

# Empirical Assessment of Carbon Reduction and Energy Transition Targets of European Companies

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**Abstract.** *The paper presents an analysis of the carbon reduction and energy transition targets set by all companies included in the STOXX All Europe 100 index. This is an emerging topic, and the scientific literature is scarce. We employ a quantitative research method, as we extract by hand the targets from various sources: corporate annual reports, Refinitiv Database, Science Based Targets etc. The research question is: Which are the directions of corporate European strategies regarding carbon emissions and reduction targets? The total number of emissions reduction targets in the sample is 427, while renewable energy targets are 89, efficiency targets are 33, and electric vehicle adoption targets are 29. The analysis reveals that most of the targets are set for a short or medium time frame. Also, most of them are expressed in absolute terms and some of them have already been achieved. The research has implications for policy setting, as we show that the regulations should be an incentive for companies to strive to achieve meaningful targets. Thus, the results show that longer term targets are more difficult to track, and progress is less disclosed in the annual reports. The countries in which the sample companies are headquartered are not yet on track to achieve the goals of the Paris Agreement, which means that environmental and disclosure policies need to be improved.*

**Keywords:** corporate strategies, targets, carbon reduction, energy transition, European companies.

## Introduction

The European Union's long-term strategy for reducing carbon emissions and energy transition is at the heart of the Green Deal and in line with the Paris Agreement of 2016. Therefore, the European Union (EU) and its partners are a group of countries that constantly update their ambitions and targets in relation to greenhouse gas (GHG) emissions reduction and the transition to green energy. The energy crisis at regional level, triggered by Russia's war in Ukraine, has become a major motivator in urging the European Commission, the UK, and their allies to seek solutions for energy transition and fossil fuel reductions. However, politicians cannot achieve these targets without the involvement of companies, large and small. The success of sustainability policies on energy efficiency and renewable energy is linked to the ability of large companies to

adapt and integrate sustainability goals in their strategies (Beusch et al., 2022). The role of each company in fighting climate change is proportional to its carbon footprint. Therefore, the research question of this paper is: *Which are the directions of corporate European strategies regarding carbon emissions and reduction targets?*

Companies are continuously trying to reduce their environmental footprint. Two ‘hot spots’ largely debated in the literature are carbon emissions and energy transition. Action in this direction is conducted in a few steps (ISO, 2006): (a) identifying opportunities to improve environmental performance; (b) informing decision-makers for process design and priority setting; (c) selecting indicators of environmental performance; (d) setting targets related to these indicators; and (e) tracking performance on the selected indicators. In this respect, our research answers the call of Fischer et al. (2007) to analyze the longer-term sustainability targets in relation to carbon reduction and energy transition. This research area is relevant to a global audience, because Europe is a trend-setter in meaningful regulations (Albu et al., 2021) and best practices regarding sustainability targets. The present paper is meaningful for policy makers because it shows how carbon reduction and energy transition targets are implemented in a sample of the most important European companies.

The research question is addressed by collecting a large sample of carbon reduction and energy transition targets set by the largest 100 companies in Europe. For this purpose, we used the complete list published by the STOXX All Europe 100 Index (i.e., the top one hundred European companies by market capitalization). The targets were primarily extracted from corporate annual reports and corroborated with various sources such as the Refinitiv database, the website of the Science Based Targets (w01), and the lists compiled by the Climate Group (w02). The large database of over 400 targets includes information such as target scope, type, quantity, coverage, measurement, timelines, reductions committed and achieved, and progress made. Also, the disclosure of different types of targets (net, gross, absolute, intensity etc.) was analyzed. We include in the energy transition category the targets referring to renewable energy and the ones regarding energy efficiency. Energy efficiency was defined as “the ratio of output of performance, service, goods or energy, to input of energy” (European Commission, 2012 para. 2(4)).

The paper is organized as follows. Relevant policies at the European level have been put in relation to corporate efforts to reduce the carbon footprint and engage in the process of energy transition. The methodology describes the database of carbon reduction and energy transition targets. The results offer insights into the complexity of target setting in four dimensions: carbon reductions, renewable energy consumption, fleet electrification, and energy efficiency. The implications for regulators and future avenues of research are discussed in the concluding section.

## **Literature review**

### ***Carbon reduction and energy transition targets in Europe***

The first international agreement in the GHG emissions domain was the Kyoto Protocol, adopted in 1997, “the world’s only legally binding treaty to reduce greenhouse emissions.” Yet, the Protocol does not cover all emissions and does not use the base year consistently (w03). Also, the targets imposed are easy to achieve. For instance, the EU committed to 8% GHG reduction under Kyoto 1 (2008 to 2012, base year 1990) and achieved 11.7% (w04). The EU’s commitment under Kyoto 2 was to reduce the GHG emissions by 20% until 2020, considering 1990 as a base year (target achieved: 31% (w05). All countries in which the sample companies have headquarters signed the Kyoto Protocol and the Paris Agreement (w06).

The purpose of the Paris Agreement is to keep the rise of the temperature at no more than 2°C above the industrial era “and pursue efforts to keep it to 1.5°C.” In total, 195 countries are signatories of the Agreement. Every five years they must submit a Nationally Determined Contribution (NDC). The targets set in the most recent NDCs for GHG reduction by the countries in which the sample companies have the headquarters are:

- 2030 (as compared to 1990 level):
  - At least 55% (EU and Norway)
  - At least 50% (Switzerland)
  - At least 68% (UK)
- 2050:
  - Net zero (EU, Switzerland, and UK)
  - Low emission society (Norway).

About 98% of Norwegian electricity production is renewable nowadays. In the EU, the renewable energy target set according to the European Green Deal for 2030 is 40%, in the UK it is 95%, and in Switzerland it is expressed as efficiency output (GW/h).

The 2030 target energy efficiency improvement in the EU is 36-39% for final and primary energy consumption (according to the European Green Deal). For Switzerland (w07) “a 43-percent reduction in average annual per capita energy consumption and a 13-percent reduction in power consumption by 2035 is achieved, as compared to the situation in the year 2000.”

### ***Carbon reduction and energy transition in the academic literature***

Most companies reporting carbon reduction and energy transition targets are multinational companies. They must observe the targets set by different governments, not directly the ones established through international agreements, such as the Kyoto Protocol or the Paris Agreement (Escobar & Vredenburg, 2011). Therefore, to achieve their purposes, international protocols need to be transposed into the national legislation of each country. The current emission reduction targets are territory-based (Ortiz et al., 2020). Their transposition into laws depends on national governments. For international protocols to be effective, a synchronization of enforcement mechanisms at the international level is also needed (Escobar & Vredenburg, 2011).

A specific accounting research direction is related to carbon disclosure (He et al., 2022; Schaltegger et al., 2015). Disclosure can be made for various organizations (Carbon Disclosure Project) or in the company’s reports (e.g., annual or sustainability reports). Authors investigate the determinants of carbon disclosure, on one hand, and their quality, on the other hand. One of the external determinants are the regulatory pressures. The companies based in countries with common law systems (Alrazi et al., 2016; Tang & Luo, 2016) and countries with clear governmental or stock exchange regulations (Dumitru et al., 2017) or companies operating in environmentally sensitive sectors (Dumitru et al., 2017) disclose more. Carbon disclosures are an incentive for the companies to improve and improve carbon performance (Qian & Schaltegger, 2017).

Setting more ambitious targets and tracking their progress and level of achievement will show that European policies are successful (Blanco et al., 2020). More difficult targets, especially for novel knowledge projects and companies operating in environmentally sensitive domains, are related with their better completion and negatively associated with monetary incentives (Ioannou et al., 2016).

## Methodology

The population is represented by all companies included in the STOXX All Europe 100 Index. The list including one hundred companies was downloaded on August 1st, 2022. These companies are headquartered in European countries, of which 63 in the European Union, one in Norway, 13 in Switzerland, and 23 in the United Kingdom. All countries in which the sample companies are based signed the Paris Agreement. All 100 companies from this list were analyzed in the present paper, in terms of their energy transition commitments. Sample companies are active in 19 sectors.

Several sources of data were used to create the database of carbon reduction and energy transition targets: the latest annual reports (integrated or sustainability reports, as of August 2022), which represent the primary source of information for the present study, CDP questionnaires, Science-Based Targets initiative (SBT), and the Climate Group EV100 and RE100 lists. Of the target indicators compiled by the Climate Group, EV100 and RE100 are frequently used by companies to show their commitment to energy transition (Dragomir et al., 2022). The Science-Based Targets discloses a target dashboard showing companies near- and long-term temperature alignment based on the GHG scopes, with the focus to ensure the Net-Zero Standard.

The relevant information regarding the targets was identified in the annual reports by searching for a set of keywords such as “greenhouse,” “target,” “carbon,” “electricity,” “vehicle,” “scope 1” etc. Content analysis is “a research technique for making replicable and valid inferences from data according to their context” (Krippendorff, 1980). This technique was used for data collection. Two experienced researchers and rechecked through several rounds to obtain inter-coder agreement and an accurate database. The data collection procedure was as such: one researcher collected data from the annual reports of sample companies, EV100 and RE100, and checked the information in CDP and SBT. Another researcher checked the information extracted. Therefore, the data collected was verified at least once for each company.

The companies were sought for in the databases provided by Refinitiv, SBT, EV100 and RE100, confirming the information extracted from the reports. The lack of relevant information was marked with zero in the database.

For each company in the sample, the following targets related to carbon reduction and energy transition were collected:

- Presence of targets related to carbon and energy transition in the latest available annual report or sustainability report (financial year 2021) – marked with 1;
- Presence of the respective targets in SBTi, EV100, or RE100 – marked with 1;
- Type of target (carbon targets; renewable energy production/consumption; electric vehicles; energy efficiency) – marked with 1, if disclosed;
- Base year (2021 or earlier) and target year (at least 2022);
- Target value or percentage change (carbon reductions or renewable energy increases)
- Scope of target emissions for carbon targets – Scope 1, Scope 2, Scope 3, or the entire value chain;
- Units of measurement (absolute or intensity; gross or net);
- Target quantity (in the respective units of measurement);
- Reduction achieved for the latest reporting period (in percentage or in absolute values);
- The quantity of emissions (gross or net) in the latest reporting period and in the base year, by scope;
- The degree of achievement for the respective target, calculated as percentage (or value) achieved divided by percentage (or value) targeted.

One row (in a spreadsheet) was dedicated to each type of target. Therefore, each company could have more than one entry in the database. Several companies reported different targets in absolute and relative units, as well as targets for different scopes and business segments. All targets specified in the report were collected, and the analysis was conducted on each of these targets. The information from the annual report and the other sources were compared for any discrepancies.

## Results and discussions

The descriptive statistics of the carbon reduction targets set by the companies included in the sample are presented in table 1.

**Table 1. Descriptive statistics of carbon reduction targets**

Carbon reduction targets	Up to 2025		2026-30		After 2030	
	Count	%	Count	%	Count	%
Total number of emissions reduction targets (total = 427)	105	-	207	-	115	-
Percentage of companies setting such targets	58%	-	85%	-	78%	-
Number and percentage of Scope 1+2 targets (total = 175)	60	57%	92	44%	23	20%
Number and percentage of Scope 3 targets (total = 142)	27	26%	86	42%	29	25%
Number and percentage of targets for the entire value chain – Scopes 1, 2 & 3 (total = 109)	18	17%	28	14%	63	55%
Number and percentage of net reduction targets on any scope (including net zero) (total = 185)	38	36%	62	30%	85	74%
Number and percentage of absolute gross reduction targets (total = 168)	45	43%	95	46%	28	24%
Number and percentage of carbon intensity reduction targets (total = 111)	36	34%	65	31%	10	9%
Number and percentage of fully achieved targets (>= 100%)	24	23%	12	6%	2	2%
Number and percentage of negative trends	3	3%	17	8%	9	8%
Number and percentage of targets with no disclosed progress	39	37%	89	43%	78	68%
Number and percentage of targets verified by SBT	16	15%	103	50%	18	16%

Source: Authors' own research.

More than half of the companies included in the sample set carbon reduction targets. Yet, we notice that most of these targets are set for 2026 or later periods. The trend is the same for the targets verified by SBT. This is an important finding of our research, showing that the environmental dimension is disconnected from the traditional performance measurement of the companies, in which budgets are set starting with periods of less than one year. Also, it can show that even though the targets are set, they are not disclosed. Overall, we notice that the companies are prudent in making any short-term commitments regarding the carbon reduction, as they prefer a medium period.

The disclosure of greenhouse gas emissions according to the Greenhouse Gas Protocol is mandatory for scopes 1 and 2 and voluntary for scope 3. This is reflected by the targets set by the companies included in our sample as well. Most of the targets are set for scopes 1 and 2. This is also the category for which most of the targets are set for a short period of time (up to 2025). A significant result for our sample is that there are companies that set targets covering the entire value chain. Yet, we notice that these targets refer mostly to longer time frames. The supply-chain carbon management is an under-explored area in the literature (He et al., 2022).

Most of the net reduction targets (45.95%) are set for 2030 or more. This is a normal result as most of these targets are Net Zero, with the deadline 2050. The gross reduction targets are less numerous and are set for shorter periods. Theoretically, this type of target is more relevant, so the finding has a positive meaning. West et al. (2020) have found that the accepted methodologies for quantifying carbon credits significantly overstate impacts on climate change mitigation. The investigation published in The Guardian (2023) corroborates the intuition that net-zero targets could be closer to greenwashing than to substantive action.

Some of the targets (8.90%) have already been achieved, even two targets set for 2030 or later. Even though this may seem a positive result, we argue that the achievement of a target should be accompanied by the introduction of another one, determining the company to continue to improve. This aspect can also be related with the companies' tendency reported in previous articles to direct the reporting towards the good news (Cotter et al., 2011).

The second part of our analysis is directed towards the renewable energy targets. The descriptive statistics are presented in table 2.

**Table 2. Descriptive statistics of renewable energy targets**

Renewable energy targets	Up to 2025		2026-30		After 2030	
	Count	%	Count	%	Count	%
Total number of renewable energy targets in the sample (overall = 89)	50	-	37	-	2	-
Percentage of companies setting such targets	46%	-	33%	-	2%	-
Number and percentage of renewable energy consumption targets (total = 74)	48	96%	26	70%	-	-
Number and percentage of fully achieved targets (>= 100%)	10	20%	4	8%	-	-
Number and percentage of targets with no disclosed progress	5	10%	7	19%	-	-
Number and percentage of targets verified by SBTi	9	18%	4	11%	-	-
Number of targets recognized by RE100	8	16%	4	11%	1	50%

Source: Authors' own research.

Our analysis shows that a considerably smaller number of targets are dedicated to renewable energy (89 as compared to 427 for carbon reduction). This may be a consequence of the European and international regulations and frameworks (Kumarasiri & Jubb, 2016). As we emphasized in the literature review section, the Paris Agreement targets refer to GHG emissions. The targets set in the European Green Deal are recently adopted and the companies may need time to implement them. So, the entities follow this trend and report less on their energy targets. Most of the targets (97.75%) are set for the short and medium term. For most of them (86.52%), the companies disclose the progress made, 15.73% being already achieved.

The descriptive statistics regarding the energy efficiency targets are presented in table 3.

**Table 3. Descriptive statistics of energy efficiency targets**

Energy efficiency targets	Up to 2025	2026-30	After 2030
Total number of energy efficiency targets in the sample (total = 33)	17	14	2
Percentage of companies setting such targets	15%	13%	2%
Number and percentage of intensity targets	10 (62%)	8 (67%)	2 (100%)

Source: Authors' own research.

Only a small number of companies disclose the energy efficiency targets set. Most of them are set for short periods of time (up to 2025) and are intensity targets.

In table 4 we included the descriptive statistics of electric vehicles targets.

**Table 4. Descriptive statistics of electric vehicles targets**

EV targets	Up to 2025	2026-30	After 2030
Total number of EV targets in the sample (total = 29)	8	20	1
Percentage of companies setting such targets	8%	19%	1%
Number and percentage of targets related to EV products and services	2 (25%)	6 (30%)	-
Number of targets recognized by EV100	3 (38%)	10 (50%)	-

Source: Authors' own research.

There are only 29 targets disclosed regarding the electric vehicles, 13 of them being recognized by EV100. Most of these targets are set for a medium period.

## Conclusion

Our research combines a management accounting tool (target setting) with nonfinancial disclosure. The present article relies on a comprehensive database of carbon reduction, renewable energy consumption, fleet electrification, and energy efficiency targets, from all companies included in the STOXX All Europe 100 Index. The findings suggest that most targets are established for a short period of time and refer to absolute targets, some of them already achieved. There is a high degree of institutionalization of the carbon reduction and energy transition targets in the sample companies. Large corporations pay attention to the requirements of international agreements (e.g., the strategies of the EU). The carbon targets, which are a response to the Paris Agreement, are present in a greater number than the energy transition targets, in the reports analyzed.

We contribute to the literature by conducting quantitative research in the management accounting domain in which the contributions are mostly based on descriptive studies, as the related information is generated for internal use mostly (He et al., 2022). Setting more ambitious targets and tracking their progress and level of achievement will show that European policies are successful (Blanco et al., 2020). In contrast, setting less ambitious and long-term targets could signal to policy makers that companies do not have the technological capacity or the managerial will to engage in reducing the effects of climate change. Energy transition targets are part of the risk management system of any organization, considering the threats to the energy supply for numerous European countries.

This is of great significance for governmental actors, as it shows that these targets need to be integrated at a higher level, through clear and comprehensive regulations. Some of the disclosed targets (even if set for 2050) are already achieved and others were 400% overachieved. This raises a challenge for European regulators, who need to impose targets that create tension and motivate the companies to strive to reach their potential (Jeswani et al., 2008). The study extends the conclusion of Kolk and Pinkse (2008) that corporate responses must be constantly updated. Moreover, the targets must be perceived by the managers as enabling, not as a control mechanism (Van der Hauwaert et al., 2022). A more critical view of such targets may be in future research. Additionally, a limit of our study is that we analyzed the targets for one year. Thus, we consider that a longitudinal study on the consistency of targets may be a contribution to the literature. Another limit of the present research is that we didn't have access to any of the companies to analyze the internal mechanisms through which decisions were made regarding the carbon reduction and energy transition targets.

The adoption of targets is not enough for their integration into the business model. Stakeholder engagement through dialogue can avoid the marginalization of legitimate interests (Beusch et al., 2022). Future research can investigate the perception of various stakeholders regarding the targets set by large companies and whether reported achievements have a real impact on society and the economy. Also, future studies can evaluate the capacity of SMEs to set carbon reduction and energy efficiency targets and to achieve such commitments. Publicly disclosed targets have become an integral part of sustainable development and the present paper opens a line of research which can generate papers on other economic environments and regulatory requirements.

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## Webography

This webography contains links to those references and resources that are available free-of-charge, without passwords, via the World Wide Web. All resources were accessed and checked in December 2022.

- w01 Science Based Targets, <https://sciencebasedtargets.org/>
- w02 Climate Group, <https://www.theclimategroup.org/>
- w03 European Commission. Progress made in cutting emissions, [https://climate.ec.europa.eu/eu-action/climate-strategies-targets/progress-made-cutting-emissions\\_en](https://climate.ec.europa.eu/eu-action/climate-strategies-targets/progress-made-cutting-emissions_en)
- w04 European Commission. Kyoto 1st commitment period (2008–12), [https://climate.ec.europa.eu/eu-action/climate-strategies-targets/progress-made-cutting-emissions/kyoto-1st-commitment-period-2008-12\\_en](https://climate.ec.europa.eu/eu-action/climate-strategies-targets/progress-made-cutting-emissions/kyoto-1st-commitment-period-2008-12_en)
- w05 European Commission. Kyoto 2nd commitment period (2013–20), [https://climate.ec.europa.eu/eu-action/climate-strategies-targets/progress-made-cutting-emissions/kyoto-2nd-commitment-period-2013-20\\_en](https://climate.ec.europa.eu/eu-action/climate-strategies-targets/progress-made-cutting-emissions/kyoto-2nd-commitment-period-2013-20_en)
- w06 United Nations - Treaty Collections - Paris Agreement  
[https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg\\_no=XXVII-7-d&chapter=27&clang=\\_en](https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en)
- w07 Switzerland SDG 7, Target 7.3, <https://www.sdgoal2030.ch/targets/7.3>