CLIMATE CHANGE ASSESSMENT

I. Basic Project Information

Project Title: SRI(P49345-002): Wind Power Generation Project
Project Budget: US$ 256.7 million
Location: Northern Province of Sri Lanka
Sector: Energy
Theme: Renewable Energy Generation
Brief Description: The project includes development of a 100 megawatts (MW) wind park, including internal medium voltage cabling, access roads and other infrastructure, and a renewable energy dispatch control center to forecast, control and manage intermittent wind power generation. The wind park will be constructed on the southern coast of Mannar Island in the Northern Province of Sri Lanka. The island has a land area of about 130 square kilometers and is entirely surrounded by sea. It is located close to the main island. The project also includes installation of the reactors of 150 megavolt-ampere reactive (MVAr) to manage voltage levels and ensure reliable operation of the wind park. The reactors of total 100 MVAr will be installed at the 220 kilovolt (kV) level at Anuradhapura grid substation in the North Central Province of the main island. One 50 MVAr will be installed at the 220 kV level at Mannar grid substation located in Mannar district of the main island (Northern Province). The project has a soft component for CEB capacity building in project engineering design review and supervision.

II. Summary of Climate Risk Screening and Assessment

A. Sensitivity of project component(s) to climate/weather conditions and sea level

Project component	Sensitivity to climate and/or weather conditions and sea level:
1. Wind power generation increased (construction of the 100 MW wind park, internal park infrastructure, and a renewable energy dispatch control center); 2. System reactive power management improved (installation of total 150 MVAr reactors); and *3.* Capacity of Ceylon Electricity Board in project engineering design review and supervision strengthened.	1. A global sea level rise of 0.2 meters (m) and 0.5 m by the years 2050 and 2100, respectively, has been predicted. The forecasted sea level rise for 2050 is expected to cause a general shoreline retreat of 10 m corresponding to a 0.2 m of shoreline retreat per year. Selected sites for the wind power plant are located 2 to 7 m above mean sea level. The life span of the project is about 25 years. Therefore, the rise of sea level would not be a risk for the proposed project. 2. The temperature rise will not have an impact on renewable energy systems. The ambient temperature in Sri Lanka has increased by 0.64 degrees Celsius (°C) over the past 40 years and 0.97°C over the last 72 years (an increase of 0.14°C per decade). However, the assessment of a more recent time band of 22 years has shown a 0.45°C increase during this period (an increase of 0.2°C per decade). 3. Rainfall in Sri Lanka is characterized by high annual variability with alternate dry and wet periods observed from 1880 until about 1970 and a significant reduction thereafter.[1] Over the period 1931 to 1990 average annual rainfall is reported to have decreased from 2,005 millimeters (mm) to 1,861 mm, a decline of 7%.[2] The change in rainfall amount and the variation between seasons would not affect any component of the proposed project. 4. The land selected for the wind farm project in Mannar Island will be subjected to increase in water table, about 0.3 m during the northeast monsoon from November to January. Mitigation is required during the construction of wind turbines. More frequent maintenance may be required.

[1] Ministry of Irrigation and Water Resource Management. 2010. *Sri Lanka Water Development Report 2010*. Colombo

[2] Jayatillake, H.M., Chandrapala, L, Basnayake, B.R.S.B, Dharmaratne, G.H.P. 2005. *Water Resources and Climate Change. Proceedings of the Workshop on Sri Lanka National Water Development Report*. World Water.

B. Climate Risk Screening	
Risk topic 1. Sea level rise 2. Rising temperatures 3. Increased precipitation	Description of the risk: 1. Sea level rise of 1–3 mm/year observed in the Asian region and is marginally higher than the global averages. An accelerated level of sea level rise has been observed during the period of 1993–2001 (3.1mm/year) for the Asian region. However, specific levels of sea level rise in areas around Sri Lanka are yet to be assessed. A global sea level rise of 0.2 m and 0.5 m is expected by the years 2050 and 2100, respectively. The forecasted sea level rise for 2050 is expected to cause a general shoreline retreat of 10 m corresponding to a 0.2 m of shoreline retreat per year. By 2100 a general shoreline retreat of 25 m is expected, corresponding to an average retreat of 0.25 m per year. 2. The ambient temperature in Sri Lanka has increased by 0.64°C over the past 40 years and 0.97°C over the last 72 years (an increase of 0.14°C per decade). However, the assessment of a more recent time band of 22 years has shown a 0.45°C increase during this period (an increase of 0.2°C per decade). 3. Rainfall in Sri Lanka is characterized by high annual variability with alternate dry and wet periods observed from 1880 until about 1970 and a significant reduction thereafter (footnote 1). Over the period 1931 to 1990 average annual rainfall is reported to have decreased from 2,005 mm to 1,861 mm, a decline of 7% (footnote 2). The decrease differed between seasons, with the highest decline in March to April inter-monsoonal period. Also, it was noted that the intensities and return period of extreme events appear to have become shorter.
Climate Risk Classification *Medium*	
C. Climate risk assessment 1. The main climate impact on the wind energy project in Mannar island is the global sea level rise. Sea level rise and storm surges may affect above ground facilities such as wind turbines, buildings, grid substations, etc. 2. Increase in temperature would not have direct impact on any of the project component. Analysis of past data suggests that atmospheric temperature is gradually rising almost everywhere in the country.[3] Varied rates of increase in temperature have been reported from different locations, and in recent years the warming trend has become faster. Annual mean air temperature anomalies have shown significant increasing trends in all stations during the recent decades. 3. Unlike in the case of temperature, no clear pattern or trend has been observed in precipitation. Some researchers, comparing the mean annual precipitation of recent and earlier periods, suggest that average rainfall is showing a decreasing trend.[4]	

III. Climate Risk Management Response within the Project

1. Sea level rise and storm surges may affect the project facilities of wind energy systems in coastal and near shore area in Mannar island. The addition of current surge, tidal levels to projected changes in sea level can provide a first approximation for impact and adaptation assessments. Project design should also incorporate these changes. Sea level rise will result in loss of coastal land, increased coastal erosion and increased salt water intrusion leading to salinization of low lying areas. A value of at least 0.2 m should be considered for future scenario in 2050. Since selected sites for the wind power plant are located 2 to 7 m above mean sea level and the life span of the project is about 25 years, the rise of sea level would not be a risk for the proposed project. Nevertheless, the project follows the best design practice of wind turbines and other facilities of wind parks located in coastal areas that includes standard adaptation measures against sea level rise and storm surges or strong winds.

2. Temperature and rainfall variability would not directly affect the other project components.

°C = degree Celsius, kV = kilovolt, m = meter, mm/year = millimeters per year, MVAr = megavolt-ampere reactive, MW = megawatt.

[3] Chandrapala, L. 1996b. *Long term trends of rainfall and temperature in Sri Lanka. In Climate Variability and Agriculture*. Abrol, Y. P., S. Gadgil and G. B. Pant. (Eds.). New Delhi, India: Narosa Publishing House. Pages 153-162.

[4] Premalal and Punyawardena (2014) and Basnayake, B.R.S.B. (2007) *Climate Change*. In Survey Department of Sri Lanka. *The National Atlas of Sri Lanka*. Colombo, Sri Lanka. Pages 54-55.