**Task 4: Insurance**

A large variety of risks are involved in the planning, construction and operation of a wind farm. One of the most unique risks is having too little or too much wind, which means that the wind turbines cannot operate and no power can be generated. Naturally, this will happen a few times a year, but when the wind slows down often or remains unfavorable for longer periods of time, the owner and investors may be faced with considerable unexpected losses. Your task is to construct an insurance product that shields the owner of a wind farm for a ‘lack of wind’, based on the data provided to you.

**Task**

The first step of the process is to consider how one can define a loss event, i.e., under which conditions a period of unfavorable wind should be considered as a loss that should be insured. Naturally, this definition may vary depending on the location that you consider. From this definition, the probability that a loss occurs and its corresponding expected value can be deducted from the provided data. Finally, this information can be used to determine a suitable premium for the insurance product. In this case, ‘suitable’ means that it provides the right balance between attractiveness of the insurance product for the consumer, and profitability for the insurer.

**Data**

You are provided with four .csv files, each containing wind data from a different location in Europe. This data was obtained from the [New European Wind Atlas](https://map.neweuropeanwindatlas.eu/) (NEWA), an open-source database that contains simulated wind data from across Europe over the past few decades. The table below elaborates what the different columns of the .csv files represent.

|  |  |  |
| --- | --- | --- |
| **Column name** | **Meaning** | **Unit** |
| TIME | Time of measurement | DD/MM/YY HH/MM/SS |
| HGT | Height above ground level of the measurement | Meters (m) |
| WS | Wind speed | Meters/second (m/s) |
| XLON | Longitude coordinate | Degrees (°) |
| XLAT | Latitude coordinate | Degrees (°) |
| POWER | Total power generated during 30 minutes | kilowatt hour (kWh) |

The location of the wind farm does not only affect the wind itself, but also the type of wind turbines that can be used. The most important difference is whether the wind farm is built on-shore or off-shore. Offshore turbines can generally have much larger blades, which means they harvest more wind and generate more power. We have selected two wind turbines, one onshore and one offshore type, that you may use for your calculations and/or considerations. Their specifications can be found in the table below.

|  |  |  |
| --- | --- | --- |
|  | **Onshore** | **Offshore** |
| Model name | Enercon E-141 EP4 4.2MW | Siemens Gamesa SG 10.0 193 10.0MW |
| Cut-in speed (m/s) | 3 | 3.5 |
| Cut-out speed (m/s) | 31 | 25 |
| Diameter (m) | 141 | 193 |
| Height (m) | variable | variable |
| Max Power (kW) | 4200 | 10000 |

**Presentation**

In the afternoon, you will have half an hour to prepare a 5 minute presentation. Focus on how you constructed your insurance product, which assumptions you made, how you took location into account and how it provides a good balance between attractiveness and profitability.

A board of managers will be present and pick a winner based on the presentations. Therefore, treat your presentation as an opportunity to convince the board that your solution is viable and profitable by providing an engaging story based on data-driven arguments.