

360° of Climate – Indices for Every Objective

Contributor

Jaspreet Duhra
Managing Director
Global Head of ESG Indices
jaspreet.duhra@spglobal.com

Summary

- There is a pressing need for the world to reduce its greenhouse gas emissions to decrease the risks and impacts of climate change. Responsible action is required by all stakeholders, including investors.
- S&P DJI is at the forefront of innovative climate index design, leveraging the strength of climate datasets created by S&P Global Trucost.
- S&P DJI's climate change index offerings cater to a broad range of investor climate objectives; divestment, low carbon, net zero and climate solutions.

Why Create Climate Indices?

The Scientific Facts

The Intergovernmental Panel on Climate Change (IPCC) has stated that “human activities are responsible for approximately 1.1°C of warming since 1850-1900.”¹ While current global climate policies aim to reduce baseline emissions, temperatures are still projected to rise by 2.5-2.9°C by 2100.² The IPCC suggests limiting global temperature rise to 1.5°C from pre-industrial levels.

¹ IPCC, “[Climate change widespread, rapid, and intensifying](#),” August 2021.

² [Climate Action Tracker](#), November 2022.

Impacts on natural and human systems from global warming have already been observed. Some impacts may be long lasting or irreversible,³ such as the loss of ecosystems.

International Commitments and Emerging Regulation

The scientific consensus that human activities are increasing global temperatures has led to international treaties and national commitments—a significant step to tackle climate change was achieved in December 2015, with the Paris Agreement. The Paris Agreement sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C, as recommended by the IPCC.⁴ The Paris Agreement has been ratified by 193 parties to the convention (out of 197⁵), who have committed to specific nationally determined contributions (individual country contributions to achieve the global emissions reduction target).

The European Union (EU) has committed to a 55% reduction in EU-wide greenhouse gas (GHG) emissions by 2030 compared with 1990. To support the EU's commitment under the Paris Agreement, it has adopted the European Green Deal⁶—a key component of which is the sustainable finance work stream and the Action Plan on Sustainable Finance Growth,⁷ an ambitious project to channel “private investment to the transition to a climate-neutral economy.” The EU's Sustainable Finance package includes voluntary standards for climate benchmark labels, which will be of particular interest to passive investors. Please see the later section on (EU) Paris-Aligned benchmarks and (EU) Climate Transition benchmarks.

Investor Demand

Two of the main factors driving investor demand for solutions that identify climate risks and opportunities in their portfolios are regulatory pressures and the scientific conclusions about climate change. The Principles for Responsible Investment (PRI) rank climate change as the highest-priority ESG issue facing investors.⁸ Climate-related risks that investors face include exposure to:

- Transitional risks of climate change (e.g., stranded assets, rising carbon prices, etc.); and
- Physical risks of climate change (e.g., sea level rise, hurricanes, etc.)

³ McGrath, Matt, “[Climate change: IPCC report warns of 'irreversible' impacts of global warming](#),” BBC News, Feb. 28 2022.

⁴ European Commission, “[Paris Agreement](#).”

⁵ The United Nations, “[Paris Agreement - Status of Ratification](#).”

⁶ The European Commission, “[A European Green Deal](#).”

⁷ The European Commission, “[Sustainable Finance](#).”

⁸ The [PRI](#) is a UN-supported international network of investors working together to implement its six aspirational principles.

Opportunities are also available for investors to finance industries and activities that lead to a lower-carbon economy.

Financial bodies are recognizing climate change as both a significant risk and an opportunity for investors and are advocating action. For example, the Financial Stability Board set up the Task Force on Climate-related Financial Disclosures (TCFD) in 2015 with the objective of improving the reporting and understanding of climate-related financial risks. The TCFD has since become a widely adopted framework. For instance, since 2021 PRI signatories have been required to publicly report on TCFD-modeled indicators related to climate change risks and opportunities.⁹

S&P Global Trucost

S&P Global Trucost data is used throughout S&P DJI's climate indices. S&P Global Trucost:

- Has over 20 years of experience providing industry-leading climate, environmental and impact data;
- Has global coverage of over 16,800 listed equities;
- Provides scenario analysis data covering transition and physical risks in line with TCFD recommendations;
- Undertakes annual company engagement;
- Partners with over 150 asset manager and asset owner clients; and
- Has been part of S&P Global since 2016.

S&P DJI's Climate Solutions

To meet the demand for climate solutions, S&P DJI's has created a spectrum of index solutions (see Exhibit 1). Our climate indices offer a range of solutions by incorporating different values and objectives to enable investors to respond to the risks and opportunities of the climate challenge.

⁹ PRI, "[Climate Reporting to the PRI.](#)"

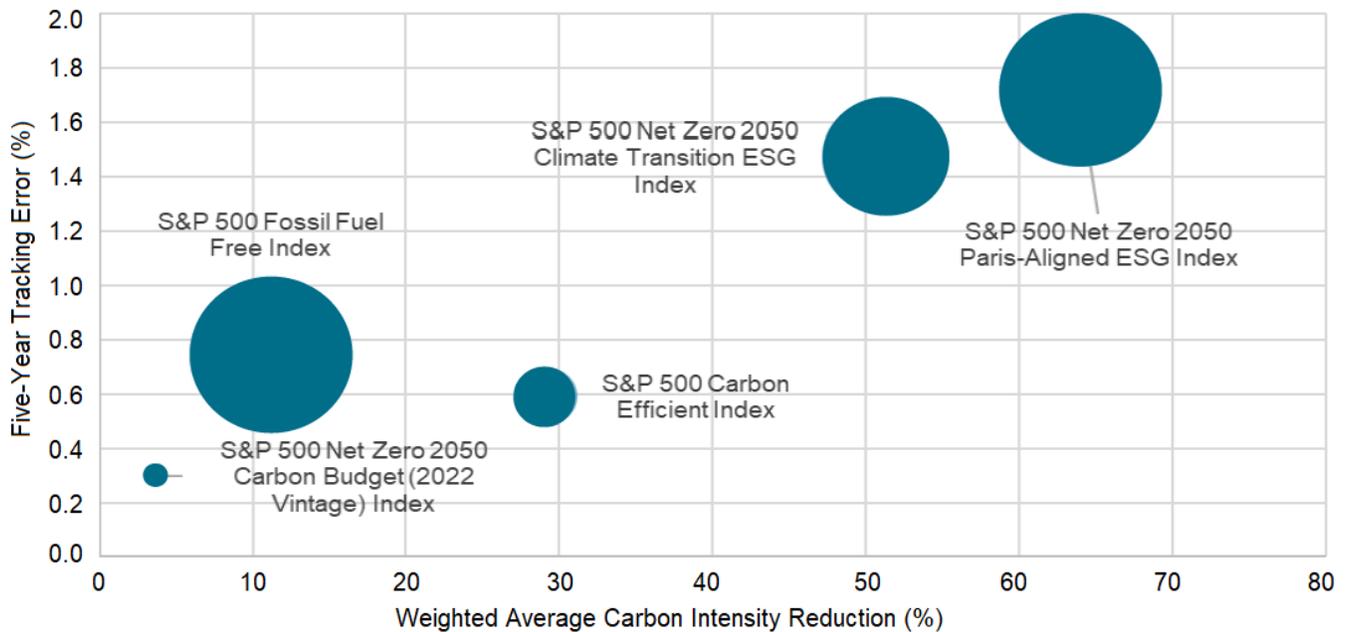
Exhibit 1: Overview of S&P DJI’s Climate Indices

Climate Objective	Index Objective	Index Series
Divest	Removes exposure to fossil fuel reserves	S&P Fossil Fuel Free Indices
Low Carbon	Targets a lower relative carbon footprint	S&P Carbon Efficient Indices S&P Carbon Control Indices
Net Zero	Aligns with a 1.5°C decarbonization trajectory	S&P PACT™ Indices (S&P Paris Aligned & Climate Transition Indices) S&P Carbon Budget Indices
Climate Solutions	Provides exposure to solution companies	S&P Global Clean Energy Indices

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

The resultant indices also offer a spectrum of outcomes with different levels of carbon reduction, exposure to fossil fuel reserves and tracking error (see Exhibit 2).

Exhibit 2: Selected Outcomes of S&P DJI’s Climate Indices



Source: S&P Dow Jones Indices LLC. Index levels data from July 29, 2017, to July 29, 2022. Tracking error provided for the S&P 500 Net Zero 2050 Carbon Budget (2022 Vintage) Index is the 63-day tracking error. Weighted average carbon intensity data as of July 29, 2022. Bubble area denotes fossil fuel reserves reduction. The S&P 500 Carbon Efficient Index was launched Oct. 22, 2018. The S&P 500 Net Zero 2050 Paris-Aligned ESG Index and S&P 500 Net Zero 2050 Climate Transition ESG Index were launched June 1, 2020. The S&P 500 Net Zero 2050 Carbon Budget (2022 Vintage) Index was launched July 25, 2022. All data prior to index launch date is back-tested hypothetical data. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Over the coming pages, a summary is provided of the different climate approaches incorporated within our indices.

S&P Fossil Fuel Free Indices

Divestment

Over 1,500 organizations have committed to divestment, with combined assets of over USD 40 trillion.¹⁰ One of the reasons investors choose to divest is the belief that fossil fuel companies are currently overvalued. The current valuations of fossil fuel companies assume that proven and probable reserves (included as assets on the balance sheet) will be realized. To achieve a 1.5°C scenario, 90% of all known fossil fuel reserves must remain in the ground.¹¹ The former Bank of England Governor Mark Carney said, “the vast majority of reserves are unburnable.”¹² As global policy shifts and action is taken to align with a 1.5°C scenario, these reserves are likely to become stranded assets.

S&P Fossil Fuel Free Index Series

We have offered the S&P Fossil Fuel Free Indices since 2015. These indices remove companies that own fossil fuel reserves, including crude oil, natural gas and thermal coal.

Results

From Exhibit 3 it can be observed the [S&P 500® Fossil Fuel Free Index](#) had slightly higher excess annualized returns of 0.11% over the past five years compared to its benchmark, the [S&P 500](#). The S&P 500 Fossil Fuel Free Index has zero fossil fuel reserve emissions exposure and a lower carbon-to-revenue footprint than the S&P 500.

Exhibit 3: S&P 500 Fossil Fuel Free Index Return and Carbon Characteristics

Characteristic	S&P 500	S&P 500 Fossil Fuel Free Index
Constituents	503	488
Five-Year Annualized Returns (%)	12.83	12.94
Fossil Fuel Reserve Emissions*	471.75	0
Carbon-to-Revenue Footprint**	191.67	165.51

Source: S&P Dow Jones Indices LLC. Data as of July 29, 2022. Past performance is no guarantee of future results. Table is provided for illustrative purposes. *Metric tons of CO2e per USD 1 million invested. **Metric tons of CO2e per USD 1 million of revenue.

¹⁰ <https://www.divestinvest.org/>

¹¹ Carbon Tracker Initiative, “[Exchanges carrying 3 times more carbon reserves than can be burned under Paris](#),” June 23, 2022.

¹² Financial Times, “[Mark Carney warns investors face ‘huge’ climate change losses](#),” Sept. 29, 2015.

S&P Decarbonization Indices

S&P Decarbonization Indices offer broad market exposure with a notably lower carbon footprint relative to the benchmark. We offer two approaches.

- Carbon Efficient Indices: Rules-based indices that incorporate a company disclosure incentive.
- Carbon Control Indices: Optimized indices that maximize carbon reduction for a given level of active share.

S&P Carbon Efficient Indices

Universal Ownership, Decarbonization and Engagement

Some investors seek a lower carbon footprint and choose not to divest from fossil fuel companies. There are many reasons for this. Large asset owners can be universal owners. They have diversified and long-term portfolios that are representative of global capital markets and divestment may not be an option. Furthermore, some investors believe it is a more effective strategy to stay invested and engage with companies to encourage change in business practices, as in the following case study.

Client Case Study – Government Pension Investment Fund (GPIF)

In 2017, S&P DJI won a mandate in partnership with S&P Global Trucost from the GPIF of Japan. The GPIF is the largest pension fund in the world, with USD 1.7 trillion in assets,¹³ and it is a universal owner of the global equity market. The GPIF asked us to create an index that would help encourage the market to transition to a low carbon economy. In response, we created the S&P Carbon Efficient Index Series. This rules-based index approach transparently helps investee companies understand why they may or may not be weighted favorably in the index. In 2022, the GPIF had an allocation of approximately USD 43 billion to investment products tracking this methodology.

Global Carbon Efficient Index Series

The objectives of this index series is to:

- Encourage better corporate performance on climate change;
- Lower the carbon footprint relative to the benchmark index; and
- Maintain the industry exposures of the benchmark index.

¹³ The Asset, "[Top asset owners' US\\$23 trillion key to unlocking net zero.](#)" Nov. 4, 2021.

Index Weighting

Three factors are used to adjust the weight of companies in this index.

- **Company disclosure of carbon emissions.** When there is no disclosure, S&P Global Trucost provides modeled data. Trucost takes into account not only a company's direct emissions, but also its direct suppliers' purchased energy and emissions.
- **Carbon efficiency relative to industry peers.** Constituents of the [S&P Global LargeMidCap](#) (approximately 3,000 stocks) are sorted into deciles based on their carbon intensity within their industries (see Exhibit 4). For example, the most carbon-efficient companies in the top decile of the Energy industry were emitting 201 metric tons of CO₂ per USD 1 million of revenue. The most inefficient companies at the bottom of the table are producing almost 10 times as much, at 1,930 metric tons of CO₂ per USD 1 million of revenue.
- **Industry impact.** Each industry is categorized as high, mid or low impact. High-impact industries have the largest spread of emissions (see Exhibit 4). The Energy sector is categorized as high.

Exhibit 4: Decile Thresholds by Industry Group

Industry Group Factor	HIGH	HIGH	MID	HIGH	HIGH	MID	MID	MID	LOW	
GICS Industry Group	Energy	Materials	Capital Goods	Commercial & Professional Services	Transportation	Automobiles & Components	Consumer Durables & Apparel	Consumer Services	Media	
Decile	1	Less than 201.2	Less than 231.95	Less than 50.38	Less than 16.31	Less than 68.57	Less than 44.28	Less than 43.4	Less than 41.05	Less than 13.95
	2	201.2-364.26	231.95-406.88	50.38-66.87	16.31-21.44	68.57-76.42	44.28-49.67	43.4-58.14	41.05-55.14	13.95-15.39
	3	364.26-510.28	406.88-507.21	66.87-79.93	21.44-22.92	76.42-101.33	49.67-59.67	58.14-68.09	55.14-78.44	15.39-16.37
	4	510.28-598.21	507.21-622.19	79.93-99.24	22.92-23.72	101.33-134.88	59.67-74.14	68.09-77.98	78.44-96.78	16.37-18.05
	5	598.21-676.75	622.19-795.77	99.24-125.37	23.72-31.88	134.88-267.96	74.14-157.83	77.98-92.44	96.78-116.09	18.05-22.26
	6	676.75-824.41	795.77-1018.63	125.37-148.8	31.88-41.02	267.96-563.66	157.83-183.26	92.44-100.46	116.09-122.61	22.26-24.99
	7	824.41-961.55	1018.63-1648.09	148.8-179.14	41.02-61.9	563.66-956.44	183.26-198.31	100.46-128.35	122.61-125.13	24.99-27.39
	8	961.55-1220.39	1648.09-2668.82	179.14-224.99	61.9-145.9	956.44-1143.91	198.31-224.06	128.35-167.75	125.13-214.87	27.39-30.21
	9	1220.39-1930.85	2668.82-4533.53	224.99-363.92	145.9-521.82	1143.91-1299.88	224.06-248.12	167.75-219.21	214.87-415.08	30.21-40.25
	10	More than 1930.85	More than 4533.53	More than 363.92	More than 521.82	More than 1299.88	More than 248.12	More than 219.21	More than 415.08	More than 40.25

Source: S&P Dow Jones Indices LLC. Data as of 2018. Data are in metric tons of CO₂e per USD 1 million of revenue. Table is provided for illustrative purposes.

Exhibit 5 illustrates how the following three factors are used to determine company weights in the index.

- **Company disclosure.** A company disclosing its carbon emissions will receive a 10% boost to its weight in the index.
- **Carbon efficiency relative to industry peers.** A highly carbon-efficient company will be positioned in the first decile and receive at least a 30% boost in the index, whereas a company with poor carbon efficiency in the tenth decile will be penalized by 30%.
- **Industry impact.** Once the previous two factors have been considered, the final weight adjustment is applied depending on the industry impact. A high-impact industry will receive a weight adjustment of x3. A low-impact industry will receive a smaller weight adjustment. The rationale is that as the overall carbon footprint of low-impact industries is smaller, a large weight adjustment from the benchmark index would do little to decarbonize the index and needlessly affect tracking error.

Hence, a high-impact company that discloses its carbon emissions and is in the top decile for carbon efficiency will receive a weight increase of 120%.

Exhibit 5: Weighting Methodology

Decile	Decile Weight Adjustments (%)							
	GHG Emissions		x3 High Impact		x1 Mid Impact		x0.5 Low Impact	
	Disclosed	Non Disclosed	Disclosed	Non Disclosed	Disclosed	Non Disclosed	Disclosed	Non Disclosed
1 st	40	30	120	90	40	30	20	15
2 nd	30	20	90	60	30	20	15	10
3 rd	20	10	60	30	20	10	10	5
Mid	10	0	30	0	10	0	5	0
8 th	0	-10	0	-30	0	-10	0	-5
9 th	-10	-20	-30	-60	-10	-20	-5	-10
10 th	-20	-30	-60	-90	-20	-30	-10	-15

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

Results

The index is sector neutral and over the five-year period, there was little difference in performance between the S&P 500 and the [S&P 500 Carbon Efficient Index](#) (see Exhibit 6). There was a notable carbon-to-revenue reduction of more than 30%, meeting the decarbonization objective.

Exhibit 6: S&P 500 Carbon Efficient Index Return and Carbon Characteristics

Characteristic	S&P 500	S&P 500 Carbon Efficient Index
Constituents	503	497
Five-Year Annualized Returns (%)	12.83	12.67
Carbon-to-Revenue Footprint*	191.67	132.76

Source: S&P Dow Jones Indices LLC. Data as of July 29, 2022. The S&P 500 Carbon Efficient Index was launched Oct. 22, 2018. All data prior to index launch date is back-tested hypothetical data. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information on the inherent limitations of back-tested performance. *Metric tons of CO₂e per USD 1 million of revenue.

The other objective of the index is to encourage better corporate disclosure. Exhibit 7 provides a sample of the information that is placed in the public domain—industry, decile ranking and disclosure status. The company's current weight in the index is also supplied. Public disclosure of company weights in the index with reasons for any adjustments provides investors with the data they need to engage with companies and provides full transparency to the constituents.

Exhibit 7: Snapshot of Publicly Disclosed Data on Constituents of the S&P Carbon Efficient Indices

Constituent	Symbol	Index Weight (%)	Decile Classification	Carbon Disclosure Status
Itochu Enex Co Ltd	8133	0.01	1	Disclosed
San-Ai Oil Co	8097	<0.01	1	Not Disclosed
Mitsuuroko Group Holdings Co Ltd	8131	<0.01	1	Not Disclosed
Modec Inc	6269	<0.01	1	Not Disclosed
Sinanen Holdings Co Ltd	8132	<0.01	1	Not Disclosed
Sala Corp	2734	<0.01	1	Not Disclosed
Bp Castrol Kk	5015	<0.01	1	Not Disclosed
Eneos Holdings Inc	5020	0.31	2	Disclosed
Idemitsu Kosan Co Ltd	5019	0.16	2	Disclosed
Iwatani Corp	8088	0.04	2	Not Disclosed
Nippon Coke & Engineering Co Ltd	3315	<0.01	2	Not Disclosed
Toyo Kanetsu Kk	6369	<0.01	2	Not Disclosed
Japan Petroleum Exploration	1662	0.02	3	Not Disclosed
Cosmo Energy Holding	5021	0.02	4	Disclosed
Fuji Kosan Co	5009	<0.01	4	Not Disclosed
Fuji Oil Co Ltd	5017	<0.01	5	Disclosed
Inpex Corp	1605	0.16	8	Disclosed

Source: S&P Dow Jones Indices LLC. Data as of March 23, 2022. Table is provided for illustrative purposes.

Index Education

For use with institutions only, not for use with retail investors.

S&P Carbon Control Indices

Index construction can range from simple screened indices such as fossil fuel free to indices that use optimizers to target particular investment or climate objectives.

The S&P Carbon Control Indices

Launched in 2021, the S&P Carbon Control Indices target maximizing carbon intensity reductions while minimizing deviations from the benchmark.

The indices are constructed by first applying exclusions based on:

- Business activity (e.g., fossil fuels, tobacco, etc.);
- Performance against the United Nations Global Compact (UNGC); and
- S&P DJI ESG Score (companies with poor S&P DJI ESG Scores relative to GICS industry group peers).

The remaining stocks are re-weighted to minimize index-level-weighted average carbon intensity compared to the market-cap-weighted benchmark subject to index active share, industry group weight, country weight and diversification constraints.

Results

These indices typically produce high rates of decarbonization—as of July 29, 2022, the [S&P Developed Ex-Australia LargeMidCap Carbon Control Index](#) had approximately one-quarter of the carbon footprint of its benchmark (see Exhibit 8). The index has also outperformed its market cap equivalent.

Exhibit 8: Comparison of S&P Developed Ex-Australia LargeMidCap Carbon Control Index and Benchmark

Characteristic	S&P Developed Ex-Australia LargeMidCap	S&P Developed Ex-Australia LargeMidCap Carbon Control Index
Constituents	1800	1012
Five-Year Annualized Returns (%)	8.96	9.42
Carbon-to-Revenue Footprint*	196.5	52.53

Source: S&P Dow Jones Indices LLC. Data as of July 29, 2022. The S&P Developed Ex-Australia LargeMidCap Carbon Control Index was launched Aug. 30, 2021. All data prior to index launch date is back-tested hypothetical data. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information on the inherent limitations of back-tested performance. *Metric tons of CO₂e per USD 1 million of revenue.

Net Zero Indices

For the world to achieve net zero,¹⁴ every part of the economy will need to reorient toward this goal. A notable proportion of global investments are managed using passive vehicles. During COP26, there was an announcement¹⁵ through the Glasgow Financial Alliance for Net Zero (GFANZ) to commit more than USD 130 trillion of private capital to transform the economy to align with net zero. The GFANZ Measuring Portfolio Alignment report states, “Since large pension funds are predominantly passive investors that control about half of capital markets, net-zero benchmark construction approaches, in addition to bottom-up portfolio alignment methods, are important.”¹⁶

S&P DJI offers two approaches to align with net zero.

- **Paris-Aligned & Climate Transition Indices** – Multifaceted indices that align with the EU’s minimum standards for benchmarks labeled EU Paris-Aligned Benchmarks (EU PAB) and EU Climate Transition Benchmarks (EU CTB) and TCFD.
- **Carbon Budget Indices** – Singular focus on decarbonization based on the most recent IPCC report.

S&P PACT Indices

Holistic Company Climate Assessments

Many investors who have implemented climate strategies around divesting or decarbonizing are looking to the next step of their climate investing journey. Some are looking for a holistic, science-based assessment of companies’ risks and opportunities regarding climate change. This requires assessing companies from multiple perspectives.

- **Transition risks.** As we limit global warming, investors will be exposed to additional transition risks; for example, stranded assets. Companies can demonstrate their resilience to these risks by setting science-based targets to align their business with a 1.5°C scenario and by demonstrating robust ESG credentials.

¹⁴ Net zero emissions are achieved when *anthropogenic emissions of greenhouse gases to the atmosphere* are balanced by *anthropogenic removals* over a specified period. See IPCC, “[Special Report: Global Warming of 1.5 °C](#),” 2021.

¹⁵ Glasgow Financial Alliance for Net Zero, “[Amount of finance committed to achieving 1.5°C now at scale needed to deliver the transition](#),” Nov. 3, 2021.

¹⁶ Glasgow Financial Alliance for Net Zero, “[Measuring Portfolio Alignment](#),” August 2022.

- **Physical risks.** As the Earth continues to warm, companies are increasingly exposed to the physical risks of climate change, such as droughts, hurricanes, etc. Even under a 1.5°C scenario, physical climate risks will occur more frequently.
- **Opportunities.** There are clear opportunities for businesses that can offer solutions aligned with a 1.5°C world. This is particularly evident in the Energy sector, where renewable energies are becoming increasingly important.

Aligning with Industry Standards

There are also important climate frameworks and labels with which investors are looking to align. In particular, the TCFD, which was discussed previously, and the EU's PAB and CTB labels.

The EU's Action Plan on Sustainable Finance included proposals for two climate benchmark labels: EU Climate-Transition Benchmarks (EU CTBs) and EU Paris-Aligned Benchmarks (EU PABs). To use these labels, the index must meet the EU's minimum standards, which include aligning with a 1.5°C trajectory. The EU PABs are built for investors who feel the immediate urgency of moving to a 1.5°C world, and these have more stringent requirements. The EU CTBs are aimed at a broader audience of investors who are looking to hedge against the risks of climate change; these benchmarks have less strict requirements.

Alignment with 1.5°C is important to forward-looking climate investors, and several investor groups have been established to support this ambition.

The S&P PACT Indices

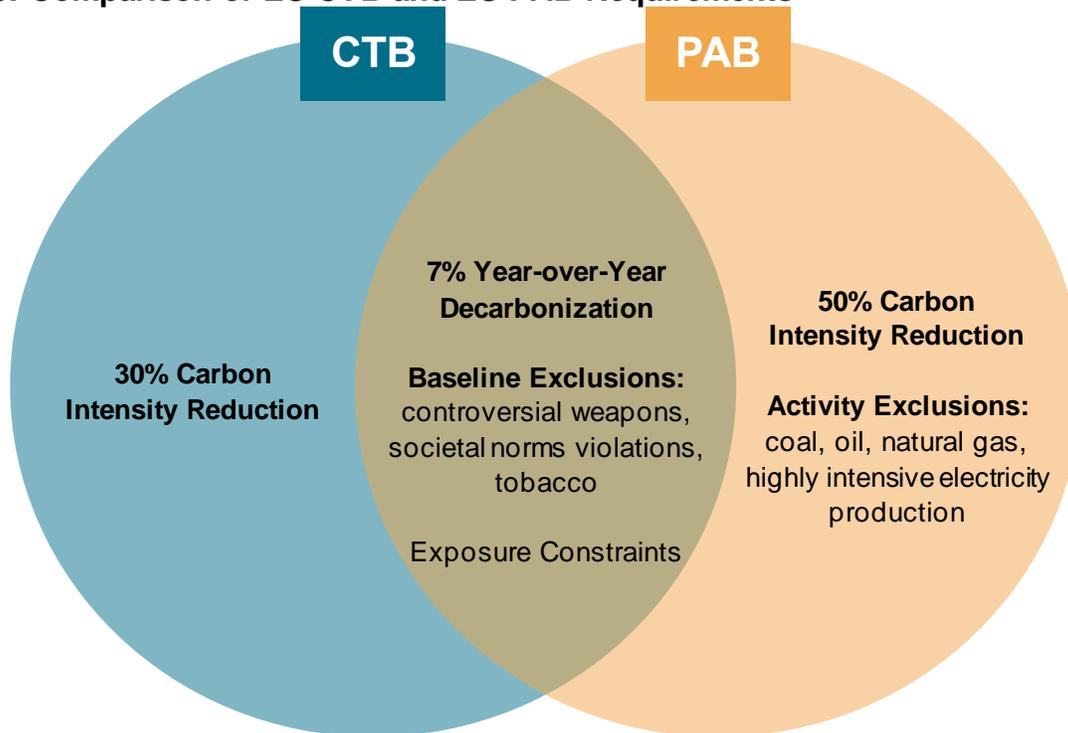
The S&P PACT Indices launched in 2020 and provide a science-based, holistic approach to climate investing aligned with 1.5°C. These indices:

- Exceed the Paris Agreement by aligning with a 1.5°C trajectory;
- Meet the minimum standards of the EU PAB and EU CTB labels and align with TCFD recommendations; and
- Stay as close as possible to the benchmark index, offering broad, diversified exposure.

Alignment with the EU Climate Benchmark Labels

Climate considerations that have been applied to the S&P PACT Indices, per the EU's minimum standards for EU CTBs and EU PABs, are highlighted in Exhibit 9.¹⁷

Exhibit 9: Comparison of EU CTB and EU PAB Requirements



Source: S&P Dow Jones Indices LLC. Chart is provided for illustrative purposes.

The S&P PACT Indices align with the EU's minimum standards for EU CTBs and EU PABs and go beyond by:

- Using forward-looking datasets to overweight companies on 1.5°C-aligned pathways, allowing for the selection of companies that are decarbonizing;
- Providing more exposure to companies with better S&P DJI ESG Scores; and
- For the Paris-Aligned indices, overweighting companies with better green-to-brown revenue share, allowing investors to have greater exposure to climate-related opportunities;
- Reducing exposure to fossil fuel reserves in order to lower stranded assets risk;

¹⁷ As set out in [Commission Delegated Regulation \(EU\) 2020/1818](#) of July 17, 2020 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards minimum standards for EU Climate Transition Benchmarks and EU Paris-Aligned Benchmarks.

- Reducing exposure to the physical risks of climate change by capping the weight of companies with higher exposure to physical risks and ensuring the index as a whole has lower physical risk exposure relative to its benchmark; and
- Including Scope 3¹⁸ emissions from the outset, ensuring that the impacts across the full value chain of the companies are taken into consideration.

Results

The [S&P 500 Net Zero 2050 Paris-Aligned ESG Index](#), with its multiple climate constraints, still had 322 constituents and a carbon-to-revenue reduction of 65% (see Exhibit 10).

Exhibit 10: S&P 500 PACT Indices Return and Carbon Characteristics

Characteristic	S&P 500	S&P 500 Net Zero 2050 Paris-Aligned ESG Index	S&P 500 Net Zero 2050 Climate Transition ESG Index
Constituents	503	322	353
One-Year Return (%)	-6.18	-7.96	-7.75
Carbon-to-Revenue Footprint*	191.67	65.45	115.02

Source: S&P Dow Jones Indices LLC. Data as of July 29, 2022. Past performance is no guarantee of future results. Table is provided for illustrative purposes. *Metric tons of CO₂e per USD 1 million of revenue.

S&P Carbon Budget Indices

Net Zero Indices Based on a Carbon Budget

During the course of this paper, we have demonstrated there are many lenses through which to look at climate change. Even a singular focus of aligning with net zero can be achieved in multiple ways. Our S&P Carbon Budget Indices are designed for index users who are looking for a simple approach, focused only on the path of decarbonization required for the world to be net zero by 2050.

The indices' design is based on the 2021 IPCC report,¹⁹ which assesses the state of climate change and progress toward keeping global temperature increases below 1.5°C compared to pre-industrial levels with 83% probability.

¹⁸ The GHG Protocol classifies a company's GHG emissions into three scopes. Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy. Scope 3 emissions are all indirect emissions (not included in Scope 2) that occur in the company's value chain—including both upstream and downstream emissions.

¹⁹ IPCC, "[Summary for Policymakers](#)," 2021.

S&P Net Zero Carbon Budget Indices

The S&P Net Zero Carbon Budget Indices target decarbonization at a rate determined by the 2021 IPCC report for the world to be net zero by 2050. For the 2022 vintage of the S&P Carbon Budget Indices, this means an initial 25% cut in volume of GHG emissions as well as an ongoing 10.1% yearly emission reduction.

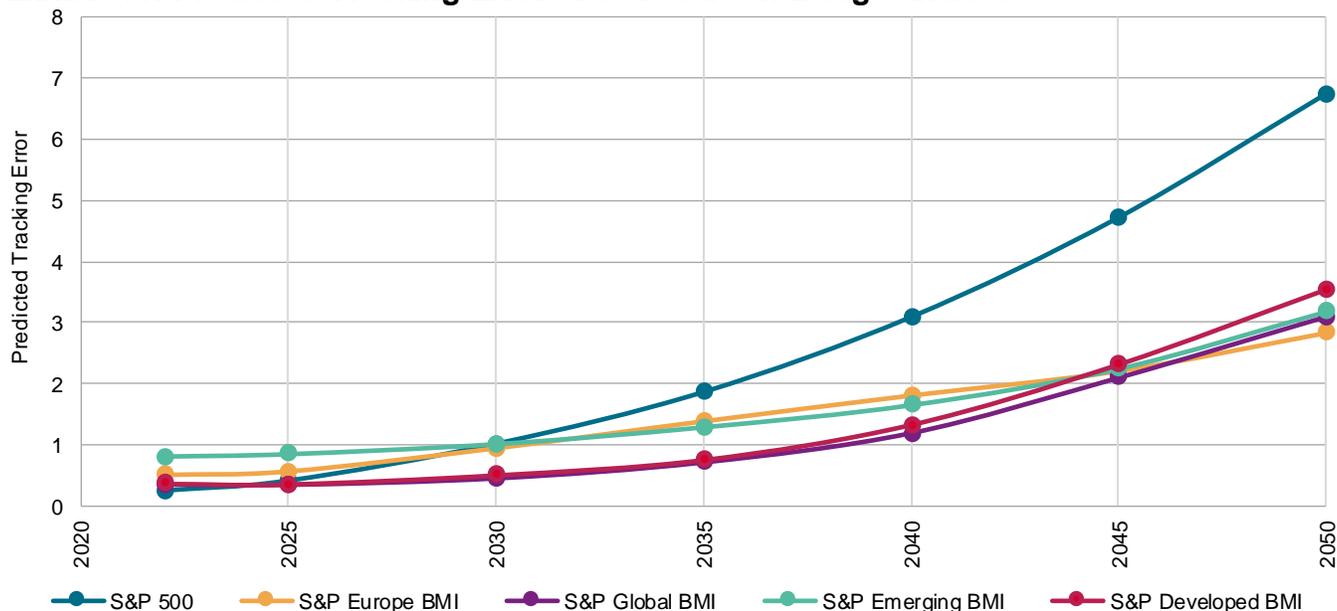
The S&P Net Zero 2050 Carbon Budget Indices are rebalanced annually. At each annual rebalance, the carbon emissions of the companies will be used to achieve the decarbonization required while minimizing sector deviations.

By basing the rate of decarbonization on the carbon budget remaining for the planet, these indices reflect the urgency of the net zero challenge. For future indices that may be launched, the current approximately -10% annual decarbonization required is expected to increase with time as the carbon budget gradually shrinks.

Results

At launch, the indices typically remain broadly invested with low tracking error relative to the benchmark. For instance, the [S&P Global Net Zero 2050 Carbon Budget \(2022 Vintage\) Index](#) had a predicted tracking error of 0.36% at launch in 2022, which is anticipated to rise to a predicted tracking error of 3.09% in 2050 (see Exhibit 11).²

Exhibit 11: Predicted Tracking Error of S&P Carbon Budget Indices



Source: S&P Dow Jones Indices LLC. Data as of June 29, 2022. Data is hypothetical future data. Chart is provided for illustrative purposes.

Exhibit 12: Comparison of S&P Global Net Zero Carbon Budget (2022 Vintage) Index and Benchmark

Characteristic	S&P Global BMI	S&P Global Net Zero Carbon Budget (2022 Vintage) Index
Constituents	14,473	11,479
Predicted Tracking Error	N/A	0.36
Carbon-to-Revenue Footprint*	250.48	230.32

Source: S&P Dow Jones Indices LLC. Data as of July 29, 2022. The S&P 500 Net Zero 2050 Carbon Budget (2022 Vintage) Index was launched July 25, 2022. All data prior to index launch date is back-tested hypothetical data. Predicted tracking error is hypothetical future data. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information on the inherent limitations of back-tested performance.

Climate Solutions

Many of the indices discussed thus far have primarily focused on minimizing exposure to companies based on climate risks. As we transition to a low carbon world, there will also be opportunities for those industries and companies that are able to pivot their offerings to more sustainable alternatives.

S&P Global Clean Energy

One industry that has been at the forefront of offering green alternatives is the energy sector. The [S&P Global Clean Energy Index](#) is constructed by:

- Identifying companies involved in clean energy production and clean energy technology, such as solar, wind, geothermal, hydro and bio energy;
- Applying exclusions, including business involvement screens, UNGC performance and companies with relatively high carbon footprints;
- Selecting companies by clean energy exposure score and market capitalization, without breaching a dilution threshold, with a target constituent count of 100; and
- Weighting constituents by product of market cap and exposure score.

Results

The S&P Global Clean Energy Index outperformed the [S&P Global BMI](#) by 14.47% over the five-year period ending July 29, 2022.

Exhibit 13: Comparison of S&P Global Clean Energy Index and Benchmark

Characteristic	S&P Global BMI	S&P Global Clean Energy Index
Constituents	14,473	97
Five-Year Annualized Returns (%)	7.9	22.37
Carbon-to-Revenue Footprint*	250.48	266.42

Source: S&P Dow Jones Indices LLC. Data as of July 29, 2022. Past performance is no guarantee of future results. Table is provided for illustrative purposes.

Conclusion

The Earth is warming. The unfortunate consequences of this can be witnessed around the globe. Many investors recognize the challenges and opportunities of climate change, and portfolio managers have deployed climate strategies to meet the expectations of asset owners. At S&P DJI, we have developed a suite of climate indices to assist investors whatever their climate objectives, from established strategies focused on divestment, low carbon and engagement to strategies based on science and aligned with the goal to limit the global temperature rise to 1.5°C.

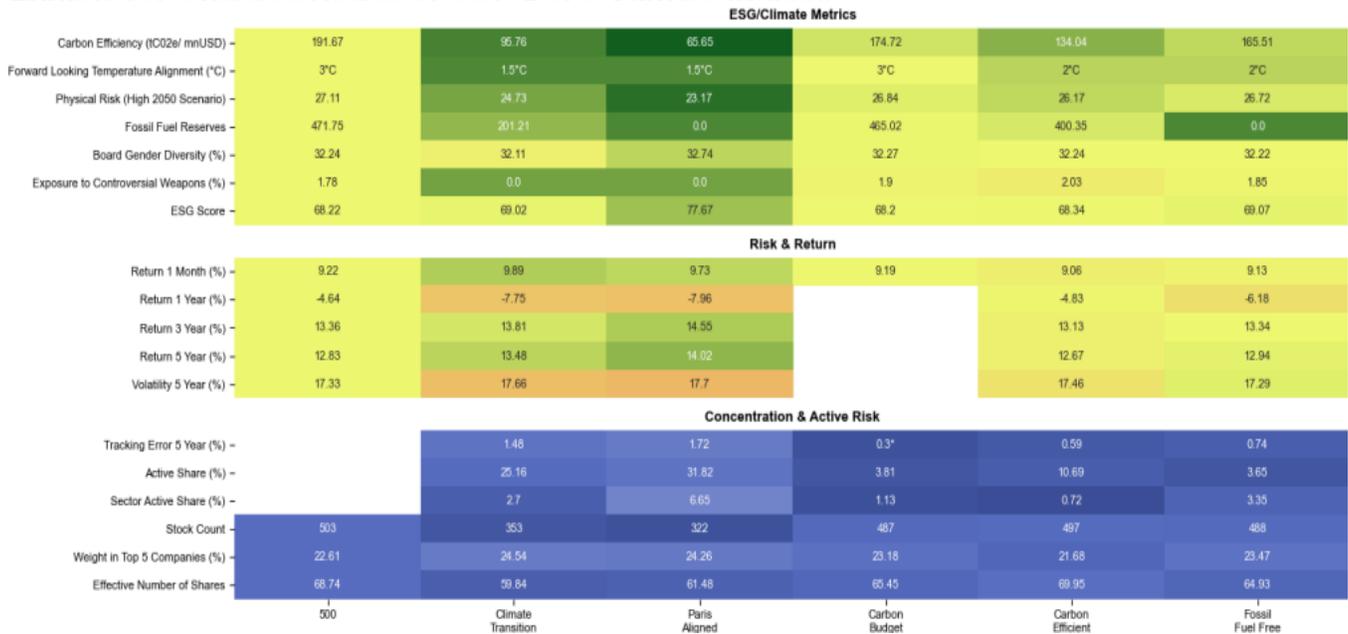
Appendix

Exhibit 14: An Overview of S&P DJI's Climate Indices

Category	S&P Fossil Fuel Free Indices	S&P Carbon Efficient Indices	S&P PACT Indices	S&P Net Zero 2050 Carbon Budget Indices	S&P Carbon Control Indices	S&P Global Clean Energy Index
Objective	Exclude companies with embedded carbon reserves	Reduce index carbon intensities within industries	Align with a 1.5°C scenario	Target a defined carbon budget compatible with the IPCC estimate	Minimize index weighted average carbon intensity	Provide exposure to companies in clean energy-related businesses
Carbon Data Used	Fossil fuel reserves	Carbon efficiency (carbon-to-revenue footprint)	Multiple datasets, including transition data and physical risk data	Decarbonization pathway data	Carbon intensity	RBICS data and GICS sub-industries
Methodology	Divest from any company with fossil fuel reserves	Tilt toward low carbon emission stocks using the S&P Global Carbon Standard	Optimized to meet multiple climate objectives and minimize active share	Optimized to align with IPCC emission estimates	Weight companies based on carbon intensity based on levels of GHG emissions	Companies that derive revenues from specific practices related to clean energy are eligible
Companies Excluded?	Yes	Yes	Yes	No	Yes	Yes

Source: S&P Dow Jones Indices LLC. Data as of June 2022. Table is provided for illustrative purposes.

Exhibit 15: Characteristics of S&P DJI’s Climate Indices



Source: S&P Dow Jones Indices LLC and S&P Global Sustainable1. Data as of July 29, 2022. The color scheme represents relative difference from the S&P 500, in the top two subplots the darker green represents “improvements” (lower carbon footprint, higher ESG score, higher return, lower volatility, etc.); and in the bottom chart, the darker the color, the lower the value (lower tracking error, lower stock count, etc.). Due to index history, the S&P 500 Net Zero 2050 Carbon Budget (2022 Vintage) Index (USD) TR tracking error is calculated using 63 days of data. The S&P 500 Carbon Efficient Index was launched Oct. 22, 2018. The S&P 500 Net Zero 2050 Paris-Aligned ESG Index and S&P 500 Net Zero 2050 Climate Transition ESG Index were launched June 1, 2020. The S&P 500 Net Zero 2050 Carbon Budget (2022 Vintage) Index was launched July 25, 2022. All data prior to index launch date is back-tested hypothetical data. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information on the inherent limitations of back-tested performance.

Performance Disclosure

The S&P 500 Fossil Fuel Free Index was launched August 28, 2015. The S&P 500 Carbon Efficient Index was launched October 22, 2018. The S&P 500 Net Zero 2050 Paris-Aligned ESG Index and S&P 500 Net Zero 2050 Climate Transition ESG Index were launched June 1, 2020. The S&P 500 Net Zero 2050 Carbon Budget (2022 Vintage) Index was launched July 25, 2022. All information presented prior to an index's Launch Date is hypothetical (back-tested), not actual performance, and is based on the index methodology in effect on the index launch date. However, when creating back-tested history for periods of market anomalies or other periods that do not reflect the general current market environment, index methodology rules may be relaxed to capture a large enough universe of securities to simulate the target market the index is designed to measure or strategy the index is designed to capture. For example, market capitalization and liquidity thresholds may be reduced. In addition, forks have not been factored into the back-test data with respect to the S&P Cryptocurrency Indices. For the S&P Cryptocurrency Top 5 & 10 Equal Weight Indices, the custody element of the methodology was not considered; the back-test history is based on the index constituents that meet the custody element as of the Launch Date. Complete index methodology details are available at www.spglobal.com/spdji. Back-tested performance reflects application of an index methodology and selection of index constituents with the benefit of hindsight and knowledge of factors that may have positively affected its performance, cannot account for all financial risk that may affect results and may be considered to reflect survivor/look ahead bias. Actual returns may differ significantly from, and be lower than, back-tested returns. Past performance is not an indication or guarantee of future results.

Please refer to the methodology for the Index for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations. Back-tested performance is for use with institutions only, not for use with retail investors.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the index is set to a fixed value for calculation purposes. The Launch Date designates the date when the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its data feed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Typically, when S&P DJI creates back-tested index data, S&P DJI uses actual historical constituent-level data (e.g., historical price, market capitalization, and corporate action data) in its calculations. As ESG investing is still in early stages of development, certain datapoints used to calculate S&P DJI's ESG indices may not be available for the entire desired period of back-tested history. The same data availability issue could be true for other indices as well. In cases when actual data is not available for all relevant historical periods, S&P DJI may employ a process of using "Backward Data Assumption" (or pulling back) of ESG data for the calculation of back-tested historical performance.

"Backward Data Assumption" is a process that applies the earliest actual live data point available for an index constituent company to all prior historical instances in the index performance. For example, Backward Data Assumption inherently assumes that companies currently not involved in a specific business activity (also known as "product involvement") were never involved historically and similarly also assumes that companies currently involved in a specific business activity were involved historically too. The Backward Data Assumption allows the hypothetical back-test to be extended over more historical years than would be feasible using only actual data. For more information on "Backward Data Assumption" please refer to the [FAQ](#). The methodology and factsheets of any index that employs backward assumption in the back-tested history will explicitly state so. The methodology will include an Appendix with a table setting forth the specific data points and relevant time period for which backward projected data was used.

Index returns shown do not represent the results of actual trading of investable assets/securities. S&P Dow Jones Indices maintains the index and calculates the index levels and performance shown or discussed but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. As a simple example, if an index returned 10% on a US \$100,000 investment for a 12-month period (or US \$10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US \$1,650), the net return would be 8.35% (or US \$8,350) for the year. Over a three-year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US \$5,375, and a cumulative net return of 27.2% (or US \$27,200).

General Disclaimer

© 2023 S&P Dow Jones Indices. All rights reserved. S&P, S&P 500, SPX, SPY, The 500, US500, US 30, S&P 100, S&P COMPOSITE 1500, S&P 400, S&P MIDCAP 400, S&P 600, S&P SMALLCAP 600, S&P GIVI, GLOBAL TITANS, DIVIDEND ARISTOCRATS, Select Sector, S&P MAESTRO, S&P PRISM, S&P STRIDE, GICS, SPIVA, SPDR, INDEXOLOGY, iTraxx, iBoxx, ABX, ADBI, CDX, CMBX, MBX, MCDX, PRIMEX, HHPI and SOVX are trademarks of S&P Global, Inc. (“S&P Global”) or its affiliates. DOW JONES, DJIA, THE DOW and DOW JONES INDUSTRIAL AVERAGE are trademarks of Dow Jones Trademark Holdings LLC (“Dow Jones”). These trademarks together with others have been licensed to S&P Dow Jones Indices LLC. Redistribution or reproduction in whole or in part are prohibited without written permission of S&P Dow Jones Indices LLC. This document does not constitute an offer of services in jurisdictions where S&P Dow Jones Indices LLC, S&P Global, Dow Jones or their respective affiliates (collectively “S&P Dow Jones Indices”) do not have the necessary licenses. Except for certain custom index calculation services, all information provided by S&P Dow Jones Indices is impersonal and not tailored to the needs of any person, entity or group of persons. S&P Dow Jones Indices receives compensation in connection with licensing its indices to third parties and providing custom calculation services. Past performance of an index is not an indication or guarantee of future results.

It is not possible to invest directly in an index. Exposure to an asset class represented by an index may be available through investable instruments based on that index. S&P Dow Jones Indices does not sponsor, endorse, sell, promote or manage any investment fund or other investment vehicle that is offered by third parties and that seeks to provide an investment return based on the performance of any index. S&P Dow Jones Indices makes no assurance that investment products based on the index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor, and S&P Dow Jones Indices makes no representation regarding the advisability of investing in any such investment fund or other investment vehicle. A decision to invest in any such investment fund or other investment vehicle should not be made in reliance on any of the statements set forth in this document. S&P Dow Jones Indices is not an investment adviser, commodity trading advisor, commodity pool operator, broker dealer, fiduciary, promoter” (as defined in the Investment Company Act of 1940, as amended), “expert” as enumerated within 15 U.S.C. § 77k(a) or tax advisor. Inclusion of a security, commodity, crypto currency or other asset within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, commodity, crypto currency or other asset, nor is it considered to be investment advice or commodity trading advice. Closing prices for S&P Dow Jones Indices’ US benchmark indices are calculated by S&P Dow Jones Indices based on the closing price of the individual constituents of the index as set by their primary exchange. Closing prices are received by S&P Dow Jones Indices from one of its third party vendors and verified by comparing them with prices from an alternative vendor. The vendors receive the closing price from the primary exchanges. Real-time intraday prices are calculated similarly without a second verification.

These materials have been prepared solely for informational purposes based upon information generally available to the public and from sources believed to be reliable. No content contained in these materials (including index data, ratings, credit-related analyses and data, research, valuations, model, software or other application or output therefrom) or any part thereof (“Content”) may be modified, reverse-engineered, reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of S&P Dow Jones Indices. The Content shall not be used for any unlawful or unauthorized purposes. S&P Dow Jones Indices and its third-party data providers and licensors (collectively “S&P Dow Jones Indices Parties”) do not guarantee the accuracy, completeness, timeliness or availability of the Content. S&P Dow Jones Indices Parties are not responsible for any errors or omissions, regardless of the cause, for the results obtained from the use of the Content. THE CONTENT IS PROVIDED ON AN “AS IS” BASIS. S&P DOW JONES INDICES PARTIES DISCLAIM ANY AND ALL EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, FREEDOM FROM BUGS, SOFTWARE ERRORS OR DEFECTS, THAT THE CONTENT’S FUNCTIONING WILL BE UNINTERRUPTED OR THAT THE CONTENT WILL OPERATE WITH ANY SOFTWARE OR HARDWARE CONFIGURATION. In no event shall S&P Dow Jones Indices Parties be liable to any party for any direct, indirect, incidental, exemplary, compensatory, punitive, special or consequential damages, costs, expenses, legal fees, or losses (including, without limitation, lost income or lost profits and opportunity costs) in connection with any use of the Content even if advised of the possibility of such damages.

S&P Global keeps certain activities of its various divisions and business units separate from each other in order to preserve the independence and objectivity of their respective activities. As a result, certain divisions and business units of S&P Global may have information that is not available to other business units. S&P Global has established policies and procedures to maintain the confidentiality of certain non-public information received in connection with each analytical process.

In addition, S&P Dow Jones Indices provides a wide range of services to, or relating to, many organizations, including issuers of securities, investment advisers, broker-dealers, investment banks, other financial institutions and financial intermediaries, and accordingly may receive fees or other economic benefits from those organizations, including organizations whose securities or services they may recommend, rate, include in model portfolios, evaluate or otherwise address.

The Global Industry Classification Standard (GICS®) was developed by and is the exclusive property and a trademark of S&P and MSCI. Neither MSCI, S&P nor any other party involved in making or compiling any GICS classifications makes any express or implied warranties or representations with respect to such standard or classification (or the results to be obtained by the use thereof), and all such parties hereby expressly disclaim all warranties of originality, accuracy, completeness, merchantability or fitness for a particular purpose with respect to any of such standard or classification. Without limiting any of the foregoing, in no event shall MSCI, S&P, any of their affiliates or any third party involved in making or compiling any GICS classifications have any liability for any direct, indirect, special, punitive, consequential or any other damages (including lost profits) even if notified of the possibility of such damages.

ESG Indices Disclaimer

S&P DJI provides indices that seek to select, exclude, and/or weight index constituents based on, but not limited to, certain environmental, social or governance (ESG) indicators, or a combination of those indicators, including the following: environmental indicators (including the efficient use of natural resources, the production of waste, greenhouse gas emissions, or impact on biodiversity); social indicators (such as, inequality and investment in human capital); governance indicators (such as sound management structures, employee relations, remuneration of staff, tax compliance, respect for human rights, anti-corruption and anti-bribery matters), specific sustainability or values-related company involvement indicators (for example, production/distribution of controversial weapons, tobacco products, or thermal coal), or controversies monitoring (including research of media outlets to identify companies involved in ESG-related incidents).

S&P DJI ESG indices use ESG metrics and scores in the selection and/or weighting of index constituents. ESG scores or ratings seek to measure or evaluate a company's, or an asset's, performance with respect to environmental, social and corporate governance issues.

The ESG scores, ratings, and other data used in S&P DJI ESG indices is supplied directly or indirectly by third parties (note these parties can be independent affiliates of S&P Global or unaffiliated entities) so an S&P DJI ESG index's ability to reflect ESG factors depends on these third parties' data accuracy and availability.

ESG scores, ratings, and other data may be reported (meaning that the data is provided as disclosed by companies, or an asset, or as made publicly available), modelled (meaning that the data is derived using a proprietary modelling process with only proxies used in the creation of the data), or reported and modelled (meaning that the data is either a mix of reported and modelled data or is derived from the vendor using reported data/information in a proprietary scoring or determination process).

ESG scores, ratings, and other data, whether from an external and/or internal source, is based on a qualitative and judgmental assessment, especially in the absence of well-defined market standards, and due to the existence of multiple approaches and methodologies to assess ESG factors and considerations. An element of subjectivity and discretion is therefore inherent in any ESG score, rating, or other data and different ESG scoring, rating, and/or data sources may use different ESG assessment or estimation methodologies. Different persons (including ESG data ratings, or scoring providers, index administrators or users) may arrive at different conclusions regarding the sustainability or impact of a particular company, asset, or index.

Where an index uses ESG scores, ratings or other data supplied directly or indirectly by third parties, S&P DJI does not accept responsibility for the accuracy or completeness of such ESG scores, ratings, or data. No single clear, definitive test or framework (legal, regulatory, or otherwise) exists to determine 'ESG', 'sustainable', 'good governance', 'no adverse environmental, social and/or other impacts', or other equivalently labelled objectives. In the absence of well-defined market standards and due to the existence of multiple approaches, the exercise of judgment is necessary. Accordingly, different persons may classify the same investment, product and/or strategy differently regarding 'ESG', 'sustainable', 'good governance', 'no adverse environmental, social and/or other impacts', or other equivalently labelled objectives. Furthermore, the legal and/or market position on what constitutes an 'ESG', 'sustainable', 'good governance', 'no adverse environmental, social and/or other impacts', or other equivalently labelled objectives may change over time, especially as further regulatory or industry rules and guidance are issued and the ESG sustainable finance framework becomes more sophisticated.

Prospective users of an S&P DJI ESG Index are encouraged to read the relevant index methodology and related disclosures carefully to determine whether the index is suitable for their potential use case or investment objective.