

DIW Weekly Report

A policy bulletin from the German Institute for Economic Research

43²⁰²¹

Economy. Politics. Science.

DIW BERLIN



327 Report by Daniela Fietze, Mats Kröger, Thorsten Müller, and Karsten Neuhoﬀ

An effective Federal Climate Change Act needs leading indicators

- Climate Change Act identifies progress in emission reductions with a delay and does not recognize transformative measures
- Additional leading indicators could improve management of the transition to climate neutrality and reduce uncertainties for the economy
- This would be in line with the Federal Constitutional Court's decision on the Climate Change Act

LEGAL AND EDITORIAL DETAILS



DIW Berlin — Deutsches Institut für Wirtschaftsforschung e. V.

Mohrenstraße 58, 10117 Berlin

www.diw.de

Phone: +49 30 897 89-0 Fax: -200

Volume 11 October 27, 2021

Publishers

Prof. Dr. Tomaso Duso; Prof. Marcel Fratzscher, Ph.D.; Prof. Dr. Peter Haan;
Prof. Dr. Claudia Kemfert; Prof. Dr. Alexander S. Kritikos; Prof. Dr. Alexander
Kriwoluzky; Prof. Dr. Stefan Liebig; Prof. Dr. Lukas Menkhoff; Prof. Karsten
Neuhoff, Ph.D.; Prof. Dr. Carsten Schröder; Prof. Dr. Katharina Wrohlich

Editors-in-chief

Sabine Fiedler; Dr. Anna Hammerschmid (Acting editor-in-chief)

Reviewer

Dr. Wolf-Peter Schill

Editorial staff

Prof. Dr. Pio Baake; Marten Brehmer; Rebecca Buhner; Claudia Cohnen-Beck;
Dr. Hella Engerer; Petra Jasper; Sebastian Kollmann; Sandra Tubik;
Kristina van Deuverden

Sale and distribution

DIW Berlin Leserservice, Postfach 74, 77649 Offenburg

leserservice@diw.de

Phone: +49 1806 14 00 50 25 (20 cents per phone call)

Layout

Roman Wilhelm, Stefanie Reeg, DIW Berlin

Cover design

© imageBROKER / Steffen Diemer

Composition

Satz-Rechen-Zentrum Hartmann + Heenemann GmbH & Co. KG, Berlin

ISSN 2568-7697

Reprint and further distribution—including excerpts—with complete
reference and consignment of a specimen copy to DIW Berlin's
Customer Service (kundenservice@diw.de) only.

Subscribe to our DIW and/or Weekly Report Newsletter at

www.diw.de/newsletter_en

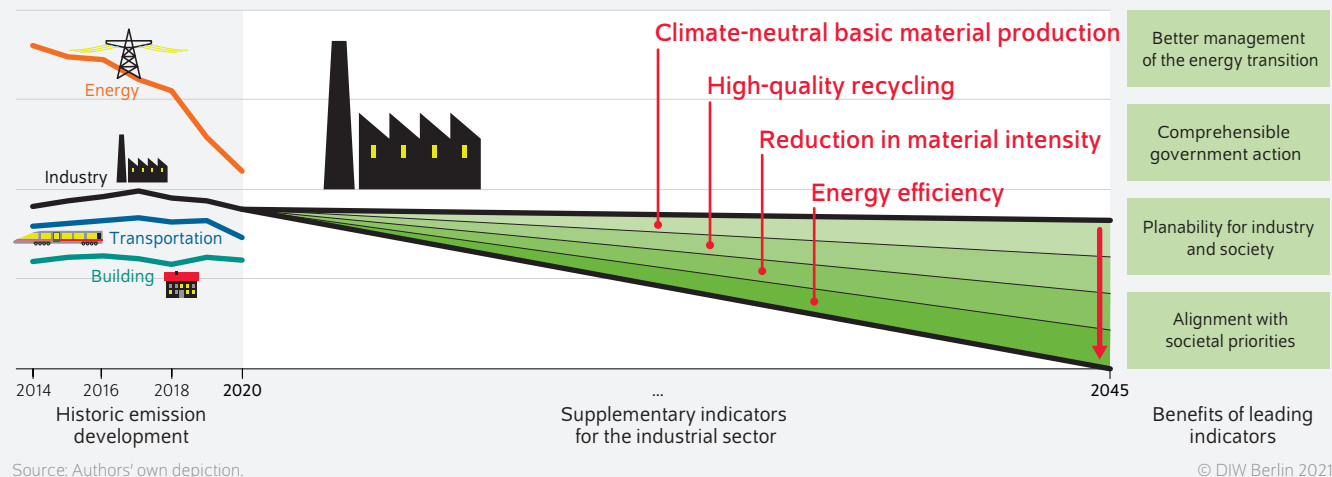
AT A GLANCE

An effective Federal Climate Change Act needs leading indicators

By Daniela Fietze, Mats Kröger, Thorsten Müller, and Karsten Neuhoﬀ

- So far, the Climate Change Act only monitors emission reductions—as a result, progress is only identified with a delay and transformative measures may not be recognized
- Additional leading indicators could improve management of the transition to climate neutrality and reduce uncertainties for the economy
- Leading indicators would be a sensible addition to the Climate Change Act and make government action more transparent
- This would also be in line with the Federal Constitutional Court's decision, which states that the legislature must create planning certainty and pressure to act towards climate neutrality at an early stage

The Climate Change Act needs supplementary indicators to identify progress and the direction of measures toward climate neutrality at an early stage



FROM THE AUTHORS

“The Climate Change Act still falls short: The transition to climate neutrality can be managed more successfully if the law were supplemented by leading indicators that make progress and shortcomings visible.”

— Karsten Neuhoﬀ —

MEDIA



Audio Interview with Karsten Neuhoﬀ (in German)
www.diw.de/mediathek

An effective Federal Climate Change Act needs leading indicators

By Daniela Fietze, Mats Kröger, Thorsten Müller, and Karsten Neuhoﬀ

ABSTRACT

To reach the climate targets, the course towards a climate-neutral society must be set now. However, the current monitoring instruments in the Climate Change Act do not provide sufficient information to policymakers and society on the effectiveness of policy instruments and programs, as they focus exclusively on greenhouse gas reduction targets, which are subject to uncertainty. Moreover, they only allow developments to be identified with a delay and map transformative measures inadequately. The Climate Change Act should be supplemented with leading indicators to address these deficits. By providing a broader information base, leading indicators could help improve the implementation of energy and climate policy measures.

A paradigm shift in climate policy has taken place over the past years, wherein the debate on the necessity of combating climate change evolved into a debate on the measures needed to achieve climate neutrality. This was fueled further by the decision of the German Federal Constitutional Court in March 2021.¹ In it, the Climate Change Act was classified as partially unconstitutional and the Federal Government was obliged to make improvements to protect the civil liberties of younger generations. According to the Court, the Climate Change Act lacked sufficient regulations for reducing emissions from 2031 onwards.

The climate neutrality discussion is also reflected in the party programs from the recent 2021 Bundestag election (Table 1). While the concept of climate neutrality was only mentioned sporadically in the party programs of the Greens and the SPD in 2017, it was mentioned in the programs of all parties represented in the Bundestag except for the AfD in 2021. Moreover, all parties—again, with the exception of the AfD—named a concrete time frame for achieving climate neutrality, be it 2035,² 2040,³ 2045,^{4,5} or 2050.⁶ Designing the path to climate neutrality will be one of the most important tasks of the new federal government.

With the Climate Change Act of 2019,⁷ lawmakers made an important step towards setting a concrete path to climate neutrality. Introducing concrete reduction targets in different

¹ Federal Constitutional Court, Decision from 24.03.2021, File no.: 1 BvR 2656/18, 1 BvR 78/20, 1 BvR 96/20, 1 BvR 288/20 (in German; available online; accessed on September 15, 2021. Accessed on March 22, 2021. This applies to all other online sources in this report unless stated otherwise).

² Die Linke, *Zeit zu handeln! Für soziale Sicherheit, Frieden und Klimagerechtigkeit, Wahlprogramm* (2021) (in German; available online).

³ Bündnis '90/ Die Grünen, *Deutschland. Alles ist drin, Wahlprogramm* (2021) (in German; available online).

⁴ Sozialdemokratische Partei Deutschlands, *Aus Respekt vor deiner Zukunft, Wahlprogramm* (2021) (in German; available online).

⁵ Christdemokratische Union Deutschland and Christlich-Soziale Union Deutschland, *Das Programm für Stabilität und Erneuerung. Gemeinsam für ein modernes Deutschland, Wahlprogramm* (2021) (in German; available online).

⁶ Freie Demokratische Partei, *Nie Gab es Mehr zu tun, Wahlprogramm* (2021) (in German; available online).

⁷ Bundesgesetzblatt, "Gesetz zur Einführung eines Bundes-Klimaschutzgesetzes und zur Änderung weiterer Vorschriften," Part I, no. 48 (2019): 2513 (in German).

Table 1

Number of times the phrases “climate neutral/CO₂ neutral/greenhouse gas neutral” were used in the party programs of the parties represented in the Bundestag

	2017	2021	Target year for climate neutrality (2021 platform)
CDU	0	18	2045
SPD	3	20	2045
Greens	3	60	2040
The Left	0	32	2035
FDP	0	5	2050
AfD	0	0	–

1 Parties do not necessarily mention the target years as requirements. Instead, they are mentioned in the description of the party's scope of action in some cases.

Source: Party programs of the parties represented in the Bundestag.

© DIW Berlin 2021

sectors of the economy aimed to make climate change mitigation measurable and make it possible to review progress. However, focusing on sectoral emission reductions exclusively is insufficient for steering and monitoring the success of climate policy.

Therefore, the reduction targets should be supplemented with further indicators that concretize the climate change targets, strengthen the monitoring mechanism for the success of government action, and reduce regulatory risks for firms and people. With these additional indicators, climate mitigation could be managed more effectively. Such a reform to the Climate Change Act would also contribute to securing the civil liberties of future generations, in line with the Federal Constitutional Court's decision.

Federal Constitutional Court: legislature must lead the early transition to climate neutrality

In a decision dated March 24, 2021, the Federal Constitutional Court ruled that the 2019 Climate Change Act is partially unconstitutional.⁸ The justification provided was that the law did not do enough to lead the constitutionally required transition to climate neutrality.

Article 20a of the German Basic Law⁹ contains a requirement to combat climate change that also commits to climate neutrality in the medium term. Above all, combating climate change entails “compliance with a temperature threshold at which human-induced global warming should be halted.”¹⁰

⁸ The exact unconstitutional passages: Section 3, paragraph 1, sentence 2; section 4, paragraph 1, sentence 3 in connection with appendix 2 of the Climate Change Act (old version), cf. Thorsten Müller, Daniela Fietze, and Hannah Scheuing, *Rechtliche Stellungnahme zur Anhörung des Ausschusses für Umwelt, Naturschutz und nukleare Sicherheit des deutschen Bundestages am 21. Juni 2021* (2021): 4 (in German; available online).

⁹ Mindful also of its responsibility towards future generations, the state shall protect the natural foundations of life and animals by legislation and, in accordance with law and justice, by executive and judicial action, all within the framework of the constitutional order.

¹⁰ The quotations appearing in the following paragraphs are all taken from the above-mentioned decision of the Federal Constitutional Court.

Once these global warming limits are reached, the requirement to combat climate change requires greenhouse gas emissions to be limited to a “neutral amount for the greenhouse gas concentration in the earth's atmosphere,” or, in other words, to climate neutrality.

The legislature must design the transition to a climate-neutral world in such a way that future generations are also left with appreciable freedom (“intertemporal safeguarding of liberties”). Emission reduction burdens must not be shifted into the future. If they are, future serious losses of freedom are to be expected.

From this situation, the Court derives obligations for the legislature: It must introduce and guide the transition to climate neutrality at an early stage in all areas of life. It must generate a level of planning certainty and development pressure that trigger social and technological development processes toward climate-neutral behavioral alternatives. The Court recognizes that “(t)echnical development and behavioral innovation are not precisely (...) predictable” in this respect. Constitutionally, it is therefore necessary to review decisions on an ongoing basis and to adjust them if necessary.¹¹ This sets the framework for improvements to the Climate Change Act. Now, the task is to fill it out in the best possible way.

Sector-level reduction targets are insufficient for achieving climate neutrality

Previously, sectoral reduction targets have been the central monitoring instrument of the Climate Change Act for reviewing and directing climate policy measures. These targets describe the path Germany intends to follow to reduce its emissions from the 1990 baseline to achieve 65 percent reduction in emissions in 2030 and climate neutrality in 2045. They are the key indicators for directing and reviewing climate policy-relevant measures in six sectors: energy, industry, transportation, building, agriculture, and waste management/other.¹² The sectoral reduction targets for 2023 to 2030 have already been adjusted according to the Federal Constitutional Court's decision in May 2021.¹³

Using emission data from the German Environment Agency (*Umweltbundesamt*, UBA), the *Expertenrat für Klimafragen* performs an annual review of to what extent the targets have been achieved in the previous year.¹⁴ If one of the sectors fails to achieve its targeted reductions, the responsible federal ministry must present a set of immediate measures (*Sofortprogramm*) that ensures the sector's compliance with emission levels for the following years.¹⁵

¹¹ Cf. Müller, Fietze, and Scheuing, *Rechtliche Stellungnahme zur Anhörung des Ausschusses für Umwelt, Naturschutz und nukleare Sicherheit*, 9.

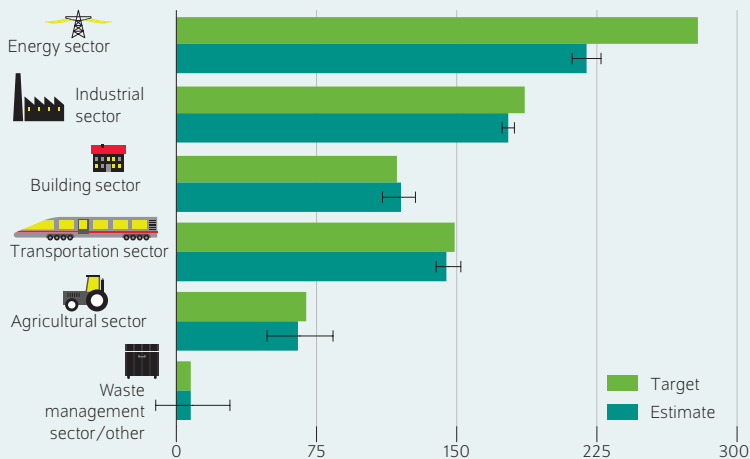
¹² Cf. Appendix 2 to Section 4 of the Climate Change Act.

¹³ Cf. Müller, Fietze, and Scheuing, *Rechtliche Stellungnahme zur Anhörung des Ausschusses für Umwelt, Naturschutz und nukleare Sicherheit*, 10.

¹⁴ Section 12, paragraph 1 of the Climate Change Act.

¹⁵ Section 8, paragraph 1 of the Climate Change Act.

Figure 1

Uncertainties in the previous years' estimation 2020Emissions in megatons of CO₂e

Source: Expertenrat für Klimafragen, Bericht zur Vorjahresschätzung der deutschen Treibhausgasemissionen für das Jahr 2020.

© DIW Berlin 2021

In many sectors, the reduction target is within the error of estimation.

By defining reduction paths for the sectors, the Climate Change Act takes an important step toward concretizing the path to climate neutrality. However, the sole use of reduction targets has significant deficits that will be discussed in the following section.

Reliable sectoral emission data only available with a delay

One issue with the Climate Change Act is that only preliminary emission data are available at the time of the German Environment Agency's reporting, which is March 15 of the year following the report year.^{16,17} Experience with reporting under the UN Framework Convention on Climate Change (UNFCCC) suggests that this preliminary data will be subject to further revision over time.¹⁸

For example, the average annual corrections between the previous year's estimates and the final emission data in the agricultural sector and waste management sector was 3.4 percent and 11.3 percent, respectively, between 2010 and 2018

(Figure 1).¹⁹ Corrections are required because data for some subsectors of the economy are available only with a delay. Moreover, there is uncertainty when it comes to recording emissions in some sectors, such as methane emissions in waste management.²⁰ In the case of the 2020 climate targets, these inaccuracies result in it being impossible to clearly determine if the climate targets were achieved in the agricultural and waste management sectors.²¹ While the emission target was supposedly achieved in the transportation sector and missed in the building sector, there is a residual probability of more than five percent of the opposite result in each case.

Non-recurring effects reduce informative value of climate policy progress

Moreover, the short-term informative value of emission data on climate policy progress is limited, as the emission reductions that can be attributed to climate policy are masked by cyclical effects or external shocks.

Emission changes are highly volatile, especially at the sector level of the Climate Change Act. (Figure 2). In the *industrial sector*, the fluctuations in economic activity have a very strong impact,²² as the negative emission developments in 2009 and 2020 as well as the "recovery" effect in 2010 show. In the *energy sector*, economic activity and fluctuating generation volumes of renewable energies as well as changes in fossil fuel prices are reflected in the data.²³ Finally, in the *building sector*, the strong fluctuations are primarily explained by the changing weather conditions between the years.²⁴ In the *transportation sector* the coronavirus restrictions are particularly evident and shown in a large decrease in emissions.

This volatility reduces the informative power of sector reduction targets as a monitoring instrument, which is also illustrated by the debate about Germany achieving its climate targets in 2020. The targets were met for multiple reasons, including the economic downturn as a result of the coronavirus pandemic, a mild winter, and high wind yields.²⁵ With these effects gone, it is already being forecast that the climate targets for 2021 for the transportation, building, and

¹⁹ Expertenrat für Klimafragen, Bericht zur Vorjahresschätzung der deutschen Treibhausgasemissionen für das Jahr 2020 (2021): 9 (in German; available online).

²⁰ Expertenrat für Klimafragen, Bericht zur Vorjahresschätzung, 9.

²¹ In its evaluation of the emission reductions, the Expertenrat comes to the conclusion that the reduction targets in the case of the building, transportation, waste management, and agricultural sectors is within the 95 percent confidence interval. Given these relatively large uncertainties, the Expertenrat concludes that achieving the targets in these sectors is "equally likely as unlikely" in the agricultural and waste management sectors. Although the targets were achieved according to the previous year's estimate, it is also entirely possible that following the corrections, the emission levels were actually above the target value (Expertenrat für Klimafragen, Bericht zur Vorjahresschätzung: 10ff and 69).

²² Umweltbundesamt, Berichterstattung unter der Klimarahmenkonvention der Vereinten Nationen und dem Kyoto-Protokoll 2021 – Nationaler Inventarbericht zum Deutschen Treibhausgasinventar 1990-2019 (2021): 142 (in German; available online).

²³ Expertenrat für Klimafragen, Bericht zur Vorjahresschätzung, 74.

²⁴ Bundesumweltministerium, Klimaschutz in Zahlen (2021): 40 (in German; available online).

²⁵ Umweltbundesamt, "Treibhausgasemissionen sinken 2020 um 8,7 Prozent," press release from March 15, 2021 (in German; available online).

¹⁶ Section 5, paragraph 1 of the Climate Change Act.

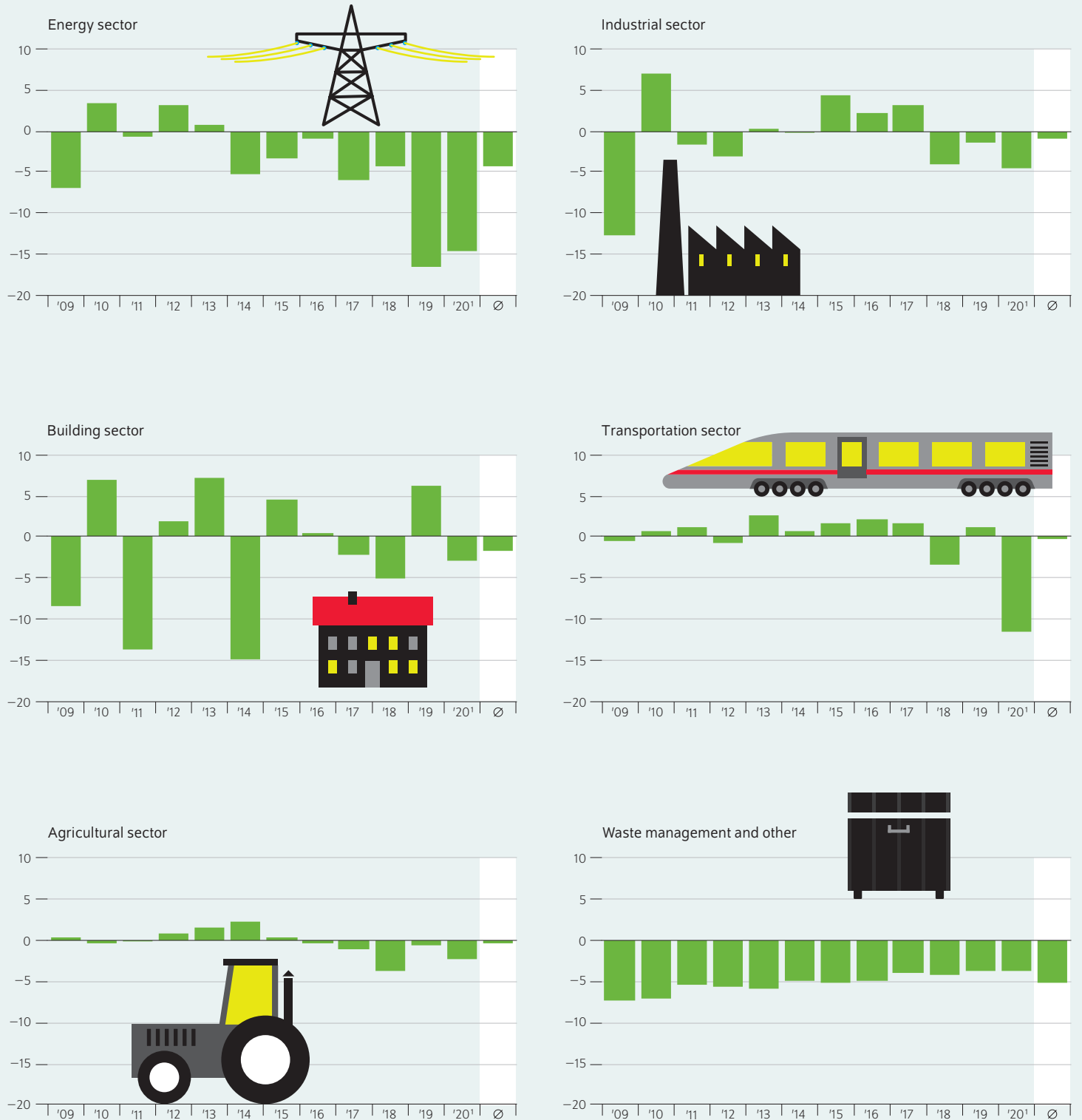
¹⁷ The UBA publishes the complete and official data in the second year following the reporting year (available online).

¹⁸ As the reports are based on comprehensive datasets of general statistics, for which the final figures for the previous year are often not available until the third quarter, estimated values still have to be used in many areas in the first quarter. However, the EU Governance Regulation (Regulation (EU) 2018/1999) stipulates in article 24, paragraph 3 that member states must submit "final data on their greenhouse gas inventories" to the EU Commission by March 15 of each year beginning in 2023. However, the extent to which the statistical reporting system must and can be adjusted for this purpose is still open.

Figure 2

Volatility of emission data

Change in emissions compared to previous year in percent



Sources: German Environment Agency; authors' own calculations.

Greenhouse gas emissions trends vary widely between years in many sectors.

industrial sectors will not be reached, requiring immediate measures.²⁶ Thus, is it reasonable to assume that the programs needed in 2020 were only delayed by the above mentioned non-recurring effects.

Sector-level aggregation prevents planning certainty and accountability

In the current Climate Change Act, a reduction target for total emissions is defined for every sector. As a result, the Act currently does not consider what emission reductions have been achieved through various activities within the sectors and in which of the subsectors progress has been made. Thus, progress in one subsector could hide a lack of progress in others. This aggregation also means that the path to climate neutrality is not defined in the individual subsectors, and thus does not contribute to coordination and reliability for investors.

Focusing on direct emission reductions does not recognize transformative measures

Not all sensible climate policy measures reduce emissions directly. In many cases, infrastructure must first be built or expanded to create the necessary conditions for significant emission reductions: providing hydrogen networks or storage capacities, for example, or developing a charging infrastructure for e-mobility. Progress in these preparatory, transformative measures is not recorded by the previous monitoring system, which could lead to short-term reduction steps being prioritized politically. This is especially problematic in areas where the short-term measures are not consistent with the long-term goal of a climate neutral society. For example, in the building sector, simple renovations reduce greenhouse gas emissions in the short term, but more extensive renovations are necessary later on. Thus, this short-term measure is not sensible in the context of climate neutrality. Therefore, additional indicators are needed to evaluate the quality of the measures implemented and thus the progress toward climate neutrality.

The delayed effect of climate policy measures on emission reductions also means that monitoring sectoral greenhouse gas emissions exclusively does not allow the government to identify undesirable developments at an early stage and to take timely corrective action. Rather, undesirable developments usually only become apparent and receive the necessary political attention once the reduction targets have already been missed.

Which leading indicators could be included in the Climate Change Act?

To address the deficiencies identified in the monitoring system, supplementary leading indicators should be added to the Climate Change Act. These leading indicators are key figures that depict intermediate steps and preparatory measures of

the transition to climate neutrality. When selecting the indicators, it should be considered that they record important developments on the path to climate neutrality and thus can already provide information on climate policy progress. A similar proposal was recently made by Duwe et al. (2021),²⁷ whose report develops an indicator system for the climate neutrality transformation that is intended to include the various structural transformations.

The following indicators should serve as examples as to what indicators in the four sectors with the highest emissions (energy, industrial, transportation, and building sectors) could look like (Table 2). Through this exemplary set of indicators, it is shown that a small number of relevant indicators can already create a better understanding for the current state of the transformation to climate neutrality in the respective sectors.

These leading indicators listed have already been used in various studies, laws, and discourses. For the Climate Change Act, they should be chosen to be consistent with the goal of climate neutrality and to simultaneously reflect the goals that emerge from the political discourse to ensure that the indicators are socially and politically anchored.

Three major challenges in the *energy sector* are the increase in renewable energy production, the allocation of temporal flexibility, and the expansion of transport capacities for electricity and hydrogen. These are covered by the indicators, as the “share of renewable energy of energy production” describes the increase in production capacity. “Storage capacity and load shifting capacity” and “flexibility that can contribute to network congestion management” can be used as indicators for the development of flexibility potentials. Finally, the “transport capacity for hydrogen” and “electricity grid expansion” map the expansion of transportation infrastructure.

Key challenges in the *industry sector* include producing climate neutral basic materials, efficiently selecting and using materials, and creating a circular economy to reduce the use of resources and energy. The “share of climate-neutral production processes” indicator maps the implementation of climate-neutral basic material processes for various materials. Furthermore, the “share of high-quality recycling” and “material intensity” indicators map circular economy and material efficiency progress. The “energy intensity” indicator captures efficiency improvements in the non-basic material producing industry.

In the *transportation sector*, separate indicators are needed for the different subsectors. The “charging infrastructure for e-mobility” and “share of climate-neutral drive technologies, differentiated according to means of transport” indicators are proposed for the personal mobility subsector while the “passenger development and capacities of public transport” and “capacity of the rail network for freight and passenger

²⁶ Agora Energiewende, *Deutschland steht 2021 vor dem höchsten Anstieg der Treibhausgasemissionen seit 1990* (2021) (in German; available online).

²⁷ Matthias Duwe et al., *Measuring progress towards climate neutrality* (Ecologic Institute: 2021) (available online).

Table 2

Examples of possible indicators

	Energy sector	Industry	Transportation	Building
1	Share of wind/solar/geothermal energy of energy production	Share of climate-neutral production for various basic materials	Number of e-mobility charging stations	Renovation rate, differentiated by depth
2	Storage capacity and load shifting capacity	Share of high-quality recycling for various basic materials	Share of climate-neutral technologies, differentiated according to means of transport	Heat consumption per square meter in new buildings
3	Flexibility that can contribute to network congestion management	Material intensity	Passenger development/public transport capacities	Share of climate-neutral heating in new buildings
4	Transport capacity for hydrogen (ton kilometers)	Energy intensity of industry excluding basic materials	Rail network capacity for freight and passenger transport	Energy use per household (excluding heating)
5	Power grid expansion (kilometers)	...	Number of domestic German flights	Use of CO ₂ /energy-intensive materials per square meter of new building space
6

Notes: Indicators followed by letters indicate that they were previously used or suggested in the following reports: A: IEA Net Zero 2050 Roadmap, B: Energiewendemonitoring, C: Nationaler Energie- und Klimaplan, D: Ecologic & IDDRI (2021), E: Agora Energiewende (2021), F: Oliver Sartor (2016), G: European Commission (2020), and H: OECD (2020).

A. IEA, Net Zero by 2050: A Roadmap for the Global Energy Sector (2021) (available online).

B. BMWi, 8. Monitoring-Bericht (2021) (in German; available online).

C. BMWi, Nationaler Energie- und Klimaplan (2020) (in German; available online).

D. Matthias Duwe et al., Measuring Progress towards Climate Neutrality (2021) (available online).

E. Agora Energiewende, Klimaneutrales Deutschland 2045 (2021) (in German; available online).

F. Oliver Sartor, "Key indicators for tracking 2030 strategies towards decarbonisation in the EU," IDDRI Working Paper (2016) (available online).

G. European Commission, "Impact assessment: Stepping up Europe's 2030 climate ambition," SWD/2020/176 final (2020) (available online).

H. OECD, Environment at a Glance (2020) (available online).

Source: Authors' own depiction.

© DIW Berlin 2021

transport" indicators could be used for rail and public transport. The "number of domestic flights" indicator reflects the shift from air traffic to other modes of transport.

In the *building sector*, there are many challenges in reducing energy use through insulation, expanding renewable energy use, and reducing construction-related emissions. The indicators "renovation rate in existing buildings" and "heat consumption per square meter in new buildings" are important indicators for consumption reduction. The "share of buildings with climate-neutral heat supply" indicator can be used to measure progress in the use of heat pumps or district heating. The "electricity consumption pro household" indicator maps the reduction of energy consumption in other areas. Finally, the "use of CO₂-intensive materials in new buildings" is an important indicator of progress toward climate neutrality in the building sector.

What should be the consequences of failing to meet the indicators?

If leading indicators are anchored in the Climate Change Act, the question arises whether there should be consequences for failing to meet the indicators and if so, what kind?

In principle, several options are conceivable: For example, failing to meet targets could not be sanctioned separately, but could simply be used to develop the emergency program according to Section 8 of the Climate Change Act as precisely as possible.

Another consequence could be the requirement to comment or provide reasoning, for example by the ministry responsible for the sector in question or the Federal Government. Further, ministers or the Federal Government could be required to revise measures within a clearly defined time frame to close the gaps. An even more far-reaching instrument would be a statutory automatism, which means if targets are not met, certain measures pre-determined by lawmakers would come into effect without any further steps.²⁸

A choice would have to be made between these options for each indicator. There are a number of arguments against anchoring statutory automatisms: There will be a large number of indicators. The task to find and determine a specific countermeasure for each of these indicators in advance is likely to significantly complicate and prolong the selection process. Often, there will also be a variety of possible responses to a failure to meet a target. In this case, pre-determined measures would waste potential for a targeted and efficient follow-up. Thus, it would be sensible to require executive action when sectoral reduction targets are missed. If the executive does not take action—for example, because they believe that they can better counter the missed target within the framework of the emergency program according to Section 8 of the Climate Change Act—they must justify this.

²⁸ Cf. Agora Energiewende's suggestion for steering via CO₂ price automatism, Agora Energiewende, *Sechs Eckpunkte für eine Reform des Klimaschutzgesetzes* (2021): 14 f. (in German; available online. Accessed on September 24, 2021).

Leading indicators offer a multitude of advantages

By introducing leading indicators, strategies for transitioning to climate neutrality will become more concrete and can be better implemented.²⁹ Thereby, the deficits identified above can be addressed while simultaneously achieving further benefits.

Leading indicators enable better management of the transition to climate neutrality

Operationalizing the climate change targets creates an early warning system that enables the German government to review whether the targets are being met at an early stage. If they are not being met, the government can take timely countermeasures. At the same time, they can also take responsibility for progress made within the legislative period. This function is already established in the Climate Change Act: The government must activate an emergency program if the sector-specific reduction targets are not met. Additional leading indicators make it easier to recognize if such a program is necessary and how it should be designed.

Leading indicators reduce uncertainties in the private sector

The additional indicators create greater certainty for the private sector by defining the time frame in which the government expects climate-neutral production in the respective subsectors. This gives firms the additional orientation they need to invest in transforming their production plants.

Leading indicators make government action comprehensible

The additional leading indicators also allow government action to be traceable by academia, the media, and civil society. The debate over potentially missing the 65 percent renewable energy target by 2030 shows how more concretely defined climate policy ambitions can result in public scrutiny of policies and support for those in power to act.³⁰ Concrete leading indicators, for example renovation rates, expansion targets for wind energy, or public transportation capacity, also support social discourse on the pace and direction of the necessary measures and thus their acceptance.

Design of leading indicators can minimize risks

Introducing leading indicators may involve certain risks. However, they can be minimized by appropriate design choices.

First, there is the risk of committing to one technology by deciding on one option too early and thereby hindering other efficient developments. Within a sector, indicators should therefore be defined in a way that leaves different technological solutions open if there is still a disagreement about the appropriate technological path to climate neutrality.

Second, there is the risk of inefficient reduction pathways if emission reductions are not prioritized in the sectors with the lowest abatement costs. To achieve climate neutrality well before 2050, however, the transition to climate-neutral technologies must succeed in parallel in all subsectors, which reduces this risk.

Third, there is the risk of inconsistency in the indicator set both between sectors as well as with respect to the overarching goal of climate neutrality. To describe a realistic pathway to climate neutrality, the indicators should be based on current scientific findings and scenarios. For example, a cabinet committee, as discussed elsewhere³¹ and as exists under the current Federal Government with the climate cabinet, is suitable for cross-sectoral coordination.

Fourth, there is the risk that with too many indicators, the relevance attributed to individual indicators will decline. Therefore, sectoral emission targets should only be supplemented with a few, easy to communicate indicators. However, the indicators should cover all major developments of the transition to climate neutrality as far as possible. Thus, a trade-off must be made between the clarity of the objectives and their completeness.

Leading indicators ensure more intertemporal liberties

Introducing leading indicators into the Climate Change Act is not necessarily mandated by the recent decision of the Federal Constitutional Court. The legislature has a great deal of leeway when drafting laws. However, introducing them would be in line with the Court's remarks calling for creating "planning security and development pressure" for climate-neutral behaviors. Indicators focusing on different subsectors within the individual sectors make it clear to firms and individuals in the sector where pressure for action exists.

Conclusion: leading indicators are a sensible further development of federal action against climate change

This Weekly Report concludes that the Climate Change Act should be supplemented with leading indicators. This would improve the central regulatory element of German climate change governance. Leading indicators are necessary because the existing monitoring system—the downstream monitoring of sector-level reduction targets—has considerable

²⁹ James Cust, "Using intermediate indicators: lessons for climate policy," *Climate Policy* 9, no. 5 (2009): 450-463.

³⁰ See Energiewirtschaftliches Institut an der Universität zu Köln, *Deutschland verfehlt das 65 Prozent-Ziel voraussichtlich (2020)* (in German; available online) or Agora Energiewende, *Wie die Ökostromlücke gestopft werden kann (2020)* (in German; available online).

³¹ Heiner Lüpke and Karsten Neuhoß, "Ausgestaltung des deutschen Klimaschutzgesetzes: Grundlage für eine bessere Governance-Struktur," *DIW Wochenbericht* no. 5 (2019): 75-81 (in German; available online).

deficits: It is fraught with uncertainties and recognizes progress only with a delay. In addition, non-recurring effects such as economic developments overshadow possible climate policy progress or failures. Moreover, the focus on emission reductions can lead to transformative measures such as constructing climate-neutral infrastructure which do not lead to immediate emission reductions being neglected. Differentiated leading indicators would operationalize the abstract sector reduction targets and help eliminate deficits of the current system. In this way, the transition to climate neutrality can be better managed.

The selection and design of leading indicators will be decisive for their effectiveness and acceptance. If it becomes clear that indicators need adjustment or further development, any modifications should happen in clearly defined processes with participation of the scientific and economic communities and civil society. In this way, the balancing act between more predictability for policymakers and firms and openness to new technical and social developments can be mastered.

Daniela Fietze is a project manager at the Stiftung Umweltenergierecht | fietze@stiftung-umweltenergierecht.de

Mats Kröger is a research associate in the Climate Policy Department at DIW Berlin | mkroeger@diw.de

Thorsten Müller is the scientific director of the Stiftung Umweltenergierecht | mueller@stiftung-umweltenergierecht.de

Karsten Neuhoff is Head of the Climate Policy Department at DIW Berlin | kneuhoff@diw.de

JEL: H11, K32, L51, O2

Keywords: Intermediary Indicators, Climate Policy, Climate Neutrality, Policy Monitoring, Climate Governance