MSCI GLOBAL LOW CARBON TARGET INDEXES METHODOLOGY

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1 INTRODUCTION

The MSCI Global Low Carbon Target Indexes are designed to address two dimensions of carbon exposure – carbon emissions and fossil fuel reserves. By overweighting companies with low carbon emissions relative to sales and those with low potential carbon emissions per dollar of market capitalization, the indexes aim to reflect a lower carbon exposure than that of the broad market. The indexes are designed to achieve a target level of tracking error while minimizing the carbon exposure.

This methodology may be applied to create MSCI Low Carbon Target Indexes from any of the existing MSCI equity indexes (herein, "Parent Indexes"). Some of the parameters applied to determine the MSCI Low Carbon Target Index may vary based on the Parent Index from which the Low Carbon Target Index is constructed.

2 CHARACTERISTICS OF MSCI GLOBAL LOW CARBON TARGET INDEXES

The MSCI Global Low Carbon Target Indexes aim to demonstrate the following characteristics across markets by re-weighting constituents relative to the underlying free float-adjusted market capitalization weighted Parent Index:

- Lower carbon exposure – in terms of carbon emissions and fossil fuel reserves[1]
- Low tracking error relative to the Parent Index
- Low active sector, country and regional biases relative to the Parent Index

[1] Defined in Appendix I

3 CONSTRUCTING THE MSCI GLOBAL LOW CARBON TARGET INDEXES

The MSCI Global Low Carbon Target Indexes are constructed using the following steps:

- Defining the Parent Index
- Defining the Carbon Exposure of each Parent Index constituent
- Defining the optimization parameters
- Determining the optimized pro forma index

The steps mentioned above are defined in detail in the subsequent sections.

3.1 DEFINING THE PARENT INDEX

The Parent Index serves as the universe of eligible securities for the Index. The MSCI Global Low Carbon Target Indexes can be constructed on any market capitalization weighted MSCI Index.

3.2 DEFINING THE CARBON EXPOSURE OF EACH PARENT INDEX CONSTITUENT

The Carbon exposure of a security is measured in terms of its greenhouse gas (GHG) emissions and its potential carbon emissions from fossil fuel reserves. The MSCI Global Low Carbon Target Indexes use MSCI ESG CarbonMetrics data provided by MSCI ESG Research Inc.

3.2.1 GREENHOUSE GAS EMISSIONS

MSCI ESG Research collects company-specific direct (Scope 1) and indirect (Scope 2) greenhouse gas emissions data from company public documents and/or the Carbon Disclosure Project. If a company does not report GHG emissions, then MSCI ESG Research estimates Scope 1 and Scope 2 GHG emissions. The data is updated on an annual basis. Since the current carbon emissions of a company are directly influenced by its current business activity, MSCI normalizes for size by dividing the annual carbon emissions of the company by the annual sales of the company.

For newly added companies to the index which do not report emission data and where MSCI ESG Research has not estimated the greenhouse gas emissions yet, MSCI uses the average emissions per dollar of issuer market capitalization for the companies in the same industry group, multiplied by the market capitalization of the company as the estimated emission for the company.

3.2.2 POTENTIAL CARBON EMISSIONS FROM FOSSIL FUELS

MSCI ESG Research collects fossil fuel reserves data where relevant for companies which have reserves, typically in the Oil & Gas, Coal Mining and Electric Utilities industries[2]. Fossil fuel reserves can be used for several applications including energy or industrial (e.g. coking coal used for steel production). For the development of the MSCI Global Low Carbon Target Indexes, only fossil fuel reserves used for energy are taken into account. The data is updated on an annual basis and based on information disclosed by companies. Sources include company publications, other public records and third party data providers. For newly added companies to the index where data is not available yet, MSCI uses zero fossil fuel reserves. The size of reserves of a company typically influences its market valuation, and hence MSCI normalizes for size by dividing the potential carbon emissions of the company by its market capitalization.

To convert reserves data to potential carbon emissions, MSCI ESG Research applies a formula from the Potsdam Institute for Climate Impact Research.[3]

3.3 DEFINING THE OPTIMIZATION PARAMETERS

At each semi-annual index review, the MSCI Global Low Carbon Target Indexes are constructed using an optimization process that aims to achieve replicability and investability, subject to the following optimization objective and constraints:

- Minimize the carbon exposure subject to a tracking error constraint of 30 basis points relative to the Parent Index
- The maximum weight of an index constituent will be restricted to 20 times its weight in the Parent Index
- The country weights in the MSCI Global Low Carbon Target Index will not deviate more than +/-2% from the country weights in the Parent Index
- The above country weight constraint will also apply on China A Stock Connect listings as a group separately in addition to the usual country weight constraint on China

[2] For more information on MSCI ESG CarbonMetrics, please refer to https://www.msci.com/index-carbon-footprint-metrics

[3] Malte Meinshausen, Nicolai Meinshausen, William Hare, Sarah C. B. Raper, Katja Frieler, Reto Knutti, David J. Frame & Myles R. Allen. *Greenhouse-gas emission Target for limiting global warming to 2 °C.* ***Nature*** 458, 1158-1162 (30 April 2009) | doi:10.1038/nature08017; Received 25 September 2008; Accepted 25 March 2009. Supplementary Information, p. 7.

- The sector weights in the MSCI Global Low Carbon Target Index will not deviate more than +/-2% from the sector weights in the Parent Index with the exception of the Energy Sector where no sector weight constraint is applied
- The one-way turnover of the MSCI Low Carbon Target Index is constrained to a maximum of 10% at each index review.

3.4 DETERMINING THE PRO FORMA INDEX

The MSCI Global Low Carbon Target Indexes are constructed using the Barra Open Optimizer in combination with the relevant Barra Equity Model. The optimization uses the Parent Indexes as the universe of eligible securities and the specified optimization objective and constraints to determine the optimized MSCI Global Low Carbon Target Indexes. After the optimization process, any securities with extremely low weights (less than 1/10th of the minimum weight in the Parent Indexes) are eliminated, and their weight is proportionately distributed over the remaining securities in order to determine the final pro forma indexes.

4 MAINTAINING THE MSCI GLOBAL LOW CARBON TARGET INDEXES

4.1 SEMI-ANNUAL INDEX REVIEWS

The changes resulting from the Semi-Annual Index Reviews of the MSCI Global Low Carbon Target Indexes will be made as of the close of the last business day of May and November, coinciding with the May and November Semi-Annual Index Reviews of the Parent Indexes. The pro forma indexes are announced nine business days before the effective date.

For the May and the November Semi-Annual Index Reviews, the Barra model data as of the end of April and the end of October is used respectively.

At each rebalancing, a constraint factor is calculated for each constituent in the MSCI Global Low Carbon Target Index. The constraint factor is defined as the weight in the MSCI Global Low Carbon Target Index at the time of the rebalancing divided by the weight in the Parent Index. The constraint factors as well as the constituents in the index remain constant between index reviews except in case of corporate events as described below.

In general, MSCI uses MSCI ESG Research data (including MSCI ESG Ratings, MSCI ESG Controversies Scores and MSCI Business Involvement Screening Research) as of the end of the month preceding the Index Reviews. For some securities, such data may not be published by MSCI ESG Research by the end of the month preceding the Index Review. For such securities, MSCI will use ESG data published after the end of month, when available.

4.2 ONGOING EVENT RELATED CHANGES

The general treatment of corporate events in the MSCI Global Low Carbon Target Indexes aims to minimize turnover outside of Index Reviews. The methodology aims to appropriately represent an investor’s participation in an event based on relevant deal terms and pre-event weighting of the index constituents that are involved. Further, changes in index market capitalization that occur as a result of corporate event implementation will be offset by a corresponding change in the Variable Weighting Factor (VWF) of the constituent.

Additionally, if the frequency of Index Reviews in the Parent Index is greater than the frequency of Index Reviews in the MSCI Global Low Carbon Target Index, the changes made to the Parent Index during intermediate Index Reviews will be neutralized in the MSCI Global Low Carbon Target Index.

The following section briefly describes the treatment of common corporate events within the MSCI Global Low Carbon Target Indexes.

No new securities will be added (except where noted below) to the Index between Index Reviews. Parent Index deletions will be reflected simultaneously.

EVENT TYPE	EVENT DETAILS
New additions to the Parent Index	A new security added to the parent index (such as IPO and other early inclusions) will not be added to the index.
Spin-Offs	All securities created as a result of the spin-off of an existing Index constituent will be added to the Index at the time of event implementation. Reevaluation for continued inclusion in the Index will occur at the subsequent Index Review.
Merger/Acquisition	For Mergers and Acquisitions, the acquirer's post event weight will account for the proportionate amount of shares involved in deal consideration, while cash proceeds will be invested across the Index. If an existing Index constituent is acquired by a non-Index constituent, the existing constituent will be deleted from the Index and the acquiring non-constituent will not be added to the Index.
Changes in Security Characteristics	A security will continue to be an Index constituent if there are changes in characteristics (country, sector, size segment, etc.) Reevaluation for continued inclusion in the Index will occur at the subsequent Index Review.

Further detail and illustration regarding specific treatment of corporate events relevant to this Index can be found in the MSCI Corporate Events Methodology book under the sections detailing the treatment of events in Capped Weighted and Non-Market Capitalization Weighted indexes.

The MSCI Corporate Events methodology book is available at:
https://www.msci.com/index-methodology

APPENDIX I: CALCULATION OF CARBON EXPOSURE METRICS

INDEX CARBON EMISSIONS –

- Parent Index Carbon Emissions –

$$\sum_i \left(\frac{(Float\ Market\ Capitalization\ * Absolute\ Emissions)}{Issuer\ Market\ Capitalization} \right)$$

- Derived Index Carbon Emissions –

$$\sum_i \left(\frac{(Derived\ Index\ Market\ Capitalization\ * Absolute\ Emissions)}{Issuer\ Market\ Capitalization} \right)$$

- Parent Index Carbon Emission Intensity is defined as Parent Index Carbon Emissions, as defined above, divided by Parent Index Sales –

$$\sum_i \left(\frac{(Float\ Market\ Capitalization\ * Absolute\ Emissions)}{Issuer\ Market\ Capitalization} \right) / \sum_i \left(\frac{(Float\ Market\ Capitalization\ * Sales)}{Issuer\ Market\ Capitalization} \right)$$

- Derived Index Carbon Emissions Intensity is defined as Derived Index Carbon Emissions, as defined above, divided by Derived Index Sales –

$$\sum_i \left(\frac{(Derived\ Index\ Market\ Capitalization\ * Absolute\ Emissions)}{Issuer\ Market\ Capitalization} \right) / \sum_i \left(\frac{(Derived\ Index\ Market\ Capitalization\ * Sales)}{Issuer\ Market\ Capitalization} \right)$$

INDEX POTENTIAL CARBON EMISSIONS FROM FOSSIL FUELS–

- Parent Index Potential Carbon Emissions from Fossil Fuels–

$$\sum_i \left(\frac{(Float\ Market\ Capitalization\ * Absolute\ Potential\ Emissions)}{Issuer\ Market\ Capitalization} \right)$$

- Derived Index Potential Carbon Emissions from Fossil Fuels–

$$\sum_i \left(\frac{(Derived\ Index\ Market\ Capitalization\ * Absolute\ Potential\ Emissions)}{Issuer\ Market\ Capitalization} \right)$$

APPENDIX II: BARRA EQUITY MODEL USED IN THE OPTIMIZATION

In order to meet its objective, the MSCI Global Low Carbon Target Index construction, since inception, made use of the Barra Global Equity Model (GEM3L) within the optimization setup. However, starting from the November 2017 Semi-Annual Index Review, the index construction used an optimization setup that used the Barra Global Equity Model for Long-Term Investors (GEMLTL). The change of optimization setup was completed without any change in the prevailing index methodology.

The following sections have been modified since September 2014:

The details on the Corporate Events treatment are now included in Section 4.2.

The following sections have been modified since June 2017:

Section 3.2

- Updated link to the description of MSCI ESG CarbonMetrics

Section 4.1

- Clarification on use of ESG data for securities whose data would be available after the end of the month preceding Index Review.

The following sections have been modified since September 2017:

Section 3.3

- Clarification on the turnover constraint applied at each index review.

The following sections have been modified since October 2017:

Appendix II: Barra Equity Model Used In the Optimization

- Added Appendix II to update the information on transition of MSCI Global Low Carbon Target Indexes to GEMLTL

The following sections have been modified since November 2017:

Section 3.3

- Updated to reflect the additional constraint on China A Stock Connect listings

CONTACT US

clientservice@msci.com

AMERICAS

Americas	1 888 588 4567 *
Atlanta	+ 1 404 551 3212
Boston	+ 1 617 532 0920
Chicago	+ 1 312 675 0545
Monterrey	+ 52 81 1253 4020
New York	+ 1 212 804 3901
San Francisco	+ 1 415 836 8800
Sao Paulo	+ 55 11 3706 1360
Toronto	+ 1 416 628 1007

EUROPE, MIDDLE EAST & AFRICA

Cape Town	+ 27 21 673 0100
Frankfurt	+ 49 69 133 859 00
Geneva	+ 41 22 817 9777
London	+ 44 20 7618 2222
Milan	+ 39 02 5849 0415
Paris	0800 91 59 17 *

ASIA PACIFIC

China North	10800 852 1032 *
China South	10800 152 1032 *
Hong Kong	+ 852 2844 9333
Mumbai	+ 91 22 6784 9160
Seoul	00798 8521 3392 *
Singapore	800 852 3749 *
Sydney	+ 61 2 9033 9333
Taipei	008 0112 7513 *
Tokyo	+ 81 3 5290 1555

* = toll free

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Our line of products and services includes indexes, analytical models, data, real estate benchmarks and ESG research.

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