, as a percentage, of the wind speed exceeding 4 on the Beaufort scale (refer to Figure 2). Use a vertical scale of 10 mm = 10%.

Month of year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	01	02	03	04	05	06	07	08	09	10	11	12	1-12
Dominant Wind dir.													
Wind probability >= 4 Beaufort (%)	63	58	55	44	42	39	44	49	58	64	66	65	53
Average Wind speed (kts)	14	13	12	12	11	10	11	12	13	14	14	14	12
Average air temp. (°C)	24	24	23	20	19	17	16	17	18	19	20	22	19

Figure 2: Weather data for Port Elizabeth

1.4 The turbine blade will begin rotating when the wind speed reaches 4 metres per second (m/s), which is equivalent to 8 knots (kts) (refer to Figure 2).
   a) How many months of the year does the wind blow on average stronger than 8 knots (kts)?
   b) Calculate the average wind speed for the year (in knots).
   c) How would you describe the wind conditions? In your opinion, is it feasible to establish a wind farm in Port Elizabeth based on the wind data?

2. Site location

You will need to locate and indicate on the map, a site that would be the best location for the wind farm. The site must be between 20 and 24km² in extent (size). Use the line scale on the map to help you. Give your reason in a paragraph or two, but be sure to consider the following points below (see the map):

- Natural areas (wetlands, river systems and coastal regions)
- The slope of the land
- Transport routes: Accessible roads to transport the turbines (trucks will be carrying loads in excess of 60 m)
- The location of Eskom power lines (so that you can feed into the national electricity grid)
- Each turbine is 50 m tall. Public concern has been raised about wind turbines being an “eye sore” and having a negative impact on tourism.
- The location of residential areas, industrial areas, agricultural areas and airports

3. Buffering – Paper GIS

Once you have located the site, draw a security buffer zone of 200 m around the perimeter.

Finally, it is time to submit the report. Make sure that your report includes all the required information. In your opinion, while considering positive and negative impacts, motivate whether the company should submit a tender or not. Do not forget to include the map and add labels, where necessary.

Reference sources:

NESRA – National Energy Regulator of South Africa (online). Available at http://www.nersa.org.za/ [5 August 2015]

http://www.windfinder.com/windstatistics/port_elizabeth

https://www.teachengineering.org

http://jeffreysbaywindfarm.co.za/