Carbon Capture and Storage Framing in the Media

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Abstract

According to IPCC models, it will be impossible to prevent global temperatures from rising two degrees above preindustrial levels without the deployment of negative emissions technologies such as carbon capture and storage (CCS), which remove carbon dioxide and other greenhouse gases from the atmosphere. Though CCS has proven itself in small projects throughout recent years, it is unclear what has inhibited policymakers from successfully mobilizing the technology on a national scale. Perhaps, the framing of CCS in national media outlets has negatively impacted public opinion, resulting in headwinds for the technology in public policy. After conducting a content analysis of recent articles about CCS in national news outlets, this paper found that more articles provided neutral framing of CCS than provided positive or negative framing. Furthermore, CCS was more frequently associated with saving the coal industry and enhanced oil extraction than mitigating climate change. To the extent that the media is consequential in influencing public opinion and subsequently political action, this begins to explain why there has been so little implementation of CCS.
Introduction

It is broadly accepted in academia that the global warming crisis of this era has arisen because of fossil fuel emissions among industrialized countries, particularly carbon dioxide (Overview of Greenhouse Gases, 2017; “Global Warming Effects and Causes: A Top 10 List,” 2009). Before the industrial revolution, atmospheric carbon dioxide levels were stable at 250 parts per million (ppm). Today, atmospheric carbon is at 405 ppm with an unfa...
effective implementation policies. When Lomax et al. (2015) set out to determine how policy makers can develop policy to extract value from NETs, they found that the general perspective on NETs is erroneous; most individuals only see NETs as a backup plan if other climate change mitigation strategies fail.

Carbon capture and storage (CCS) is a NET with immense capacity to reduce greenhouse gas emissions and has been tested in numerous projects globally (Kintisch, 2014; Biello, 2014). With 344 out of 400 scenarios modeled by the IPCC that have a 50% or better chance of no more than 2°C warming calling for the successful and large-scale uptake of negative-emission technologies (Mooney, 2015), it begs the question as to why the United States has not been able to mobilize a CCS strategy on a national scale. The United States, one of the countries with the highest levels of greenhouse gas emissions, only has 21 active CCS project sites currently and most them are on a small commercial scale (“Non-Power Plant Carbon Dioxide Capture and Storage Projects,” 2016). As one of the greatest culprits of climate change, there is an implied responsibility from the Paris Agreement for the United States to mobilize NETs on a national scale. Therefore, it is wise to explore what has inhibited effective CCS policy in the United States thus far, such as the opinions Americans have toward CCS.

Literature Review

Exploring public opinion of carbon capture and storage (CCS) is best illustrated internationally by Ashworth et al. (2013). This policy research tackled the goal of determining how public preferences to CCS compare among Australia, Canada, the Netherlands, and Scotland. Of particular importance in this research article was assessing the individual views on potential solutions for carbon mitigation, namely, CCS. Citizens were recruited in all four countries to join discourse in focus groups proctored by a local expert in CCS. Questionnaires
were administered to participants before, during, and after the discussions to assist in data collection and quantitative research. The results showed that participants feared that concentration on CCS would detract from investment in renewables, and expressed global fears of leaks, safety, and longevity. Most notably, awareness of CCS in all four countries ranged from moderate to poor, with the higher performing groups likely only justified by recent CCS controversies in the locality that increased their awareness. These results illustrate how a lack of public awareness is a major hindrance to the mobilization of CCS on a grander scale.

A narrower scope on the public acceptance of CCS is provided by Ashworth, Pisarski, and Thambimuthu (2009). Their research study sought to determine the public acceptance of CCS in two rural communities in Queensland, Australia where a project for integrated gasification combined cycle (IGCC) with CCS had been proposed. Similar to Ashworth et al (2013), two workshops with members of the community were held with a six-month separation to allow for reflection time among participants. These workshops were facilitated by a diverse array of CCS stakeholders to help lead discussion and challenge individual attitudes towards CCS. Ultimately, this presence of what participants considered to be “industry experts” increased their perception of the credibility of the information provided in the workshops. Furthermore, it was found that engaging with the citizens early in the project planning stage led to an increase in positive attitudes towards CCS, especially when it was explained with relevance to climate change. Though researches commented upon the dearth of similar case studies in the field, the concerns among the residents paralleled those found by Ashworth et al (2013); both groups were concerned that the acceleration of CCS may cause a divestment from renewables.

Though more limited, there has also been research in the US on attitudes toward CCS. Wong-Parodi and Ray (2009) build upon the conclusions from Queensland, Australia by
studying two segregated communities that were potentially project sites for California’s Department of Energy Funded West Coast Regional Partnership (WESTCARB). These two communities, Rio Vista and Thorton, offer differing perspectives based on socioeconomic demographics since Rio Vista is predominantly Hispanic with lower income citizens while Thorton is mainly comprised of Caucasians and higher income citizens. The paper seeks to answer to two concrete questions: “What factors explain community perceptions of the risks of carbon sequestration?” and “What do communities located near actual or potential sequestration sites view as the risks of carbon sequestration?” Similar to the approach in Australia, workshops were organized and interviews were conducted to retrieve quantitative and qualitative data from participants. In conclusion, both communities were concerned that inadequate knowledge within the CCS industry would pose safety risks to the community. Neither the government nor the industry were trusted by either group. However, the Thorton residents did not express any interest in having a voice during the lifetime of this project while the Rio Vista community did. These findings suggest that future research of this category needs to increase efforts to pull data from the whole spectrum of citizens in a community, not just two distinct groupings, to deduce the resultant desires of all involved parties.

Furthermore, Curry (2004), sought to draw conclusions about the level of public understanding and awareness of climate change and CCS technology. Using an alternative methodology, a MIT research team conducted a 1,200-participant survey to produce a data set which quantitatively represented the general United States. This survey asked participants seventeen questions about the environment, global warming, and climate change-mitigation technologies. Data analysis was performed with appropriate sample weights (to allow for extrapolation) and controlling for demographic factors. Broadly, it was found that the United
States public believes in climate change and is supportive of addressing it, but is uncertain about what the causes are and what technologies are available to combat it. These findings are capitalized on by those of Ashworth et al. (2013) which showed that the public awareness of CCS in particular is lacking as a technology to combat climate change.

Though Ashworth et al. (2013) and Curry (2004) identified a lack of CCS awareness among the populations studied, the attitudes of those with awareness remains unknown. Looking beyond these studies, no nationwide US polling exists which reveals the public opinion of CCS. Therefore, if the public opinion of CCS is sought after to explain CCS policy inhibitions in the United States, then attitudes may need to be deduced by utilizing national media framing as a proxy. It has been argued that framing provided by the media has influence upon public opinion.

Tyshenko (2014) delved into research which revealed that the media has an immense influence on public opinion, particularly when reporting on scientific information. With a desire to understand how the public perception of nanotechnology in Canada was influenced by mass media, Canadian news media was deconstructed by analyzing its framing of nanotechnology. Recent studies showed that positive attitudes toward nanotechnology were rooted in optimistic discussion of innovation and potential, not knowledge of the technology itself. Therefore, analyzing the framing of nanotechnology presented by the news media would enable interested parties to make immediate deductions on the public perception of nanotechnology. It was found that the coverage of nanotechnology in Canada heavily emphasized positive framing which directly correlated to positive attitudes among the Canadian public. This was likely augmented due to scant discussion of risk in the media, but a significant focus on emerging research and potential.
As Tyshenko established, the media has an immense influence on public opinion. However, Tyshenko is unable to conclusively establish how diverse kinds of framing in the media specifically effect public opinion. Olive (2016) revealed that analyzing the framing of the media is an effective strategy for understanding how public opinion is influenced. Recognizing that there was a great variance in support and opposition towards fracking in Canada, Olive sought to find out why there was such variation in provincial responses to uncertain risks posed by fracking. To understand how the media was influencing this variation, national and provincial Canadian newspapers through a particular time period were analyzed. Papers relating to fracking were derived from library databases through a keyword search and each article was examined for its respective framing of fracking. Overarching frameworks included in the study were economic, environmental, and political. Conclusively, it was realized that the discussions of every article could be related to one of five common issues. It was also found that the framing differed distinctly based on the news source and that all papers agreed upon the risk posed to water quality by fracking and the immediate benefits to the economy. However, the ultimate magnitude of risk discussion in the articles was paltry in comparison to the actual quantity of risks known to be associated with fracking.

Explanations for the dearth of CCS implementation in the United States traverse nearly every angle of policy analysis, but one of the greatest issues highlighted through the literature review is public opinion and awareness. Clearly, there is a relationship between a lack of awareness of CCS and a lack of CCS implementation. Widespread public awareness of CCS technologies could catalyze the emergence of effective energy policy in the United States, but every relevant survey on CCS awareness shows that the overwhelming majority of the public isn’t aware of what CCS is, let alone potential it has to help resolve the issue of climate change.
Additionally, it is not conclusively known if members of the public who are aware of CCS even perceive it as a viable option for tackling the climate change issue. Since the public is exceptionally unaware of CCS and doesn’t have pre-formed notions, the influence of the media will be highly consequential for the future of the technology. Understanding how influential media outlets are representing CCS in the United States and how these representations influence public perception would be of high value for policymakers in the energy sector. How has carbon capture and storage been framed in the major media outlets influencing public perception over recent years?

**Methods**

Given the desired findings of this research question, content analysis of media in the United States merits the most straightforward approach for arriving at a conclusion. Since it isn’t definitively known which media outlets have the greatest influence upon the public perception of CCS, a prediction as to what media outlets are most influential will need to be deduced in order to stay within the scope of this research and develop a sampling plan. This prediction can be derived from a value judgement based upon generalized preexisting data on media outlets. Using total average circulation and website traffic as parameters, influential media outlets will be defined by being those which lead in both categories.
Table 1: Prevalence of major US media outlets with total average circulation (Alliance for Audited Media) and website traffic ranking (“The top 500 sites on the web,” 2017).

<table>
<thead>
<tr>
<th>Media Outlet</th>
<th>Total Average Circulation</th>
<th>Website Traffic (Alexa rank in the USA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA Today</td>
<td>2,301,917</td>
<td>101</td>
</tr>
<tr>
<td>Wall Street Journal</td>
<td>1,337,376</td>
<td>126</td>
</tr>
<tr>
<td>New York Times</td>
<td>2,101,611</td>
<td>24</td>
</tr>
<tr>
<td>CNN</td>
<td>N/A</td>
<td>18</td>
</tr>
<tr>
<td>Washington Post</td>
<td>474,767</td>
<td>37</td>
</tr>
</tbody>
</table>

Though leading in digital presence (see Table 1), CNN will be omitted due to its lack of physical newspaper distribution. The Wall Street Journal will also be omitted for having an exceptionally low website traffic ranking. Therefore, the bold media outlets in Table 1 will comprise the data sources for the sampling plan.

Articles pertaining to CCS will be extracted from the selected media outlets through LexisNexis Academic. With regards to the research parameters, LexisNexis will be searched for “Carbon Capture AND Storage” using the All News Search subject search from January 1st, 2013 to March 6th, 2017. Results from USA Today, The New York Times, and The Washington Post in the geographic location “US State” can be explicitly filtered for through the advanced search feature. This search results in 219 articles which will comprise the data sample for content analysis.

Since the research question aims to understand not if, but how CCS is framed by these media outlets, the content analysis will take a more qualitative approach using thematic data coding. The actual themes used emerged through analysis of the data itself after a diverse set of
5% of the articles were read. 5% of the articles (219) approximates to 11 total articles to draw themes from. Since dividing the 11 articles proportionally by source would exclude USA Today, one USA Today article was chosen at random. For the other 10 articles, five articles were chosen at random from The Washington Post and The New York Times respectively. As a result, themes 1 – 8 in Table 2 emerged from analysis of the 5% specified. Theme 9 (discussion of risks) was appended due to the influence it was found to have on the groups studied by Ashworth et al. (2013) and Wong-Parodi and Ray (2009). Additionally, it was determined that Theme 10 (costs blamed for shortcomings or inhibitions) merited consideration due to its notable frequency once analysis of the comprehensive data set began. Themes 1-3 were denoted as “requisite” themes (bold in Table 2) as all articles contained one of them, while themes 4-10 were “optional” themes as articles could contain any combination of them, but they weren’t required.
<table>
<thead>
<tr>
<th>Framing</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positively, as a possible and viable solution.</td>
<td>“The technology is available; each component of that technology has been in use, has been tested and is viable.”</td>
</tr>
<tr>
<td>Negatively, as a technology which isn't viable or isn't possible.</td>
<td>“So far, negative emissions are basically science fiction, says Oliver Geden of the German Institute for International and Security Affairs.”</td>
</tr>
<tr>
<td>Neutrally. Neither positive nor negative framing or just passing reference.</td>
<td>“They also rely on so-called &quot;negative emission technologies&quot; such as bioenergy combined with carbon capture and storage.”</td>
</tr>
<tr>
<td>As a necessary, required, or needed technology.</td>
<td>“The [Intergovernmental Panel on Climate Change] models show that CCS is critical to keeping our global temperature increases within 2 degrees Celsius of pre-industrial levels,”</td>
</tr>
<tr>
<td>With politics to blame for shortcomings.</td>
<td>“the Department of Energy has initiated a structured closeout of federal support for the project”</td>
</tr>
<tr>
<td>With an optimistic future outlook.</td>
<td>“Ms. Heitkamp said that businesses, too, were likely to continue development of carbon capture technology”</td>
</tr>
<tr>
<td>With a bleak or pessimistic future outlook.</td>
<td>“the outlook for CCS has been clouded by the diminished appeal of enhanced oil recovery”</td>
</tr>
<tr>
<td>As a benefit to the economy.</td>
<td>“the pure streams of carbon dioxide can actually be used to help push more oil out of the earth in a procedure called &quot;enhanced oil recovery,&quot; potentially improving the economic value of the entire process”</td>
</tr>
<tr>
<td>With discussion of risks associated with it.</td>
<td>“Bright ideas for fighting climate pollution may sound great, but a researcher explains why they're too risky to attempt”</td>
</tr>
<tr>
<td>With costs blamed for shortcomings or inhibitions.</td>
<td>“the New York Times is out with a highly critical report about the Kemper Plant in Mississippi, which the paper says has suffered from major cost overruns”</td>
</tr>
</tbody>
</table>

Table 2: Framing themes used for content analysis of articles pertaining to CCS. Examples supplementing the framing definitions were derived from articles in the actual data set. Code numbers for themes correspond to the code numbers used in results.

Results
Table 3: The total number of publications containing themes 1-10 respectively is displayed. Vertical height corresponds to the number of publications. Requisite themes 1-3 are listed first with the optional themes following in order of prevalence. Percentages of theme prevalence by source and total are provided below with numeric totals in parenthesis.

<table>
<thead>
<tr>
<th>Theme Code</th>
<th>Number</th>
<th>New York Times</th>
<th>Washington Post</th>
<th>USA Today</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37.44% (82)</td>
<td>31.24% (29)</td>
<td>49.32% (108)</td>
<td>30.59% (67)</td>
<td>20.55% (45)</td>
</tr>
<tr>
<td>2</td>
<td>13.24% (29)</td>
<td>28.56% (25)</td>
<td>30.59% (67)</td>
<td>18.26% (40)</td>
<td>20.55% (45)</td>
</tr>
<tr>
<td>3</td>
<td>49.32% (108)</td>
<td>49.32% (108)</td>
<td>49.32% (108)</td>
<td>49.32% (108)</td>
<td>49.32% (108)</td>
</tr>
<tr>
<td>4</td>
<td>30.59% (67)</td>
<td>30.59% (67)</td>
<td>30.59% (67)</td>
<td>30.59% (67)</td>
<td>30.59% (67)</td>
</tr>
<tr>
<td>5</td>
<td>20.55% (45)</td>
<td>20.55% (45)</td>
<td>20.55% (45)</td>
<td>20.55% (45)</td>
<td>20.55% (45)</td>
</tr>
<tr>
<td>6</td>
<td>18.26% (40)</td>
<td>18.26% (40)</td>
<td>18.26% (40)</td>
<td>18.26% (40)</td>
<td>18.26% (40)</td>
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<tr>
<td>7</td>
<td>15.98% (35)</td>
<td>15.98% (35)</td>
<td>15.98% (35)</td>
<td>15.98% (35)</td>
<td>15.98% (35)</td>
</tr>
<tr>
<td>8</td>
<td>10.96% (24)</td>
<td>10.96% (24)</td>
<td>10.96% (24)</td>
<td>10.96% (24)</td>
<td>10.96% (24)</td>
</tr>
<tr>
<td>9</td>
<td>7.76% (17)</td>
<td>7.76% (17)</td>
<td>7.76% (17)</td>
<td>7.76% (17)</td>
<td>7.76% (17)</td>
</tr>
<tr>
<td>10</td>
<td>3.65% (8)</td>
<td>3.65% (8)</td>
<td>3.65% (8)</td>
<td>3.65% (8)</td>
<td>3.65% (8)</td>
</tr>
</tbody>
</table>

Theme Prevalence

- **1** Positively, as a possible and viable solution.
- **2** Negatively, as a technology which isn't viable or isn't possible.
- **3** Neutrally. Neither positive nor negative framing or just passing reference.
- **4** As a necessary, required, or needed technology.
- **5** With politics to blame for shortcomings.
- **6** With an optimistic future outlook.
- **7** With a bleak or pessimistic future outlook.
- **8** As a benefit to the economy.
- **9** With discussion of risks associated with it.
- **10** With costs blamed for shortcomings or inhibitions.
Of the requisite themes, neutral framing (theme 3) is featured by the greatest number of publications at 108 instances (see Table 3). Certainly, it was anticipated that there would be some articles which would merely pass CCS by reference, but it was never fore sought that essentially half the data (see Table 4) would take neither a positive nor a negative stance and subsequently have minimal impact on public opinion. Arguably, the presence of specific requisite themes is more impactful than the presence of the optional themes on public opinion, so the surprisingly large findings for neutral framing has interesting implications.

Positive framing (theme 1) which totaled 82 instances is therefore outpaced by neutral framing by 26 publications (see Table 3). It is interesting to note that of the articles which weren’t neutral, positive framing still surpassed negative framing (see Table 4), but being surmounted by neutral framing with such a sizable margin makes it difficult to deduce its potential effect on public opinion. Nonetheless, positive framing articles provided exceptional arguments which championed CCS technology:

"It's essential that we recognize that accelerated carbon capture and storage (CCS) development and deployment is critical to meeting the Paris Agreement climate goals. CCS is safe, reliable, cost-effective, and efficient - reducing emissions from coal power production by up to 90%." - There's actually a way for Trump to help coal and still help the climate; It's called carbon capture and storage. (The Washington Post)

Lastly, negative framing (theme 2) was founded among 29 or 13% (see Table 3 and Table 4) of the publications examined. Though comprising the minority of the requisite themes, news subscribers who fell victim to the slim probability of reading a negatively framed CCS article could be easily deterred from CCS technology by the statements made:
“No sane government will sacrifice its economy today - by dramatically curtailing fossil-fuel use - for the uncertain benefits of less global warming sometime in the foggy future” - There's still no fix for climate change (The Washington Post)

“... $8 billion in loan guarantees for fossil fuel technologies like carbon capture and sequestration, which hasn't proven to be anything but excessively expensive.” - Plan B for climate change (The Washington Post)

Table 4: The total share of themes 1-3 (positive, negative, and neutral) is displayed with corresponding percentages.

Of the optional themes, theme 4 (a necessary, required, or needed technology) was seen most often in the articles examined. At 67 publications, theme 4 appeared in 30.6% of the content analyzed (see Table 3). It is arguable that this theme could have the greatest implications on positive public attitudes due to the “urgency” it projects upon CCS implementation, so it is quite notable that it was the most prevalent optional theme. However, while the need for CCS as a technology to counteract climate change did arise in some articles,
"The [Intergovernmental Panel on Climate Change] models show that CCS is critical to keeping our global temperature increases within 2 degrees Celsius of pre-industrial levels," notes Fatima Ahmad, a fellow at the Center for Climate and Energy Solutions (C2ES)’ - Wind and solar energy are doing great. Do we still need nuclear power? (The Washington Post)

the need for CCS to save the coal industry or to promote enhanced oil extraction operations was found to be discussed much more frequently:

“... high efficiency coal is certainly better than low efficiency coal," he added, noting that carbon capture and storage technology was "the most important hope" for coal's future” - Slowdown in Carbon Emissions Worldwide, but Coal Burning Continues to Grow (The New York Times)

“The two very different plants together mark the arrival of a technology, often called "CCS" for short, that has been heralded as essential to the future of coal burning in particular” - America's first 'clean coal' plant is now operational - and another is on the way; Two U.S. plants that capture carbon emissions from coal are becoming operational. (The Washington Post)

“The beauty of it all was this: Sixty-five percent of the plant's carbon dioxide, a greenhouse gas released by all coal-fired power plants, would be captured, carried through a 62-mile-long pipeline and injected into old oil reservoirs to boost output of precious crude.” - The coal plant to end all coal plants? (The Washington Post)

It is overwhelming plausible that the ability of theme 4 to cause public opinions on CCS to become more positive is overshadowed by the exceptional frequency of coal industry and enhanced oil extraction discussion. Theoretically, members of the public who are seeking to understand the viability of CCS as a climate change solution would be deterred after learning
that the technology is actually perpetuating activities which contribute to climate change in the first place.

Trailing by 22 publications, theme 10 (with costs blamed for shortcomings or inhibitions) was the second most common optional theme seen at 45 occurrences in the data set (see Table 3). Theme 5 (with politics to blame for shortcomings) followed closely with 40 occurrences in the data set. It may be hypothesized that these themes indirectly influence public opinion by providing readers with the opportunity to determine if they believe the inhibitors for CCS technology can be overcome. Though leaders in the optional theme categories, it isn’t likely that theme 10 and theme 5, with occurrence rates of 20.55% and 18.26% respectively (see Table 3), had significant impacts on public opinion given their proportions to the data set.

Table 5: A side by side comparison of themes 6 (with an optimistic future outlook) and 7 (with a bleak or pessimistic future outlook).

<table>
<thead>
<tr>
<th></th>
<th>New York Times</th>
<th>Washington Post</th>
<th>USA Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimistic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pessimistic</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Though present in just a minority of publications, themes 7 and 6 are the only optional themes which share an opposing relationship similar to that of the requisite themes (see Table 5). Though not mandatory, more sources voluntarily framed the future of CCS technology pessimistically than optimistically in the data set analyzed by a margin of 11 instances. This
differs with the deduction made from the requisite themes that when given the opportunity to provide positive or negative framing, more articles provided a positive framing. Apparently, framing for CCS in the present isn’t analogous to framing for CCS in the future based upon this content analysis.

Lastly, themes 2 (negatively, as a technology which isn't viable or isn't possible), 8 (as a beneficial technology for the economy), and 9 (with discussion of risks associated with it), appeared least often with totals instances of 29, 17, and 8, in the data set, respectively (see Table 3). These low proportions in the data set don’t suggest deducing the implications of their prevalence on public opinion.

Also, though common in many other content analysis papers on news media, comparison of specific themes among sources bears minor significance here since all sources had widely varying quantities of articles published within the scope of analysis.

Analysis

Determining how carbon capture and storage has been framed in the major media outlets influencing public perception over recent years merits an unexpected, yet straightforward analysis given the research results. Assuming the predictions of major media outlets influencing public perception were acceptable (see Table 1), the overwhelming prevalence of neutral framing explains the lack of public awareness of CCS which was found in the literature review by Curry (2004) and Ashworth et al (2013). As aforementioned, the high prevalence of neutral framing was unexpected, but it provides an explicit explanation for poor public awareness levels since it isn’t possible for the public to make informative conclusions on CCS if most of their media isn’t providing a framework.
Furthermore, a breakdown of theme 4 (a necessary, required, or needed technology) revealed that CCS was more often associated with the coal industry and enhanced oil extraction than climate change. Since Ashworth, Pisarski, and Thambimuthu (2009) found that an explanation of CCS with its relevance to climate change increased positive attitudes towards the technology, it is likely that the greater association with the coal industry and enhanced oil extraction would explain an absence of positive attitudes among the public. Additionally, if readers are considering CCS as a technology for solving climate change, framing CCS with operations which perpetuate climate change are likely to cause readers to not view CCS as a viable climate change solution and this could augment negative attitudes.

However, the prevalence of other themes still does not explain the public concern of risks noted by Ashworth et al. (2013) and Wong-Parodi and Ray (2009). Comprising just a mere 3.65% of the content analyzed (see Table 3), the prevalence of risk discussion in the data results alternatively suggests that the public concern of risks should be nonexistent. Perhaps this actually is the overwhelming case on the national scale and the prior research was skewed due to localization, but the confliction still merits addressing.

Besides the neutral theme and risk discussion theme, the prevalence of other themes did help to explain public attitudes towards CCS by using the media as a proxy. For instance, with only 7.76% of articles (see Table 3) mentioning that CCS was beneficial for the economy, it is understandable that both Ashworth et al. (2013) and Ashworth, Pisarski, and Thambimuthu (2009) witnessed a fear of renewable divestment due to CCS advancement in both populations analyzed. Theoretically, if the populations had not been informed that CCS was beneficial for the economy by the media, it can be common to assume that new environmental technologies come coupled with negative economic externalities.
Other themes which helped to explain public attitudes toward CCS were the optimistic and pessimistic themes. Tyshenko (2014) revealed that positive attitudes toward nanotechnology were rooted in optimistic discussion of innovation and potential. If, similarly, positive attitudes towards CCS were boosted by optimistic discussion, the research findings would suggest that negative attitudes towards CCS is more prevalent since there were more occurrences of the pessimistic theme in the articles analyzed than the optimistic theme (see Table 5).

**Conclusion**

It is imperative to address the limitations this research project faced and the implications they have on how these findings may be interpreted for other researchers and policymakers. Most notably, the thematic coding for this project was performed by one independent researcher. To improve the quality of the data results, it would have been ideal to have multiple researchers perform content analysis on the same data set to promote consistency. The number of articles analyzed, thoroughness of themes analyzed, and other limitations because of the scope the project must all be taken into consideration when determining the sufficiency of the results. Undoubtedly, many of the deductions made regarding the association of CCS to the coal industry could have been better legitimized if association with coal was one of the themes recognized in the content analysis. Unfortunately, adherence to the methods technique outlined did not result in the theme’s derivation from the random data set and led to the most evident source of improvement for the research.

More importantly, this research revealed numerous avenues for future research which would be highly valuable for resolving energy policy issues. Of particular significance is finding out whether actual public opinion on CCS matches that of the media proxy by performing a national survey. Likewise, determining how these themes have influenced public opinion with
regards to other environmental technologies could help researchers deduce how they influence public opinion on CCS. Would doing a content analysis for other environmental technologies provide similar frameworks and quantities of articles from the same sources over the same time span? If other technologies such as solar roof panels result in a much higher quantity of articles found in that time span then this could also explain why CCS may be overshadowed in the public. How would including other news sources in the data analysis affect the results? Do these trends for media framing also hold outside the United States? What other obstacles are there to informing the public of emerging technologies beyond just prevalence in the media? All these research questions would provide priceless findings for building upon the gaps recognized in this paper.

Nonetheless, this paper makes valuable contributions to resolving the policy issue it sought after in the research question. The results showed that of people who are aware of CCS, it is more likely that they hold positive attitudes than negative based upon the media proxy. However, the neutral framing provided by the majority of the articles revealed most Americans still just aren’t aware of what CCS is and this is a likely explanation as to why policymakers aren’t witnessing public support which would catalyze political action leading to more CCS implementation. As a result, it may be necessary for policymakers to consider the externalities of increased CCS implementation without considering constituent opinions.
References


