Product Carbon Emissions

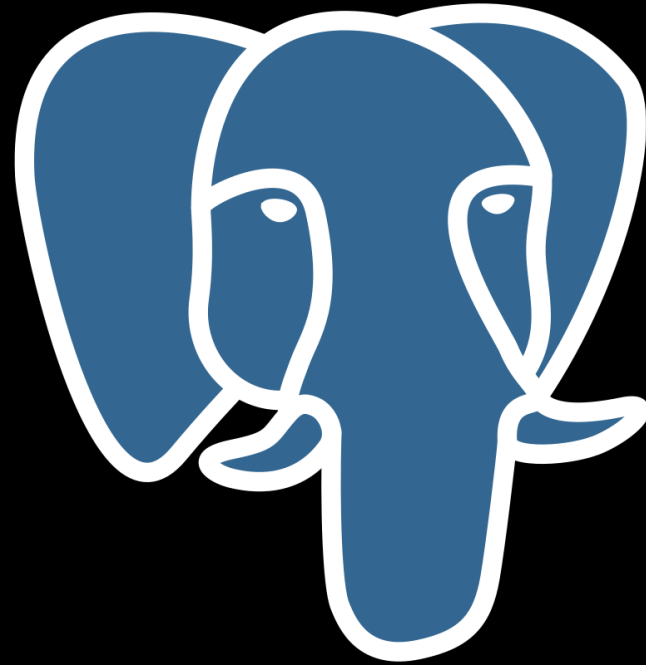Michael Rodriguez

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Dataset

The dataset used for this project exploration is from The Carbon Catalogue. A collection of product carbon emission footprints created by Carbon Disclosure Project (CDP). This dataset consists of:

- 866 products
- 145 companies
- 30 industry groups
- 28 reporting countries

Meinrenken, Christoph J, Daniel Chen, Ricardo A Esparza, Venkat Iyer, Aruna Prasad, Sally Paridis, and Erika Whillas. 2022. "The Carbon Catalogue – Carbon Footprints of 866 Commercial Products from 8 Industry Sectors and 5 Continents". figshare. https://doi.org/10.6084/m9.figshare.c.5408100.v1.

Technologies Used

Analysis Questions

- How many products are in the dataset? (to confirm with source)
- What unique countries are in the dataset?
- Provide a sample of 10 companies in the dataset.
- How many companies are in each country?
- How many products come from each country?
- What is the carbon footprint of industry groups in the most recent year?
- What product(s) weigh the most in the dataset?
- What products occur the most in the dataset?
- What is the cumulative carbon footprint from the earliest year in the dataset?
- Which countries have the largest footprint for each industry?
- What are the top 3 contributing industries to the carbon footprint of USA, China, and India?
- Compare the footprint of the United States between 2015 and 2016.

Query 1

How many products are in the dataset? (to confirm with source)

```
SELECT COUNT(id) AS number_of_products
 FROM carbon_emissions;
```

Query 2

What unique countries are in the dataset?

SELECT DISTINCT country
 FROM carbon_emissions
 ORDER BY country;

country
text 🔒
Australia
Belgium
Brazil
Canada
Chile
China
Colombia
Finland
France
Germany
Greece
India
Indonesia
Ireland
Italy
Japan
Lithuania
Luxembourg
Malaysia
Netherlands
South Africa
South Korea
Spain
Sweden
Switzerland
Taiwan
United Kingdom
USA

Query 3

Provide a sample of 10 companies in the dataset.

SELECT DISTINCT company
 FROM carbon_emissions
 LIMIT 10;

company text 🔒
Quanta Storage Inc.
Fabrica de Tapas Bavaria
TETRA PAK
WOLF
CONTRAF-NICOTEX-TOBACCO GmbH
Ricoh Co., Ltd.
Georg Fischer
Brambles
Trelleborg AB
Yokohama Rubber Company, Limited

Query 4

How many companies are in each country?

SELECT COUNT(DISTINCT company) AS number_of_companies,
    country
  FROM carbon_emissions
  GROUP BY country
  ORDER BY COUNT(DISTINCT company) DESC;

country text	number_of_companies bigint
USA	39
Japan	21
Taiwan	13
United Kingdo…	8
France	7
South Korea	6
Switzerland	6
Sweden	5
Germany	5
Spain	5
China	4
Brazil	4
Italy	3
South Africa	3
India	2
Finland	2
Lithuania	1
Luxembourg	1
Malaysia	1
Netherlands	1
Belgium	1
Greece	1
Colombia	1
Chile	1
Canada	1
Australia	1
Ireland	1
Indonesia	1

Query 5

How many products come from each country?

SELECT country, COUNT(product_name) AS number_of_products
FROM carbon_emissions
GROUP BY country
ORDER BY number_of_products DESC;

country text	number_of_products bigint
USA	305
Japan	110
Germany	67
Taiwan	60
Finland	35
Netherlands	35
United Kingdo...	32
Switzerland	28
Sweden	26
Italy	23
South Korea	22
France	20
Brazil	17
India	16
Spain	13
South Africa	11
Belgium	8
China	6
Canada	6
Ireland	6
Australia	6
Malaysia	4
Chile	3
Luxembourg	2
Colombia	2
Greece	1
Lithuania	1
Indonesia	1

Query 6

What is the carbon footprint of industry groups in the most recent year of the dataset?

```
SELECT industry_group,
    COUNT(id) AS number_of_products,
    ROUND(SUM(carbon_footprint_pcf), 1) AS total_industry_footprint
 FROM carbon_emissions
WHERE year = (SELECT MAX(year) FROM carbon_emissions)
GROUP BY industry_group
ORDER BY total_industry_footprint DESC;
```

industry_group text	number_of_products bigint	total_industry_footprint numeric
Materials	11	107129.0
Capital Goods	4	94942.7
Technology Ha...	22	21865.1
Food, Beverag...	22	3161.5
Commercial & ...	2	740.6
Software & Ser...	1	690.0

Query 7

What product(s) weigh the most in the dataset?

```
SELECT product_name, weight_kg, carbon_footprint_pcf AS emissions_kg_co2
  FROM carbon_emissions
  WHERE weight_kg = (SELECT MAX(weight_kg) FROM carbon_emissions)
```

product_name text	weight_kg numeric	emissions_kg_co2 numeric
Wind Turbine G128 5 Megawats	600000	3718044
Wind Turbine G132 5 Megawats	600000	3276187

Query 8

What products occur the most in the dataset?

SELECT product_name

 FROM carbon_emissions

 GROUP BY product_name

HAVING COUNT(product_name)

    >=ALL(SELECT COUNT(product_name) FROM carbon_emissions GROUP BY product_name)

 ORDER BY product_name ASC;

product_name text
Average of all products sold to Brask...
ColorQube 8870
ColorQube 8900
ColorQube 9200
Glass container
Phaser 6600
Residential Air Conditioner
Tetra Brik Aseptic Base 1000ml
Tetra Brik Aseptic Base 250ml
Tetra Brik Aseptic Slim 200ml
Tetra Brik Aseptic Slim 250ml

Query 9

What is the cumulative carbon footprint from the earliest year in the dataset?

```sql
SELECT DISTINCT year,
        SUM(carbon_footprint_pcf) OVER (ORDER BY year RANGE BETWEEN
UNBOUNDED PRECEDING AND CURRENT ROW) as cummulative_carbon_footprint
FROM carbon_emissions
ORDER BY year;
```

year integer	cummulative_carbon_footprint numeric
2013	496078.1324
2014	1044310.73511
2015	11854718.33502
2016	13467474.88532
2017	13696003.71372

Query 10

Which countries have the largest footprint for each industry?

```
WITH max_of_country AS
(
SELECT industry_group,
                    ROUND(SUM(carbon_footprint_pcf), 1) AS total_industry_footprint,
                    country
  FROM carbon_emissions
  GROUP BY industry_group, country
)


SELECT industry_group, country
  FROM max_of_country
WHERE total_industry_footprint IN (SELECT MAX(total_industry_footprint) FROM max_of_country GROUP BY industry_group )
  GROUP BY industry_group , country
  ORDER BY country;
```

industry_group	country
Trading Comp...	Australia
Capital Goods	Brazil
Consumer Dur...	China
Forest and Pap...	Finland
Household & P...	France
Technology Ha...	France
Automobiles & ...	Germany
Tobacco	Greece
Mining - Iron, A...	India
Containers & P...	Ireland
Consumer Dur...	Japan
Food & Bevera...	Japan
Gas Utilities	Japan
Tires	Japan
Utilities	Japan
Materials	Luxembo...
Chemicals	Netherlan...
Food, Beverag...	South Kor...
Semiconductor...	South Kor...
Electrical Equi...	Spain
Energy	Spain
Food & Bevera...	Switzerla...
Food & Staples...	United Ki...
Telecommunic...	United Ki...
Commercial & ...	USA
Consumer Dur...	USA
Media	USA
Pharmaceutica...	USA
Retailing	USA
Semiconductor...	USA
Software & Ser...	USA
Technology Ha...	USA
Textiles, Appar...	USA

Query 11

What are the top 3 contributing industries to the carbon footprint of USA, China, and India?

```
WITH emis_by_country AS
(
SELECT industry_group,
                ROUND(SUM(carbon_footprint_pcf), 1) AS total_industry_footprint,
                country,
    RANK() OVER (PARTITION BY country ORDER BY ROUND(SUM(carbon_footprint_pcf), 1) DESC) as country_rank
  FROM carbon_emissions
  GROUP BY industry_group, country
)


SELECT industry_group,
    total_industry_footprint,
                country,
                country_rank
  FROM emis_by_country
WHERE country IN ('USA', 'China', 'India') AND country_rank<=3
ORDER BY country, country_rank;
```

industry_group text	total_industry_footprint numeric	country text	country_rank bigint
Materials	76.0	China	1
Consumer Durables & Apparel	50.0	China	2
Technology Hardware & Equipment	13.6	China	3
Materials	12335.0	India	1
Mining - Iron, Aluminum, Other Metals	8181.0	India	2
Chemicals	4058.0	India	3
Automobiles & Components	137007.0	USA	1
Technology Hardware & Equipment	132500.1	USA	2
Pharmaceuticals, Biotechnology & Life Sciences	72486.0	USA	3

Query 12

Compare the footprint of the United States between 2015 and 2016.

```sql
SELECT country,
    SUM(data15.carbon_footprint_pcf) AS footprint_2015,
        SUM(data16.footprint_2016) AS footprint_2016
FROM carbon_emissions data15 JOIN (SELECT country,
                        SUM(carbon_footprint_pcf) AS footprint_2016
                FROM carbon_emissions
                WHERE year = 2016 AND country = 'USA'
                GROUP BY country) AS data16
        USING(country)
WHERE year = 2016
GROUP BY country;
```

country text	footprint_2015 numeric	footprint_2016 numeric
USA	84903.895	7216831.075