The Monkey Island data pack: monkey-data.zip

There are several files in the data pack, data are usually provided as .csv (comma separated values). It is strongly recommended to use an engineering software like MATLAB to process and plot the data. To be clearer: Excel is not suitable to process large amounts of scientific data!

river-*.csv

There are three rivers that can be used for hydroelectric generation. The files give the average flow in each hour of the years between 2022 and 2024. The flow is given in m^3/s and it is measured at the points indicated by the green arrows on the map. You should use the topographic map of the island to determine water heads available at the sites (you should include head losses, as learnt in Fluids, if appropriate).

If the turbine is fish-friendly, you can intercept 50% of flow. If it isn't than you can only take 10% from each river. Note that diverting water into a pipe is NOT fish-friendly, no matter what turbine you use. There can only be one hydro-plant on each river. Dams are not permitted on the island; weirs, channels and ducts are possible, with the above flow limits. Although there are several other rivers on the island, they cannot be used for a range of reasons (environmental, lack of data, shortage of water, etc.).

solar+wind.csv

This file gives beam, diffused, reflected and total irradiance on a plane at a selection of inclinations (0°, 35°, 40°, 45° and 90°, as indicated), with hourly resolution. Units are W/m^2. It also gives the height of the Sun at those times, so you can make some adjustments if you choose a different angle for your PV (see formula given in slides). It gives the air temperature, if you wish to know.

The file also provides hourly wind speeds on the island (the average within the specified hour) for three years. Speed is in m/s and is measured at 10 m altitude at the location 35.000° N, 37.500° W. You can use the wind rose on the map to help you site the turbines. Use the wind speed correction formulae to adjust for hub heights. Wind turbines can only be placed onshore as a wide marine reserve lies all around the island.

turbines-data.xlsx

This file contains some information about a selection of wind and water turbines. You may use these or find others in the web (you will reference the webpage of the manufacturer in your report). Since you will have to cost your system, finding data and prices on the web is a good idea (but you are advised against pestering manufacturers for quotes). Your report will look much better if you are basing your calculations on real turbines, rather than, say, a hypothetical (and non-existent) 50 MW Archimedes screw. Do keep in mind that hydro turbines, like wind turbines, have a rating and won't generate more than that, no matter how much water flows.

demand.csv

Demand is provided for three years and it has hourly resolution. The file gives the average power (in kW) during the specified hours (which is obviously the same value as the total energy in that hour, in kWh). This is the demand you have to satisfy, but remember that you can, to a reasonable extent and with full explanation, resort to DSM to mitigate peaks etc.

Monkey Island is inhabited by environmentally aware people who would comply with reasonable Demand Side Management requests and accept to pay a little premium for their energy (i.e. more than, e.g. European prices, but not exorbitant prices either).

monkey-island-map.png

This is an image file with the map of the island. It is important as it tells you where the island is in the world (of course, in another multiverse) and its topography, which you need to determine reasonable water heads and the indicative slope of any duct you may want to install. You can use it to site your generators, for example taking into account shading caused by tall hills, or to ensure you don’t place your wind turbine leeward. People mostly live near roads and on the coast, but in this project we are not paying too much attention to the transport of electricity from generation site to consumers.

B59ES Assignment Checklist 2024/25

Here are some guidelines for your assignment.

- We need to see your clear method of calculating the electricity generation for each technology used.
- You must define variables/parameters of the formulas.
- All your numbers must have units (if applicable).
- The **word limit is 6000** and the **page limit is 20** (*including* appendices and annexes). Kindly make good use of the limited space available. *Brevity is the soul of wit*.

System Design and Sizing of components

Detail the different components you choose for your project and how you calculate the electricity generation of the technologies used as well as sizing of energy storage.

- Choose an appropriate configuration for your electricity generation. You will need a mix of renewable technologies. How much electricity does each technology provide?
- You should show that you are proficient in calculating the output of the various technologies used.
- Choose the most appropriate energy storage technology; justify your choice.
- Include a financial analysis: at a minimum, it will include calculation of the LCoE. Be careful to implement the equation correctly!

Results and Discussion

Explain how your different components go together; you should show how well your system works:

- Show that your configuration can work to achieve a stable grid (i.e. demand and generation, with the help of storage, are nearly the same at each hour)
- What control mechanisms have you built in?
- Why did you choose this particular configuration? What are its main advantages? Are there disadvantages?
- Have you considered alternatives? Which alternatives? Provide reasons why these alternatives have not been chosen.
- Compare your solution to other projects already implemented. How realistic do you think your solution is?
- Is your system economically feasible? If not, what would need to happen so that it does become feasible?

References

References have to be used whenever you quote facts and/or figures that are not general knowledge, in each section of your paper/report (including introduction).

References MUST be cited in the text (depending on the reference style you have chosen). A simple bibliography at the end of the report is not sufficient.

The mark for referencing is based on

- Number (minimum number of appropriate references to get marks awarded is 10)
- Quality (academic journals vs. websites)
- Correct placement in the text and correct format

Figures and Tables/General Layout

Each figure/table MUST have a number (and be referred to in the text) and caption that describes it.

A reference to the source you have taken it from (except, of course, if you gathered the data and made the graph yourself).

Ten simple rules to better figures:

1. Know Your Audience
2. Identify Your Message
3. Adapt the Figure
4. Captions Are Not Optional
5. Do Not Trust the Defaults
6. Use Colour Effectively
7. Do Not Mislead the Reader
8. Avoid “Chartjunk”
9. Message Trumps Beauty
10. Get the Right Tool

For details and examples: https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003833