The Problem

A relatively small solar photo-voltaic (PV) facility has already been installed, owned and operated by RECo, to supplement the town and mining electricity demand. This solar PV field is 1.7MW in size. ARENA has previously suggested that this could be expanded to 6.7MW at a total cost of $10.3M, but this never eventuated.

Hypothetically, the electricity supply for Weipa could be largely renewable by using an appropriately sized combination of wind and solar PV connected to battery storage. In this way, the diesel currently being used to generate electricity by Rio Tinto could be mostly replaced, with the diesel generators then only used for emergency supply and/or during lengthy periods of weather unsuitable for wind or solar power generation.

To provide electricity for the mine and the town, it is hypothetically proposed that RECo build, own and operate

a new solar PV plus onshore wind energy generation facility, coupled to Li-Ion batteries. This could replace 22 hours per day of diesel-generated electricity when the weather is favourable (in winter and spring).

Your task is to evaluate this new proposal by RECo, considering Weipa's cyclical climate and its average demand for electricity in two distinct periods: summer and winter. In this regard, you will need to design the plant to:

(1) achieve the electrical energy supply of 22 hours per day during the favourable weather months in winter/spring;

(2) the size of the battery storage required to ensure 22 hours supply during this period; and

(3) the proportion of diesel backup (greater than 2 hours/day) needed for the summer period (when the sunlight and wind are not as favourable).

Any diesel-generated electricity required by the new system will be provided by Rio Tinto via its existing generation facilities.

The average Capacity Factors for solar PV and wind for the two six-month periods (summer and winter/spring) can be determined from the graphical data supplied in Figure 1 and 2.

The life of the project is expected to be 40 years (i.e. the project concludes 40 years after the project becomes operational in 2025). The calculated real, after-tax Weighted Average Cost of Capital (WACC) for RECo is hypothetically estimated as 5%. However, there are weather, environmental, financial, social, and other risks associated with the project. By undertaking a risk assessment for the unique ESG issues at Weipa, you will need to decide on an appropriate IRR for the project's financial returns. In a similar way, you will need to decide on the proportions of solar PV and onshore wind, together with battery storage, within the constraints of annual electricity supply and your developed key risks.

Then, you will need to estimate the electricity price that needs to be charged by RECo to the mining company to achieve the internal rate of return (IRR) you have chosen after your risk assessment.

In your assessment, you should consider (and make assumptions regarding) the following:

- Sizing and positioning the components of the system appropriately;
- The system capital cost, including equipment shipping transfers to Weipa.
- Appropriate ongoing replacement costs associated with the system over its life.
- Operational costs (including labour and maintenance).
- Provisions for rehabilitation and closure of the system (which lies near environmentally-sensitive areas).

Then, you will need to estimate the electricity price that needs to be charged by RECo to the mining company to achieve the internal rate of return (IRR) you have chosen after your risk assessment.

In your assessment, you should consider (and make assumptions regarding) the following:

- Sizing and positioning the components of the system appropriately;
- The system capital cost, including equipment shipping transfers to Weipa.
- Appropriate ongoing replacement costs associated with the system over its life.
- Operational costs (including labour and maintenance).
- Provisions for rehabilitation and closure of the system (which lies near environmentally-sensitive areas).

Your Report

Your financial assessment should include the following:

- A cover letter addressed to RECo;
- An executive summary (1 page);
- A table of contents (1 page);
- An introduction (1 page);
- An outline of your methodology and approach to the financial assessment process (1 page);
- The key risks associated with the project (2 pages);
- A summary description of your capital and operating cost estimates, including a sensitivity analysis (3 pages). The parameters (and associated ranges of sensitivity) should strongly be supported by literature and your understanding of energy flows;
- A statement of the expected benefits to RECo's customer, Rio Tinto (1 page), including
  (i) the avoided costs of the replaced diesel;
  (ii) the savings in CO_{2e} emissions from the investment (t/year); and
  (iii) the implications of a future Net Zero Emissions Policy – this should include the potential avoided costs of a CO_{2e} price; and

- A conclusion making a clear recommendation (1 page).

The Financial Assessment should have a maximum length of 9 pages, not including the cover letter, executive summary or table of contents. In addition to the report submission via Turnitin (Blackboard), you should also submit a Microsoft Excel financial spreadsheet on Blackboard to support your recommendations.

As per the marking rubric provided on Blackboard, this task will assess your ability to write a professional report, to think critically about the financial analysis of major projects and to broaden your knowledge base to consider business decisions.

Your financial assessment should be robust, making assumptions for all major elements and justifying decisions for your methodology and output.

Clear presentation is important in the financial assessment. Do not confuse the brevity of the assessment with the amount of thought required. Spelling, punctuation, grammar and formatting errors will be heavily penalised. It is recommended that you proofread your work thoroughly and ensure it is readable, logical, free from errors and consistently formatted (e.g. dot point formatting is consistent).

Details and Hints

Rio Tinto's existing diesel generators have a capacity of 26MW, with a Capacity Factor hypothetically estimated as 90%. Using this information, you can calculate the average MWh of electricity demand in Weipa.

For the financial input parameters, use the cost data from the *GenCost 2020-21* (CSIRO) report plus those in the *Australian Power Generation Technology Report*, along with the reported cost reduction factors for investment in 2025. Compare these with the quoted capital costs of the current and originally-proposed ARENA system (6.7MW total).

Efficiency of conversion of diesel to electricity in the reciprocating diesel engines is estimated as 40% - this enables calculation of the amount of diesel replaced by renewable energy.

The mine operates 24/7, 365 days per year, and can be considered to have a constant energy demand.

The diesel in Weipa is transported by sea-barge from Cairns and is expected to have a higher price. You should consider the wholesale price for the avoided diesel cost.

It may be assumed that the Australian Tax Office (ATO) will allow for the (straight line) depreciation of capital assets over a 10 year timeframe for batteries and 20 years for solar PV and wind systems. You may assume these are the useful lives of these components.

The project will use the existing electricity transmission lines at Weipa. The existing diesel generators and diesel storage will be held in reserve and not dismantled.

Weipa has relatively frequent high-category tropical cyclones in the summer monsoon season, when renewable energy generation will not be possible.

Figure 1 Solar PV system capacity factors at Weipa. Source: www.renewables.ninja

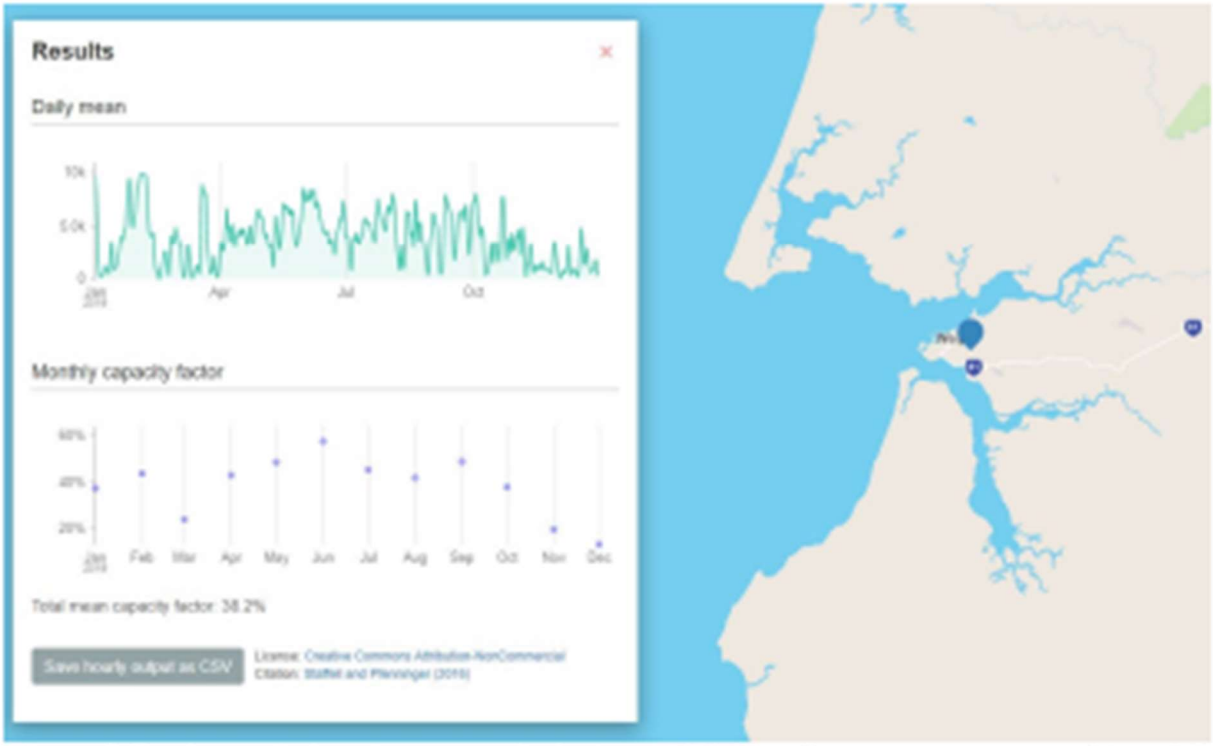

Figure 2 Onshore wind system capacity factors at Weipa. Source: www.renewables.ninja