

According to BERTopic, what do Danish Parties Debate on when they Address Energy and Environment?

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Abstract

This paper investigates how two policy areas, *Environment* and *Energy* were dealt with by seven Danish left and right wing parties in their electoral manifestos (2007-2019) and parliamentary debates between 2009 and 2020. The main aim is to determine whether the topics discussed by the parties in the debates are the same as those addressed in the electoral manifestos, and whether the parties give the same weight to the two policy areas in the manifestos and debates. We both determine how often and for how long time the parties address the two policy areas in the two datasets, and we compare the topics addressed in the electoral manifestos and those generated by a topic modeling system, BERTopic. Both a multilingual and a Danish BERT model are tested.

In our comparison, we take into account the relation between issue and party competition, the parties' profile and their being part of the government or the opposition, as proposed by Danish political scientists. Our comparison shows that only a few parties have a consistent behavior in the Parliament and in their electoral manifestos with respect to the topics that they address.

1 Introduction

The multidisciplinary interest for both parliamentary debates and parties' manifestos has grown since they have been made freely available in digitized form, and they have also been annotated with different types of information, see e.g. (Koehn, 2005; Hajlaoui et al., 2014; Erjavec et al., 2022; Burst et al., 2020).

In this paper, we investigate how the policy areas *Environment* and *Energy* are dealt with by seven Danish left and right wing parties in their electoral manifestos (2007-2019) and parliamentary debates between 2009 and 2020. The main aim is to determine how and how often the political parties address these policy areas in the election manifestos

and in the parliamentary debates. The two policy areas are defined from the responsibility domains in the Danish Parliament where *Energy* includes climate issues and *Environment* covers pollution problems in nature, air, food, consumer goods etc. The interest for these subjects has been gradually increasing the past decades, especially because of the growing awareness in the population and media of the consequences of pollution for the climate and people's health (Nash and Steurer, 2022).

The seven Danish parties included in this study were chosen because they were the largest ones in the investigated period. Going from the leftmost to the rightmost wing, the seven parties are the following:

- The Red-Green Unity List (*Enhedslisten*) is the leftmost party in the Danish parliament and was formed from the union of three different small left wing parties. This party has a green profile, which is also reflected in its English name.
- Socialist People's Party (*Socialistik Folkeparti*) is a left wing party that in 2009-2020 has supported and/or has been part of governments with a social democratic prime minister. Also this party has a green profile.
- The Social Democratic Party (*Socialdemokratiet*) is the largest Danish centre party and has been leading two governments in the investigated period (2014-2016, and 2019-).
- Danish Social Liberal Party (*Radikale Venstre*) is a centre party that in 2009-2020 has supported and/or has been part of governments headed by the Social Democratic Party. The party has a green profile.
- The Liberal Party (*Venstre*) has been leading

two right wing governments in the investigated time (2009-2014, 2016-2019). After the 2019 election, it has lost its central position as the largest right wing party.

- Conservative People's Party (*Konservative Folkeparti*) has been part of the two right wing governments headed by the Liberal Party.
- Danish People's Party (*Dansk Folkeparti*) got popularity in the 90s and 00s for its strong line against immigrants. It has recently lost many votes and consequently members in the Parliament.

The paper is organized as follows. In section 2, we shortly present relevant literature about party and issue competition and studies on how Environment and Energy have been dealt with by Danish and Nordic parties. Then we shortly introduce topic modelling and BERTopic. In section 3, we analyse the Danish manifestos and determine how often the two policy areas are addressed by the seven parties in them, in section 4, we describe the Danish parliamentary corpus, and account for how often and how the relevant policy areas have been treated by the seven parties, inter alia using the clusters generated by BERTopic from this data (Grootendorst, 2022). In section 5 a comparison of the results of the analyses of each party's treatment of Environment and Energy is presented, and in section 6, we conclude and present future work.

2 Background

To investigate how different parties have addressed specific policy areas in their parliamentary speeches and election manifestos, political scientists have counted the number of contributions by the parties on those areas using parliamentary agenda items, e.g. Green-Pedersen and Krogstrup (2008); Alonso and da Fonseca (2012) and quasi-sentences¹ coded with various policy areas by the Manifesto Project (Burst et al., 2020).

Many articles by political scientists study the political stance of different parties taking into account issue and party competition, according to which parties concentrate on specific "hot" issues in certain periods of time to obtain the favor of the electors (Baumgartner et al., 2011). Green-Pedersen

¹A quasi-sentence is defined in https://manifesto-project.wzb.eu/down/papers/handbook_2021_version_5.pdf to be a statement or message and thus in most cases is a sentence.

and Mortensen (2010, 2015) suggest that issue and party competition cannot alone explain different parties' political activities in the Danish multiparty political system. Analysing the policy areas addressed in the manifestos and parliamentary agendas of thirteen Danish parties between 1953 and 2007, they include other factors such as the parties' specific profiles and issue engagement, the composition of governments and opposition blocs. (Proksch and Slapin, 2012) present an intraparty model describing how party leadership controls their party's parliamentary debates favouring party control or backbencher parliament members' exposure depending on the situation, and they discuss how this affects different political systems testing their model on data from the United Kingdom and Germany. Schwarzbözl et al. (2020) compare party manifestos and news and find that smaller parties are mostly not covered by the news on issues they do not "own", while the media mostly forces the larger parties to talk about topics that are salient at that point of time. Debus and Tosun (2021) analyze the parliamentary debates of Green parties from the Czech Republic, Finland, Germany, Ireland, Sweden, and Norway over 3-5 years and conclude that Green parties not only address issues related to the environment, but also topics such as energy, agriculture, and minority rights. All this topics constitute what they define as the green agenda.

In part of our study, we follow the strategy used by political scientists of counting and comparing how often different parties have addressed specific issues in their manifestos and parliamentary debates.

Topic modelling, as well as other NLP methods, has been applied to digitized parliamentary speeches the past years in order to identify policy areas and issues (Greene and Cross, 2017). The most frequently applied topic modelling methods have been Latent Dirichlet Allocation (LDA) (Blei, 2012) and Non-Negative Matrix Factorization (NMF) (Gillis and Vavasis, 2014). Recently, new topic modelling systems, which use pre-trained embeddings, have been released such as TOP2VEC (Angelov, 2020) and BERTopic (Grootendorst, 2022). A comparison between BERTopic, LDA, NMF, and Top2Vec was made by Egger and Yu (2022) who identify the use of embeddings as the most promising advantage of BERTopic and Top2Vec, which, according to the authors, embedding result in more meaningful and coherent topics.

BERTopic is modular and can be used in various modes and with different pre-trained models (Grootendorst, 2022). It includes a multilingual pre-trained model, which comprises Danish, and this was the main reason to use it in this study. To our best knowledge, it has not been applied previously to the Danish datasets that we address in our study. BERTopic, first converts documents into their embedding representation via a pre-trained language model. Then, it reduces the embeddings’ dimensionality in order to optimize the clustering process. Finally, BERTopic extracts the topic using a custom class-based variation of TF-IDF, c-TF-IDF (Grootendorst, 2022).

We apply BERTopic to extract the main topics addressed by the Danish parties’ parliamentary speeches in the Environment and Energy policy areas, and we use two pre-trained models: a) the multilingual BERT model included in BERTopic and b) the Certainly Danish BERT model². Henceforth, we call BERTopic trained with the two models, *BERTopic-multi* and *BERTopic-danish* respectively.

Various coherence metrics for evaluating topic models have been addressed the past decades, e.g. (Lau et al., 2014; Bhatia et al., 2017, 2018), and evaluation systems have been implemented e.g. in the python module gensim and the OCTIS system (Terragni et al., 2021). In this paper, we manually go through the topics generated by BERTopic for comparing them with the topics addressed in the party manifestos.

3 Energy and Environment in the Seven Parties’ Manifestos

Electoral manifestos of parties from many countries have been continuously collected and enriched with policy areas annotations by the Manifesto Project (Burst et al., 2020)³. The data is freely available, and we downloaded for each of the seven Danish parties the manifestos that preceded the parliament elections in 2007, 2011, 2015 and 2019. The files are in csv format, and they contain the text of the manifestos divided into quasi-sentences. Each quasi-sentence is annotated with one of 57 policy areas codes, including code 000 that marks quasi-sentences having no category. The policy code which is relevant for our study is 501 covering “Environmental Protection” which also in-

²<https://certainly.io/blog/danish-bert-model/>

³<https://manifesto-project.wzb.eu/>

cludes Energy.

The total number of quasi-sentences in the parties’ manifestos is shown in Table 1, while the number of words is in Table 2. The length of the mani-

Party	2007	2011	2015	2019
Red-Green Unity List	331	693	122	373
Socialist People’s P.	73	621	216	719
Social Democratic P.	139	175	584	2,841
Danish Social Liberal P.	56	149	35	707
Liberal Party	165	253	116	177
Conservative People’s P.	131	151	47	1,131
The Danish People’s P.	52	392	39	112

Table 1: Quasi-sentences in the Parties’ Manifestos

Party	2007	2011	2015	2019
Red-Green Unity List	2,590	8,367	1,576	4,787
Socialist People’s P.	483	7,789	3,003	10,927
Social Democratic P.	1,086	2,061	6,088	37,076
Danish Social Lib. P.	330	1,939	438	10,089
Liberal Party	1,407	3,066	1,379	2,001
Conserv. People’s P.	1,130	1,754	587	14,690
The Dan. People’s P.	369	5,581	546	1,742

Table 2: Words in the Parties’ Manifestos

festos differs from party to party and changes for each election period. The Danish People’s Party’s manifesto from 2015 is the shortest one (35 quasi-sentences and 546 words), while the longest manifesto is the Social Democratic Party’s 2019 manifesto with 2,841 quasi-sentences and 37,076 words. The percentage of quasi-sentences with code 501 in the seven parties’ manifestos is shown in Table 3. The left wing and center parties address Environ-

Party	2007	2011	2015	2019
Red-Green Unity List	9.7	3	5	6.7
Socialist People’s P.	15	6.1	15.7	11.4
Social Democratic P.	6	6.9	4.8	14.7
Danish Social Liberal P.	17.9	0.7	8.6	8.8
Liberal Party	4.8	4.7	0	6.8
Conservative People’s P.	7.6	0.4	0	8.4
The Danish People’s P.	15.4	2	0	6.25

Table 3: Percentage of Quasi-sentences with Environmental Content

ment in all their manifestos, while the right wing parties do not cover Environment Protection at all in their 2015 manifestos. The table also shows that Environment is an important theme for all parties in their 2019 manifestos confirming the increasing interest for environment and climate changes in Danish politics pointed out by Nash and Steurer (2022).

In the following, we present a short overview of the main topics addressed by the parties in their manifestos. The Red-Green Unit List's electoral manifesto in 2007 criticize the right-wing government for not having implemented green policies, and they stress that environment is more important than the market. In all the four manifestos, the party promises to fight for policies act to reduce the CO₂-emission, pursue sustainable fishing and agriculture, enlarge the number of wild nature areas, ensure animal welfare, reduce the number of cars by supporting public transport and car sharing.

The manifestos of the Socialist People's Party address climate changes and the possibility to stop them. The 2011 manifesto refers to common environmental and energy policies of left wing and centre parties, and it lists the green policies that the party has previously proposed in the parliament. In the manifestos from 2011 to 2019, the main actions to be taken are addressed, e.g. the reduction of harmful substances in food and products, the use of alternative energy, finding solutions for keeping drinking water clean by avoiding pollution and preservation of wild nature areas.

The Social Democratic Party in 2007 argues that the climate crisis is a global problem and cannot be solved by Denmark alone. The party intends to fight for achieving better international agreement for CO₂ emission. The manifesto also suggest to see the climate crisis as an opportunity for developing green technologies. The following manifestos address common green policies, such as having more wild nature areas, protecting the sea environment, diminishing the use of pesticides, supporting alternative energy and more green technologies. In 2015 a green Denmark is contrasted to a right wing Denmark. In the 2019 manifesto, examples of the negative consequences of CO₂ emission on the climate, nature and people's health are listed as an argument for fulfilling the CO₂ emission goals stated in the Paris agreement. Again the opportunity to be a country that develops green technologies is stressed, and the list of actions to be taken is much longer than in the preceding manifestos.

In their manifestos from 2007-2015, the Danish Social Liberal Party only promises to contribute to the CO₂ emission reduction goals, while in 2019 it criticizes right wing governments for not having been ambitious in their environment and energy policies. The manifesto also reports some of the negative consequences of climate changes and list

the areas the party wants to focus on, e.g. a sustainable agriculture, the development of alternative energy and green technologies, subsidies for electric vehicles and prohibition of harmful substances in clothing and food.

The Liberal Party only briefly addresses Environment and Energy in their manifestos. In 2019, they justify the need to have green policies with the climate changes that have become evident in recent years, and they promise to support sustainable energy sources, recycle waste and avoid pollution of drinking water.

The Conservative Party's 2007 manifesto advertises that the party is the Danish green party and lists issues related to environment and energy, but without presenting the party's policy, e.g. they write that Denmark has a beautiful nature and nice forests that must be preserved, people must be able to eat without being afraid of getting ill, animals must be treated well, and common European regulations are needed. In the 2011 and 2015 manifestos, the environment is not dealt with, while in 2019 the party writes that Denmark must continue its international engagement for achieving better environmental agreements. Finally, the results for a better environment achieved by the right wing government over the past years are listed.

The Danish People's Party addresses food quality and environment in few lines. In the manifestos from 2007 and 2019, they only focus on the welfare of animals and underline that they are not protected by the EU.

4 The Parliamentary Debates on Energy and Environment

The Danish parliamentary data, which we use, are an extended version of *The Danish Parliament Corpus (2009-2017)* v.2 released under the CLARIN-DK repository in 2021⁴. This extended version contains speeches from 2009-2020 and can be obtained from the two authors. The corpus comprises the transcripts of speeches of the Danish Parliament and information about the speaker, the timing of the speech⁵, and one or two policy areas addressed by it. The annotation of 19 policy areas is described in (Navarretta and Hansen, 2022), two of these being *Environment* and *Energy* which comprises

⁴<https://repository.clarin.dk/repository/xmlui/handle/20.500.12115/44>

⁵The transcripts and most metadata are freely downloadable from the Danish Parliament's website <ftp://oda.ft.dk>

climate. Table 4 shows the parties of the ministers for the two areas in the investigated period. The Social Democratic Party, under the two gov-

Party	Energy	Environment
Red-Green Unity List	0	0
Socialist People's Party	0	1
Social Democratic Party	1	2
Danish Social Liberal Party	2	0
Liberal Party	3	5
Conservative People's Party	2	0
The Danish People's Party	0	0

Table 4: Parties of the Ministers of Energy and Environment

ernments it headed (2014-2016, 2019-2020), only had one Energy and two Environment ministers, while the Socialist People's Party and the Danish Social Liberal Party had one Environment minister and two Energy ministers, respectively. Under the Liberal Party's headed governments (2009-2014, 2016-2019), five Environment and three Energy ministers were liberal, and two Energy ministers were conservative. The distribution of ministers per party might skew the amount of speeches given on the two policy areas.

Out of the 454,516 speeches containing a policy area annotation, 37,329 (8.2%) are about *Environment* and *Energy*. We extracted all the speeches from the seven parties that were coded with one or both of these policy areas. The total number of words in the speeches annotated with Energy and/or Environment is 4,670,100. The length of the speeches varies from few words to thousands of them.

In Figure 1 the percentage of time used by the 7 parties in discussing Environment and Energy is shown. All parties speak relatively more about Environment than about Energy. The party that speaks relatively more time about Environment is the Socialist People's Party, closely followed by the Liberal Party, the Social Liberal Party and the Red-Green Union List. The parties that speak relatively more time about Energy are the Social Liberal Party, the Red-Green Union List, and the Liberal Party. Finally, the parties that speak relatively more about both policy areas are the Social Liberal Party, the Red-Green Union List, the Socialist People's Party and the Liberal Party.

Table 5 shows the total number of speeches and words in the debates about Environment and Energy produced by each party. The speeches of the chairmen are excluded from the counting and the

further processing, since they do not address specific policy areas, and only contain words related to chairing the speeches. The table shows that members of the Liberal Party produced the highest number of speeches in the two policy areas, followed by those from the Social Democratic Party. Since both these parties headed two governments in the studied period, this is not surprising. The fact that both the number of speeches and words is highest for the Liberal Party, is probably due to the fact that most ministers for the two policy areas (eight ministers) were liberals in the studies period, while the Social Democratic Party only had three ministers in total for the two areas. The party that spoke less about Environment and Energy is the Conservative Party, followed by the Danish Social Liberal Party and the Socialist People's Party. This is surprising since both the Conservative People's Party and the Danish Social Liberal Party had to Energy ministers in the studied period, while the Socialist People's Party had an Environment minister. The Red-Green Union List, on the other hand, speaks relatively much on both policy areas given that they have not been part of a government.

4.1 Topic modeling

We run BERTopic with the two pre-trained BERTopic-multi and BERTopic-danish models on the parliamentary speeches about Energy and Environment by the seven parties. The transcribed speeches were tokenized and lemmatized⁶. The parameters used are mostly those suggested in BERTopic (best practices)⁸.

The relevance of the clusters generated by BERTopic w.r.t. the studied areas was determined by the first author of the paper. In all cases, BERTopic-multi generated more clusters than (or the same number of clusters as) BERTopic-danish. The relevance of the clusters is often similar, but a more thorough comparison by more humans, as well as with a system as OCTIS must be performed in the future. In the following we discuss the results generated with BERTopic-multi. All topics are presented in their English translation. In the cases when the generated topics were not found relevant to the studied policy areas, they belonged to

⁶The tokenizer and lemmatizer are those provided in the *Text Tonsorium* workflow⁷ available in the CLARIN-DK infrastructure (Jongejan, 2016).

⁸UMAP was called with the following parameters: $n_neighbors = 15$, $n_components = 5$, $min_dist = 0.0$, $metric = 'cosine'$, $random_state = 42$. min_topic_size was 15 while top_n_words was set to 10

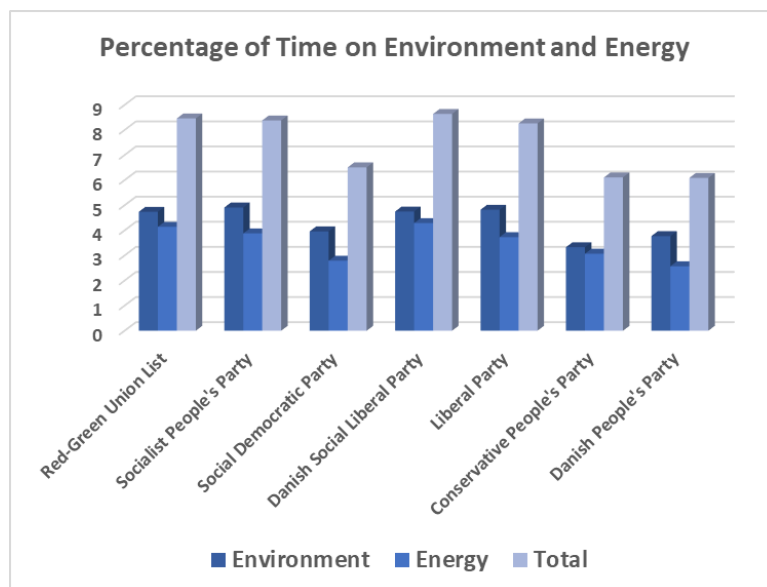


Figure 1: The Percentage of Speech Time on Environment and Energy for the 7 Parties

Party	Total Speeches	Total Word
Red-Green Union List	2,452	104,415
Socialist People's Party	1,499	68,924
Social Democratic Party	3,279	141,114
Danish Social Liberal Party	1,405	76,023
Liberal Party	4,372	180,040
Conservative People's Party	1,012	47,529
The Danish People's Party	1,957	76,820

Table 5: Number of Speeches and Words about Environment and Energy per Party

the domain of parliamentary speeches, e.g. clusters containing lemmas such as spokesperson, minister, chairmen, names of different politicians, decision processes, countries, the EU, the government and/or specific parties.

Out of the 26 topic clusters generated by BERTopic-multi from the speeches of the Red-Green Union List, 21 address Environment and Energy, covering all the issues presented in the party's manifestos. A few examples of the clusters are the following:

- *forest, nature, bio diversity, national park, decline, area, spokesman, proposal, goal, species*
- *coastal protection line, analysis of the coast, coast, spokesman, coastal protection project, camping bungalow, oresund, building, sea environment, north sea*
- *agriculture, spokesman, farmer, year, agriculture package, nature, crop, minister, bill, nitrogen*

- *spokesman, electricity, energy saving, heat pump, transport, consumer, scales, settlement circle on energy, price, energy*
- *public procurement, windmill, mill, windmill industry, project, offshore wind farm, offshore wind project, capital, offshore wind park, project design*
- *eu, substance, prohibition, pesticide, child, drinking water, denmark, spray poison, country, product*

The Red-Green Union List has a very strong green profile, and it is therefore not surprising that their speeches address the same topics presented in the party's manifestos. It is however interesting that this party stands out so clearly since it was not in coalition nor in government in the investigated time span. The variety of issues addressed by the Red-Green Union List confirms the existence of a green agenda in parties with a strong environmental profile (Debus and Tosun, 2021).

Of the 11 topic clusters generated from the

speeches of the Social People’s Party, 9 are specific to Environment and/or Energy, and they deal with some of the themes addressed by the party in their manifestos, e.g. the reduction of harmful substances in food and products, the use of alternative energy, keeping drinking water clean and preservation of wild nature areas. An example referring to substances that pollute the subsoil water (the water which Danish people drink) and are dangerous especially for children is the following: *pesticide, bisphenol, material, child, subsoil water, proposal, prohibition, insecticide, investigation, phtalate*.

29 topic clusters were generated from the speeches of the Social Democratic Party, and 24 of these are specific to the investigated domain. Some of these clusters refer to climate or energy policy, e.g. *climate, world, climate minister, climate law, government, climate change, minister, denmark, climate agreement, year*, while others refer to alternative energy sources, recycling of garbage, transport, pollution, agriculture, and coastal protection. These clusters address concrete environmental and energy issues and less generic policies which were often addressed in the party’s manifestos.

Only two clusters were generated from the speeches of the Danish Social Liberal Party, and none of them are specific to Energy and Environment. On the same data, BERTopic-danish also generated 2 clusters, and one of these partly addresses the pollution of drinking water. In its manifestos, the party shortly addressed the negative consequences of climate change, CO2 reduction, electric cars and harmful substances in clothing.

21 out of 38 clusters generated from the speeches of the Liberal Party are relevant to the domain we focus on. For example, one cluster refers to recycling of plastic: *micro plastic bead, plastic, product, plastic product, carrier bag, pollution by plastic, initiative, waste treatment plant, waste, strategy for plastic* and one addresses harmful substances: *pesticide, remains of pesticides, urine, maximum value, food, fruit, food standards agency, woman, risk, researcher*. Other relevant clusters refer to noise pollution, alternative energy sources, garbage pollution, recycling, pollution of drinking water, air pollution and coastal and sea protection.

In the 2019 manifesto, the Liberal Party writes that they will support sustainable energy sources, waste recycling and avoid pollution of drinking water, while in the preceding manifestos, they nearly do not address Environment and Energy. In the

Parliamentary debates, instead, the party addresses many relevant topics. The fact that three Energy ministers and five Environment ministers come from this party in the investigated period can explain the difference between the content of the two datasets in these policy areas.

Six out of the nine generated clusters from the Conservative People’s Party’s debates belong to the studied domain, and the clusters concern coastal protection, the windmill industry, harmful substances in food, biodiversity and climate agreement involving Greenland and the Faeroe Islands, which are autonomous countries under the Danish Kingdom. This party addresses more environment and energy themes in the Parliamentary debates than in the manifestos.

17 clusters were generated from the Danish People’s Party’s speeches. Seven of these contain in part terms specific to the investigated policy areas and address coast protection, wind mill industry, biodiversity, harmful substances and the EU, as well as climate policy (*co2, denmark, climate, climate change, world, country, climate policy, people’s party, energy, proposal*). Only the theme about harmful substances and the EU is common to the manifestos. In the case of this party, they discuss more relevant subjects on Environment and Energy in the debates than in the manifestos.

In one party’s case, the clusters generated with BERTopic-danish contained more relevant clusters than those generated by BERTopic-multi, but in general BERTopic-multi produced many relevant clusters with respect to the studied domain.

5 Discussion

The Red-Green Union List is the party whose behaviour towards Environment and Energy is most consistent w.r.t. what they promise in their electoral manifestos and what and how often they debate about these issues in the Parliament. Given that The Red-Green Union List has not been part of any government and has only partially supported the left-wing and centre bloc in two of the four legislation periods, it is remarkable that they debate in the Parliament all the issues they discussed in their manifestos.

The Socialist People’s Party does not address in the debates all the issues which they list in their manifestos. The party presents itself as a green party, but their focus on Environment and Energy in the manifestos and parliamentary debates is not

as strong as that of the Red-Green Union List. This is also surprising because the party had one Environment minister during part of one legislation.

The Social Democratic Party discusses in the debates many of the issues that it addresses in the manifestos. The clusters generated by BERTopic only concern concrete issues, while also more general policy strategies are addressed in the manifestos, which for example underline the country's green profile and international climate agreements. This can be explained by the fact that the party chaired two governments and had one Energy and two Environment ministers in the investigated period. Moreover, their strategy in the manifestos is to address general policy decisions, while the debates concern concrete issues.

The fact that BERTopic (BERTopic-danish) only generates one relevant cluster from the Danish Social Liberal Party's debates is surprising. The party presents itself as a green party, and it had two Energy ministers in the studied period. The relevant cluster concerns pollution of drinking water, while in its manifestos, the party shortly addresses many themes such as the negative consequences of climate change (flood in Denmark), CO2 reduction, electric cars and harmful substances in clothing. The reason for the incongruence between the party's profile, its manifestos and the parliamentary debates can be due to the fact that the Social Liberal Party was part of a coalition and a bloc with many parties with a green profile. This is in line with the suggestion by [Green-Pedersen and Mortensen \(2015\)](#) that party and issue competition interplay with coalition and bloc structure and with intraparty mechanisms as those discussed by [\(Proksch and Slapin, 2012\)](#).

The Liberal Party is much more active on Energy and Environment in the debates than in its manifestos. In fact, the parties' members address many relevant themes in the former data. This can be explained by the fact that the Liberal Party headed two governments and had three Energy and five Environment ministers in the investigated period.

The Conservative People's Party does only seldom contribute to the debates about Energy and Environment (six relevant clusters), but this is a little better than the few lines addressing the two areas in two out of four manifestos. The more high level of activity in the parliament is due to the two conservative Energy ministers in the studied period. This can also be seen in one of the clusters

in which they address energy in Greenland and the Faroe Islands.

Finally, the Danish People's Party is not active on Energy and Environment in the manifestos, while they address a few relevant themes in the parliamentary debates. However, the welfare of animals, which was the most important issue in the environmental protection area which they discussed in the manifestos is not present at all in the clusters from the debates.

6 Conclusion and Future Work

In this paper, we presented a study aimed to determine how seven Danish left and right wing parties have addressed two policy areas, Energy and Environment in their election manifestos (2007-2019) and parliamentary speeches from 2009 to 2020. We counted the contributions of the parties on these areas, following a methodology proposed by political science researchers ([Green-Pedersen and Krogstrup, 2008](#); [Alonso and da Fonseca, 2012](#)), we analysed the content of the manifestos' quasi sentences coded as related to environmental protection, and we run BERTopic with two pre-trained models on the parliamentary speeches of the parties to get relevant topic clusters. To our best knowledge, BERTopic has not been earlier applied to Danish Parliamentary debates.

Our study shows that BERTopic is useful for extracting political issues in parliamentary speeches about specific policy areas. Our quantitative and content-wise comparison of how the seven parties address Energy and Environment in the public more user friendly manifestos and in the parliamentary debates is different due to many factors as proposed e.g. in [\(Green-Pedersen and Mortensen, 2015; Proksch and Slapin, 2012\)](#).

One limitation of this study is that only one human judged the relevance of the clusters generated by BERTopic. Testing BERTopic with BERTopic-multi and BERTopic-danish on the parliamentary speeches, we found that the former model individuates more relevant clusters in the majority of cases, and the clusters generated with the two types of pre-trained models are in some cases different. Future work should investigate the differences between the two models further, e.g. applying more coherence metrics and human judges. Since we wanted to study the themes addressed in the parliamentary speeches, a strategy could be to merge the clusters generated by the two pre-trained models.

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