IMF GLOBAL LOW CARBON TECH TRADE & IMPACT

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Contents

OVERVIEW OF THE DATASET

This comprehensive dataset sheds light on the global trade of low-carbon technology products, illustrating their economic and environmental significance over nearly three decades. The information encapsulates key metrics that underline how countries engage with green technologies through exports, imports, and other trade activities. By examining these patterns, the dataset highlights the worldwide push toward sustainable energy solutions and its impact on economies.

Source: Compiled from the Department of Economic and Social Affairs and the IMF.

KEY ATTRIBUTES AND DATA COLUMNS

The dataset contains 42 columns, categorized as follows:

BASIC IDENTIFIERS

- *ObjectId*: A unique identifier for each record.
- *Country*: Name of the country involved in the trade.
- *ISO2/ISO3*: Standardized 2-letter and 3-letter codes for countries (e.g., "PK/PAK" for Pakistan).

INDICATORS

- *Indicator*: Describes the specific trade metric (e.g., exports, imports, comparative advantage).
- *Unit*: Measurement unit of the data (e.g., USD, percentage, index).

TRADE-SPECIFIC DETAILS

- *CTS_Code*: A code representing the type of trade activity (e.g., ECBTLA for comparative advantage).
- *CTS_Name*: Name of the trade activity (e.g., "Trade in Low Carbon Technology Products; Exports").

- *CTS_Full_Descriptor*: Detailed descriptor linking the data to environmental and climate change initiatives.

TRADE FLOWS

- *Trade_Flow*: Direction of trade (e.g., exports, imports).
- *Scale*: Units of the data scale.

YEARLY DATA

- Columns from F1994 to F2023 represent annual trade data, such as the export or import value for each year.
- Missing values indicate unreported data for specific years or countries.

SAMPLE INDICATORS IN THE DATASET

COMPARATIVE ADVANTAGE

An index measuring a country's relative advantage in low-carbon product trade.

EXPORTS OF LOW CARBON TECHNOLOGY PRODUCTS

Measured in USD, reflecting economic contribution to green technology.

IMPORTS OF LOW CARBON TECHNOLOGY PRODUCTS

Highlights the adoption of sustainable technology in each country.

DATA SCOPE

The dataset provides insights into:

YEARLY TRENDS

Growth of trade in low-carbon technologies over the years.

COUNTRY-LEVEL ANALYSIS: TRADE

Performance, competitiveness, and dependency on green technology imports or exports.

SUSTAINABLE DEVELOPMENT

Contribution towards global climate goals.

END-TO-END WORKFLOW FOR POWER BI DASHBOARD DEVELOPMENT

The data cleaning process was performed after loading the dataset into Power BI using the Power Query Editor. This step ensured the data was prepared and standardized for accurate analysis and visualization. The key steps in the cleaning process include:

LOADING THE DATASET

- The raw dataset was imported into Power BI.
- Preliminary checks were conducted to identify inconsistencies, missing values, and irrelevant columns.

DATA CLEANING AND PREPARATION USING POWER QUERY

ISSUES FOUND IN THE DATASET

Missing Values

Significant missing data in several columns:

- ISO2: 33 missing values.

- ISO3: 22 missing values.

- Year columns have varying amounts of missing data, with earlier years (e.g., F1994 to F1999).

Inconsistent Country Names

Country names appear consistent but are verbose. Examples include:

- 'Afghanistan, Islamic Rep. of' instead of simply 'Afghanistan'.

- 'Türkiye, Rep. of' instead of 'Turkey'.

RESOLVING INCONSISTENCIES

Remove Unnecessary Columns

Columns to remove are:

✓ **ObjectId**

- Purpose: This column is an autogenerated ID or serial number used to uniquely identify rows.
- Issue: It is redundant because rows can already be identified using meaningful columns like 'Country'.
- Conclusion: Does not add analytical value and can be safely removed.

✓ **ISO2 and ISO3**

- Purpose: Contain 2-letter (ISO2) and 3-letter (ISO3) country codes.
- Issue: These are redundant because the '**Country**' column already provides human-readable country names.
- Conclusion: Removed unless explicitly needed for analysis.

✓ **Source**

- Purpose: Provides metadata about the source of the data.
- Issue: While useful for traceability, it does not contribute to insights or analysis.
- Conclusion: Not required for analysis-focused projects.

✓ **CTS_Code and CTS_Name**

- Purpose: Coded identifiers and descriptions for indicators.
- Issue: These are redundant as the '**Indicator**' column already provides detailed descriptions.
- Conclusion: Both can be safely removed to simplify the dataset.

✓ **CTS_Full_Descriptor**

- Purpose: A verbose, detailed description of indicators.
- Issue: It duplicates the 'Indicator' column, which is sufficient for analysis.
- Conclusion: Adds unnecessary verbosity and can be removed.

✓ **Scale**

- Purpose: Indicates the scale of measurement (e.g., Index, US Dollars, Percent).
- Issue: The **'Unit**' column already captures this information.
- Conclusion: If 'Unit' is clear and sufficient, 'Scale' becomes redundant and can be removed.

✓ **Trade_Flow**

- Purpose: Specifies trade measures (e.g., exports, imports).
- Issue: The '*Indicator*' column already differentiates trade types (e.g., Exports of low-carbon products).
- Conclusion: Likely redundant and can be removed.

- The "**Country"** column has been standardized to resolve inconsistencies in country names.
- Missing values in the "**Year"** columns were replaced with '**0**' for consistency and clarity in analysis.
- Unpivot **"Year"** columns (F1994 - F2023) with **'Year'** and **'Value'** columns. This makes time-series analysis easier.
- **Exclusion of "World" Entry in Data Processing:**

  In the data preparation stage, the "World" entry was filtered out using Power Query to ensure the dataset used in the visualizations only reflects identifiable and well-defined countries. The "World" entry's purpose and coverage were ambiguous, potentially representing undefined or overlapping regions. Removing this entry enhances the accuracy and reliability of the insights by eliminating any uncertainty in the data. This preprocessing step ensures that all visualizations and analyses focus solely on specific,

actionable country-level contributions, aligning with the dashboard's goal of delivering precise and credible insights.

DATA MODELING AND PREPARATION FOR VISUALIZATIONS

After filtering and cleaning the dataset in Power Query, a new column named **Region** was introduced to group countries into their respective geographical regions (e.g., Asia, Europe, Americas, etc.). This regional categorization enables aggregated insights and facilitates comparative analysis across regions.

Additionally, several measures were created in Power BI using DAX (Data Analysis Expressions) formulas to support advanced analysis and visualizations. These measures include **Export to Import Percentage, Export to Import Ratio, Total Countries, Total Trade Growth, Total Trade Value, Trade Value Earliest Year, Trade Value Latest Year, and Yearly Growth Rate.**

The use of DAX allowed for dynamic calculations, such as aggregating data across specific time periods and generating custom metrics tailored to visualization requirements. This process not only ensured the dataset was clean and well-structured but also enhanced its utility for generating meaningful insights. When combined with interactive visualizations like slicers and charts, the dashboard became a powerful tool for real-time analysis and decision-making.

DASHBOARD DESIGN AND VISUALIZATION

PURPOSE OF THE VISUALIZATION AND INSIGHTS FRAMEWORK

The insights presented in this report are primarily derived from the **Clustered Bar Charts** and **Matrix Visualizations**, which focus on trade growth percentages and total trade values by country. These visualizations effectively highlight comparative trends, such as leading exporters and importers, as well as the highest trade growth performers.

The remaining visualizations in the dashboard are intentionally designed for dynamic exploration. With the use of slicers for **Country** and **Indicator** selections, stakeholders can delve deeper into the dataset, uncovering tailored insights that suit their specific analytical needs. This flexibility allows for the

analysis of localized trends, comparative performance, and detailed exploration of low-carbon technology trade dynamics.

DYNAMIC DASHBOARD WITH SLICERS

Why Include Slicers

To introduce interactivity and flexibility, enabling users to tailor the analysis to specific **Countries** or **Indicators**.

Purpose

Slicers simplify navigation and improve decision-making by highlighting localized trends or comparative insights without needing static charts.

Insights Facilitated

- Identification of regional trade leaders or laggards.
- Comparative performance of indicators such as export/import balance, trade growth, or value distribution.
- Custom exploration of specific areas like growth hotspots or high-value sectors.

METRIC CARDS

Purpose of Metric Cards

Present key summary statistics at a glance to provide context and a foundation for deeper analysis.

Total Trade Value (Latest Year)

- *Insight:* Highlights the immense financial scale of low-carbon technology trade ($4.47T).
- *Purpose:* Emphasizes the economic impact and demand for sustainability in global trade.

Total Number of Countries Involved in Trade

- *Insight:* Showcases global participation with 209 active trading countries.
- *Purpose:* Reflects the universality of the low-carbon technology trade network.

Total Trade Growth (Cumulative Growth)

- *Insight:* Demonstrates the long-term trend with 796.27% growth, showcasing exponential adoption and innovation.
- *Purpose*: Highlights historical growth as a foundation for understanding current dynamics.

GEOGRAPHICAL MAP VISUALIZATION

Purpose

Break down trade contributions by region for a spatial understanding of trade distribution.

Insights Facilitated

- Identification of dominant trade regions (e.g., Asia, Europe).

- Exploration of growth potential in emerging economies.
- Visualization of regional hubs driving the low-carbon trade market.

RIBBON CHART

Why Create

To compare relative performance of trade indicators over time.

Purpose

Highlight shifts in the trade ecosystem.

Insights Facilitated

- Changes in the balance of exports vs. imports as trade expands.
- Evolution of key indicators over the analyzed period.

LINE CHART

Why Create

To track the trajectory of trade growth over time.

Purpose

Present absolute growth trends in trade volume or specific indicators.

Insights Facilitated

- Longitudinal trends for trade values or indicator performance.
- Impact of time-sensitive events (e.g., policy shifts or market disruptions).

CLUSTERED BAR CHARTS

Highlights the Top 10 Exporters along with their trade shares and the Top 10 Importers with their contributions, explaining the dominance of specific countries in global trade.

Insights of Top 10 Exporters

- *Global Leaders in Trade:* Countries like China, Germany, and the United States are major global exporters, influencing the production and distribution of low-carbon technologies.
- *Renewable Energy Exports:* These nations export critical components like solar panels (China), wind turbines (Germany), and energy-efficient equipment (U.S.).
- *Economies of Scale:* Their high export volumes drive down the costs of low-carbon technologies, making them more accessible globally.
- *Technological Innovation:* Investments in research and development by these countries advance low-carbon solutions, such as electric vehicles and green manufacturing processes.
- *Policy Influence:* They shape global trade standards, encouraging sustainable practices and fostering international cooperation on low-carbon goals.
- *Challenges:* Transitioning traditional industries to low-carbon alternatives requires policy changes, funding, and international collaboration to overcome barriers.

Insights of Top 10 Importers

- *Global Demand Leaders:* Countries like China, the United States, and Germany dominate global imports, showcasing their significant consumption and investment capacity for advanced technologies, including low-carbon solutions.
- *Influence on Supply Chains:* High import volumes reflect these countries' role in shaping global supply chains, potentially increasing demand for low-carbon and sustainable products.

- *Low-Carbon Transition:* Their import patterns can incentivize exporters to innovate and align with low-carbon standards to meet stringent environmental requirements in these markets.
- *Adoption of Technology:* As major consumers of industrial goods, these nations have the purchasing power to adopt and scale up low-carbon technologies, such as renewable energy systems and electric vehicles.
- *Policy as a Driver:* Importing nations often implement policies (e.g., tariffs, subsidies) that encourage greener imports, further accelerating the global transition to sustainability.
- *Challenges:* Balancing economic growth with environmental commitments may require enhanced regulatory frameworks and international cooperation.

MATRIX VISUALIZATION

Total Trade Growth Chart: Displays the top countries with the highest percentage growth in trade, highlighting emerging markets.

- *Slovak Republic Leads Growth:* Among the listed countries, the Slovak Republic exhibits the highest trade growth rate at 96.7%, indicating robust economic and trade expansion.
- *Emerging Markets Surge*: Hungary (71.7%) and Romania (68.2%) follow closely, showcasing rapid trade growth likely driven by industrialization and integration into global trade networks.
- *China's Consistent Performance*: China, with a growth rate of 65.6%, maintains strong momentum, highlighting its continued global trade influence alongside its focus on innovation and technology.
- *Opportunities in High-Growth Regions*: The rapid growth in these countries presents significant opportunities for low-carbon technologies and sustainable trade practices as they expand their industrial bases.

- *Stable Growth in Poland:* Poland, with a growth rate of 63.8%, underscores steady and sustainable trade development, likely linked to its strategic position in Europe.
- *Focus for Established Economies*: Countries with slower growth, though not explicitly detailed here, may need to innovate and adapt to the shifting trade dynamics led by these rapidly growing economies.

Trade Value Latest Year Chart: Shows the latest trade values by country, identifying leading contributors to global trade.

Asia (Dominates Trade)

- China the largest contributor globally, with substantial manufacturing and export capabilities.
- Japan a leading innovator in green technology, ranking fourth globally.

Europe (Dominates Trade)

- Germany: Second-largest contributor, a leader in green industrial technologies.
- United Kingdom: A major player, emphasizing sustainable energy and exports.

Emerging Economies (Shows Most Promise for Growth)

Key Potential Growth Areas

- Africa: Countries like South Africa, Kenya, and Egypt are investing in renewable energy and green infrastructure.
- South America: Brazil and Chile are notable for their focus on sustainable energy solutions.
- Southeast Asia: Nations like Vietnam, Indonesia, and Thailand are becoming hubs for green manufacturing and innovation due to favorable policies and investment.

Global Perspective

Region A (Asia) and Region B (Europe) currently dominate, but Region C (Emerging Economies) presents opportunities for global partnerships, market expansion, and technology transfer to drive sustainable development.