

**Realindex – Graduate Quantitative Developer   
Technical Assessment**

*The objective of this task is to write code, using either R or Python, to calculate some simple metrics relating to the carbon footprint of a portfolio of listed companies. As a rough guide you should expect this task to take approximately 30-60 minutes, though it will not be timed.*

Carbon Intensity (CI) is a popular metric for assessing the carbon footprint of a company. It is calculated as the ratio of carbon emitted by the company (over a given fiscal year, in tons of CO2), to the revenue of the company (over the same period in $million USD). The carbon emitted by a company is typically calculated by summing the carbon emitted directly as a result of their business operations (Scope 1), and the carbon emitted when generating energy, such as electricity, that is consumed by the company (Scope 2).

Investors are often interested in the aggregate carbon footprint for a portfolio of companies that they are invested in. The weighted average Carbon Intensity (WACI) of all the companies in the portfolio can be used for this purpose. The weights that are used in this calculation represent the proportional dollar value of each investment in the portfolio on a given date.

WACI can also be calculated for a benchmark portfolio (such as the ASX 20, which tracks the performance of the largest 20 companies listed on the Australian Stock Exchange). In this case the weights reflect the proportional total market value of each company in the benchmark on a given date.

To formalise this, we can define WACI as

*Where:*

***n*** is the total number of companies in the portfolio, on a given date

***units*** is the number of units of a company held in the portfolio, on a given date

***price*** is the price of one unit of the company, on a given date, in a given currency

***C02scope1*** is the last reported annual Scope 1 carbon emissions for a company (in CO2 T), on a given date

***C02scope2***is the last reported annual Scope 2 carbon emissions for company (in CO2 T), on a given date

***revenue*** is the last reported annual revenue for a company (in $million USD), on a given date

**Using the information above, please implement code to answer the following questions:**

Using the provided data for the RI\_20 portfolio and the ASX\_20 benchmark

1. Calculate the Weighted Average Carbon Intensity (WACI) for both the portfolio and the benchmark.
2. For both the portfolio and benchmark, calculate the WACI within each category group, and the contribution of each category to the total WACI calculated in part 1.
3. For both the portfolio and benchmark, use a bar graph to visualise the category data calculated in part 2.
4. State any assumptions you have made (if any).

You must use either R or Python to calculate the results, and submit this code with your response. You can make use of contributed libraries/packages in your code if you choose to. We will be assessing the quality of your code as well as the accuracy of your answers. If you are selected to proceed to the interview stage of the recruitment process be prepared to explain your code and answer questions related to your solution.

If you have any questions about the assessment please contact:  
Layla St Clair - [layla.stclair@firstsentier.com](mailto:layla.stclair@firstsentier.com)

**Answers**

1. Portfolio WACI Answer:   
   Benchmark WACI Answer:
2. Category Group Breakdown

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Portfolio** | | **Benchmark** | |
| **Category Group** | **Weighted Average** | **Contribution to Total** | **Weighted Average** | **Contribution to Total** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |

1. Graph
2. Assumptions:

**Code** – please paste your code below and also include in a zipped file (some email systems block python / R files when attached).

Language:

Code:

**Data Files**

**ID Map – security identifier mapping reference data**

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| SEDOL | 7 digit unique alphanumeric global security identifier – e.g. B03FYZ4 |
| Ticker | Stock symbol that helps identify a security on an exchange. A unique identifier – e.g. CBA |
| Company Name | Name of the company |
| Category Group | A stock has been assigned a category group |

**Portfolio Holdings – contains portfolio holdings data**

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| Portfolio | Portfolio Name – e.g. RI\_20 |
| Type | Type of security – e.g. Equity / Cash / Futures / Bonds |
| Ticker | Stock symbol that helps identify a security on an exchange. A unique identifier – e.g. CBA |
| Units | Number of units owned by the portfolio – e.g. 100 |
| Price | Price of the security in dollars – e.g. $40.33 |

**Benchmark Holdings – contains benchmark weights**

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| Index Code | Index Name |
| Ticker | Stock symbol that helps identify a security. A unique identifier – e.g. CBA |
| Index Weight | Percentage weight of the security in the index |

**Carbon Data – contains carbon data**

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| SEDOL | 7 digit unique alphanumeric global security identifier – e.g. B03FYZ4 |
| Issuer Name | Company Name |
| Emissions Scope 1 | Scope 1 emissions are the direct GHG emissions that occur from sources that are controlled or owned by the reporting organisation (e.g., emissions that result from fuel combustion in furnaces and vehicles).  Measured in CO2 T - tons of carbon dioxide equivalent (CO2e). |
| Emissions Scope 2 | Scope 2 emissions are indirect GHG emissions associated with the purchase and use of electricity, steam, heat, or cooling by the reporting organisation.  Measured in CO2 T - tons of carbon dioxide equivalent (CO2e). |
| Emissions Scope 3 | Scope 3 emissions result from activities and assets not owned or controlled by the reporting organisation, but that the organisation indirectly impacts in its value chain (e.g., transportation and distribution, purchased goods and services).  Measured in CO2 T - tons of carbon dioxide equivalent (CO2e). |
| Revenue USD | Company Revenue in USD |