

Communicating Climate Change: A Comparison Between Tweets and Speeches by German Members of Parliament

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Abstract

Twitter and parliamentary speeches are very different communication channels, but many members of parliament (MPs) make use of both. Focusing on the topic of climate change, we undertake a comparative analysis of speeches and tweets uttered by MPs in Germany in a recent six-year period. By keyword/hashtag analyses and topic modeling, we find substantial differences along party lines, with left-leaning parties discussing climate change through a crisis frame, while liberal and conservative parties try to address climate change through the lens of climate-friendly technology and practices. Only the AfD denies the need to adopt climate change mitigating measures, demeaning those concerned about a deteriorating climate as climate cult or fanatics. Our analysis reveals that climate change communication does not differ substantially between Twitter and parliamentary speeches, but across the political spectrum.

1 Introduction

Anthropogenic climate change (CC) is one of the major issues that societies are facing today. This is reflected in the vast amount of CC-related discourse that is distributed via different forms of media including, for instance, traditional newspapers and various social media. By their nature, platforms like Twitter are available to professional users and to the general public alike. In our work, we focus on members of the German parliament (MPs) as one specific group of actors that engages in CC discourse. More precisely, we are interested in their communication on Twitter on the one hand, and their parliamentary speeches on the other.

While Twitter is a more recent development, parliamentary speeches are a traditional means for politicians to convey their ideas and positions. Obviously, these domains imply different audiences: Tweets are aimed at the general public (and thus

to potential voters), while speeches are first of all directed at other MPs, and only indirectly meant to – sometimes – reach a broader audience.

This situation prompts us to compare the communications of MPs in the two arenas: Is CC equally prominent as a topic? Are the same aspects of CC discussed? How does this differ between parties? – We take the German Bundestag, and especially a six-year period starting in 2016, as the basis for our study.

The paper is structured as follows: After discussing related work, we explain our data collection and present corpus statistics in Section 3. Then, in Section 4 we provide analyses of term and hashtag use, while Section 5 conducts a topic modeling experiment. The findings are discussed in Section 6, and we conclude the paper in Section 7.

2 Background and Related Work

Social media has become an essential tool of political communication. Research includes the role of social media in political campaigning (e.g., [Bright et al., 2020](#)), voting (e.g., [Jacobs and Spierings, 2016](#)), popularity of politicians (e.g., [Van Aelst et al., 2017](#)), disinformation campaigns ([Keller et al., 2020](#)), as well as elite communication with citizens (e.g., [Munger et al., 2019](#)).

Among various currently popular social platforms, Twitter has become a major player in political communication ([Freelon and Karpf, 2015](#); [Graham et al., 2013](#)). In Germany, the 2009 Bundestag elections became the first instance in which MPs used Twitter on a large-scale ([Plotkowiak and Stanoevska-Slabeva, 2013](#)). Since then, Twitter has established itself as a crucial communication channel for many MPs. Yet, social media creates a distinct communication environment, in which salient topics do not necessarily resemble those discussed among a mass audience ([Stier et al., 2020](#)). As Stier

et al. point out, however, when discussing policies, politicians and their followers on Twitter tend to share similar priorities, pointing to a communication approach that is targeted at a like-minded audience (Plotkowiak and Stanoevska-Slabeva, 2013). Recently, this aspect has been investigated from the perspective of news-sharing behavior by MPs in the U.S., the UK, and in Germany (Lasser et al., 2022).

With this growing relevance of Twitter for political communication, the platform has also become a tool for science communication, in particular in respect to CC. In 2013, the United Nations Intergovernmental Panel on Climate Change (IPCC) released its Fifth Assessment Report (AR5), which was the first report that utilized Twitter as a communication tool (Newman, 2017). Newman found that events such as the IPCC report provide an opportunity to draw attention to CC-related issues on Twitter, allowing actors to strategically communicate with their audience, e.g., by adjusting their language in the interaction with different audiences (Walter et al., 2019).

Given that CC becomes an increasingly pressing issue (Ripple et al., 2021), CC-related communication of political elites also deserves further attention. Recent evidence shows that politicians promoting environmental messages on Twitter are also more likely to vote pro-environmentally (Greenwell and Johnson, 2023).

Besides such approaches in the Social Sciences, the NLP community has recently also given more attention to CC communication (Stede and Patz, 2021). For example, Vaid et al. (2022) detect subtopics as well as stances toward CC on a Twitter dataset. An interesting combination of methods was proposed by Jiang et al. (2017), who use LDA to generate topics containing keywords that represent sentiment targets, and employ SentiWordNet to annotate that part of text with a sentiment value. In this way, they try to distinguish different media for reporting with specific attitudes toward CC topics. Farrell (2019) uses NLP to identify several ten thousand people and philanthropic organizations in the U.S. engaged in disseminating CC misinformation.

Parliamentary speech on CC has recently been tackled with manual analyses of framing, for the European Parliament (Kinski and Servent, 2022) and in comparison to the U.S. (Wendler, 2022). Automatic approaches, on the other hand, to our

Party Name	Orientation
The Left	Left
The Greens	Ecological
SPD	Social Democratic
FDP	Liberal
CDU/CSU	Conservative
AfD	Right/Populist

Table 1: Parties in Parliament and Political Orientation.

knowledge are rare; one related long-term study on the development of debates about coal in the Bundestag, using Dynamic Topic Modeling, was presented by Müller-Hansen et al. (2021).

3 Data

In this work, we gather MP communications from two sources: tweets and parliament speeches. We use a subset of a tweet set collected by Lasser et al. (2022) who compared the distribution of low-quality news sources on Twitter by political elites in the U.S., the UK and Germany from January 1st 2016 until March 15th 2022. We apply the same timeframe to our present study that addresses only Germany.

During this time, six parties were represented in parliament¹ – see Table 1 for a list with their political orientation. Our timeframe includes (parts of) the three legislative periods 18 (2013-2017), 19 (2017-2021) and 20 (as of 2021). Importantly, both FDP and AfD were not represented in the 18. parliament. Also, the government changed: While CDU/CSU and SPD formed a government in legislative periods 18 and 19, a new government consisting of SPD, the Greens and FDP was formed in period 20.

3.1 MP Tweets

The German subset of tweet IDs provided by Lasser et al. (2022) consists of all tweets from former and present MPs published in the mentioned timeframe (n=754,233). After collecting the tweets in December 2022 via the Twitter API² and removing non-German data, a corpus of 673,786 tweets remained. We filtered this set using keywords related to CC and activist groups (see Appendix A), leading to our final corpus of 30,242 tweets from 635 MPs, which, on average, consist of 32 tokens.

¹Due to lack of data we ignore the SSW, which is a regionalist party of the Danish minority, and independent MP.

²Due to Twitter privacy regulations only the tweet IDs could be distributed by Lasser et al. (2022).

We apply minimal preprocessing to the tweets for topic modelling. Social media idiosyncrasies such as links, emojis, mentions and hashtags are removed for that purpose, but they remain in the data for hashtag and climate compound analyses (Section 4).

3.2 MP Speeches

For compiling our corpus of speeches, we used the Open Discourse dataset (Richter et al., 2020), which contains all transcripts of speeches in the German parliament from September 1949 until May 2021 (n=907,644). In order to search for speeches focusing on CC, we applied a slightly modified set of keywords where hashtag keywords have been replaced with their proper form, e.g. *fridays for future* instead of *#fridaysforfuture*. As the Open Discourse data set only covers months until May 2021, we manually collected the relevant speech transcripts of the missing months. Our final corpus consists of 5,351 speeches, including speeches of MPs and of ministers (most of whom are also MPs).

First experiments revealed that the transcripts contain substantial noise, i.e., material that is not related to CC. To improve results, we separated the speeches into paragraphs and filtered them with the same set of keywords. For our analyses, we treat the paragraphs as individual documents (n: 13,794; average number of tokens: 69). While paragraphs and tweets are still of rather different lengths (69 vs. 32 tokens, on average), using paragraphs allows for a more meaningful comparison than using the full speeches.

4 Analyses

For determining the relevance of the CC issue, and the stances toward it, we first analyse our data statistically, looking at speech and tweet volumes, frequencies of hashtags, and use of subjective "climateX" noun compounds (e.g., Klimapolitik, Klimaschutz, Klimakrise). We are interested in differences between parties, and between tweets and speeches. We present absolute counts and proportions, where proportions in Section 4.1 are calculated with respect to corpus sizes, while in the other two sections, proportions for hashtags and compounds are calculated with respect to total hashtag/compound counts by party.

4.1 Volume of CC Communication

Both CC corpora show a rather skewed party distribution (see also Appendix 7). Of the 30,242 tweets on CC, 13,509 (45%) were tweeted by the Greens, followed by the FDP (4,057; 13%) and the SPD (4,023; 13%). The smallest amount of tweets has been contributed by the AfD (2,208; 7%).

A different pattern can be observed in the speeches on CC. As the amount of speeches roughly correlates with a party's representation in parliament, the CDU/CSU, who had most seats in legislative periods 18 and 19, held most speeches (1,446; 28%), with the SPD ranking second (1,180, 22%). Note, however, that the size of the parliamentary group can only serve as a proxy. Other factors such as political orientation have an influence, which is arguably why the Greens have a similar proportion of speeches (20%) as the SPD. The least number of speeches were given by the FDP (416; 8%).

4.2 Hashtags

Being a social media convention, hashtags are not used in speeches, and thus we entirely focus on the twitter corpus in this section.³ Results are given in Table 2. While substantial usage of hashtags is indicated by the absolute counts, proportions appear comparatively low. This is caused by the overall large amount of individual hashtags that are being used.

All parties except the AfD most often use the tag *#climateprotection* (*#klimaschutz*, 1% (AfD) - 10% (SPD)). The Left and, especially, the Greens make use of the term *#climatecrisis* (*#klimakrise*, 2% (The Left), 4% (The Greens)), while it is not among the top hashtags of the other parties. In addition, the Left tweets on *#climatejustice* (*#klimagerechtigkeit*, 2%), on *#transporttransition* (*#verkehrswende*, 3%), and is the only party mentioning the anti-coal activist movement *Ende Gelände* (*#endegelaende*, 2%). While mentioning transport as well (2%), the Greens also use *#energytransition* (*#energiewende*, 2%) and *#coalphaseout* (*#kohleausstieg*, 2%). Being in the government for the whole timeframe, the social democratic SPD frequently uses *#climateprotectionlaw* (*#klimaschutzgesetz*, 2%) and *#climatechange* (*#klimawandel*, 2%), a term that is rather avoided by the Greens (in favor of *crisis*). All the

³Note that we will subsequently mention the translated hashtags where appropriate in addition to the original German ones.

The Left		The Greens		SPD	
Hashtag	C P	Hashtag	C P	Hashtag	C P
#klimaschutz	351 .04	#klimaschutz	2,751 .09	#klimaschutz	624 .10
#fridaysforfuture	238 .03	#klimakrise	1276 .04	#energiewende	261 .04
#verkehrswende	206 .03	#verkehrswende	736 .02	#spd	170 .03
#klimawandel	168 .02	#kohleausstieg	608 .02	#klimaschutzgesetz	144 .02
#klimagerechtigkeit	148 .02	#energiewende	497 .02	#klimawandel	116 .02
#klimakrise	146 .02	#klima	429 .01	#fridaysforfuture	89 .01
#endegelaende	130 .02	#fridaysforfuture	388 .01	#klima	85 .01
#kohleausstieg	121 .01	#btw21	334 .01	#bundestag	82 .01
#klimastreik	113 .01	#groko	293 .01	#kohleausstieg	70 .01
#dielinke	112 .01	#laschet	275 .01	#co2	56 .01
FDP		CDU/CSU		AfD	
Hashtag	C P	Hashtag	C P	Hashtag	C P
#klimaschutz	608 .08	#klimaschutz	477 .08	#afd	602 .09
#co2	276 .04	#klima	124 .02	#energiewende	198 .03
#energiewende	246 .03	#co2	100 .02	#co2	174 .02
#klima	171 .02	#klimawandel	87 .02	#klimahysterie	152 .02
#emissionshandel	150 .02	#energiewende	75 .01	#klima	144 .02
#klimawandel	115 .02	#bundestag	57 .01	#fridaysforfuture	134 .02
#kohleausstieg	115 .02	#cdu	57 .01	#klimawandel	89 .01
#fdp	105 .01	#wasserstoff	56 .01	#klimaschutz	84 .01
#versorgungssicherheit	101 .01	#nachhaltigkeit	53 .01	#grüne	80 .01
#groko	91 .01	#grünen	50 .01	#grünen	76 .01

Table 2: Hashtag Counts (C) and Proportions (P) By Party.

more left-leaning parties mention #fridaysforfuture (1% (The Greens; SPD) – 3% (The Left)).

The liberal FDP emphasizes economic interests with #energytransition (#energiewende, 3%), #emissiontrading (#emissionshandel, 2%), #coalphaseout (#kohleausstieg, 2%), and #servicesecurity (#versorgungssicherheit, 1%). The conservative CDU/CSU is the only party mentioning #hydrogen (#wasserstoff, 1%) and #sustainability (#nachhaltigkeit, 1%), in addition to #climate (#klima, 2%) and #climatechange (#klimawandel, 2%). The rightwing AfD uses #afd (9%) as their top hashtag and is the only party using the term #climatehysteria (#klimahysterie, 2%). Neither of the more right-leaning parties has Fridays For Future or any other social movement among their top hashtags. In contrast, they often apply #co2 (2% (CDU/CSU; AfD) – 4% (FDP)).

4.3 Stance-Conveying Climate Compounds

For the climate compound analysis we use a slightly modified version of the "climate change discourse glossary", which consists of 249 polit-

ically charged German noun compounds starting with *climate* (*Klima*), i.e., compounds whose use indicates the author's stance towards the issue.⁴ For matching glossary entries against terms, hyphenated and non-hyphenated variants are treated as the same compound. Results are shown in Table 3.

Tweets: We decided to keep the hashtags when matching the tweets, which results in some overlap with the previous analysis. This, however, allows us to show a more complete picture on the usage of climate compounds.⁵ In contrast to hashtag use, only a small number of climate compound types are used frequently by the parties, and we concentrate on those here.

⁴The glossary of noun-noun compounds is available here: <http://www.klimadiskurs.info>. As one exception to the N-N pattern, we add the N-Adj compound *climate-friendly* (*klimafreundlich*) to our study, as it also conveys a stance toward CC.

⁵Not all climate compounds used as hashtags are represented in the glossary, e.g., *Klimaschutz* ('climate protection'), a term that neutrally describes actions.

The Left (Tweet)		The Greens (Tweet)		SPD (Tweet)	
Compound	C P	Compound	C P	Compound	C P
klimagerechtigkeit	235 .44	klimakrise	1,951 .77	klimatefreundlich	109 .43
klimakrise	208 .39	klimatefreundlich	164 .06	klimakrise	88 .35
klimatefreundlich	25 .05	klimagerechtigkeit	157 .06	klimateleugner	10 .04
klimateaktivist	18 .03	klimatekanzler	54 .02	klimatekanzler	8 .03
klimatekanzler	7 .01	klimatekanzlerin	37 .01	klimagerechtigkeit	6 .02
FDP (Tweet)		CDU/CSU (Tweet)		AfD (Tweet)	
Compound	C P	Compound	C P	Compound	C P
klimatefreundlich	75 .43	klimatefreundlich	90 .52	klimatehysterie	193 .34
klimakrise	27 .16	klimakrise	23 .13	klimatewahn	70 .12
klimateaktivist	13 .08	klimatekonsens	11 .06	klimakrise	30 .05
klimatekonsens	7 .04	klimateaktivist	10 .06	klimateaktivist	27 .05
klimatenationalismus	6 .03	klimatekompetenz	7 .04	klimatekult	26 .05
The Left (Speech)		The Greens (Speech)		SPD (Speech)	
Compound	C P	Compound	C P	Compound	C P
klimakrise	54 .35	klimakrise	403 .84	klimatefreundlich	68 .56
klimagerechtigkeit	31 .20	klimatefreundlich	31 .06	klimakrise	34 .28
klimatefreundlich	30 .19	klimateleugner	7 .01	klimatekonsens	4 .03
klimatepäckchen	11 .07	klimatezerstörung	6 .01	klimateleugner	4 .03
klimateleugner	7 .04	klimatepäckchen	5 .01	klimateaktivist	2 .02
FDP (Speech)		CDU/CSU (Speech)		AfD (Speech)	
Compound	C P	Compound	C P	Compound	C P
klimatefreundlich	11 .28	klimatefreundlich	120 .79	klimatehysterie	35 .19
klimatekonsens	9 .23	klimakrise	17 .11	klimatereligion	16 .09
klimatenationalismus	4 .10	klimateleugner	4 .03	klimaterettung	15 .08
klimakrise	4 .10	klimatekonsens	2 .01	klimateleugner	14 .08
klimatekanzler	2 .05	klimatekompetenz	1 .01	klimakrise	13 .07

Table 3: Compound Counts (C) and Proportions (P) By Party (Top: Tweet Corpus; Bottom: Speech Corpus).

First, *climate crisis* (*Klimakrise*) is used by all parties, though with very different frequency (5% (AfD) - 77% (The Greens)), which contrasts with the respective hashtag which is only used by the the Left and the Greens. *Climate-friendly* (*klimatefreundlich*) is applied by all parties except the AfD (5% (The Left) - 52% (CDU/CSU)). Other frequently used compounds include *climate justice* (*Klimagerechtigkeit* by the Left (44%) and the Greens (6%)) and *climate activist* (*Klimateaktivist*). Importantly, the AfD exclusively uses a number of compounds that clearly convey negative judgement on the activist movement, including *climate hysteria* (*Klimatehysterie*, 34%), *climate delusion* (*Klimatewahn*, 12%), and *climate cult* (*Klimatekult*, 5%).

Speeches: Some of the patterns found in tweets re-emerge in the speeches. First, *climate crisis* is used by all parties, with proportions ranging from 7% to 84%, the highest of which is associated with the Greens. Second, *climate-friendly* is mentioned by all parties except the AfD (6% (The Greens) - 79% (CDU/CSU)). Third, *climate justice* is frequently used by the Left (20%), and the AfD often applies *climate hysteria* (19%). Contrasting with the tweet data, however, the FDP makes more notable usage of *climate consensus* (*Klimatekonsens*, 23%), while the AfD uses *climate religion* (*Klimatereligion*, 9%), *climate rescue* (*Klimaterettung*, 8%), and *climate denier* (*Klimateleugner*, 8%).

Topic Labels Tweet Corpus	
T1	emissions,trading,reduction
T2	railroad,transport infrastructure
T3	dates
T4	climate crisis,package,justice
T5	energy transition,supply
T6	EU, multilateralism
T7	climate protection
T8	politics,police
T9	innovation,technology
Topic Labels Speech Corpus	
T1	CO2 emissions,trading,reduction
T2	investment,finances
T3	EU,security,NATO
T4	dates,goals,climate neutrality
T5	CC,dogma,politics
T6	energy transition,renewables,efficiency
T7	railroad,transport infrastructure
T8	politics,democracy,human rights
T9	climate protection,implementation

Table 4: Topic Labels For Tweet and Speech Corpora.

5 Topic Modeling

For topic modeling we use BERTopic (Grootendorst, 2022), a technique based on transformers (Devlin et al., 2019), clustering and a class-based variation of TF-IDF, i.e. c-TF-IDF. The BERTopic algorithm works as follows:

In a first step, documents are embedded in order to create vector space representations that can be used for semantic clustering. Here, we use Sentence-BERT (SBERT) (Reimers and Gurevych, 2019). Second, the dimensionality of embeddings is reduced using UMAP (McInnes et al., 2020), after which documents are clustered using HDBSCAN (McInnes et al., 2017), a hierarchical version of the original DBSCAN algorithm. This allows for soft clustering as unrelated documents are treated as noise. Third, topic representations are created using c-TF-IDF.

We use the same hyperparameters for both the tweet and speech datasets. We remove frequent words 1) by applying BM-25 weighting and 2) by taking the square root of the term frequency after normalizing the frequency matrix instead of taking the default term frequency in the c-TF-IDF algorithm. Both options can be set in BERTopic. We use the SBERT model *all-mpnet-base-v2*. The

minimum cluster size of HDBSCAN is set to 15. Finally, we apply the Maximal Marginal Relevance algorithm (Carbonell and Goldstein, 1998) to diversify the topic representation, using a mild score of 0.2 (with 0=no diversity, 1=complete diversity). We train topic models on the full tweet and speech corpora and on individual party subsets, resulting in 14 topic models.

In the following, we will describe the topics provided by the trained models. Due to space limitations we will concentrate on the topics that were associated with most documents and were interpretable from a climate (policy) perspective. The topic labels, which were manually derived from the models, can be found in Table 4 for the full tweet and speech corpora, and in Table 5 for individual party subsets. See Appendix C for the actual topic representations.

5.1 Topics in Tweets

The topic model trained on the full tweet corpus obtains a diverse set of CC-related topics (see Table 4; top). The most prominent topic (T1) focuses on emissions and their trading and reduction, followed by a topic about transport infrastructure (T2). Other topics concentrate on climate crisis and justice (T4), energy transition (T5), climate protection (T7) and innovation and technology (T9). Another one deals with the EU and multilateralism (T6).

With respect to the models trained on party subsets, there are several similarities and differences to be observed (see Table 5; top). First, all parties talk about CO2 emissions. However, certain differences can be observed. While the Left mainly discusses emission reduction, the other parties except the AfD also focus on pricing. The liberal FDP mentions emission trading. Second, all parties except the AfD are associated with date topics. These topics are characterized by the mention of several years, which are connected to certain climate goals. Third, the Left, the Greens and the SPD have topics related to transport transition and infrastructure among their most common topics (The Left: T6; The Greens: T2; SPD: T2), while the other parties do not. Fourth, most parties have a topic concentrating on energy transition and renewables⁶. The AfD is the only party mentioning nuclear energy and having their own topic on wind energy. Fifth, both FDP and CDU/CSU have innovation/technology

⁶Note that while not among the top topics, the Greens had two topics on energy: 1. energy transition; 2. fossil fuels.

	The Left (Tweet)	The Greens (Tweet)	SPD (Tweet)
T1	politics,parties	climate crisis,adaptation	CO2 emissions,pricing
T2	climate politics,protection	railroad,streets	cities,transport
T3	profit,economy	CO2 emissions,reduction,pricing	dates
T4	CO2 emissions,reduction	dates	climate protection,elites
T5	dates	EU,green(washing)	EU,council presidency
T6	street,city	politics,police	energy transition,renewables
	FDP (Tweet)	CDU/CSU (Tweet)	AfD (Tweet)
T1	CO2 emissions,trading	CO2 emissions,pricing,reduction	CO2 emissions
T2	climate politics,protection	dates	CC,protection,world climate
T3	innovation,technology	innovation,technology	climate hysteria,socialism
T4	dates	economy,feasibility	diesel,car,fuel
T5	energy sources, transition	industry,sector	energy transition,nuclear
T6	economy	energy sources,transition	wind energy
	The Left (Speech)	The Greens (Speech)	SPD (Speech)
T1	climate politics,protection	climate crisis,protection	climate protection, costs
T2	energy,transition, "bürgerenergie"	CO2 emissions,trading	energy transition,renewables
T3	CO2 emissions,car	energy transition,renewables	CO2 emissions,pricing
T4	transport infrastructure	coal committe,phase-out	technology,industry
T5	finances,investment	EU	EU
T6	digitalisation,transformation	dates,goals	money,investment
	FDP (Speech)	CDU/CSU (Speech)	AfD (Speech)
T1	CO2, emissions trading	CO2 emissions,trading	energy sources,transition
T2	energy,transition,politics	EU,Russia	CO2 emissions
T3	-	energy transition,renewables	CC,climate religion
T4	-	railroad,money	CC,climate dogma
T5	-	e-mobility,fuels	money
T6	-	farming	economy,EU

Table 5: Topic Labels By Party (Top: Tweet Corpus; Bottom: Speech Corpus).

topics. Finally, some topics are attached to individual parties. The Greens provide a topic concerning the EU and green(washing). The SPD has a topic mentioning EU and EU council presidency. Industry is a topic exclusive to the CDU/CSU and the AfD is the only party talking about climate hysteria and socialism.

5.2 Topics in Speeches

The topic model trained on the full speech corpus produces similar topics as the one trained on tweet data, e.g emissions trading and reduction (T1), energy transition (T6) and transport infrastructure (T7) (see Topic 4; bottom). However, new topics include investment and finances (T2) and politics, democracy and human rights (T8). Furthermore, the EU topic has a special focus on security and NATO, while the transport infrastructure topic (T7) is less dominant.

The general trend found in the tweet data, can be identified as well in the party subsets of the speech data (see Table 5; bottom, labelled (Speech)). Again, all parties concern themselves with CO2 emissions and/or energy transition, the latter of

which, however, appears now to be a more dominant topic for left-leaning parties. Furthermore, the AfD has speech topics revolving around climate religion and dogma, which are semantically similar to climate hysteria.

Still, some minor differences can be found. For instance, transport was represented in the most common tweet topics of the Greens and SPD, which is not the case for the respective speech subsets. Except for the Greens, no topics on years/goals can be found. Finally, the CDU/CSU has stronger focus on e-mobility and transport in general than in the tweet corpus.

6 Discussion

Although political communication can be domain dependent (Stier et al., 2020), our findings indicate a strong overlap between compounds, hashtags, and topics prevalent on social media and in parliamentary debates. Politically left-leaning parties (such as the Left, the Greens, and the SPD) tend to discuss CC in terms of its negative and heterogeneous impact (as indicated by the use of the compound *climate crisis* (*Klimakrise*) and *climate*

justice (Klimagerechtigkeit) in both speeches and tweets. Especially the Greens make use of this terminology, thereby connecting to various activist groups (e.g., Fridays For Future, Extinction Rebellion, Last Generation) that use *climate crisis* as a frame to highlight the severe and urgent need to counteract the negative consequences of CC. The Left uses *climate justice* more consistently on Twitter and in parliament, compared to both Greens and SPD. While also using *climate crisis*, the SPD most frequently uses *climate-friendly (klimafreundlich)*, which might be indicative for an approach that tries to balance the urgency of CC with measures that are seen as not too invasive for citizens and the economy. This balanced approach is also reflected in the topics, including cities, transport; climate protection, elites (Twitter); and climate protection, costs; technology, industry; and money, investment (speeches).

In contrast, traditionally more business-friendly parties, such as the FDP and CDU/CSU, use *climate-friendly* to a greater extent, which might indicate a stronger orientation towards economic transformation and technological advancements. This interpretation is supported by the topics for both parties, which include innovation and technology, energy sources and transition, as well as e-mobility and fuels in case of the CDU/CSU.

Whereas these five parties acknowledge the need to address CC, although using different framings, the AfD uses terminology that frames CC and corresponding protective measures as hysterical (*Klimahysterie*), fanatical (*Klimawahn, Klimareligion*), or cult-like (*Klimakult*). A similar pattern is found in the AfD topics, which include climate hysteria and socialism on Twitter and climate religion as well as climate dogma in parliament speeches.

This general pattern is reflected by the hashtags #transporttransition (#verkehrswende) and #energytransition (#energiewende). While the Greens, the SPD, the FDP and the CDU/CSU frequently use the latter, only the Left and the Greens explicitly mention the transition of transport. This difference also emerges in the topics, where those related to transport infrastructure or railroads are associated with left-leaning parties, while topics related to energy transition and emissions reduction are more broadly distributed. This may be due to transport being framed as a social topic by the Left and the Greens, e.g., with a potential for many people to benefit from lower train ticket prices and improved

railroad infrastructure. The FDP and CDU/CSU, however, may interpret transport transition as having negative consequences for the automobile industry, a traditionally strong industry sector in Germany, which is why the CDU/CSU discusses e-mobility and alternative fuels in parliament and uses #hydrogen (#wasserstoff). In contrast, the energy transition is seen as having a strong potential for economy and technological innovation, while being at the same time crucial for emissions reduction. This makes it a more suitable topic to be adopted by parties of different orientations. In sum, compounds, hashtags, and topics reflect the respective parties' political orientation and their stance towards CC and climate protection, with comparatively small differences between parliamentary speeches and communication on Twitter.

7 Conclusion

We studied the communication of German MPs on Twitter and in parliamentary speeches, concentrating on the topic of CC, for which we created corpora that cover the same 6-year period. By topic modeling, hashtag analysis and comparing the use of stance-marked noun compounds, we looked for differences between parties on the one hand, and between the communication in the two channels, on the other hand.

Our analysis reveals, that differences in climate communication primarily emerge across the political spectrum, with left-leaning parties focusing more heavily on the negative impacts of CC and economics-oriented parties concentrating more on economic transformation and technological advancements. The AfD is the only party denying the need to adopt CC mitigating measures and demeaning those concerned about a deteriorating climate as climate cult or fanatics. Differences between tweets and speeches are less salient.

In a follow-up study, we plan to investigate the climate communicative behavior of individual MPs with respect to their roles in climate-related committees, as well as conduct a time-sensitive analysis using dynamic topic modeling.

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References

- Jonathan Bright, Scott Hale, Bharath Ganesh, Andrew Bulovsky, Helen Margetts, and Phil Howard. 2020. Does Campaigning on Social Media Make a Difference? Evidence From Candidate Use of Twitter During the 2015 and 2017 U.K. Elections. *Communication Research*, 47(7):988–1009.
- Jaime Carbonell and Jade Goldstein. 1998. The use of mmr, diversity-based reranking for reordering documents and producing summaries. In *Proceedings of the 21st Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, SIGIR '98, page 335–336, New York, NY, USA. Association for Computing Machinery.
- Jacob Devlin, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova. 2019. BERT: Pre-training of deep bidirectional transformers for language understanding. In *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1 (Long and Short Papers)*, pages 4171–4186, Minneapolis, Minnesota. Association for Computational Linguistics.
- J. Farrell. 2019. The growth of climate change misinformation in US philanthropy: evidence from natural language processing. *Environmental Research Letters*, 14(3).
- Deen Freelon and David Karpf. 2015. Of big birds and bayonets: hybrid Twitter interactivity in the 2012 Presidential debates. *Information, Communication Society*, 18(4):390–406.
- Todd Graham, Marcel Broersma, Karin Hazelhoff, and Guido van 't Haar. 2013. BETWEEN BROADCASTING POLITICAL MESSAGES AND INTERACTING WITH VOTERS. *Information, Communication Society*, 16(5):692–716.
- Matthew P. Greenwell and Thomas F. Johnson. 2023. Is it all talk: Do politicians that promote environmental messages on social media actually vote-in environmental policy? *Energy, Ecology and Environment*, 8(1):17–27.
- Maarten Grootendorst. 2022. Bertopic: Neural topic modeling with a class-based tf-idf procedure.
- Kristof Jacobs and Niels Spierings. 2016. Saturation or maturation? The diffusion of Twitter and its impact on preference voting in the Dutch general elections of 2010 and 2012. *Journal of Information Technology and Politics*, 13(1):1–21.
- Ye Jiang, Xingyi Song, Jackie Harrison, Shaun Quegan, and Diana Maynard. 2017. Comparing attitudes to climate change in the media using sentiment analysis based on Latent Dirichlet Allocation. In *Proceedings of the 2017 EMNLP Workshop: Natural Language Processing meets Journalism*, pages 25–30, Copenhagen, Denmark. Association for Computational Linguistics.
- Franziska B. Keller, David Schoch, Sebastian Stier, and Jung Hwan Yang. 2020. Political Astroturfing on Twitter: How to Coordinate a Disinformation Campaign. *Political Communication*, 37(2):256–280.
- Lucy Kinski and Ariadna Ripoll Servent. 2022. Framing Climate Policy Ambition in the European Parliament. *Politics and Governance*, 10(3):251–263.
- Jana Lasser, Segun Taofeek Aroyehun, Almog Simchon, Fabio Carrella, David Garcia, and Stephan Lewandowsky. 2022. Social media sharing of low-quality news sources by political elites. *PNAS Nexus*, 1(4). Pgac186.
- Leland McInnes, John Healy, and Steve Astels. 2017. hdbSCAN: Hierarchical density based clustering. *Journal of Open Source Software*, 2(11):205.
- Leland McInnes, John Healy, and James Melville. 2020. Umap: Uniform manifold approximation and projection for dimension reduction.
- Kevin Munger, Richard Bonneau, Jonathan Nagler, and Joshua A. Tucker. 2019. Elites tweet to get feet off the streets: Measuring regime social media strategies during protest. *Political Science Research and Methods*, 7(4):815–834.
- Finn Müller-Hansen, Max W. Callaghan, Yuan Ting Lee, Anna Leipprand, Christian Flachsland, and Jan C. Minx. 2021. Who cares about coal? Analyzing 70 years of German parliamentary debates on coal with dynamic topic modeling. *Energy Research Social Science*, 72(101869).
- Todd P. Newman. 2017. Tracking the release of IPCC AR5 on Twitter: Users, comments, and sources following the release of the Working Group I Summary for Policymakers. *Public Understanding of Science*, 26(7):815–825.
- Thomas Plotkowiak and Katarina Stanoevska-Slabeva. 2013. German politicians and their Twitter networks in the Bundestag Election 2009. *First Monday*, 18(5):1–19.
- Nils Reimers and Iryna Gurevych. 2019. Sentence-BERT: Sentence embeddings using Siamese BERT-networks. In *Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing and the 9th International Joint Conference on Natural Language Processing (EMNLP-IJCNLP)*, pages 3982–3992, Hong Kong, China. Association for Computational Linguistics.
- Florian Richter, Philipp Koch, Oliver Franke, Jakob Kraus, Fabrizio Kuruc, Anja Thiem, Judith Högerl, Stella Heine, and Konstantin Schöps. 2020. Open Discourse.
- William J. Ripple, Christopher Wolf, Thomas M. Newsome, Jillian W. Gregg, Timothy M. Lenton, Ignacio Palomo, Jasper A J Eikelboom, Beverly E. Law, Saleemul Huq, Philip B. Duffy, and Johan Rockström. 2021. World Scientists' Warning of a Climate Emergency. *BioScience*, 71(9):894–898.

Manfred Stede and Ronny Patz. 2021. [The climate change debate and natural language processing](#). In *Proceedings of the 1st Workshop on NLP for Positive Impact*, pages 8–18, Online. Association for Computational Linguistics.

Sebastian Stier, Arnim Bleier, Haiko Lietz, and Markus Strohmaier. 2020. [Election Campaigning on Social Media: Politicians, Audiences, and the Mediation of Political Communication on Facebook and Twitter](#). *Political Communication*, 35(1):50–74.

Roopal Vaid, Kartikey Pant, and Manish Shrivastava. 2022. [Towards fine-grained classification of climate change related social media text](#). In *Proceedings of the 60th Annual Meeting of the Association for Computational Linguistics: Student Research Workshop*, pages 434–443, Dublin, Ireland. Association for Computational Linguistics.

Peter Van Aelst, Patrick van Erkel, Evelien D’heer, and Raymond A. Harder. 2017. [Who is leading the campaign charts? Comparing individual popularity on old and new media](#). *Information Communication and Society*, 20(5):715–732.

Stefanie Walter, Ines Lörcher, and Michael Brüggemann. 2019. [Scientific networks on Twitter: Analyzing scientists’ interactions in the climate change debate](#). *Public Understanding of Science*, 28(6):696–712.

Frank Wendler. 2022. *Framing Climate Change in the EU and US After the Paris Agreement*. palgrave macmillan, Cham/Switzerland.

A Keywords

- Table 6: Keywords.

B Basic Corpus Statistics

- Table 7: Tweet and Speech Distribution By Party.

C Topics

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Keywords Tweets	Keywords Speeches
klima	klima
erwärmung	erwärmung
treibhaus	treibhaus
co2	co2
kohle	kohle
energiewende	energiewende
verkehrswende	verkehrswende
#fff	-
#fridaysforfuture	fridays for future
#endegelände	ende gelände
#endegelaende	-
#letztegeneration	-
#extinctionrebellion	extinction rebellion

Table 6: Keywords.

Party Name	Tweet Count	Tweet Proportion	Speech Paragraph Count	Speech Proportion
The Left	3,208	0.11	660 1609	0.12
The Greens	13,509	0.45	1038 2767	0.20
SPD	4,023	0.13	1180 3028	0.22
FDP	4,057	0.13	416 1086	0.08
CDU/CSU	3,237	0.11	1446 3811	0.28
AfD	2,208	0.07	611 1493	0.11

Table 7: Tweet and Speech Distribution By Party.

Topic 1 (n: 2,890)	Score	Topic 2 (n: 1,346)	Score	Topic 3 (n: 641)	Score
emissionen	0.151	bahn	0.203	2038	0.275
emissionshandel	0.146	straße	0.194	2030	0.229
vermieter	0.113	straßen	0.171	2022	0.172
diesel	0.113	berlin	0.166	2035	0.158
1990	0.103	autobahn	0.162	2045	0.152
reduzieren	0.102	straßenbau	0.122	2025	0.139
emissionshandels	0.101	bahnhof	0.113	kohleausstieg	0.136
benzin	0.100	bundesstraßen	0.111	2023	0.125
fuels	0.099	bahnstrecken	0.110	2026	0.114
tonne	0.097	parkplätze	0.096	2029	0.108
Topic 4 (n: 537)	Score	Topic 5 (n: 525)	Score	Topic 6 (n: 458)	Score
klimakrise	0.143	energiewende	0.243	eu	0.218
klimapolitik	0.141	energie	0.179	europa	0.216
klimapaket	0.125	energieversorgung	0.145	europäische	0.197
klimawandel	0.122	energiesicherheit	0.134	europäischen	0.165
klimapolitisch	0.117	energieeffizienz	0.121	multilateralismus	0.133
klimakompetenz	0.104	energiekonzerne	0.120	europäisch	0.131
klimanotstand	0.103	energieerzeugung	0.113	nationale	0.128
klimagerechtigkeit	0.103	energieeffizientes	0.108	europäischer	0.114
klimaprogramme	0.099	energiepreise	0.105	nationalismus	0.113
shutdown	0.099	energiepolitische	0.105	europäisches	0.106
Topic 7 (n: 444)	Score	Topic 8 (n: 384)	Score	Topic 9 (n: 362)	Score
klimaschutzes	0.128	politik	0.220	innovationen	0.318
klimaschutzmaßnahmen	0.125	politiker	0.167	innovation	0.287
klimaschützer	0.121	politischen	0.153	technologien	0.253
klimaschutzministerium	0.110	politikern	0.146	technologieoffenheit	0.224
naturschutz	0.109	politikerinnen	0.116	innovationskraft	0.160
marktzentrierter	0.108	polizeigewalt	0.113	technologischen	0.158
klimaschutzaktivisten	0.108	haushaltspolitiker	0.103	technologieoffene	0.145
lebensqualität	0.104	polizisten	0.101	technologieweltmeister	0.142
klimaschutzkonzept	0.101	klassenpolitik	0.099	technologieoffen	0.140
elitenprojekt	0.096	klimaschutzpolitik	0.098	innovativ	0.120

Table 8: Topics Tweet Corpus (n: 30,242).

Topic 1 (n: 232)	Score	Topic 2 (n: 216)	Score	Topic 3 (n: 136)	Score
politik	0.248	klimapolitik	0.212	profite	0.283
union	0.243	klimaschutz	0.209	wirtschaft	0.277
fdp	0.240	klimaziele	0.182	investitionen	0.270
gerechtigkeit	0.240	klima	0.173	profit	0.258
linke	0.223	klimakrise	0.161	finanzieren	0.199
neoliberale	0.191	klimakatastrophe	0.161	profitinteressen	0.192
Topic 4 (n: 106)	Score	Topic 5 (n: 68)	Score	Topic 6 (n: 61)	Score
co2	0.535	2030	0.428	straße	0.495
emissionen	0.349	2038	0.418	straßen	0.377
ausstoß	0.269	2035	0.320	tausenden	0.319
sinken	0.205	2022	0.297	stadt	0.272
vermieter	0.204	2020	0.262	toll	0.253
co ²	0.200	idealerweise	0.253	freitag	0.238

Table 9: Topics Tweet Corpus (The Left; n: 3,208).

Topic 1 (n: 1,011)	Score	Topic 2 (n: 689)	Score	Topic 3 (n: 606)	Score
klimakrise	0.139	autobahnen	0.216	co2	0.297
klimaanpassung	0.119	bahn	0.214	emissionen	0.205
klimaregierung	0.106	straße	0.211	bepreisung	0.171
klimaschutzmaßnahmen	0.104	straßen	0.196	reduzieren	0.143
klimapaket	0.099	berlin	0.171	vermieter	0.136
klimakonferenz	0.098	autobahn	0.169	tonne	0.135
Topic 4 (n: 415)	Score	Topic 5 (n: 320)	Score	Topic 6 (n: 286)	Score
2038	0.293	europa	0.288	politik	0.280
2030	0.277	green	0.233	politische	0.202
2035	0.182	europäische	0.186	politischen	0.176
2019	0.173	europäischen	0.185	politiker	0.174
2022	0.165	europäisch	0.175	politisch	0.155
2021	0.155	greenwashing	0.173	polizei	0.150

Table 10: Topics Tweet Corpus (The Greens; n: 13,509).

Topic 1 (n: 287)	Score	Topic 2 (n: 143)	Score	Topic 3 (n: 115)	Score
co2	0.401	berlin	0.328	2030	0.390
vermieter	0.269	bahn	0.324	2038	0.343
bepreisung	0.260	straße	0.292	2045	0.291
mieter	0.233	bahnfahren	0.280	2040	0.267
emissionen	0.221	hamburg	0.228	2021	0.265
ausstoß	0.216	städten	0.219	2050	0.259
Topic 4 (n: 105)	Score	Topic 5 (n: 82)	Score	Topic 6 (n: 81)	Score
klimaschutz	0.256	eu	0.436	energiewende	0.435
klar	0.199	ratspräsidentschaft	0.367	energien	0.375
elitenprojekt	0.187	europäische	0.277	erneuerbaren	0.342
vorgeschoben	0.187	europas	0.225	energie	0.283
moorschutz	0.187	rat	0.224	thysseogas	0.237
klimaprogramme	0.187	europäischer	0.217	energy	0.237

Table 11: Topics Tweet Corpus (SPD; n: 4,023).

Topic 1 (n: 1,035)	Score	Topic 2 (n: 345)	Score	Topic 3 (n: 175)	Score
emissionen	0.221	klimapolitik	0.237	innovationen	0.356
co2	0.214	klimaschutz	0.225	innovation	0.319
emissionshandel	0.214	klima	0.189	technologieoffenheit	0.290
ausstoß	0.185	klimawandel	0.185	digitalisierung	0.273
ets	0.181	retten	0.171	technologien	0.265
zertifikate	0.157	klimaziele	0.166	bildung	0.238
Topic 4 (n: 78)	Score	Topic 5 (n: 70)	Score	Topic 6 (n: 70)	Score
2030	0.370	energiewende	0.490	wirtschaft	0.314
2038	0.365	energien	0.350	planwirtschaftlichen	0.272
2022	0.300	energie	0.333	planwirtschaftlicher	0.262
2021	0.284	energiepolitischen	0.309	wirtschaftliches	0.255
2035	0.274	energieträger	0.276	plan	0.248
2026	0.258	volatile	0.274	sonderwirtschaftsregionen	0.240

Table 12: Topics Tweet Corpus (FDP; n: 4,057).

Topic 1 (n: 369)	Score	Topic 2 (n: 130)	Score	Topic 3 (n: 82)	Score
co2	0.362	2020	0.314	innovationen	0.488
ausstoß	0.244	2038	0.304	technologien	0.435
emissionen	0.235	früher	0.245	innovation	0.349
bepreisung	0.201	nrw	0.243	friedman	0.288
reduziert	0.180	beschlossen	0.233	technik	0.286
heißt	0.176	jahre	0.218	extremismus	0.259
Topic 4 (n: 75)	Score	Topic 5 (n: 51)	Score	Topic 6 (n: 50)	Score
wirtschaft	0.361	industrieland	0.486	energiewende	0.475
marktwirtschaft	0.294	industrie	0.356	energien	0.358
wirtschaftlichkeit	0.241	industriestandort	0.300	gas	0.315
wirtschaftlich	0.239	industriention	0.285	offshore	0.312
landwirtschaft	0.230	sozialverträglich	0.255	windenergie	0.309
wirtschaftliche	0.230	strukturwandel	0.241	pv	0.309

Table 13: Topics Tweet Corpus (CDU/CSU; n: 3,237).

Topic 1 (n: 169)	Score	Topic 2 (n: 120)	Score	Topic 3 (n: 73)	Score
co2	0.490	klimawandel	0.317	klimahysterie	0.316
ausstoß	0.258	klima	0.288	sozialismus	0.297
emissionen	0.223	klimaschutzes	0.261	klima	0.294
einführung	0.193	wärmer	0.253	klimaziele	0.269
gegen	0.192	weltklima	0.250	klimahysteriker	0.266
abschaffen	0.190	klimaschutz	0.245	türkei	0.265
Topic 4 (n: 69)	Score	Topic 5 (n: 67)	Score	Topic 6 (n: 36)	Score
diesel	0.475	energiewende	0.497	wind	0.465
autos	0.447	energie	0.386	windräder	0.419
benzin	0.400	energiepolitik	0.334	windkraftanlagen	0.367
liter	0.394	kernenergie	0.254	windrad	0.367
ein	0.233	elon	0.240	windkraft	0.367
emissionsfreien	0.232	kostensteigerung	0.240	windkraftwerk	0.327

Table 14: Topics Tweet Corpus (AfD; n: 2,208).

Topic 1 (n: 1,062)	Score	Topic 2 (n: 433)	Score	Topic 3 (n: 351)	Score
co2	0.229	euro	0.267	europa	0.216
emissionshandel	0.198	investitionen	0.194	eu	0.215
emissionen	0.190	investieren	0.163	europäische	0.213
ausstoß	0.164	ausgaben	0.143	europäischen	0.209
emissionshandels	0.124	investiert	0.141	sicherheitspolitik	0.134
carbon	0.120	finanzieren	0.133	nato	0.131
atmosphäre	0.118	finanzierung	0.125	europas	0.131
sektoren	0.114	billionen	0.124	multilateralismus	0.128
leakage	0.105	subventionen	0.121	europäer	0.121
reduzierung	0.097	bundeshaushalt	0.120	terrorismus	0.120
Topic 4 (n: 279)	Score	Topic 5 (n: 239)	Score	Topic 6 (n: 210)	Score
2030	0.265	klimawandel	0.236	energiewende	0.268
klimaschutzplan	0.198	klimapolitik	0.229	energien	0.226
klimaziele	0.168	klima	0.218	energie	0.154
klimaneutralität	0.154	klimadogma	0.209	erneuerbarer	0.138
klimaschutzprogramm	0.150	klimavertagungsprogramm	0.193	energieeffizienz	0.131
koalitionsvertrag	0.147	klimapaket	0.181	fertigstellung	0.128
klimaschutzziel	0.137	klimabesteuerung	0.178	umweltverträglichkeit	0.128
ambitionierter	0.136	abrüstung	0.162	energiepolitische	0.123
fahrplan	0.123	klimapolitisch	0.158	energieversorgung	0.122
jahre	0.123	klimaretter	0.157	energiekonzern	0.119
Topic 7 (n: 186)	Score	Topic 8 (n: 165)	Score	Topic 9 (n: 154)	Score
bahn	0.373	politik	0.264	durchzuführen	0.207
straße	0.231	demokratie	0.239	effizienten	0.185
straßen	0.217	klimaschutzpolitik	0.199	klimaschutz	0.177
straßenverkehr	0.192	menschenrechte	0.183	kämpfe	0.177
straßenbau	0.173	polizisten	0.172	klimaschutzplan	0.174
finanzierungskreislauf	0.151	demokratische	0.163	erweitert	0.169
wasserstraßen	0.145	gesellschaftliches	0.160	klimaschutzgesetz	0.167
autobahn	0.141	menschenrechtsschutz	0.159	brandt	0.161
bahnreform	0.135	kulturpolitik	0.155	klimaschutzhaushalt	0.156
bahnhöfen	0.132	populisten	0.146	klimaschutzbemühungen	0.156

Table 15: Topics Speech Corpus (n: 13,794).

Topic 1 (n: 208)	Score	Topic 2 (n: 108)	Score	Topic 3 (n: 84)	Score
klimapolitik	0.225	energiewende	0.400	co2	0.390
kollegen	0.222	energien	0.322	co	0.333
klimaschutz	0.207	bürgerenergie	0.318	emissionen	0.299
klimawandel	0.206	energie	0.298	ccs	0.227
haben	0.199	windkraft	0.241	tonne	0.227
zuschauer	0.190	pv	0.224	autos	0.224
Topic 4 (n: 82)	Score	Topic 5 (n: 50)	Score	Topic 6 (n: 37)	Score
bahn	0.351	euro	0.426	digitalisierung	0.349
autobahnen	0.310	milliarden	0.373	transformation	0.297
straßenverkehr	0.290	lufthansa	0.271	industrie	0.277
straßen	0.275	einzelplan	0.271	industriepolitik	0.268
straße	0.243	investitionen	0.265	internet	0.261
straßenbau	0.229	finanzieren	0.236	interdisziplinarität	0.248

Table 16: Topics Speech Corpus (The Left; n: 1,609).

Topic 1 (n: 306)	Score	Topic 2 (n: 186)	Score	Topic 3 (n: 129)	Score
klimakrise	0.231	co2	0.380	energiewende	0.349
klimaschutz	0.224	co	0.288	erneuerbaren	0.329
klimaforschung	0.184	emissionen	0.263	energien	0.326
klimapolitik	0.182	emissionshandel	0.257	windenergie	0.266
deutschland	0.166	ausstoß	0.223	energieeffizienz	0.236
haben	0.164	reduzieren	0.181	wind	0.185
Topic 4 (n: 94)	Score	Topic 5 (n: 93)	Score	Topic 6 (n: 70)	Score
kohlekommission	0.320	europäische	0.341	2020	0.382
kohleausstieg	0.254	europäischen	0.315	2030	0.379
kohle	0.246	eu	0.311	klimaschutzziel	0.303
kohlekraftwerk	0.236	europa	0.309	klimaschutzplan	0.278
kohleausstiegsgesetz	0.216	europas	0.210	kohleausstieg	0.252
datteln	0.213	brexit	0.202	klimapaket	0.233

Table 17: Topics Speech Corpus (The Greens; n: 2,767).

Topic 1 (n: 116)	Score	Topic 2 (n: 100)	Score	Topic 3 (n: 100)	Score
klimaschutz	0.298	energiewende	0.342	co2	0.430
kostet	0.260	energien	0.309	bepreisung	0.335
klimawandel	0.253	erneuerbaren	0.298	co	0.310
verschwörung	0.251	energie	0.239	ausstoß	0.271
bürgerinnen	0.230	energieversorgung	0.206	tonne	0.222
klimapaket	0.224	energieforschung	0.187	emissionen	0.201
Topic 4 (n: 90)	Score	Topic 5 (n: 83)	Score	Topic 6 (n: 64)	Score
technologien	0.229	europa	0.373	euro	0.487
industrie	0.215	eu	0.313	milliarden	0.451
digitalisierung	0.205	europäische	0.271	investieren	0.315
innovationen	0.204	europäischen	0.269	investitionen	0.290
wirtschaft	0.200	ratspräsidentenschaft	0.202	forschung	0.238
gewerkschaften	0.186	migration	0.193	bildung	0.234

Table 18: Topics Speech Corpus (SPD; n: 3,028).

Topic 1 (n: 186)	Score	Topic 2 (n: 40)	Score
emissionshandel	0.407	energiewende	0.635
co2	0.402	vermieter	0.397
co	0.385	energiepolitik	0.388
das	0.369	mieter	0.387
auf	0.333	energie	0.355
nicht	0.323	allerletzter	0.355

Table 19: Topics Speech Corpus (FDP; n: 1,086).

Topic 1 (n: 85)	Score	Topic 2 (n: 84)	Score	Topic 3 (n: 71)	Score
co2	0.349	europa	0.359	energiewende	0.439
emissionen	0.252	europäische	0.325	erneuerbaren	0.263
ksg	0.228	eu	0.323	energien	0.261
emissionshandel	0.215	union	0.319	haben	0.218
zur	0.207	europäischen	0.273	erfolg	0.204
maßnahmen	0.204	russland	0.245	energieversorgung	0.202
Topic 4 (n: 51)	Score	Topic 5 (n: 40)	Score	Topic 6 (n: 38)	Score
bahn	0.357	elektromobilität	0.423	landwirtschaft	0.377
euro	0.329	mobilität	0.313	landwirte	0.272
mobilität	0.322	fuels	0.311	bauern	0.245
milliarden	0.308	elektroautos	0.258	land	0.231
verkehrsträger	0.284	kraftstoffen	0.256	forstwirtschaft	0.228
millionen	0.236	verbrennungsmotor	0.243	erwartungen	0.221

Table 20: Topics Speech Corpus (CDU/CSU; n: 1,446).

Topic 1 (n: 244)	Score	Topic 2 (n: 217)	Score	Topic 3 (n: 103)	Score
energiewende	0.336	co2	0.347	klimawandel	0.353
strom	0.289	co	0.319	klima	0.313
energien	0.232	emissionen	0.297	klimareligion	0.255
gigawatt	0.227	ausstoß	0.229	öffentlichen	0.230
wind	0.225	ipcc	0.220	menschengemachten	0.218
gas	0.207	celsius	0.218	haben	0.214
Topic 4 (n: 75)	Score	Topic 5 (n: 62)	Score	Topic 6 (n: 60)	Score
klimawandel	0.374	euro	0.527	wirtschaft	0.324
klimadogma	0.344	milliarden	0.481	eu	0.322
klima	0.332	millionen	0.281	budgetrecht	0.264
ablasshandel	0.315	000	0.267	europäischen	0.259
keine	0.304	ministerin	0.255	gesellschaft	0.240
klimabesteuerung	0.293	vierköpfige	0.247	planwirtschaft	0.232

Table 21: Topics Speech Corpus (AfD; n: 1,493).