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Green Energy Indexes & Financial Markets: An In-Depth Look

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# Green Energy Indexes & Financial Markets: An In-Depth Look

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#### Abstract

This paper aims to provide better transparency around green energy indexes. After selecting green energy indexes that meet the established criteria, we build a database listing the companies in these indexes and compare them with a financial benchmark. Our study allows investors to adjust their hedging horizons with green concerns, to pave the way for further academic analyses, or issue a new call to public authorities on the need to redirect financial flows towards greener activities.

Key words: Financial markets, Green energy indexes.

JEL classification: G15, Q42.

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## Introduction

Scientific researchers are unanimous: it is urgent to limit global warming to less than two degrees relative to the pre-industrial level to curb its effects on the ecosystem and humankind. The rise in temperatures, precipitations, melting ice, or the increase in ocean acidification have drastically changed the environment and, therefore, the life cycle of land and marine species. Human is impacted, global warming threatens food security, risks aggravating health problems and generating migratory movements. The poorest countries and populations are the most at risk, thus increasing existing inequalities (IPCC, 2014).

Several mitigation pathways are achievable, but all require substantial reductions in greenhouse gas emissions in the coming decades and are expected to reach zero by the end of the century. Therefore, nations face many technological, economic, and societal challenges. The private sector holds a central role in reducing greenhouse gas emissions and in its power to act, together with the public sector, in financing adaptation and mitigation (IPCC, 2014).

Several financial instruments can be used to finance green projects, such as grants, stocks' and bonds' issuance, or the allocation of credits. This study focuses on equity portfolios composed of green companies.<sup>2</sup> Indeed, these green financial indexes are marked by very high heterogeneity. The methods of selecting companies differ from one index to another. Some indexes favor a "best-in-class" approach, choosing the best companies for all sectors. In contrast, others apply an exclusionary method, excluding companies that do not meet specific socio-environmental criteria. We also observe a plurality in assessing a company's "green" character; qualitative or quantitative ways. Finally, green financial indexes are diverse in their environmental sectors' representation; some indexes focus on specific sectors while others cover the full range of green activities (Inderst et al., 2012).

Faced with such a plurality, it is costly for investors wishing to invest in these products to know which index to select. Investors may be all the more reluctant as they fear "greenwashing",<sup>3</sup> the high volatility of these indexes returns, or because they do not perceive the financial climate risks to which they are exposed. This last point particularly echoes Mark Carney's 2015 speech to Lloyd's of London explaining that *"climate change is the Tragedy of the Horizons."* The climate change consequences will felt over a time horizon beyond one of the current economic actors, which creates no incentive to bear its cost at the expense of future generations. The short-termism of markets amplifies this phenomenon.

 $<sup>^{2}</sup>$ A green company is a company with "non-damaging" activities for the environment. The literature generally identifies activities related to renewable energy, wastewater treatment, and energy efficiency as "green". The nuclear and hydroelectric power sectors are controversial, while biofuels and shale gas generate consensus shifts (Inderst et al., 2012).

<sup>&</sup>lt;sup>3</sup>As defined in Bachelet et al. (2019), "the term of greenwashing includes companies that declare a commitment to environmental responsibility that is greater than in reality".

Nevertheless, since the signing of the Paris Agreements in 2015, we have seen a growing awareness of environmental issues reflected in the increasing growth of investments in the green energy sectors (BloombergNEF, 2020). The signal is positive, but the amounts remain insufficient if we want to stay on track for global warming under two degrees; according to the IPCC (2014), investments in low-carbon energy technologies or energy efficiency must increase sixfold between 2016 and 2050.

Hence, increasing transparency around green financial products is a necessary condition to achieve this goal. The aim of this paper and thus its main contribution is to assume the cost of information research and therefore bring more readability around green energy indexes.

First, we identify among green indexes those that meet the following criteria: (i) the index provides a global representation of the green sectors, (ii) the companies' screening method is exclusive, (iii) the build-up index method is transparent, and (iv) the companies' list in the index is publicly available. Second, we construct a database listing all the firms that have or made up these green indexes over time. Finally, to better understand the dynamics of green indexes, we compare the constituents of the global green index to those of a benchmark index and include a sectoral dimension.

The main results are as follows. Two green financial indexes meet the above criteria: the WilderHill Green Energy Index (ECO) and the WilderHill New Energy Global Innovation Index (NEX). Besides, the green indexes' composition is more volatile than that of the financial benchmark (S&P Global 1200). Indeed, the environmental market is younger; the companies in the index are more likely to default, be acquired by a larger group, or fail to achieve sufficient capitalization to make up the index from year to the next. Lastly, few firms jointly compose the worldwide green index (NEX) and the financial benchmark.

Our results are of relevance to investors, academics, and governments. They enable investors to better understand green indexes relative to a benchmark and, therefore, to optimize their investment behavior. For academics, the database clears the way for further studies, such as analyzing the interconnection between the green stock index (NEX) and the financial benchmark (S&P Global 1200) worldwide (with or without a sectoral grid) and without fear of statistical bias. This database can also allow a more microeconomic investigation of the companies constituting the green indexes and their various low-carbon strategies. Finally, for public authorities, these results raise the matter of reorienting financial portfolios towards climate issues. Indeed, financial benchmarks, such as the S&P Global 1200, are proxies for economic activity and serve as a reference for financial professionals. This last point is all the more true since, in recent years, we have witnessed strong growth in ETFs (Exchange Traded Funds), financial products whose sole purpose is to replicate the performance of a given index and not to outperform it. Further, to be included in a mainstream index, a high capitalization is required, which creates an overweight of companies belonging to the fossil fuel sectors. In Stephens and Guez (2018), they show that the vast majority of benchmarks have a composition implying a trajectory, not towards two degrees of warming but five degrees (on average). Therefore, we strongly encourage public authorities to seize this issue and, in particular, to rebound from the pandemic crisis, not to rebuild society as it was before but as it will be tomorrow. One course of action would be to implement large-scale policies redirecting financial flows towards greener activities and ensuring that environmental issues are better taken into account.

The paper is organized as follows. Section 1 describes green energy investment trends. Sections 2 and 3 present the green energy and the benchmark index selected. Section 4 outlines the main results by comparing the green and sectoral indexes' components, and Section 5 concludes the paper.

## 1 Green investment trends



Figure 1: Investments in global green energy and upstream oil and gas sectors

Source: Right axis - World Energy Outlook, IEA (2016; 2020); Left axis - BloombergNEF's Clean Energy Investment Trends report (2020).

Figure 1 displays investments in green energy (blue) and upstream oil and gas sectors (black) worldwide from 2006 to 2020 and emphasizes that fossil energy investments are higher than those for green energy in absolute value (\$bn). Nevertheless, the 2014 oil prices drop has led to a substantial fall in oil and gas investments, while those for the green energy sector continue to rise. This result is encouraging, but as underlined in the introduction, the financial needs to move toward low carbon economies require much more.

When we focus on the pandemic crisis effects on these sectors, we observe first that both have

declined. During the Great Lockdown, the oil demand was almost at a standstill, and producers faced barrel storage capacity problems. It created panic in the WTI futures market,<sup>4</sup> causing oil prices to fall into negative territory, from \$18 to \$-37 a barrel (Mignon, 2020). Not surprisingly, investments in oil and gas decreased sharply. However, assuming that the substitution effect between the two sectors occurs, one would expect a shift in investments to alternative energies.

Nevertheless, as this figure shows, this is not the case, and even more, the drop in investments for green energy is more pronounced than for fossil energy. This phenomenon echoes the literature on the subject, emphasizing the absence of a clear relationship and, therefore, substitution effects between the green and fossil sectors (Henriques and Sadorsky, 2008). The substantial drop in green energy investments could be lightning with regards to its composition. Indeed, as outlined in Figure 2, which identifies all classes of new green energy investments, the vast majority falls into the asset finance category. This asset class surveys all new renewable projects (excluding large hydro) financed by companies' internal balance sheets, loans, or equity capital. For instance, in the second quarter of 2020, new investments in asset finance amount to \$52 billion against \$13 billion in small scale solar, \$1 billion in public markets, and \$1 billion in venture capital and private stock (VC&PE).<sup>5</sup>



Figure 2: New global green energy investments by asset class (\$bn)

Source: BloombergNEF (2020). For asset class definitions, we refer the readers to this report.

As a result, we infer that green companies bear a large part of the project execution risk. In regular periods, the feasibility of green projects stands almost exclusively on government

<sup>&</sup>lt;sup>4</sup>West Texas Intermediate Crude Oil

<sup>&</sup>lt;sup>5</sup>For exact definitions of asset classes, we refer readers to the following reports: BloombergNEF (2020) and Frankfurt School-UNEP Centre (2020).

incentives such as feed-in tariffs, tax incentives, or green certificates. These incentives secure the revenues allowing green projects to become "bankable." Hence, the future cash flows are more predictable, encouraging lenders to provide debts (Frankfurt School-UNEP Centre, 2020). Nevertheless, in times of great uncertainty, such as that created by the pandemic, investors seek safe placements. As a result, they withdrew their risky investments such as green assets and move to safer products; this is the "fly to liquidity" effect (Longstaff, 2002). Lastly, from an ethical point of view, investors are more prone to finance the environmental transition in periods of expansion, whereas financial concerns prevail in times of crisis.

These phenomena shed some light explaining why the decline in new green energy investments is so sharp. Moreover, as shown in Figure 3, this downturn has affected all geographic areas with a notable decrease for the United States (-60.36%) and China (-52.58%) and a more moderate fall for Europe (-33.66%) over the year. On this last point, we identify that Europe even experienced a strong rebound in new green energy investments in the second quarter of 2020 (142%), mainly driven by offshore wind projects. In fact, in 2020, four of the top five asset finance deals are European, with offshore wind projects in the Netherlands and the United Kingdom in first and second place – the "Vattenfall Hollandse Zuid Offshore Wind Portfolio" (\$3,850m) and the "SSE Seagreen Offshore Wind Portfolio Phase I" (\$3,839m), respectively. France takes fourth and fifth place with the offshore wind projects "EDF and Enbridge Fecamp Offshore Wind Farm" (\$2,713m) and "Iberdrola St Brieuc Offshore Wind Farm" (\$2,664m) (BloombergNEF, 2020).<sup>6</sup>

As displayed by Figure 3a, we observe that over time the top leaders of new green energy investments are APAC (Asia Pacific region), EMEA (Europe Middle East and Africa region), and AMER (North Central and South America regions) with China, Europe, and the United States (BloombergNEF, 2020). However, the first position has shifted several times over the period studied between these three markets (Figure 3b). Europe has started as the dominant player until 2011, at which time European green investments start to decrease drastically, and thus has been overthrow by China in 2013. Indeed, there was a slowdown in the solar boom for Germany and Italy, while at the same time, China raised its investments in solar PV (photovoltaic) and wind (Frankfurt School-UNEP Centre, 2020). Since then, China has remained the "green" leader, although it experienced a sharp drop in investments in 2016 resulting from the financial crisis (Frankfurt School-UNEP Centre, 2017). Chinese top position can notably be related to its internal policy of energy independence (Zou et al., 2020). Moreover, the United States was overthrow by China in 2009 and has since moved closer to Europe. However, in 2019, we observed strong growth of U.S. new green investments as "developers rushed to qualify for tax credits before they expire" (Frankfurt School-UNEP Centre, 2020).

<sup>&</sup>lt;sup>6</sup>The third place is reached by an offshore wind project in Taïwan, the "CIP Changhua Zone Changfang Xidao Offshore Wind Portfolio" (\$3,632m).



Figure 3: Global new green energy investments (\$bn)

(a) By geographical zones







Source: BloombergNEF (2020). Note: APAC, Asia-Pacific region; EMEA, Europe Middle East and Africa region, and AMER, North Central and South-America region.

Finally, the leaders in the environmental sectors are unquestionably solar and wind, as underlined in Figure 4. Indeed, there has been a substantial decline in the cost of generating electricity from wind and solar since 2009 (Figure 5). The largest decline has been for PV technologies, from \$300 per MWh in 2009 to \$136 in 2013 and \$50 in 2019. We also notice a sharp drop in offshore wind electricity costs, from \$230 per MWh in 2012 to \$78 in 2019. The cost of onshore wind, for its part, is quite stable and has seen a relatively less pronounced decline than its peers, with \$92 per MWh in 2009 to \$48 in 2019. The fall in wind and solar electricity costs is related to lower capital costs (such as turbines) and increased equipment performance. Since the last reductions in the renewable energy electricity cost, two-thirds of the world's population live in a country where solar and/or wind electricity is the cheapest resource. Of course, this last point depends on several national factors such as the country's natural resources, its internal policies, or its finance cost characteristics (Frankfurt School-UNEP Centre, 2020).



Figure 4: Global new green energy investments by sectors (\$bn)

Source: BloombergNEF (2020).

Figure 5: Green electricity costs over time (\$/MWh)



Source: Frankfurt School-UNEP Centre (2020).

## 2 The green energy index

As we emphasized in the introduction, it is not always simple to select a green energy index as these products are highly heterogeneous. Therefore, in this section, we outline the criteria that led us to choose the "WilderHill New Energy Global Innovation Index (NEX)" as a green benchmark and therefore focus our analysis on this index.

#### 2.1 Which green energy index?

First of all, we select the green indexes that meet the following criteria. The green index must provide an overall representation of environmental sectors, apply an equal weighting method (some companies must not lead the index), follow an exclusionary approach, and provide a list of the companies making up the index for each year. It must also have a temporality sufficiently long and serve as a reference for financial investors and academics.

Two green energy indexes meet these criteria and focus respectively on the U.S. and global markets: the WilderHill Green Energy Index (ECO) and the WilderHill New Energy Global Innovation Index (NEX).<sup>7</sup> In this study, we select the NEX as the benchmark green index; it is more meaningful to analyze the global level before going down to a finer level. Therefore, we make an exhaustive presentation only of the NEX, but for the sake of completeness, we provide in the appendix the ECO index components (Table A3).<sup>8</sup>

The NEX index is composed of nearly 100 companies "whose innovative technologies focus on generation and use of cleaner energy, conservation, efficiency, and the advancement of renewable energy  $[\ldots]$ " (NEX Rule Book, 2020). It is calculated by Solactive using a modified equal-weighted methodology, is quarterly restructuring, and no share may exceed 5% of the total weight.

The eligibility criteria are several: (i) at least half of the companies are listed outside the U.S. stock market, (ii) a minimum of 10% of the companies' market value must be related to their green activities, and this index favors "purer play" – 50% of companies' market value comes from green activities, (iii) small and medium-sized companies can play a leading role in the index, while larger companies make up the index if they have a growing activity in green sectors or if they are a benchmark, and (iv) the conglomerates' number is limited to 20% of the index composition.

The selection process imposes that companies have to be listed on a national stock exchange or primary market. They must have a three-month average market capitalization of at least

<sup>&</sup>lt;sup>7</sup>We do not retain the S&P Global Green Energy Index because we do not have access to the index's composition (only the composition of its underlying ETF).

<sup>&</sup>lt;sup>8</sup>A potential extension of this work would be to carry out a comparison between the green indexes of different geographical areas.

\$100 million and a high volume of transactions.

Finally, several subsectors compose the index: Energy Conversion, Energy Efficiency, Power Storage, Renewables – Biofuels and Biomass, Renewable – Other, Renewable Solar, and Renewable – Wind (NEX Rule Book, 2020).<sup>9</sup>

## 2.2 The NEX

As one of our key objectives is to provide greater clarity around green energy indexes, we build a database listing all companies in the green index selected, the NEX. These data may help academics or investors gain better insights into the green energy market and the diverse companies that make up this index over time.

We retrieve the NEX index's composition every first quarter of the year, from 2006 – its launch date – to 2020.<sup>10</sup> This database is freely available on the NEX website and allows us to get companies' names, geographic locations, affiliated environmental sectors, and weights in the index.

First, Table A2 presents the list of companies (rows) that have made up or are making up the NEX between 2006 and 2020. For each year (columns), if the company is included in the index, the value is 1 and 0 otherwise. We highlight several results. On average, the index comprises 95 companies, although each year, the companies' number increases. The index is growing, which is in line with the increasing demand for green investments. Besides, over the entire period, 309 companies made up the index, highlighting high volatility in company inflows and outflows. We can explain this phenomenon by the youthfulness of the environmental market and the NEX eligibility criteria. Indeed, in green markets, companies are more likely to go bankrupt, be absorbed by larger firms, or not be able to obtain sufficient capitalization from one year to the next.

Second, Tables A4 and A5 represent the geographical distribution of the index, i.e., the percentage of companies making up the index according to their country or geographical area.<sup>11</sup> For all years, the top three countries in the index are the United States, Germany, and Japan (on average 32.40%, 8.44%, and 6.74%, respectively). Therefore, even though more than 50% of companies locate outside the U.S. market, the U.S. remains the leading country in the index's composition. China appears in fourth place, followed by Hong Kong (with 6.43% and 5.26%, respectively). Over time, the leading roles of the United States and Germany are diminishing. For example, 43.21% of the index companies were American in 2006, but only 24.18% in 2020. On the contrary, the Asian companies in the index are growing, particularly in China, Hong

<sup>&</sup>lt;sup>9</sup>We provide the definitions of the environmental sectors in Table A1 in the appendix.

<sup>&</sup>lt;sup>10</sup>Due to a lack of data availability, we recover the index compositions in the fourth quarter for 2006 and 2007. <sup>11</sup>UN standards determine the country's assimilation to a geographical area

<sup>&</sup>lt;sup>11</sup>U.N. standards determine the country's assimilation to a geographical area.

Kong, Taiwan, and South Korea. For instance, the share of Chinese companies amounts to 2.27% in 2007 against 10.99% in 2020. At last, we also have a growing position of European economies leading by Northern countries. We infer that the NEX composition correctly follows the evolution of the leading economies in the green energy market (see Section 1), notably the growing role of Asian economies such as China.

Third, Table A6 displays the NEX environmental sector breakdown for each year (see Table A1 for the environmental sector definitions).<sup>12</sup> The energy efficiency, wind, and solar sectors make up the bulk of the index, accounting respectively for 27.23%, 23.73%, and 23.34% of companies. On the contrary, energy conversion and storage companies play a smaller role, at 1.82% and 5.33%, respectively. Besides, the share of index companies in biofuels and biomass represents on average 10%, which is still significant. Nevertheless, biofuel companies' share is declining over time, from 14.26% in 2008 to 8.80% in 2020. This result underscores the changing consensus around these activities. The impact of biofuels on greenhouse gas emissions is not unanimous. It depends on raw materials or agricultural practices; sometimes, the net outcome is unfavorable due to deforestation, overexploitation of land and water resources, or the destruction of biodiversity. Biofuels' growing demand has also contributed to rising food prices, threatening the poorest' food security (FAO, 2008). Furthermore, as expected, there is an increase in the shares of wind and solar companies in the index.

Finally, as Table A7 points out, the companies' average weight is about 1% in the index's constitution, while the minimum and maximum are about 0.25% and 2%, respectively. This result is reassuring as the risk that few companies drive the market variations is low.

In summary, we have chosen the WilderHill New Energy Global Innovation Index (NEX) as the benchmark index for alternative energy. The NEX index composition highlights that (i) green energy indexes are highly volatile,<sup>13</sup> (ii) the NEX tracks changes in the green energy market, i.e., geographically or in environmental sectors, and (iii) company weights are limited in the index.

## 3 The financial benchmark

Regarding the choice of the benchmark, we select an index that provides both a global and sectoral representation of the world stock market. Indeed, let us recall that one of this paper's goals is to provide an exploitable database for further studies. Thus, the inclusion of a sectoral dimension offers a greater data granularity and thus opens the field of perspectives. For example, it would be interesting to analyze the interconnection between green stock assets and sectoral ones to refine our analysis of green financial products.

<sup>&</sup>lt;sup>12</sup>Before 2008, sector names were different. For further details: https://nexindex.com/

 $<sup>^{13}\</sup>mathrm{We}$  found the same results for the ECO index (Table A3).

#### 3.1 Which sectoral stock indexes?

To select the sectoral stock indexes, we first choose an Industry Classification System (ICS). There are two main industrial classifications. The production-oriented classification matches companies by business activities in identifying similar production processes. The best known is NAICS (North American Industry Classification System, 1997), which reflects North American economic activity. In contrast, the market-oriented classification selects firms that meet similar demands and operate in the same markets. The financial community follows this classification, especially for stock screening, risk management, stock index building, or sector identification. The best known are GICS (Global Industry Classification Standard, 1997) and ICB (Industry Classification Benchmark, 2001) (Phillips and Ormsby, 2016, for a survey). We aim to compare the green and nongreen indexes; thus, choosing a market-oriented classification is intuitive. Moreover, these classifications allow a more reliable representation of the sectoral concentration (Hrazdil and Zhang, 2012) and perform to explain stock market return comovements (Bhojraj et al., 2003).

Second, we discriminate between market-oriented classifications. The Dow Jones and the FTSE produce the ICB, which is more suitable for European case studies, while the Standard & Poor's (S&P) and the MSCI provide the GICS, which better fits for U.S. or worldwide analyses. Our study focusing worldwide, we select the GICS classification: the latter is the first market-oriented classification (developed in 1999), is revised annually, and contains four hierarchical classifications – 11 sectors, 24 industry groups, 69 industries, and 158 sub-industries.

Finally, we focus on sectors as the risk of going down to a more refined level is to drown out information and select the subindexes of the S&P Global 1200 – S&P Global 1200 Communications Services, Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Information Technology, Materials, Real Estate, and Utilities.

The S&P Global 1200 is a global index capturing 70% of the world's market capitalization covering seven regions and thirty countries. It is composed of seven sub-indexes: S&P 500 (U.S.), S&P Europe 350, S&P TOPIX 150 (Japan), S&P/TSX 60 (Canada), S&P/ASX All Australian 50, S&P Asia 50, and S&P Latin America 40. Each company in the index must meet liquidity requirements, and each region has a corresponding sectoral representation. Moreover, each region's weight corresponds to its relative size in the global stock market based on a "float-adjusted market value" method. The restructuring is quarterly, and the launch date is in 1999 (S&P Dow Jones indexes).

## 3.2 The S&P Global 1200

We retrieve on Datastream the S&P Global 1200 sectoral indexes' compositions from 2006 to 2020; we get the companies' names with their introduction year, asset class, exchange market,

sector, and sub-sector. We do not have companies' weights in the indexes. Besides, before analyzing the S&P Global 1200 compositions, we assess the impact of the 2018 GICS restructuring on this index. The communications services sector – earlier the telecommunications services – includes companies formerly belonging to the consumer discretionary and information technology sectors (MSCI). We found that 33 companies over 1200 have changed sectors, which is negligible (Table A8).

First, we observe that the index composition grows over time -1073 companies in 2006 versus 1219 in 2020 – but is much less volatile than the NEX (Table A9).<sup>14</sup> This result is not surprising as this index is older than the NEX, and companies are characterized by greater capitalization and liquidity.

Second, according to Table A10 representing the distribution by country of the S&P Global 1200, the top three countries in the index are the United States, Japan, and the United Kingdom – on average, 41.36%, 12.79%, and 7.70%. Canada and France follow these countries with 4.78% and 4.49% of the index's average weight, respectively. Moreover, after Japan, the leading Eastern Asian country is Hong Kong (in eight position), and China does not have a preponderant role in this index. The analysis by geographical zones (Table A11) reinforces these results. The index is mainly composed of American and mostly Northern American companies – roughly 50% of the index composition. European companies with Western and Northern European companies follow American ones. Asian companies play a non-negligible role, representing 20.28% of the index composition: Eastern Asia and notably Japanese companies drive this result. These outcomes remain unchanged over the years.

Finally, regarding the S&P Global 1200 sectoral distribution (Table A12), the sectors with the highest weight are those of industry (16.25%), finance (16.16%) and discretionary consumption (12.26%), while the energy, real estate, and communication services sectors are the ones with the lowest weights – 4.93%, 4.94%, 5.44%, respectively. The S&P Global 1200 composition reflects the heterogeneities among the world's economic sectors.

In summary, we select the S&P Global 1200 sectoral indexes as a benchmark, and several considerations support this choice: choosing a market-oriented classification, focusing on the global market, and therefore using the GICS rather than the ICB classification. Also, working on the S&P Global 1200 sectoral indexes is suitable as they have a long history, serve as a reference for investors, and we have access to their compositions.

 $<sup>^{14}\</sup>mathrm{We}$  cannot provide the S&P Global 1200 companies' list as we retrieved the data from the paid software Datastream.

## 4 The green index vs. the benchmark

			S&P	NEX	S&P	NEX
NEX	S&P Global 1200	Sectors	Date	Date	Weight	Weight
aisin seiki	""	cons discr	2006-2020	2006-2007	NA	1.48%
archer daniels midland	""	cons staples	2006-2020	2006	NA	1.52%
brookfield renewable energy	brookfield asset man	financials	2006-2020	2012-2013	NA	1.87%
credit suisse real estate fund green property	credit suisse group	financials	2006-2020	2019-2020	NA	0.88%
edf energies nouvelles	edf	utilities	2006-2020	2007 - 2011	NA	2.08%
fortum oyj	11 11	utilities	2006-2020	2006-2015	NA	1.68%
iberdrola renovables sa	iberdrola	utilities	2006-2020	2006-2011	NA	2.34%
johnson controls inc	johnson controls intl.	industrials	2006-2020	2009-2016	NA	1.60%
johnson matthey		materials	2006-2020	2006	NA	0.91%
kingspan group		industrials	2006-2020	2007-2020	NA	1.46%
marubeni		industrials	2006-2020	2006	NA	3.41%
novozymes a/s series	novozymes b	materials	2006-2020	2006-2020	NA	1.39%
nrg yield inc	nrg energy	utilities	2006-2020	2017 - 2018	NA	1.65%
orsted		utilities	2016-2020	2018-2020	NA	1.39%
rwe		utilities	2006-2020	2006	NA	1.36%
				2016 /		
samsung sdi co	samsung electronics	info tech	2006-2020	2018-2020	NA	1.29%
sekisui chemical ltd	sekisui house	cons discr	2006-2020	2006	NA	0.98%
siemens gamesa renewable	siemens	industrials	2006-2020	2018-2020	NA	1.35%
signify nv (philips lighting nv)	philips eltn.koninklijke	health care	2006-2020	2017-2020	NA	1.52%
sociedad quimica y minera de chile		materials	2006-2020	2019-2020	NA	1.34%
umicore	""	materials	2006-2020	2006-2009	NA	1.52%
vestas wind systems	""	industrials	2006-2020	2006-2020	NA	1.73%

#### Table 1: Companies in both NEX and S&P Global 1200

Sources: Datastream and the WilderHill New Energy Global Innovation Index

Note: this table shows all companies in both the NEX and the S&P Global 1200 over time – we consider a group and its subsidiaries similar. The date and weight columns are, respectively, the years in which the companies make up the index and their average weight (in %). The S&P Global 1200 companies' weights are not available.

Table 1 displays all similar components between the NEX and the S&P Global 1200; we consider a group and its subsidiaries as identical, e.g., "brookfield renewable energy" and "brookfield asset man". If a company is in both indexes, we report its economic sector, its entry and exit dates in the indexes, and the NEX company's weight – we do not have these data for the S&P Global 1200.

Twenty-two companies are in both the NEX and the S&P 1200. In ascending order, six are in utilities, five in industrials, four in materials, two in consumer discretionary and financials, one in consumer staples, health care, and information technology. All of these companies are in the S&P Global 1200 each year, but 22 companies out of roughly 1200 are negligible. For the NEX, the periods when these 22 companies make up the index are highly volatile and low. For example, ten of these companies are in the index for less than two years, and only three each year: Kingspan Group (2007-2020), Novozymes (2006-2020), and Vesta's wind systems (2006-2020). These companies' weights are moderate – 1.46%, 1.39%, and 1.73%, respectively (average for all years).

In sum, few companies are simultaneously in the green and financial benchmarks over time. The policy implications of these results are discussed in the conclusion.

#### **Descriptive statistics**

As emphasized in the previous sections, we select the NEX and the S&P Global 1200 Communication Services, Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Information Technology, Materials, Real Estate, and Utilities. The data comes from Datastream, and the period runs from 2006-03-06 (NEX launch date) to 2020-06-19 daily. All the variables are in the first logarithmic difference (Figure A1) to deal with non-stationarity issues (Table A13).<sup>15</sup>

First, Table A14 shows that the variables display the usual financial series properties : (i) the asset return means are zero, (ii) the series' skewnesses are less than zero – with minimums of – 1.08 and -0.67 reached by the energy and NEX indexes,(iii) series have asymmetric distributions spreading to the left – distribution tails are ticker than those of the Normal law, implying a higher probability of extreme points, and (iv) we reject the null hypothesis of normality at the 5% significance level.

Second, according to Figure A2, all variables' correlations are significant, positive, and high. Regarding the NEX, the highest correlations are with the industrial (0.842), material (0.841), and financial (0.795) indexes, while the health care (0.651), utility (0.656), and consumer staple (0.667) sectors have the lowest correlations.





Source: Datastream

<sup>&</sup>lt;sup>15</sup>According to Augmented Dicker-Fuller – ADF (Dickey and Fuller, 1981), Kwiatkowski-Phillips-Schmidt-Shin test – KPSS (Kwiatkowski et al., 1992), and Philips-Perron – PP (Phillips and Perron, 1988) tests, all series in logarithm are non-stationary at conventional levels. In the first log difference, all tests conclude that all series are stationary at 5%.

Finally, Figure 6 draws the NEX and the S&P Global 1200 sectoral indexes (in logarithm). We observe that these variables co-move strongly and undergo significant drops in crisis times, e.g., 2008 and 2020. The NEX is more volatile than the S&P Global 1200 sectoral indexes, linked to the "fly to liquidity" mechanism and the green stock index's volatile constitution (see Sections 1 and 2, respectively).

For NEX, its prices were high between 2007 and 2008; during this period, we recorded strong global demand, very high oil prices, and significant government subsidies to environmental sectors. Nevertheless, its prices dropped during the global financial crisis and never returned to their pre-crisis levels. In 2013, the index prices rose again until the Covid-19 crisis, which generated a strong market crash. This drop appears nevertheless temporary as the index prices returned to their pre-pandemic levels; however, it is still early to estimate the pandemic impact on the financial sphere.

## 5 Conclusion

In recent years, green energy investments have been on the rise but remain insufficient to limit global warming below two degrees. Several factors hamper investors in their commitment to finance green projects and notably the lack of information around them. The lack of readability is particularly striking around green financial indexes as they are characterized by strong heterogeneity both in the company selection process or green assessment. Therefore, this article aims to provide information about green indexes, thus helping to fill this gap.

First, we discriminate between several green financial indexes based on established criteria: (i) the index provides broad coverage of the environmental sectors, (ii) the index construction method is transparent, (iii) the companies are selected using the exclusionary method, and (iv) all company lists in the index are publicly available for all years. As a result, we select the WilderHill Green Energy Index (ECO) and the WilderHill New Energy Global Innovation Index (NEX). Although we provide the constituents of both indexes, we focus our analysis on the worldwide green index, the NEX. The NEX correctly tracks the green energy landscape, with a growing role for Asian economies, wind, and solar sectors. However, we note that the green energy index is highly volatile in its composition, with many companies joining and leaving it each year. The youth of the environmental market and the NEX eligibility criteria can explain this volatility.

Second, we choose the S&P Global 1200 as the benchmark for the global financial index and recover its sectoral sub-indexes (i.e., communication services, consumer discretionary, consumer staples, etc.) In comparing the green and financial benchmarks, we point out that few companies simultaneously compose both indexes over time. This result allows for further academic studies in this field since the risk of multicollinearity between these indices has been ruled out. For example, it would be interesting to analyze the interconnection between the green market and the benchmark with a sectoral grid. Additionally, this database could be used to measure the carbon footprint of the green index and compare it to the benchmark. It would also be worthwhile to expand the analysis using the IPCC (2014) projections and study whether the green energy indexes are on track for global warming below two degrees.

Finally, this result highlights the low coverage of green companies in global benchmarks. Today, finance is not structured to redirect financial flows towards a climate-friendly world, even though this is critical. Financial indexes, such as the S&P Global 1200, serve as a benchmark for financial professionals and are particularly appreciated since the ETF boom. However, these indices are characterized by high capitalization and liquidity requirements, resulting in a bias toward carbon-intensive companies. The responsibility does not lie with the index, which is a representation of the current economic sphere. However, it seems necessary to break out of this spiral to create tomorrow's world rather than reproducing today's environment.

We therefore strongly encourage public authorities to rebound from the pandemic crisis by rebuilding greener societies and adopting ambitious environmental policies.

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## A Appendix

NEX sectors	Abb	Definitions
Energy Conversion	ECV	"The Energy Conversion sector covers conversion technologies and fuels. Hydrogen & fuel cell technology for example is included, from production and storage of hydrogen, to distribution as well as related technologies. [] Advanced turbines, and lower-carbon fuel systems may also be covered in this sector, as well as potentially whole systems such as alternative fuel vehicles allowing renewables to power new greener transportation."
Energy Efficiency	EEF	"Companies in this sector are working to deliver step-change improvements in efficiency of existing generation and distribution systems. Important technologies include software to improve electricity demand management or reduce grid losses, as well as breakthroughs in motor or generator design. This sector could also include technologies for combined heat and power (i.e. those which enable the capture and use of waste heat from power generation). [] We may include in this sector technologies that reduce use of energy in homes, retail and commercial buildings. These may include building components that reduce energy use, intelligent systems for managing power consumption and technologies that more efficiently use power. Note: Nuclear power is not considered green energy for purpose of this Index, and it is thus Excluded (very minor tangental involvement will not disqualify a company)."
Energy Storage	ENS	"We include here too newly emerging storage technologies, and also extant mechanical technologies like flywheels and components like ultra-capacitors, which are potentially complimentary with batteries. Systems built around large-scale storage such as EVs (Electric Vehicles) like electric cars, electric buses and trucks, electric ships, trains and planes etc. might potentially be included here as well."
Renewables, Biofuels and, Biomass	RBB	"Liquid transportation fuels including biodiesel and bioethanol can be derived from a range of biomass sources, including sugar cane, rapeseed/canola, soybeans, and importantly ahead as being greener, cellulosic biomass. The Index may include suppliers of biofuels, of the processing technologies and equipment, logistics and distribution players, manufacturers of energy systems specially adapted for the use of biofuels and products. The Index may also include companies involved in production and consumption of solid or gaseous fuels derived from biomass. Solid biomass can also consist of crop residues such as straw. []"
Renewables. Other	ROH	"This sector allows coverage of companies active in renewable categories other than main ones of solar, wind. For example, geothermal power has long played a part in the energy mix of countries with natural geothermal resources, such as Iceland and Japan. [] Hydroelectric too is seeing some new use as the world shifts to new energy solutions, but with understandable controversies about its ecological impacts and so sustainability of large-scale hydroelectric power projects; that said there's interesting advances in smaller-scale, low-head hydro and even micro-scale, the latter technologies aenerally preferred for this Index."
Renewables, Solar	RSR	"The Solar sector covers all technologies that capture energy directly from the sun, either using a photovoltaic (PV) material, or via solar thermal technologies such as concentrators, stirling engines etc. The solar energy sector is already substantial - and growing quickly. []"
Renewables, Wind	RWD	"Wind is a major and growing renewable technology that's had relatively large impacts on (green) energy usage over the past few decades. [] This Wind sector includes components, parts and subassemblies for wind turbines, as well as manufacturers of turbines themselves. Also new fields relating to wind are starting up. And a big portion too of this sector increasingly consists of related developers, generators, utilities and engineering firms that have sprung up to exploit opportunities to build wind farms around the world."

## Table A1: Definitions of the environmental sectors in the NEX index

Source: WilderHill New Energy Global Innovation Index (https://nexindex.com/Sector\_Definitions.php) Note: ECV: Energy Conversion, EEF: Energy Efficiency, ENS: Energy Storage, RBB: Renewables - Biofuels & Biomass, ROH: Renewables - Other, RSR: Renewable - Solar, RWD: Renewable - Wind.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Σ
5n plus inc	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
a123 systems inc	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	3
abengoa sa	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	10
acciona sa	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	9
actelios spa	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
active power	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
acuity brands inc	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	8
advanced battery technologies	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
advanced lithium electrochemistry	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
aerovironment inc	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	6
aisin seiki co	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
aixtron se	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	4
akenerji elektrik uretim	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	5
albioma sa	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	7
ameresco inc	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	10
american superconductor	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	8
amyris inc	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3
anhui bbca biochemical	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
ao smith corp	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	6
apollo solar energy	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
archer daniels midland	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
arima optoelectronics corp	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
atlantica yield plc	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
ats automation tooling	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
audax renovables sa	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
aventine renewable energy	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
avista	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ayen enerji	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3
babcock & brown	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	4
baldor electric co	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	5
ballard power systems	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	11
baoding tianwei bao	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
bcpg pcl	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
bharat heavy elect	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
bkw fmb energie	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	3
bloom energy corp	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
blue solutions	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3
boralex inc	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	6
brasil ecodiesel industria	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	3
broadwind energy inc	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
brookfield renewable energy	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2

Table A2: NEX index composition for all years

byd co ltd	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
canadian hydro developers	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	4
canadian solar inc	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	7
canvest environmental protection	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
capital stage ag	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	4
capstone turbine corp	1	1	1	1	1	0	0	0	1	1	0	0	0	0	0	7
caverion corp	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
centrotec sustainable ag	0	1	1	0	0	0	0	0	1	1	1	0	0	0	0	5
centrotherm photovoltaics ag	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	4
china datang corp	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	6
china everbright international	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	7
china high speed	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	12
china longyuan electric	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
china longyuan power	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	9
china ming yang	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
china power green	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
china power new	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
china singyes solar	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	6
china suntien green	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	4
china titans energy	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	3
china windpower group	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
chugai ro co	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
clearway energy inc	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
climate exchange plc	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
comverge inc	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
conergy ag	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	4
contact energy ltd	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
cosan sa industria	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	9
covanta holding corp	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	8
credit suisse real	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
cree inc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
cropenergies ag	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	4
cs real estate	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
cs wind corp	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
dalian east new	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	4
daqo new energy	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
dialight plc	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	6
distributed energy	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
diversa	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
dong energy a/s	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
drax group plc	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	3
eaga plc	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	3
ebara corp	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3

echelon corp	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	7
ecopro co ltd	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
edf energies nouvelles	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	5
edp renovaveis sa	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	12
ef-on inc	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2
elster group se	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
emcore	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
encavis ag	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
enel green power	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	6
ener1 inc	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	3
energy absolute pcl	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	6
energy conversion devices	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	6
energy development corp	0	0	0	1	1	0	1	1	1	1	1	1	1	0	0	9
energy developments	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	5
enernoc inc	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	11
enphase energy inc	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	6
envitec biogas ag	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	3
eolus vind ab	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
epistar corp	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	12
equipment group	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
erex co ltd	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
ersol solar energy	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
evergreen solar inc	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	4
everlight electronics co	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	5
falck renewables spa	0	0	0	0	0	0	1	1	1	1	1	0	0	1	1	7
fdg electric vehicles	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	5
first solar inc	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
fortum oyj	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	10
fuel systems solutions	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	6
fuelcell energy inc	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	11
gamesa corporacion tecnologica	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	12
gcl poly energy	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	10
gcp infrastructure investments	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	5
gevo inc	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
gigasolar materials corp	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	5
goldpoly new energy	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
green energy technology	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
green plains inc	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	5
greencoat uk wind	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	5
greentech energy systems	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	3
gs yuasa corp	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
gt advanced technologies	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	3
gt solar international	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	3

gurit holding ag	0	1	1	1	1	1	0	0	0	0	0	0	0	1	1	7
gushan environmental energy	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
hanergy solar group	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
hanergy thin film	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
hannon armstrong sustainable	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
hansen transmissions international	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	4
harris & harris	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
hexcel corp	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
huaneng renewables corp	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	6
hydrogenics corp	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
iberdrola renovables sa	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	6
infigen energy	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
infinis energy plc	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
innergex renewable energy	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	9
intelligent energy holdings	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2
international rectifier corp	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	10
itron inc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
ja solar holdings	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	12
japan wind development	0	1	1	1	1	0	0	1	1	0	0	0	0	0	0	6
jinkosolar holding co	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
johnson controls inc	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	8
johnson matthey plc	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
kandi technologies group	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
kingspan group plc	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
kior inc	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	3
landis+gyr group ag	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
ldk solar co	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	4
lextar electronics corp	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
linear technology	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
lsb industries inc	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	5
lsi industries inc	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
lynas corp ltd	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
marubeni corp	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
maxwell technologies inc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	14
medis technologies	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
meidensha corp	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
memc electronic materials	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	8
mercury nz ltd	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
meridian energy ltd	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
meyer burger technology	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	11
mgp ingredients	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
mighty river power	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3
molycorp inc	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3

motech industries inc	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	8
nel asa	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
neo-neon holdings ltd	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	4
neo solar power	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	9
neoen sa	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
nexolon co ltd	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
nibe industrie-b	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
nibe industrier ab	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	8
nio inc adr	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
nordex ag	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
northland power inc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
novozymes a/s series	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
npc inc	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	3
nrg yield inc	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
odelic co ltd	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	3
opower inc	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2
ormat technologies inc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
orsted a/s	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
osram licht ag	0	0	0	0	0	0	0	0	1	1	0	1	1	1	0	5
pacific ethanol inc	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
panda green energy	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
pattern energy group	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	6
phoenix solar ag	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
plug power inc	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	10
pne ag	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
pnoc energy development	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
polypore international inc	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	6
power-one inc	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	7
power integrations inc	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	6
powercell sweden ab	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
powersecure international inc	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3
praj industries ltd	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	7
puget energy	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
pv crystalox solar	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	3
pv crystalox wi	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
q-cells se	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	7
quantum fuel	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
quimica y minera	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
rec silicon asa	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	6
rec solar asa	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
renewable energy corp	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	8
renewable energy group	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	8
renewables infrastructure group	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1	6
5 I																1

renova inc	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
repower systems ag	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
ricardo plc	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	7
rockwool international a/s	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	8
roth & rau	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	5
rubicon technology inc	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	4
rwe st class	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
saeta yield sa	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	3
saft groupe sa	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	11
saltx technology holding	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
samsung sdi co	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	4
sanyo electric co	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	5
sao martinho s/a	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	9
scatec solar asa	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
schmack biogas ag	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
scottish & southern	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
sechilienne sidec	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	6
sekisui chemical ltd	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
senvion sa	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	3
seoul semiconductor co	0	0	0	0	0	1	1	1	1	1	1	0	1	1	1	9
sgl carbon ag	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
sharp corp	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	4
shunfeng international green	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	4
shunfeng photovoltaic international	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
siemens gamesa renewable	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
signify nv	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
silver spring networks	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	4
sino-american silicon products	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	8
sinopoly battery ltd	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
sky solar holdings	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
sma solar technology	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	12
sociedad quimica y	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
solar millennium ag	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	5
solarcity corp	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3
solaredge technologies inc	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	5
solaria energia y	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	5
solarworld ag	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	8
solazyme inc	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	5
solon se	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	5
spcg pcl	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	7
str holdings inc	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
sunedison inc	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3
sunnova energy international	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

sunpower corp	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
sunrun inc	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
suntech power holdings	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	7
sunways ag	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
super energy corp	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
superblock pcl	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
suzlon energy ltd	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	4
taewoong co ltd	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	6
takuma co ltd	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
tanaka chemical corp	0	0	0	0	1	1	0	0	0	0	0	1	1	1	0	5
techem ag	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
terraform power inc	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	6
tesla inc	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	10
the renewables infrastructure	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
theolia sa	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	3
tilt renewables ltd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
toho tenax	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
tpi composites inc	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
transalta renewables inc	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	6
trina solar ltd	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	6
trony solar holdings	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
ultralife batteries inc	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	4
umicore sa	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	4
unison co ltd/south	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2
united photovoltaics group	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	3
united renewable energy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
universal display corp	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	11
utilitywise plc	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	3
vanguarda agro sa	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
veeco instruments inc	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	9
verasun energy corp	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
verbio ag	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
verbio vereinigte bioenergie	0	1	1	0	0	0	0	0	0	0	0	1	0	1	1	5
verbund ag	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
verenium corp	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
vestas wind systems	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
vivint solar inc	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	6
voltabox ag	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
w-scope corp	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
wacker chemie ag	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
wasion group holdings	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	9
west holdings corp	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	7
willdan group inc	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2

woongjin energy co	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
xinjiang goldwind science	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	12
xinjiang tebian	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
xinyi energy holdings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
xinyi solar holdings	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	6
yingli green energy	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	9
zhejiang yankon group	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	5
zoltek cos inc	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	8
Σ	81	88	86	89	86	100	97	94	102	107	104	97	105	109	91	

Source: WilderHill New Energy Global Innovation Index Note: this table represents the list of companies (rows) that composed or made up the NEX index between 2006 and 2020. For each year (columns), if the company belongs to the index, the value is 1 and 0 otherwise.

## Table A3: ECO index composition for all years

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Σ
a123 systems inc	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	3
active power inc	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	5
advanced battery tech	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	3
advanced energy industries	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	7
air products	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
aixtron se	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	6
albemarle corp	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
amer power conversion	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
amer superconductor	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ameresco inc	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	10
american superconductor corp	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	13
amerigon inc	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	5
amtech systems inc	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	4
amyris inc	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	6
applied materials	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	5
aqua metals inc	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2
ascent solar technologies	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	4
atlantica yield plc	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
ballard power systems	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	15
beacon power corp	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
bloom energy corp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
boc group ads	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
broadwind energy inc	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	4
calpine corp	1	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	8
canadian solar inc	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	10
capstone turbine corp	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
cd technologies	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
central vt pub	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

china bak battery	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	4
china ming yang	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	6
china wind systems	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
comverge inc	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	4
cosan ltd	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	7
cpfl energia sa	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	5
cree inc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
cypress semiconductor	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
cytec industries inc	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
daqo new energy	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	7
distributed energy sys	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
echelon corp	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	11
emcore corp	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	6
ener1 inc	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
energy conversion devices	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	7
energy focus inc	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
enernoc inc	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	6
enphase energy inc	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	6
esco technologies inc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
evergreen	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
evergreen solar inc	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	6
first solar inc	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
fuel systems solutions	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	9
fuelcell energy inc	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	13
general cable corp	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
gentherm inc	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	8
gevo inc	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	3
gt advanced technologies	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	3
gt solar international	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
gushan environmental energy	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
hanwha q cells	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	4
hanwha solarone co	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	3
hexcel corp	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	5
hydrogenics corp	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	9
idacorp inc	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	9
impco technologies	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
intermagnetics general	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
international rectifier corp	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	10
itc holdings corp	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	5
itron inc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
ja solar holdings	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	11
jinkosolar holding co	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
kaydon corp	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2

kior inc	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
kyocera corp adr	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
lime energy co	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
livent corp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
lsi industries inc	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	3
magnetek inc	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
maxwell technologies inc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	15
mechanical technology	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
medis technologies ltd	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4
memc electronic materials	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	8
mgp ingredients inc	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
molycorp inc	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3
myr group inc	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
nio inc adr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
nova biosource fuels	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
ocean power technologies	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	4
om group inc	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	9
opower inc	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2
orion energy systems	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
ormat technologies inc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
pacific ethanol inc	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
pattern energy group	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	6
plug power inc	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	12
polypore international inc	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	5
portland general electric	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	3
power integrations inc	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
power-one inc	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3
powersecure international inc	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	5
praxair inc	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
puget energy	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
quanta services inc	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	12
quantum fuel systems	1	1	1	0	1	1	0	0	0	1	1	0	0	0	0	0	7
rare element resources	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	4
raser technologies inc	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
renesola ltd ads	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	5
renewable energy group	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	7
rubicon technology inc	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	7
satcon technology corp	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
scottish power ads	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
semileds corp	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
silver spring networks	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	4
sky solar holdings	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	4
sociedad quimica minera	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	11

sola international inc	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	3
solarcity corp	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3
solaredge technologies inc	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	5
solazyme inc	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	5
spire corp	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
str holdings inc	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	4
sunedison inc	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3
sunnova energy international	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
sunpower corp	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
sunrun inc	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	5
suntech power holdings	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	8
terraform global inc	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
terraform power inc	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	6
tesla motors inc	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	10
tpi composites inc	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
trina solar ltd	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	9
ultralife batteries inc	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	5
universal display corp	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
uqm technologies inc	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	7
us geothermal inc	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	4
valence technology inc	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
veeco instruments inc	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
verasun energy corp	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
verenium corp	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
vivint solar inc	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2
willdan group inc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
woodward inc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
workhorse group inc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
yingli green energy	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	8
zoltek companies inc	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	9
$\sum$	38	40	39	42	51	54	57	56	50	53	53	42	37	40	39	39	

Source: WilderHill Clean Energy Index Note: this table represents the list of companies (rows) that composed or made up the ECO index between 2005 (its launch date) and 2020. For each year (columns), if the company belongs to the index, the value is 1 and 0 otherwise.

Table A4: NEX index composition by country (in %)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean
australia	2.47	2.27	2.33	2.25	1.16	1.00	1.03	1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90
austria	0.00	1.14	1.16	1.12	1.16	1.00	1.03	1.06	0.98	0.93	0.96	1.03	0.95	0.92	1.10	0.97
belgium	1.23	1.14	1.16	1.12	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38
bermuda	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06	0.00	0.00	0.00	0.00	2.86	0.00	0.00	0.26
brazil	1.23	2.27	2.33	2.25	2.33	3.00	3.09	2.13	1.96	0.93	0.96	1.03	0.00	0.00	0.00	1.57
canada	4.94	2.27	2.33	4.49	1.16	0.00	2.06	1.06	1.96	4.67	4.81	5.15	4.76	4.59	6.59	3.39
cayman	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.48	0.00	0.00	0.70
chile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.92	0.00	0.12
china	0.00	2.27	2.33	3.37	2.33	12.00	11.34	9.57	0.98	10.28	9.62	9.28	3.81	8.26	10.99	6.43
denmark	2.47	3.41	3.49	4.49	3.49	3.00	3.09	3.19	2.94	2.80	2.88	3.09	2.86	2.75	3.30	3.15
finland	1.23	1.14	1.16	1.12	1.16	1.00	1.03	1.06	0.98	0.93	0.00	1.03	0.95	0.92	1.10	0.99
france	1.23	3.41	4.65	4.49	3.49	3.00	2.06	2.13	2.94	2.80	2.88	1.03	0.95	1.83	2.20	2.61
germany	12.35	17.05	15.12	11.24	10.47	9.00	6.19	4.26	4.90	5.61	4.81	6.19	5.71	8.26	5.49	8.44
hong kong	1.23	1.14	1.16	2.25	6.98	6.00	6.19	7.45	14.71	8.41	7.69	9.28	1.90	4.59	0.00	5.26
india	3.70	2.27	0.00	1.12	1.16	1.00	1.03	1.06	0.98	0.93	0.00	0.00	0.00	0.00	0.00	0.88
ireland	0.00	1.14	1.16	1.12	1.16	1.00	1.03	1.06	0.98	0.93	0.96	1.03	0.95	0.92	1.10	0.97
israel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	1.03	0.00	0.92	0.00	0.19
italy	1.23	1.14	1.16	0.00	0.00	1.00	2.06	2.13	1.96	1.87	1.92	0.00	0.00	0.92	1.10	1.10
japan	12.35	10.23	8.14	6.74	8.14	5.00	4.12	4.26	4.90	3.74	4.81	6.19	7.62	8.26	6.59	6.74
luxembourg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.06
netherlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	0.95	0.92	1.10	0.27
new zealand	1.23	1.14	1.16	1.12	1.16	1.00	1.03	1.06	1.96	1.87	1.92	2.06	1.90	2.75	4.40	1.72
norway	1.23	1.14	1.16	1.12	1.16	1.00	1.03	1.06	1.96	0.93	0.00	0.00	1.90	1.83	2.20	1.18
philippines	0.00	1.14	1.16	1.12	1.16	1.00	1.03	1.06	0.98	0.93	0.96	1.03	0.95	0.00	0.00	0.84
portugal	0.00	0.00	0.00	1.12	1.16	0.00	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.22
shanghai	2.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
singapore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.06
south korea	0.00	0.00	0.00	0.00	0.00	2.00	4.12	4.26	1.96	1.87	2.88	0.00	1.90	4.59	4.40	1.87
spain	3.70	5.68	5.81	5.62	5.81	5.00	4.12	4.26	2.94	2.80	3.85	4.12	2.86	3.67	5.49	4.38
sweden	0.00	0.00	0.00	0.00	0.00	0.00	1.03	1.06	0.98	0.93	0.96	1.03	1.90	0.92	3.30	0.81
switzerland	0.00	2.27	2.33	2.25	2.33	2.00	1.03	1.06	0.98	0.93	0.96	1.03	2.86	3.67	4.40	1.87
taiwan	0.00	1.14	1.16	1.12	2.33	2.00	3.09	4.26	3.92	3.74	5.77	7.22	5.71	6.42	6.59	3.63
thailand	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06	1.96	1.87	1.92	3.09	2.86	3.67	0.00	1.10
turkey	0.00	0.00	0.00	0.00	0.00	1.00	1.03	2.13	0.98	0.93	0.96	1.03	0.00	0.00	0.00	0.54
uk	2.47	1.14	3.49	4.49	4.65	2.00	0.00	1.06	2.94	5.61	6.73	7.22	6.67	4.59	4.40	3.83
usa	43.21	34.09	36.05	34.83	36.05	35.00	37.11	35.11	36.27	31.78	29.81	25.77	23.81	22.94	24.18	32.40

Source: WilderHill New Energy Global Innovation Index Note: the percentage of companies making up the NEX index by country.

## Table A5: NEX index composition by geographical area (in %)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean
America	<b>49.38</b>	38.64	40.70	41.57	39.53	38.00	42.27	39.36	540.20	37.38	35.58	31.96	42.86	<b>28.44</b>	30.77	38.44
Caribbean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.48	0.00	0.00	0.70
Northern America	48.15	36.36	38.37	39.33	37.21	35.00	39.18	37.23	38.24	36.45	34.62	30.93	31.43	27.52	30.77	36.05
South America	1.23	2.27	2.33	2.25	2.33	3.00	3.09	2.13	1.96	0.93	0.96	1.03	0.95	0.92	0.00	1.69
Asia	19.75	518.18	3 13.95	515.73	22.09	30.00	31.96	35.11	31.37	33.64	35.58	<b>38.14</b>	24.76	36.70	28.57	27.70
Eastern Asia	16.05	14.77	12.79	13.48	19.77	27.00	28.87	29.79	26.47	28.04	30.77	31.96	20.95	32.11	28.57	24.09
Southern Asia	3.70	2.27	0.00	1.12	1.16	1.00	1.03	1.06	0.98	0.93	0.00	0.00	0.00	0.00	0.00	0.88
South Eastern Asia	0.00	1.14	1.16	1.12	1.16	1.00	1.03	2.13	2.94	3.74	2.88	4.12	3.81	3.67	0.00	1.99
Western Asia	0.00	0.00	0.00	0.00	0.00	1.00	1.03	2.13	0.98	0.93	1.92	2.06	0.00	0.92	0.00	0.73
Europe	27.16	539.77	41.86	5 39.33	36.05	30.00	23.71	<b>23.40</b>	26.47	27.10	26.92	<b>27.84</b>	30.48	32.11	36.26	31.23
Northern Europe	7.41	7.95	10.47	12.36	11.63	8.00	7.22	8.51	10.78	12.15	11.54	13.40	15.24	11.93	15.38	10.93
Southern Europe	4.94	6.82	6.98	6.74	6.98	6.00	6.19	6.38	5.88	4.67	5.77	4.12	2.86	4.59	6.59	5.70
Western Europe	14.81	25.00	24.42	20.22	17.44	16.00	10.31	8.51	9.80	10.28	9.62	10.31	12.38	15.60	14.29	14.60
Oceania	3.70	3.41	3.49	3.37	2.33	2.00	2.06	2.13	1.96	1.87	1.92	2.06	1.90	2.75	4.40	2.62

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Source: WilderHill New Energy Global Innovation Index Note: according to the United Nations standards, the percentage of companies making up the NEX index by geographical area.

Table A6: Sector weights of the NEX index after 2008 (in %)

	FCV	FFF	FNS	BBB	ROH	RSR	BWD
	ECV		2.01	14.22	1.011	10.00	1000
2008 Q1	3.93	13.56	2.94	14.26	6.99	30.00	28.34
2008 Q2	3.81	17.85	2.81	14.32	6.47	27.03	27.71
2008 Q3	3.31	20.03	3.33	13.14	6.54	27.27	26.39
2008 Q4	2.25	23.93	3.57	12.09	6.48	26.63	25.05
2009 Q1	2.77	15.14	5.29	14.19	8.25	25.70	28.68
2009 Q2	2.42	12.89	4.79	12.21	6.49	30.57	30.63
2009 Q3	2.59	13.77	5.38	10.76	6.81	29.24	31.45
2009 Q4	2.25	15.20	7.10	11.26	7.10	27.51	29.58
2010 Q1	2.04	16.93	8.65	12.25	6.73	25.03	28.36
2010 Q2	1.90	17.29	8.53	12.36	6.58	24.29	29.05
2010 Q3	1.97	20.31	8.86	11.70	6.59	24.42	26.16
2010 Q4	1.79	24.32	8.80	11.21	6.02	24.16	23.71
2011 Q1	1.50	26.95	6.99	10.50	9.46	24.59	20.00
2011 Q2	1.50	23.34	8.06	10.69	9.53	25.76	21.04
2011 Q3	1.28	22.72	6.24	10.17	10.49	24.60	24.32
2011 Q4	1.14	25.06	4.12	12.13	11.63	26.48	19.45
2012 Q1	1.60	28.01	4.01	13.85	14.70	20.83	17.00
2012 Q2	1.34	28.14	4.16	14.61	13.98	22.00	15.96
2012 Q3	2.32	28.30	6.70	14.22	8.35	21.17	19.00
2012 Q4	1.50	33.93	2.97	14.50	14.50	19.59	13.04
2013 Q1	1.31	33.43	2.63	15.42	14.05	15.90	14.14
2013 Q2	1.31	33.43	2.63	15.42	14.05	17.54	15.62
2013 Q3	1.25	35.04	2.35	14.61	13.06	19.10	14.58
2013 Q4	1.28	35.26	2.28	14.02	12.47	19.58	15.10
2014 Q1	1.17	33.13	2.34	12.17	10.33	23.95	16.91
2014 Q2	1.11	34.20	2.00	12.16	9.86	23.16	17.52
2014 Q3	1.42	33.42	2.30	12.44	9.09	23.78	17.56
2014 Q4	1.42	33.67	2.26	12.31	8.45	24.67	17.22
2015 QI	1.68	33.88	2.14	11.54	6.84	24.86	19.06
2015 Q2	1.22	33.68	2.26	9.55	6.90	24.88	21.50
2015 Q3	0.95	32.97	3.18	8.05	4.52	24.65	25.67
2015 Q4	0.95	33.54	3.09	9.19	5.19	20.40	27.65
2016 QI	1.01	34.83	3.61	9.38	4.26	20.14	26.77
2016 Q2	1.02	32.18	3.09	7.15	0.18 F 97	21.60	29.18
2016 Q3	1.12	31.00	4.54	1.10	0.87 5.90	21.09	28.01
2010 Q4	1.00	32.00	5.56	0.40	5.20	17.02	20.14
2017 Q1 2017 Q2	1.00	01.00 22.69	5.04 6.50	9.05	0.45	17.92	29.14 26.75
2017 Q2	0.07	20.00	0.30 5.01	0.70	4.92	18.75	20.73
2017 Q3	0.76	30.88 20.26	0.91 6.75	9.11	4.55	10.00	29.98
2017 Q4	1.14	29.30	0.73	0.21	4.08	20.08	29.20
2018 Q1	0.80	20.50	2.04	7.74	2.00	23.37	25.00
2018 Q2 2018 Q3	0.80	20.50	8.60 8.48	6.60	3.90	22.50	25.50
2018 Q3	1.05	29.02	0.40	7.04	3.63	23.07	27.12
2010 Q4	1 /9	30.25	0.96	Q /Q	4 40	21.70	20.34
2013 Q1 2010 O2	1.42	90.07 90.79	9.30 0.11	0.40 6.13	4.49 1 11	20.72	20.40
2013 62	2 77	23.12 99.64	0.43	0.13	5.66	21.75	21.42
2013 Q3 2010 A	3.77 4.00	22.04	9.40 8.00	9.40 10.00	6.00	20.41	22.04 23.00
2013 94	5 50	23.00	6.60	8 80	6.60	20.00	20.00
2020 Q1	5.50	23.10	6 00	8.00	6 00	26.40	22.00
	1.00	20.00	5.99	10.00	7 56	20.40	
mean	1.82	21.23	0.33	10.92	06.1	23.34	23.13

Source: WilderHill New Energy Global Innovation Index. For more details, https://nexindex.com/historical\_sectors.php Note: ECV: Energy Conversion, EEF: Energy Efficiency, ENS: Energy Storage, RBB: Renewables - Biofuels & Biomass,ROH: Renewables - Other, RSR: Renewable - Solar, RWD: Renewable - Wind. Before 2008, the names (and classification) of the sectors were different.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean
Mean	1.21	1.13	1.16	1.14	1.16	1.00	1.03	1.03	0.98	0.93	0.96	1.03	0.95	0.92	1.10	1.05
Min	0.29	0.15	0.15	0.26	0.40	0.28	0.18	0.15	0.15	0.13	0.19	0.25	0.18	0.22	0.70	0.25
Max	3.60	2.50	2.09	2.54	1.97	1.70	1.94	1.79	1.64	1.84	1.74	1.83	1.60	1.73	1.64	2.01

Source: WilderHill New Energy Global Innovation Index Note: this table represents the minimum, mean, and maximum company weight composing the NEX index for each year.

Table A8: GICS restructuration (2018) and the S&P Global 1200

Company name	Country	Sector before 2018	New sector
activision blizzard inc	USA	Information Technology	Communication Services
akamai technologies inc	USA	Information Technology	Information Technology (new subsectors)
alphabet inc	USA	Information Technology	Communication Services
charter communications inc	USA	Consumer Discretionary	Communication Services
comcast corp	USA	Consumer Discretionary	Communication Services
delivery hero ag	DEU	Information Technology	Consumer Discretionary
dentsu inc	JPN	Consumer Discretionary	Communication Services
dish network corp	USA	Consumer Discretionary	Communication Services
disney (walt) co	USA	Consumer Discretionary	Communication Services
ebay inc	USA	Information Technology	Consumer Discretionary
electronic arts inc	USA	Information Technology	Communication Services
facebook inc	USA	Information Technology	Communication Services
fuji media holdings inc	JPN	Consumer Discretionary	Communication Services
grupo televisa sab	MEX	Consumer Discretionary	Communication Services
informa plc	GBR	Consumer Discretionary	Communication Services
interpublic group of cos	USA	Consumer Discretionary	Communication Services
itv plc	GBR	Consumer Discretionary	Communication Services
live nation entertainment	USA	Consumer Discretionary	Communication Services
naver corp	KOR	Information Technology	Information Technology (new subsector)
netflix inc	USA	Consumer Discretionary	Communication Services
news corp	USA	Consumer Discretionary	Communication Services
nintendo co ltd	JPN	Information Technology	Communication Services
omnicom group	USA	Consumer Discretionary	Communication Services
pearson plc	GBR	Consumer Discretionary	Communication Services
publicis groupe sa	$\mathbf{FRA}$	Consumer Discretionary	Communication Services
ses sa	LUX	Consumer Discretionary	Communication Services
shaw communications inc-cl b	$\operatorname{CAN}$	Consumer Discretionary	Communication Services
shopify inc	CAN	Information Technology	Information Technology (new subsector)
tencent holdings ltd	CHN	Information Technology	Communication Services
twitter inc	USA	Information Technology	Communication Services
ubi soft entertainment sa	$\mathbf{FRA}$	Information Technology	Communication Services
united internet ag	DEU	Information Technology	Communication Services
verisign inc	USA	Information Technology	Information Technology (newsubsector)
viacom inc	USA	Consumer Discretionary	Communication Services
vivendi sa	$\mathbf{FRA}$	Consumer Discretionary	Communication Services
wpp plc	GBR	Consumer Discretionary	Communication Services
discovery communications inc	USA	Consumer Discretionary	Communication Services

Source: StructureReviewChanges2018 (MSCI) and Datastream.

Note: this table shows all companies in the S&P Global 1200 Index that have changed sectors (or subsectors) with the 2018 GICS reclassification.

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	$\sum$
####	financials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	health care	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	health care	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	9
####	health care	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	financials	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	6
####	info tech	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	cons discr	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	comm services	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	cons discr	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	financials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	info tech	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	cons discr	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	info tech	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	info tech	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
####	financials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	6
####	cons staples	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	utilities	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	financials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	financials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	health care	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	utilities	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	materials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	financials	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	11
####	materials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	cons discr	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	cons staples	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	info tech	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	materials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
####	industrials	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
$\sum$		1073	1091	1097	1109	1127	1140	1147	1164	1177	1190	1196	1201	1209	1217	1219	

## Table A9: S&P Global 1200 composition from 2006 to 2020

Source: Datastream Note: this table represents the list of companies (rows) that composed or made up the S&P Global 1200 index between 2006 and 2020. For each year (columns), if the company belongs to the index, the value is 1 and 0 otherwise.

Table A10: S&P Global 1200 composition by country (in %)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean
australia	3.82	3.76	3.74	3.70	3.73	3.86	3.84	3.78	3.91	3.95	3.93	3.91	3.97	3.94	3.94	3.85
austria	0.19	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.17
belgium	0.84	0.82	0.82	0.81	0.80	0.79	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.74	0.78
brazil	1.30	1.47	1.46	1.44	1.42	1.40	1.39	1.37	1.36	1.34	1.34	1.33	1.32	1.31	1.31	1.37
canada	4.75	4.77	4.74	4.87	4.88	4.82	4.80	4.73	4.76	4.79	4.77	4.75	4.80	4.77	4.76	4.78
chile	0.75	0.73	0.73	0.72	0.71	0.70	0.70	0.69	0.68	0.67	0.75	0.75	0.74	0.74	0.74	0.72
china	0.65	0.64	0.64	0.63	0.62	0.61	0.61	0.60	0.59	0.59	0.59	0.58	0.58	0.58	0.57	0.61
colombia	0.19	0.18	0.27	0.27	0.27	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
denmark	0.93	0.92	0.91	0.90	1.06	1.05	1.05	1.03	1.02	1.01	1.09	1.08	1.08	1.07	1.07	1.02
finland	1.03	1.01	1.00	0.99	0.98	0.96	0.96	0.95	0.93	0.92	0.92	0.92	0.91	0.90	0.90	0.95
france	4.57	4.58	4.65	4.60	4.61	4.56	4.53	4.47	4.42	4.45	4.43	4.41	4.38	4.35	4.35	4.49
germany	3.63	3.57	3.56	3.52	3.55	3.51	3.49	3.61	3.65	3.70	3.68	3.75	3.72	3.70	3.69	3.62
hong kong	3.08	3.02	3.01	3.16	3.28	3.25	3.23	3.18	3.14	3.28	3.26	3.25	3.56	3.53	3.53	3.25
ireland	0.47	0.55	0.55	0.54	0.53	0.53	0.52	0.52	0.51	0.50	0.50	0.50	0.50	0.49	0.49	0.51
italy	1.21	1.28	1.28	1.35	1.33	1.32	1.31	1.46	1.44	1.43	1.51	1.50	1.49	1.48	1.48	1.39
japan	13.33	13.11	13.04	12.98	13.13	12.98	12.99	12.80	12.74	12.61	12.54	12.49	12.41	12.33	12.31	12.79
luxembourg	0.19	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.17
mexico	1.49	1.47	1.46	1.44	1.42	1.58	1.57	1.72	1.70	1.68	1.67	1.67	1.65	1.64	1.64	1.59
netherlands	1.40	1.37	1.37	1.35	1.33	1.32	1.31	1.29	1.36	1.43	1.42	1.42	1.49	1.56	1.56	1.40
new zealand	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.08	0.08	0.08	0.08	0.03
norway	0.65	0.64	0.64	0.63	0.62	0.61	0.61	0.60	0.59	0.59	0.59	0.58	0.58	0.58	0.57	0.61
portugal	0.19	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.17
singapore	0.75	0.73	0.73	0.72	0.71	0.70	0.70	0.69	0.68	0.67	0.67	0.67	0.66	0.66	0.66	0.69
south korea	1.12	1.10	1.09	1.08	1.06	1.05	1.05	1.03	1.02	1.01	1.00	1.00	0.99	0.99	0.98	1.04
spain	1.30	1.37	1.37	1.35	1.42	1.49	1.48	1.46	1.44	1.60	1.59	1.58	1.57	1.56	1.56	1.48
sweden	2.33	2.29	2.28	2.25	2.22	2.19	2.18	2.15	2.12	2.10	2.09	2.16	2.32	2.30	2.30	2.22
switzerland	3.26	3.21	3.19	3.25	3.19	3.16	3.14	3.09	3.06	3.03	3.01	3.00	2.98	3.04	3.04	3.11
taiwan	2.05	2.02	2.01	1.98	1.95	1.93	1.92	1.89	1.87	1.85	1.84	1.83	1.82	1.81	1.80	1.90
united kingdom	7.92	7.97	7.93	7.84	7.81	7.81	7.85	7.73	7.65	7.56	7.53	7.49	7.44	7.48	7.47	7.70
united states	40.63	40.79	40.93	41.03	40.82	41.05	41.24	41.67	41.80	41.68	41.72	41.80	41.60	41.74	41.84	41.36

Source: Datastream Note: the percentage of firms making up the S&P Global 1200 index by country.

## Table A11: S&P Global 1200 composition by geographic area (in %)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean
America	49.11	49.40	) 49.59	49.77	49.51	49.82	49.96	50.43	50.55	50.42	50.50	50.54	50.37	50.45	50.53	50.06
Central America	1.49	1.47	1.46	1.44	1.42	1.58	1.57	1.72	1.70	1.68	1.67	1.67	1.65	1.64	1.64	1.59
Northern America	45.39	45.55	45.67	45.90	45.70	45.88	46.03	46.39	46.56	46.47	46.49	46.54	46.40	46.51	46.60	46.14
South America	2.24	2.38	2.46	2.43	2.40	2.37	2.35	2.32	2.29	2.27	2.34	2.33	2.32	2.30	2.30	2.34
Asia	20.97	20.62	220.51	20.56	20.76	520.53	3 20.49	20.19	20.05	20.00	19.90	19.82	20.02	19.88	19.85	20.28
Eastern Asia	20.22	19.89	19.78	19.84	20.05	19.82	19.79	19.50	19.37	19.33	19.23	19.15	19.35	19.23	19.20	19.58
South Eastern Asia	0.75	0.73	0.73	0.72	0.71	0.70	0.70	0.69	0.68	0.67	0.67	0.67	0.66	0.66	0.66	0.69
Europe	30.10	30.16	6 30.08	29.94	29.99	29.82	29.73	3 29.64	29.48	29.58	29.60	29.64	29.69	29.75	29.70	29.79
Northern Europe	13.33	13.38	13.31	13.17	13.22	13.16	13.16	12.97	12.83	12.69	12.71	12.74	12.82	12.82	12.80	13.01
Southern Europe	2.70	2.84	2.83	2.89	2.93	2.98	2.96	3.09	3.06	3.19	3.26	3.25	3.23	3.20	3.20	3.04
Western Europe	14.07	13.93	13.95	13.89	13.84	13.68	13.60	13.57	13.59	13.70	13.63	13.66	13.65	13.72	13.70	13.75
Oceania	3.82	3.76	3.74	3.70	3.73	3.86	3.84	3.78	3.91	4.03	4.01	4.00	4.05	4.03	4.02	3.89

Source: Datastream Note: according to the United Nations standards, the percentage of firms making up the S&P Global 1200 index by geographical area.

Table A1	2: S&P	Global	1200	composition	by	economic sector	(in	%	)
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	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean
communication services	5.31	5.32	5.38	5.41	5.32	5.26	5.32	5.50	5.52	5.55	5.52	5.50	5.46	5.59	5.58	5.44
consumer discretionary	12.21	12.19	12.12	12.26	12.33	12.28	12.21	12.29	12.32	12.18	12.29	12.32	12.32	12.33	12.31	12.26
consumer staples	7.83	7.70	7.75	7.75	7.63	7.63	7.59	7.56	7.48	7.56	7.61	7.66	7.69	7.64	7.63	7.65
energy	4.75	4.77	4.83	4.87	4.88	5.00	5.14	5.07	5.01	4.96	4.93	5.00	4.96	4.93	4.92	4.94
financials	16.12	16.41	16.32	16.32	16.50	16.32	16.30	16.07	16.23	16.13	16.05	15.99	15.88	15.86	15.83	16.16
health care	9.13	8.98	8.93	8.84	8.87	8.86	8.89	8.93	8.84	8.74	8.70	8.66	8.60	8.63	8.61	8.81
industrials	16.31	16.32	16.23	16.14	16.06	16.32	16.30	16.32	16.31	16.22	16.22	16.24	16.29	16.19	16.32	16.25
information technology	9.32	9.35	9.39	9.47	9.58	9.47	9.50	9.45	9.60	9.75	9.70	9.66	9.84	9.78	9.76	9.58
materials	8.39	8.52	8.48	8.39	8.43	8.42	8.37	8.25	8.16	8.32	8.28	8.33	8.35	8.55	8.53	8.38
real estate	4.94	4.86	4.83	4.78	4.70	4.82	4.80	4.98	5.01	5.13	5.10	5.08	5.05	5.01	5.00	4.94
utilities	5.68	5.59	5.74	5.77	5.68	5.61	5.58	5.58	5.52	5.46	5.60	5.58	5.54	5.51	5.50	5.60

Source: Datastream Note: the percentage of firms making up the S&P Global 1200 index by economic sector according to the 2018 GICS classification.





Source: Datastream

Table A13: Unit root tests

	ADF	Model	PP	Model	KPSS	Model
NEX	-0.21	3	-0.19	3	4.67	1
$p1200\_comm\_svs$	0.44	3	-2.54	2	1.68	1
$p1200\_cons\_discr$	1.13	3	1.23	3	3.17	1
$sp1200\_cons\_staples$	1.59	3	1.65	3	2.56	1
$sp1200\_energy$	-0.49	3	-0.48	3	1.78	1
sp1200_financials	-0.45	3	-0.44	3	4.77	1
$sp1200\_health\_care$	1.58	3	1.69	3	4.13	1
$sp1200\_industrials$	0.55	3	0.63	3	2.96	1
$sp1200\_info\_tech$	1.92	3	2.01	3	5.47	1
$p1200\_materials$	-3.10*	2	-3.07*	2	0.71	1
$p1200\_real\_estate$	0.38	3	0.41	3	3.64	1
sp1200_utilities	0.39	3	0.44	3	5.04	1
$\Delta$ NEX	-38.27*	3	-50.02*	3	$0.12^{*}$	2
$\Delta \text{ sp1200\_comm\_svs}$	-23.74*	3	$-58.47^{*}$	3	$0.04^{*}$	2
$\Delta \text{ sp1200\_cons\_discr}$	-40.59*	3	-52.26*	3	$0.09^{*}$	2
$\Delta \text{ sp1200\_cons\_staples}$	$-44.67^{*}$	3	-58.22*	3	$0.06^{*}$	2
$\Delta \text{ sp1200}\_\text{energy}$	-33.73*	3	-58.46*	3	$0.11^{*}$	2
$\Delta$ sp1200_financials	-41.01*	3	-53.98*	3	$0.12^{*}$	2
$\Delta$ sp1200_health_care	-43.34*	3	-58.55*	3	$0.13^{*}$	2
$\Delta \text{ sp1200\_industrials}$	-40.46*	3	-52.36*	3	$0.06^{*}$	2
$\Delta \text{ sp1200\_info\_tech}$	$-42.74^{*}$	3	-58.61*	3	$0.24^{*}$	2
$\Delta$ sp1200_materials	-41.22*	3	-50.46*	3	$0.04^{*}$	2
$\Delta$ sp1200_real_estate	-39.33*	3	$-54.78^{*}$	3	$0.08^{*}$	2
$\Delta$ sp1200_utilities	-44.93*	3	$-56.75^{*}$	3	$0.08^{*}$	2

Note: ADF, the Augmented Dickey-Fuller test (Dickey and Fuller, 1981), PP, the Phillips-Perron test (Phillips-Perron, 1988), and KPSS, the Kwiatkowski-Phillips-Schmidt-Shin test (Kwiatkowski et al., 1992). For each test, we indicate the test statistic and the chosen model: 1 for trend and constant, 2 for constant, 3 without constant and trend. For the ADF and PP tests, the critical values at the 5% threshold for these three models are -3.41, -2.86, and -1.95, respectively. For the KPSS test, we test only the first two model specifications; the critical values at 5% are 0.146 and 0.463. The star indicates the stationarity of the variable at the 5% threshold. Note that the S&P 1200 material index in logarithm is, according to the ADF and PP tests, non-stationary at the 1% threshold but not at 5%.

	NEX	Comm_svs	Cons_discr	Cons_staples	Energy	Financials
Mean	0.00	0.00	0.00	0.00	0.00	0.00
Median	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	0.12	0.10	0.13	0.08	0.16	0.12
Minimum	-0.13	-0.09	-0.10	-0.09	-0.21	-0.12
Std.Deviation	0.01	0.01	0.01	0.01	0.02	0.01
Skewness	-0.67	-0.17	-0.12	-0.54	-1.08	-0.34
Kurtosis	12.38	13.07	15.83	15.69	23.17	14.96
Jarque-Bera	13958.87	15760.80	25603.13	25218.83	63951.65	22294.53
p.value	0	0	0	0	0	0
	Health_care	Industrials	Info_tech	Materials	Real_estate	Utilities
Mean	0.00	0.00	0.00	0.00	0.00	0.00
Median	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	0.10	0.10	0.10	0.10	0.14	0.12
Minimum	-0.08	-0.10	-0.10	-0.12	-0.10	-0.12
Std.Deviation	0.01	0.01	0.01	0.01	0.01	0.01
Skewness	-0.30	-0.55	-0.28	-0.51	-0.15	-0.23
Kurtosis	13.78	12.29	10.74	11.91	15.41	21.32
Jarque-Bera	18129.78	13586.55	9363.89	12498.63	23937.98	52159.32
p.value	0	0	0	0	0	0

#### Table A14: Descriptive statistics

Note: all variables are in first logarithm difference. The Jarque-Bera test (1980) allows testing the null hypothesis of normality distribution. For all variables, we reject the normality.



## Figure A2: Correlation matrix

Note: all correlation coefficients are significant with p-values at zero.