Sovereign emissions

Facts, uncertainties and best practices

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In brief

- Despite the relevance and scale of the sovereign bond market, there is no unified standard for sovereign emissions reporting for investment portfolios.
- Industry standardization can improve with technological advances and greater availability of open-source data.
- Investment policies should acknowledge trade-offs in choosing data, avoid being regressive, and incentivize a positive policy trajectory.

Introduction

Investor demand for emissions data across asset classes has increased dramatically against the backdrop of increasing pledges for climate action and inflows to climate strategies. Following the COP26 summit last year, over 150 countries submitted new climate plans to maintain the goal of limiting global temperature rise to 1.5°C by 2030. At the same time, the Net Zero Asset Managers Initiative, an international group of asset managers committed to supporting the goal of net zero greenhouse gas (GHG) emissions by 2050 or sooner, reached over 220 signatories, equivalent to over USD 57 trillion in assets.[1] The Net Zero Asset Owners Alliance, representing an additional USD 10 trillion in assets, has made a similar commitment.[2] For corporations, the Greenhouse Gas Protocol has become a widely adopted standard for accounting and reporting on GHG emissions in a complete, transparent and consistent manner.[3]

However, standardization on emissions reporting has lagged for the sovereign bond market, despite its size and global relevance. While there are several publicly available estimates for sovereign emissions, there are still more questions than answers for investors looking for a clear and consistent approach.

We review facts, uncertainties, and best practices for integrating sovereign emissions data into investment processes and policies.

The path of emissions policy

Sovereign policy will be vital in determining our success or failure in tackling climate change. Global emissions are roughly double where they were 50 years ago, which has resulted in irreversible changes to our world (**Exhibit 1**). Containing global warming to international goals of 1.5°C will require drastic reductions beyond net zero emissions.[4] Scientists estimate approximately a 6% decline in global emissions in 2020, largely due to the Covid-19 pandemic, but the reopening trajectory suggests this was only a temporary decline.[5] However, at a country level, we can observe more structural declines, specifically for the EU, US and Japan (**Exhibit 2**), driven by the adoption of carbon regulation schemes, transitions from coal to natural gas, and an increasing share of renewables in energy production.[6] China, the US and the EU continue to account for the majority (50%) of global emissions and their policy paths will be critical.

The complexities of sovereign emissions accounting

It is evident that a country's emissions are a key consideration in assessing the sovereign's environmental standing. However, there is currently no unified standard for sovereign emissions reporting for investment portfolios.

First, we should understand that sovereign emissions are estimations made by scientists. Generally, we want to account for carbon sources and carbon sinks. Carbon sources release more carbon (e.g., CO_2, methane) into the atmosphere than they absorb. They are largely related to the burning of fossil fuels but also some industrial, agricultural, and energy production processes. Carbon sinks absorb more carbon from the atmosphere than they release. They include plants, soil, the ocean, and the developing area of engineered (artificial structures that accumulate and store carbon) sinks. Scientists estimate sovereign emissions primarily by looking at energy balances across different economic activities and multiplying these balances with estimation factors from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Land use, land use change, and forestry are not always included in sovereign emissions as they are technically complex and heavily debated: deforestation or conversions of natural lands and waters can release stored carbon, especially when burning is involved, whereas reforestation and conservation practices can improve carbon sinks locally. Offsets for carbon sinks can be estimated using land cover data and are often reported separately.

Exhibit 1: Historical global emissions

Global emissions likely declined in 2020 due to the pandemic, but they remain at over double what they were 50 years ago

MT CO_2/year by Country - top 10 and RoW

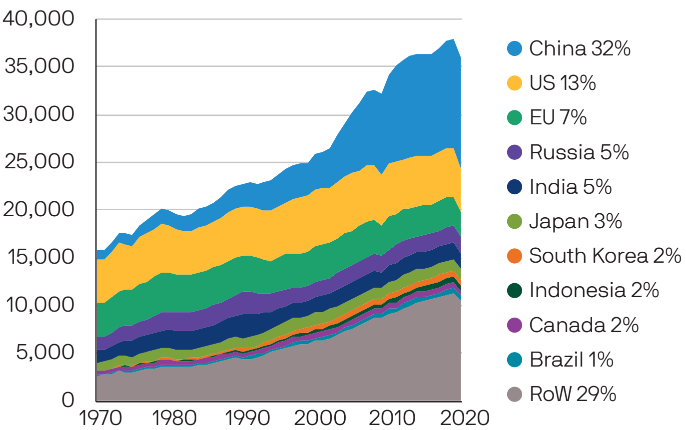
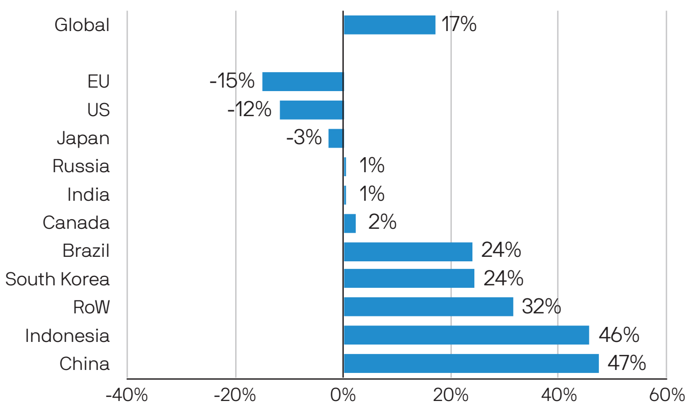


Exhibit 2: CO_2 emissions 10-year change

EU, US and Japan have all seen emissions decline over the last 10 years while China has increased significantly

10 year change in CO_2 emissions (2015-2019 average vs 2005-2009 average)

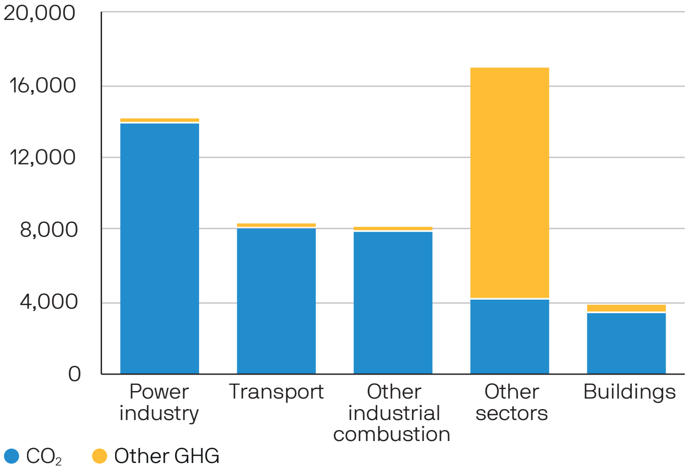


Source: EU EDGAR 2021 Report. Note EDGAR data uses International Energy Agency (IEA) data through 2017 and estimation for more recent years, with data from BP and FAOSTAT. This creates higher uncertainty for more recent data. Data reflects only fossil CO_2 from combustion, flaring, industrial processes (cement, steel, chemicals and urea) and product use. Does not include short-cycle carbon or other greenhouse gases. Does not include land use, land use change and forestry.

Exhibit 3: Sovereign emissions by greenhouse gas type

CO_2 represents 75% of Greenhouse Gas (GHG) emissions globally, driven primarily by burning of fossil fuels

MT CO_2 eq (2018)



Other GHG emissions are very significant for climate change, but data tends to be less reliable and available

Greenhouse Gas	Typical Sources	Global Warming Potential	Estimation Uncertainties
Carbon (CO_2)	Fossil fuels, cement, land use	1x	5% OECD; 10% non-OECD
Methane (CH4)	Agriculture, landfills, energy use	~25	30–40%
Nitrous Oxide (N_2O)	Agriculture, fossil fuels	~300	100%+
Flourinated Gases (F- Gases)	Industrial processes, refrigeration	~10,000	100%+

Global Warming Potential (GWP) is the heat absorbed by any greenhouse gas in the atmosphere as a multiple of the same mass for carbon dioxide (CO_2), hence the GWP of CO_2 is 1x.

Source: EU EDGAR 2021 Report. Other sectors includes primarily agricultural activities. Does not include land use, land use change and forestry.

There are a few different major sources for estimations of sovereign emissions. Some countries report their own emissions estimates, referred to as nationally determined contributions (NDCs). NDCs pose a challenge for cross-country comparison as they are not broadly available for all countries. They also create potential conflicts of interest as they are self-reported by government officials. Beyond NDCs, public and private organizations have created databases with comparable cross-country data. Most databases ultimately refer back to the same primary sources: the International Energy Association (IEA), British Petroleum Statistics (BP), and the Food and Agriculture Organization of the United States (FAOSTAT). IEA offers broader country coverage than BP, but its data is not freely available for the most recent three years. FAOSTAT primarily covers GHG emissions from agriculture and related land use. EU EDGAR and Global Carbon Project refer to these sources, with additional estimations for recent years or trade effects (**Appendix Exhibit A**).

The GHG protocols (scope 1, 2, 3) set for corporate carbon accounting do not apply to sovereigns. Instead, the Partnership for Carbon Accounting Financials (PCAF) has proposed multiple potential approaches that can be summarized as involving four key decisions.[7]

1 **CO_2 vs. total GHG**: Carbon emissions represent 75% of global GHGs. The bulk of these emissions come from the burning of fossil fuels. While other GHGs are highly relevant for global warming, estimation uncertainties and data availability present challenges (**Exhibit 3**). Currently available estimates of total GHGs are also highly correlated to CO_2 emissions (**Appendix Exhibit B**). Exceptions include countries such as Brazil and Indonesia that see higher methane from agricultural activities.

2 **Consumption vs. production**: Ideally, emissions should account for carbon leakage – for example, Mongolia should not bear full responsibility for coal exports that are ultimately consumed in China. Consumption-based data adjusts for carbon leakage but relies on models to make these adjustments, and data availability is typically lower.

3 **Territorial vs. bottom-up**: Most emissions data today is territorial, counting emissions produced (and possibly consumed) within national boundaries. This can lead to some double counting of private sector emissions. Another approach is a bottom-up method, where emissions are calculated at the government and private sector levels and then summed. This approach allows for a much more nuanced view of a country's emissions, is more analogous with the GHG corporate protocol, and avoids the double counting problem. However, data availability can be quite limited for a bottom-up approach.

4 **Per GDP vs. per capita**: The unit of normalization for assessing carbon intensity is also a source of debate. The most commonly used approaches are emissions per GDP and emissions per capita (population adjusted). Per GDP is more analogous to the corporate approach of emissions per unit revenue; however, the results tend to benefit larger developed markets vs. smaller emerging markets. The per capita approach mitigates some of this income bias effect.

Data availability limits some choices today as the most reliable data with broad country coverage is focused on carbon, production-oriented, and territorial. High-level country comparisons are generally similar regardless of source and approach, although normalization can have a bigger impact. For example, regardless of data source and approach, China and the US account for the largest proportion of absolute global emissions. However, China comes out as a top global emitter when looking per GDP data but not when looking at per capita data. The opposite is true for the US (**Appendix Exhibit C**).

Future of emissions data

We believe industry standards will develop further as technology enhances the availability of open-source data.

Technology will improve global measurability and accountability for emissions. Produced or territorial emissions from sovereigns can be measured and monitored from the ground, the air (drones or airplanes), or space. Gas emissions can be monitored by changes in their concentrations in the atmosphere. While a station on the ground can monitor local emissions, requiring many sensors distributed around the country (the current approach for air quality), an airplane or drone can monitor emissions along a flightpath. In the future, sensors could provide continuous regional monitoring of methane, nitrous oxide, and fluorinated gases (F-gases), particularly at locations that are known sources. Sensors have been used in the past to create inventories of F-gases and quantify methane emissions from agriculture and leaking oil and gas infrastructure. Station and airborne monitoring advances will improve data significantly – but countries will still need to submit to GHG monitoring.

Satellite technology can also allow monitoring from space. Present methodologies are not precise enough to monitor source locations from CO_2. However, other GHGs can be monitored due to their lower concentrations in the atmosphere and distinct radiative properties. Methane has been a major focus in the last decade for its abundance where organic matter decomposes (landfills, agriculture practices) and in leakage from the oil and gas industry. Historically, methane monitoring satellites were built and launched by government science agencies such as the European Space Agency and Italian Space Agency, but a new set of satellites for Earth monitoring is being deployed by nonprofits and corporations. For example, MethaneSAT, a subsidiary of the Environmental Defense Fund, is on schedule to launch its methane monitoring satellite after October 1, 2022. The satellite will be capable of identifying sources of methane and will be free and open source. Satellites belonging to GHGSat, a Canadian satellite company, have also been used to identify leaks in oil and gas infrastructure. Finally, satellites can help quantify sovereign changes in land cover and forest density, identifying reductions in major carbon sinks. Voluntary carbon registries such as Verra are even developing protocols including satellite data.

Considering emissions data in investment policies

Today, investors interested in incorporating emissions data in their investment policies need to be aware of the limitations in data availability and make choices that align with their goals.

Clarifying the objective is an important first step in determining which data to use. Is the objective to lower risks because emissions regulation and divestments may hurt the creditworthiness of a high emission sovereign? Or is the objective to help finance and incentivize energy transition? If the latter is the goal, investors should be wary of using indicators with an income bias, such as emissions per GDP, which might discourage investment by poorer countries in the energy transition.[8] The Paris Agreement and pledges around COP26 call for an investment of USD 100 billion per year from rich countries toward poor countries to help mitigate the impact of climate change.[9] Supporting issuance of green and sustainable bonds can be one way for investors to participate in this pledge.

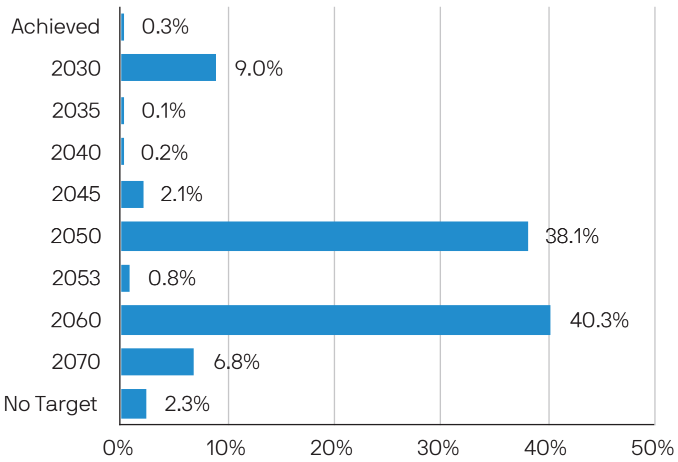
Incorporating forward-looking information incentivizes a positive policy trajectory. Investors can consider net zero or carbon neutrality pledges and related policies, whether those policies are enshrined in law, and whether there is reliable reporting (**Exhibit 4**). It is also key to consider whether countries are following through on their pledges. One way to gauge this is by looking at investment in renewables. While China has the highest absolute emissions of any country, it has also invested over USD 1 trillion in energy transition projects (renewables and industrial logistics) since 2014, dwarfing efforts by any other country (**Exhibit 5**).

Additional forward-looking trackers are also available for developed countries (**Appendix Exhibit D**). The Climate Action Tracker (CAT) is one of the most followed sources and provides a simple overview of whether countries' climate change policies and actions are compatible with the Paris Agreement. Ratings are accompanied by analysis on where further progress is needed, which can be useful third-party information to refer to when engaging with sovereigns.

Exhibit 4: Net zero pledges

137 countries have some commitment to emissions reduction or neutrality but with limited accountability mechanisms

% of Global GHG Emissions by Country Carbon Neutral Year

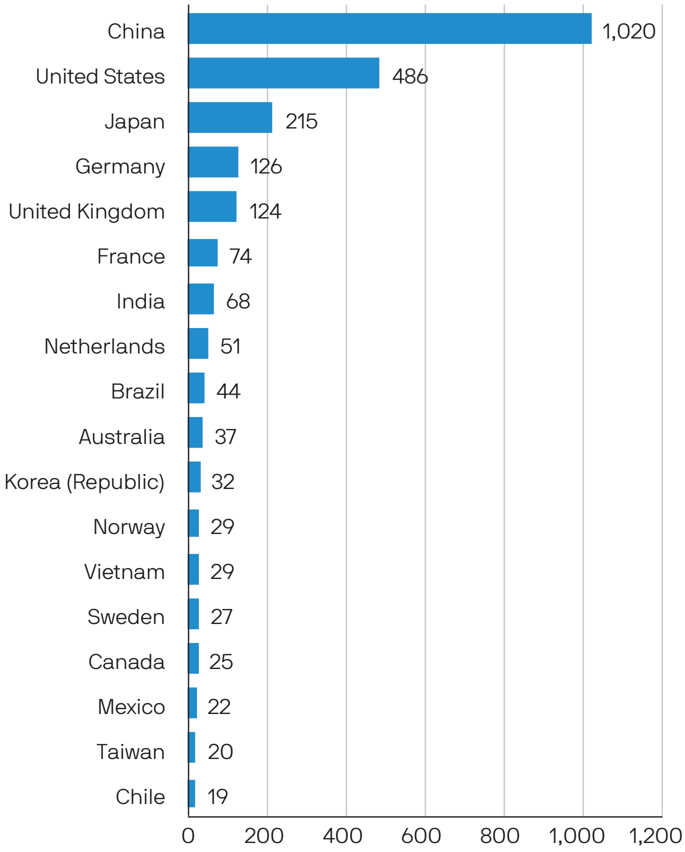


Source: NetZeroTracker; data as of April 2022.

Exhibit 5: Energy transition investment

China has invested over $1trillion in energy transition since 2014

Energy Transition Investment (2014 to 2020, $bn)



Source: Bloomberg; data as of July 2021.

Conclusion

Emissions data is being more widely evaluated than ever by regulators and by investors interested in mitigating risk and/or making an impact. Understanding how sovereign emissions are estimated, what the current data can and cannot tell us, and the possibilities for the future is becoming part of a foundational ESG toolkit for sovereign investors. Policymakers should prioritize making better emissions data freely available to improve global accountability and decision making. This will also improve transparency and comparability in climate-related disclosure in investment portfolios. By pushing for better disclosures and reflecting emissions data in their investment decisions, investors can help to drive the transition to a low-carbon world.

Appendix

Exhibit A: Sovereign emissions by greenhouse gas type

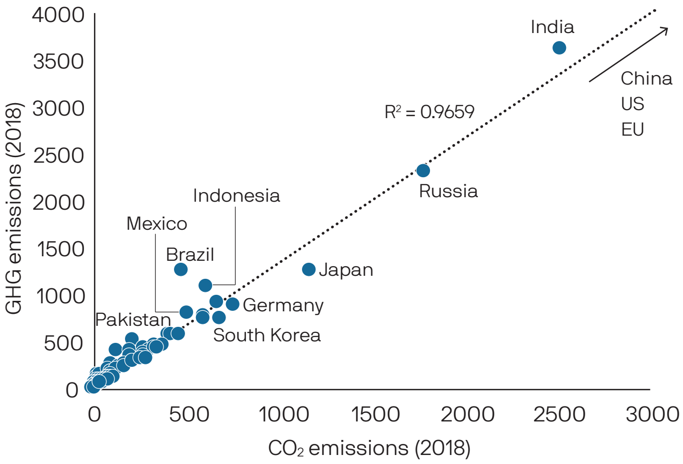
Emissions – which data source should we use?

	Primary Sources			Secondary Sources	
	IEA	**BP**	**FAOSTAT**	**EDGAR**	**Global Carbon Project**
Organization	International Energy Agency	BP Statstical Review of World Energy	UN Food and Agriculture Organization	European Commission	Future Earth and World Climate Research Programme
Perspective	Production	Production	Production	Production	Consumption
Scope	CO_2 + select GHG	CO_2	Agriculture GHG	CO_2 + GHG	CO_2
Years	2000-2020	1965-2020	1961-2019	1970-2020	1990-2019
Countries	over 150	80	191	228	118
Free	No	Yes	Yes	Yes	Yes
Land use, land use change, and forestry	No	No	Yes	Reported separately, but only by region.	No
Methodology Highlights	CO_2 derived from IEA energy balances using IPCC 2006 guidelines. CH4 and N_2O estimates added in 2021.	CO_2 derived from BP energy balances using IPCC 2006 guidelines.	Emissions from agriculture and associated land use	IEA historical data used to 2017, then extended with estimation from BP and FAOSTAT.	CO_2 data from multiple sources adjusted for trade using a global supply chain model (Peters, 2012). Consumption-based data has an additional one-year lag.

Source: J.P. Morgan Asset Management; As of June 2022.

Exhibit B: Different approaches to emissions can result in similar high-level country comparisons, but there can be large difference for some countries

Cross-country comparisons are similar for CO_2 and GHG, though a few countries have greater GHG from agriculture related activity



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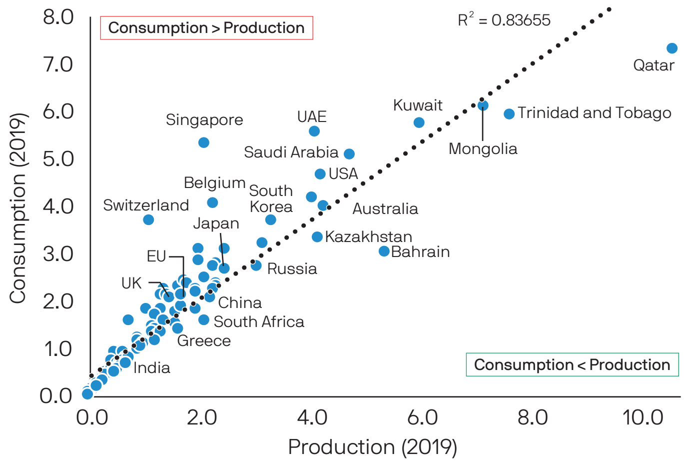
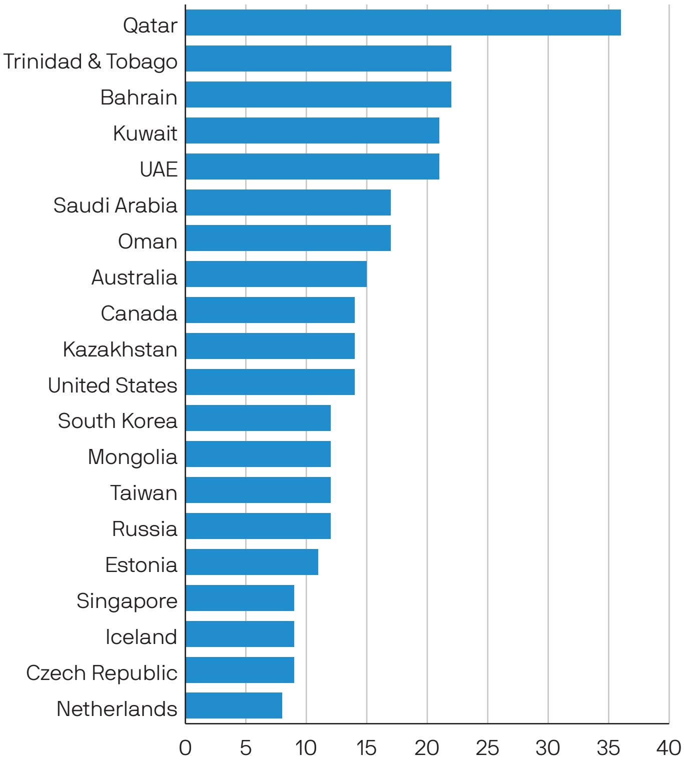


Source: EU EDGAR 2021 Report. Global Carbon Project April 2022.

Exhibit C: Top emitters when normalized by population or GDP

Many EMs already have a higher share of renewables



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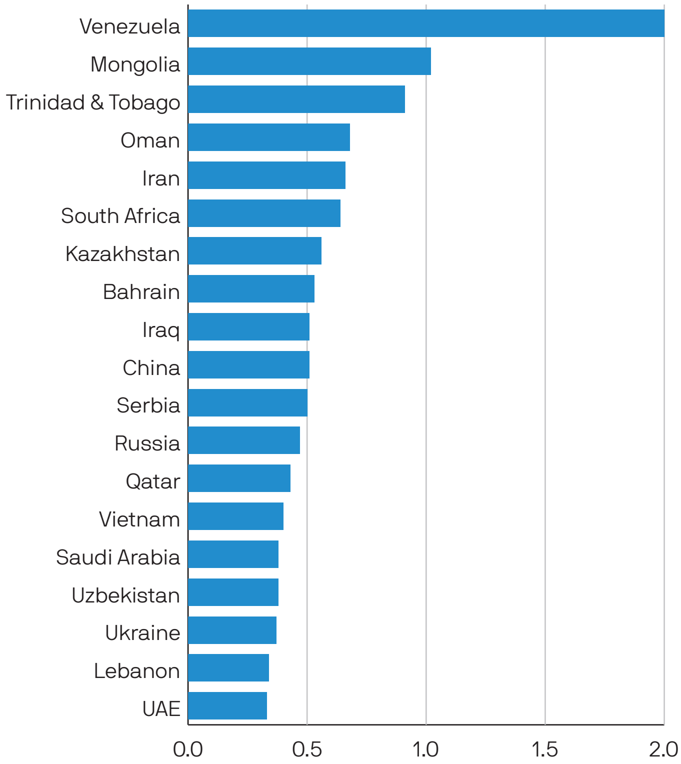

Source: EU EDGAR 2021 Report.

Exhibit D: Forward-looking climate policy trackers

Other GHG emissions are very significant for climate change, but data tends to be less reliable and available

	Net Zero Tracker (NZT)	Climate Action Tracker (CAT)
Organization	Energy and Climate Intelligence Unit Data-Driven EnviroLab NewClimate Institute Oxford Net Zero	Climate Analytics NewClimate Institute
Countries	198 countries	39 countries + EU
Ratings	No ratings	Five categories: 1.5°C Paris Agreement compatible, almost sufficient, insufficient, highly insufficient, critically insufficient
Methodology	NZT tracks public information on sovereigns' net zero targets/plans, greenhouse gas coverage, reporting mechanism and use of carbon credits (offsets).	Overall rating is based on climate change targets and policies. Sovereigns' ratings will reflect both domestic efforts and global "fair share contribution", recognizing the need for developed countries to support developing countries in achieving global mitigation goals.

Source: J.P. Morgan Asset Management; As of June 2022.

Endnotes

1 Net Zero Asset Managers Initiative Progress Report. November 2021.

2 Net Zero Asset Owner Statistics, June 2022.

3 Understanding Carbon Exposure Metrics. Kevin Roy and Rebecca Thomas. J.P. Morgan Asset Management. November 2021.

4 IPCC Sixth Assessment Report. August 2021.

5 COVID curbed carbon emissions in 2020 – but not by much. Jeff Tollefson. Nature. January 2021.

6 The Global Carbon Market. Sarah Kapnick. J.P. Morgan Asset Management. October 2021.

7 Draft new methods for public consultation – green bonds, sovereign bonds, emissions removal. Partnership for Carbon Accounting Financials (PCAF). November 2021.

8 Sovereign ESG Investing: We can do better. Jean Pesme and Anderson Caputo Silva. June 2021.

9 The broken $100-billion promise of climate finance – and how to fix it. Jocelyn Timperly. October 2021.

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Accounting for Carbon: Sovereign Bonds. Trucost by S&P Dow Jones Indices. June 2018.

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