Memo: 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 electricity. 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).
WSW = 21% to 22% SW = 17% to 18% a combined 38 to 40% of the time the wind is WSW and SW

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

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

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)? (**12 months)**

b) Calculate the average wind speed for the year (in knots). **(162/12 months = 13,5 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? **(ideal conditions, wind is constant throughout the years)**

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 18 and 20km² 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) – **(Mention aspects such as the migratory routes of birds. The actual surface area footprint of each turbine is small, so some of the land could be converted from land use zone agriculture to nature conservation. Then the original biodiversity of the land can improve.)**
- The slope of the land **(gentle and undulating slope is most suitable)**
- Transport routes: Accessible roads to transport the turbines (trucks will be carrying loads in excess of 60 m) **(being close to the highway will increase ease of delivery)**

- The location of Eskom power lines (so that you can feed into the national electricity grid) **(the power lines are not indicated)**
- 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.
  (This will be a problem because the best location is along the coast to maximise the efficiency of the wind turbines, although this is an example of weighing up the positive and negative factors of locating any new initiative. Maybe you could consider once-off compensation for the residents.)
- The location of residential areas, industrial areas, agricultural areas and airports **(There is an airport in the area. The learners can investigate the maximum distance that a wind turbine may legally be located from an airport. They can use the reference sources indicated below.)**

3. Buffering – Paper GIS (georafic information system)

Once you have located the site, draw a security buffer zone of 200 m around the perimeter. **(The easiest way to do the is to measure a surface area of 22 km that will fit along the coast. Then the learners can draw in the wind farm following the natural slope and the roads.)**

The Humansdorp map used in the matric finals a few years ago can be used to locate the new wind farm at Jeffreys Bay. One can then design a paper GIS activity around buffering, cross sections, and intervisibility. Added to this, the impact on tourism, and whether the people of Jeffreys Bay have benefited from the wind power generated in the area (for example a reduction in the unit price of electricity paid to Eskom or the local municipality).

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/