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# The Social Construction and Framing of Tailpipe Emissions in the Media

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## **The Social Construction and Framing of Tailpipe Emissions in the Media**

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## 1. Introduction

The reduction of tailpipe emissions is a critical issue in the U.S. Vehicle emissions containing carbon monoxide, particulate matter, and nitrogen oxides degrade the quality of air and damage lung and heart function. Urban areas in the northeast and California suffer from severe air quality issues caused by tailpipe emissions.

Mass communication through the media can help communicate the risks of tailpipe emissions and help set the political agenda. This study examines media coverage of tailpipe emissions in the Associated Press State and Local Wire from 2000 to 2008. Using a framing analysis approach, the researchers focused on the policy actors and issue frames in media coverage relating to tailpipe emissions. Frames define problems, provide causal analysis, moral judgment, and remedy promotion <sup>[2]</sup>.

The analysis shows that government and industry officials were the most prominent sources in the news articles. However, the prominence of environmental groups, scientists and individual citizens changed depending on the primary focus of the article. In particular, articles that focused on public policy initiatives were more likely to cite government officials and less likely to cite alternative sources.

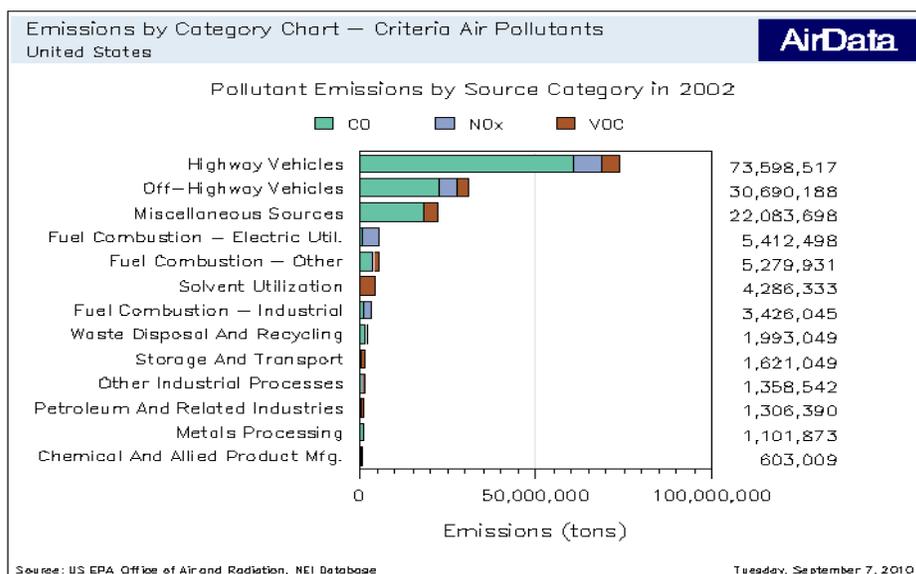
Numerous studies of vehicle emission control policies have suggested that, in many cases, technology and “technological optimism” have shaped the policy process. The analysis indicates that tailpipe emissions are defined either as a public health or environmental issue, but in either case, ‘technological fixes’ are the most prominent solution promoted by policy actors in the media.

This finding is instructive to policy-makers seeking to reduce tailpipe emissions to meet societal goals. There is a lack of a publicly available discourse regarding non-technology solutions to tailpipe emissions. This in turn limits public understanding of the range of solutions necessary to reduce motor vehicle emissions.

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### 1.1 Tailpipe Emissions

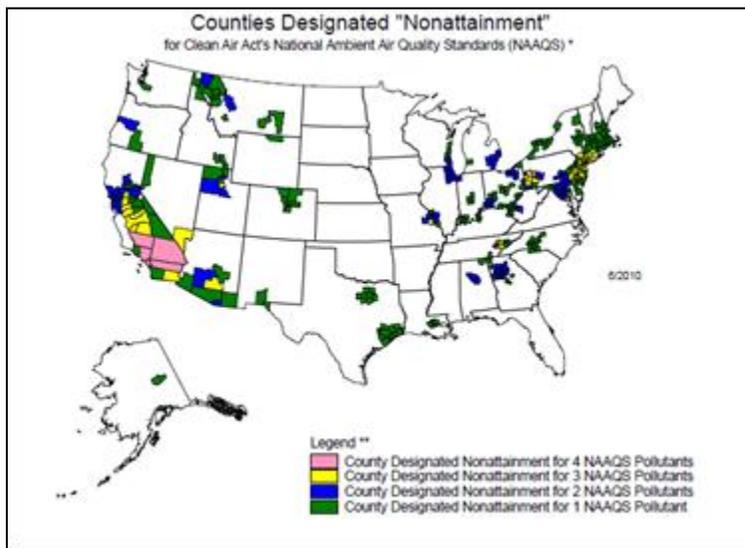
Tailpipe emissions from the transportation sector are a significant source of air pollution and greenhouse gas emissions in the U.S. Emissions from the tailpipes of vehicles include nitrogen oxides (NOX), volatile organic compounds (VOCs), hydrocarbons (HC), particulate matter (PM), carbon dioxide (CO<sub>2</sub>) and carbon monoxide (CO) <sup>[3]</sup>. Nitrogen oxides and VOCs play key roles in the formation of ground level ozone <sup>[4]</sup>.

**Figure 1-1-A. Emissions by Source**

There is a large body of evidence that ground level ozone leads to premature death and contributes to lung and heart conditions [4]. Ambient CO concentrations have been shown to increase mortality rates and hospital visits for cardiovascular disease [5]. Highway vehicles are the largest source of CO, NOX and VOC emissions (See

**Figure 1).** In cities with high levels of air pollution, mobile sources are estimated to contribute between 35% and 70% of HC and NOX emissions and 90% or more of CO emissions [6]. Fine particulate matter from vehicle emissions has been shown to have negative effects on human health leading to higher rates of mortality [7,8]. The California Air Resources Board recently estimated that fine particle pollution leads to thousands of premature deaths in California every year [7]. Air toxics such as benzene and formaldehyde, both present in tailpipe emissions, are recognized carcinogens [9].

Although air quality standards have been put in place, air quality issues associated with tailpipe emissions remain a significant challenge. In 2000 the South Coast Air Quality Management District, which governs air quality in Southern California, cited mobile-source emissions as the greatest contributor to human exposure to air toxics [3]. Figure 1-1-B shows that over 30 states in the U.S. have counties classified as nonattainment under the National Ambient Air Quality Standards (NAAQS) [10]. In particular, major metropolitan areas in California and in the Northeast suffer from poor air quality due, in part, to tailpipe emissions.

**Figure 1-1-B. Nonattainment Regions in the U.S.**

Source: EPA, 2011

Additionally, transportation activities accounted for one third of CO<sub>2</sub> emissions in 2009. Sixty percent of transportation CO<sub>2</sub> emissions come from personal vehicle use <sup>[11]</sup>.

## 1.2 Public Policy & Automobile Emissions

Automobile use grew steadily starting in the 1920s and by the 1950s the automobile was the dominant mode of transportation in the U.S. <sup>[12,13]</sup>. Between 1947 and 1964 the number of automobiles nearly doubled in the US <sup>[14]</sup>. It was during this period that researchers in the public health community connected various auto related pollutants, particulates, and ground-based ozone to lung disease, asthma and other associated diseases <sup>[15]</sup>. As early as 1953, officials in the Los Angeles area requested U.S. automakers to reduce vehicle emissions. Although policy-makers occasionally targeted reducing travel demand as a part of these early efforts, the central focus was on “technological fixes” and command and control regulatory regimes requiring the automakers to develop vehicles, engines and pollution control equipment to reduce individual vehicle emissions <sup>[12,16,17,18]</sup>. In 1954 Governor Knight of California clearly expressed the strategy that is still pursued today when he proclaimed that “smog (from vehicle emissions) is a scientific and engineering problem and not a political or legal one” <sup>[19]</sup>.

Following the lead of California, states began adopting vehicle emissions control regulations in the 1950s. During this era, air pollution concerns were believed to be a local and state

level concern, therefore, the federal government played a limited role in vehicle emissions control. In 1963 the U.S. Congress promulgated the Clean Air Act (CAA) which recognized the role of the federal government in the governance of air quality and vehicle emissions. Shortly thereafter, the federal government adopted emission standards for hydrocarbon and carbon monoxide emissions from motor vehicles which were implemented in 1966 [3,15].

In 1967, the U.S. Congress amended the CAA and states were pre-empted from issuing their own vehicle standards. However, California was exempted and allowed to draft emission standards, based on its historical leadership and continuing severe air pollutions problems [20].

The beginning of the 1970s was marked by increased urgency and public pressure to develop more effective policies to reduce air pollution. Before this period, there was concern for balancing the costs and benefits of regulation; however, due to the increased public pressure, the EPA enacted stricter regulations with little regard for their costs [15]. The 1970 CAA amendment encompassed a broader array of strategies to reduce emissions such as gas rationing, bike lanes, public transit, and carpooling; although, these policies were not pursued nearly as vigorously as emissions standards [15]. Emission standards were increased drastically, requiring automakers to reduce emissions of HC, CO and NOx emissions by ninety percent [15].

The auto industry's response to emission standards has been generally consistent for the past six decades – opposition to the standard citing impacts on vehicle design and prices. For example, the emissions standards proposed in the 1970 CAA were delayed three times and were never fully implemented due to legal challenges and pressure from the auto industry [15].

In 1977, Congress amended the CAA again giving states the right to choose the federal vehicle emission standards or California's emissions standards [20]. The 1977 amendments also created the National Ambient Air Quality Standards (NAAQS), which set uniform national air quality standards. NAAQS held states accountable to ambient concentrations of criteria pollutants, relying on the power of the purse as an incentive. States that do not meet these standards, referred to as nonattainment states, are required by law to develop state implementation plans to bring them into compliance with the standards or else they risk losing federal transportation funding. The 1977 amendments also required states with severe air quality issues to implement vehicle inspection and maintenance programs. The discretion left to administrators and the complexity of the Clean Air Act left policy implementation and enforcement interpretations to a group of “organized interests, government officials, scientists, technicians and other insiders” [17].

In 1990 another set of amendments to the Clean Air Act tightened vehicle emissions standards, placed more requirements on inspection and maintenance programs, and mandated reformulated fuels in nonattainment areas [6]. The amendments also required nonattainment states to implement vehicle inspection and maintenance programs. The coalition of policy actors that have participated in the policy debate around tailpipe emissions are government policy-makers, concerned citizens, scientists, and auto industry officials [21].

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### 1.3 Policy Strategies to Reduce Emissions

In general, there are four types of policy strategies used to reduce emissions from the transportation sector: increasing transportation system efficiency (e.g. signal timing, road design); switching vehicle fuels (e.g. electricity from renewable energy sources); increasing

vehicle efficiency by requiring low, ultralow, super-ultralow and partial zero emission vehicles (e.g. LEVs, ULEVs, SULEVs and PZEVs); and reducing vehicles miles traveled (VMT) by switching transportation modes <sup>[22]</sup>.

Reducing vehicle miles traveled can be achieved through a variety of mechanisms such as individual behavioral shifts, changes in mode choice, urban planning, and carpooling. In general reducing VMT requires individual behavior change or much larger societal changes. Very generally, the approach in national and state policy has been to force technologies and then require consumers to maintain these technologies for as long as possible <sup>[19]</sup>.

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## 1.4 The Technological Fix

Public policy scholars have used several theoretical lenses to understand the policy process behind vehicle emission control policies. These studies suggest that beliefs in technology and “technological optimism” shaped the emissions control policy process.

The term “technological fix” was coined by nuclear scientist Alvin Weinberg who believed that redefining social problems as technical problems allowed scientists and engineers to develop solutions that did not have to address the complexities and unpredictability of human behavior <sup>[23]</sup>. A central criticism of technological fixes is that they can be inadequate at addressing broader social issues. Technology fixes deflect from the roots of the problem, leaving the solutions to a “technocratic elite that would first develop and turn to centralized solutions” <sup>[24]</sup>. These solutions rely on technology over any changes in individual behavior.

However, substantial reductions in tailpipe emissions and vehicle related GHG emissions will require changes in travel behavior in addition to improvement in vehicle efficiency <sup>[13,18,25]</sup>. Yet, policy makers have historically been reluctant to address travel demand. Instead they’ve solely relied on technological fixes to reduce tailpipe emissions.

## 2. Research Methods

There are two analytical approaches we draw from in this report: an examination of the issue frames in the media discourse and an analysis of the sources or sponsors of those frames. Examining news media discourse is important because of the central role of the media in providing information to citizens and policy-makers, information that enhances the ability to participate in the public discourse and meet normative democratic goals <sup>[26]</sup>.

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### 2.1 Media Frames

Mass media coverage of policy issues can influence how consumers’ think and policy makers act <sup>[27,28]</sup>. Frame analysis of media discourse provides a structure for analyzing the core meanings in policy news coverage. Framing is the process of collecting pieces of perceived reality and assembling a narrative that connects those pieces to promote a particular interpretation. Frames define problems, provide causal analysis, moral judgments and promote particular solutions <sup>[27,29,30]</sup>. Gamson and Modigliani defined a frame as a “central organizing idea... for making sense of relevant events, suggesting what is at issue” <sup>[29]</sup>.

Frames are not the objective structure of the material, but one way to view, discover and to look at how the world is being interpreted <sup>[30,31]</sup>. Frames contain a number of condensing

symbols that suggest the core theme of the frame in shorthand. These can be described with a metaphor or other symbolic device [28,29,32,33]. Frames must have a position on the issue at hand [28].

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## 2.2 Sources

Frames are introduced and advocated for by sponsors. The ability of a sponsor to promote their frame depends on many factors, including the sponsor's economic and cultural resources, knowledge of journalistic practices, and sponsorship skills [28,33]. The information that is published in the news is heavily influenced by the people and organizations that journalists gather information from, who are referred to as news sources. News sources influence the focus and content of news coverage [34,2,35]. Limiting source diversity can reduce the variety of information and viewpoints available to citizens and policy-makers and constrain policy outcomes [36,37].

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## 2.3 Media Analysis

The researchers collected 1,471 Associated Press news stories written between 2000 and 2008 from the LexisNexis database using a keyword search of the Associated Press Local & State Wire service. Articles selected for analysis had to contain three or more sentences directly related to motor vehicle emissions, contain more than 200 words, originate from within the U.S. and be identified as a news story. The AP wire service's influence in the policymaking arena and its widespread use by newspapers around the U.S. makes it an acceptable measure of the mass media information available to the general public [37,38,39]. Choosing the Associated Press also provided an opportunity to analyze the contribution of various states to the overall coverage of tailpipe emissions.

Researchers first coded the entire population of articles for the primary article theme. The news articles grouped around five thematic areas: news stories about air quality and the impacts of air pollution; stories about vehicle emissions testing programs; stories about new technologies or innovative approaches to reducing vehicle emissions; news stories about policies to regulate vehicle emissions; and news stories about greenhouse gas emissions related to motor vehicles [36].

Researchers grouped the sources in the news articles into eight categories: 1) federal, state and local government officials; 2) environmental interest groups; 3) business interest groups; 4) vehicle manufacturers; 5) other business interests; 6) federal, state and regional legislators; 7) independent unaffiliated scientists (usually at a university); and 8) individual citizens. Those sources were then grouped into three broad categories: 1) government officials; 2) business and industry organizations; and 3) environmental interest groups, individual scientists and citizens. The unit of analysis was the citation where a source was either quoted or paraphrased by the journalist on the topic of tailpipe emissions.

The researchers selected a random sample of 12 percent of the population stratified by year for an extensive coding of the articles [40]. After comparing the distribution of datelines and article themes from the sample to the population the researchers considered the sample an acceptable representation of the population. The sample was split into two groups, even years and odd years, which the authors independently coded.

The data on source use is not normally distributed so a non-parametric Kruskal-Wallis test, similar to an analysis of variance, was used to test article characteristics against source use

[41]. Kruskal-Wallis pairwise comparisons were conducted to test source use between pairs of years and themes.

The authors used Krippendorff's coefficient to measure intercoder reliability to check for systematic human coding errors and flaws in the coding criteria [42,43]. High levels of intercoder reliability indicate that coding categories were mutually exclusive and reliably applied to the text data [43]. A random sample of 15 percent of articles from the population was coded by the second author to assess intercoder reliability of the article themes. Krippendorff's coefficient for themes was 0.81, which was considered acceptable. In order to test reliability at the source citation level the two authors cross-coded a random sample of 15 percent of the coded source citations. Krippendorff's coefficient for sources was 0.94 and considered acceptable.

We grouped policy solutions into two broad categories; technology and alternatives. The technology frame implicitly and, occasionally, explicitly promotes automobility through the use of clean fuel, emissions testing, vehicle maintenance, emissions standards, and other technological innovations that reduce individual vehicle emissions. This array of strategies does not address travel behavior or transportation system design; instead, it focuses on vehicle consumers by making new technologies available through mandates or incentives. For example, here is EPA Administrator Stephen Johnson displaying the technology frame: "By cleaning up our fuels and vehicle exhaust, EPA is paving the road toward a cleaner environment and healthier drivers," he said" [44].

The alternative frame encompasses any mention of alternatives to automobility, such as public transit, carpooling, avoiding unnecessary trips in vehicles, smart growth strategies or changes in settlement patterns that could reduce per capita VMT. The same sense of futility and cynicism expressed in the behavioral problem definition was often expressed in promoting alternatives to automobility. For example, "Jim Renfro, air resources specialist at the Great Smoky Mountains National Park, had simple advice for Piedmont residents caught in the haze and heat. "You really ought to stay indoors and not breathe," he said. Some Triangle residents said they were aware of the ozone warning but ignored the state's recommendations to find alternate transportation..." [45]. This statement from a consumer in North Carolina referring to the state's ozone alert also expresses a sense of futility: "I saw the warning on the way to work this morning, but I was on 'E' and absolutely had to get gas," said Karen Wilson, a Durham social worker" [45].

## 3. Data Analysis

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### 3.1 Article Themes

We found five types of news topics: 1) public policy-related articles covering various debates at the state and federal level about motor vehicle emissions regulatory policies and initiatives; 2) stories about vehicle emissions testing; 3) stories about technologies designed to reduce tailpipe emissions, i.e. hydrogen cars or new tailpipe emissions control equipment; 4) stories focused on the impacts of tailpipe emissions on human health and, 5) a small number of stories on the GHG emissions from vehicles. In total the topics of public policy and emission testing accounted for over two thirds of AP coverage from 2000-2008.

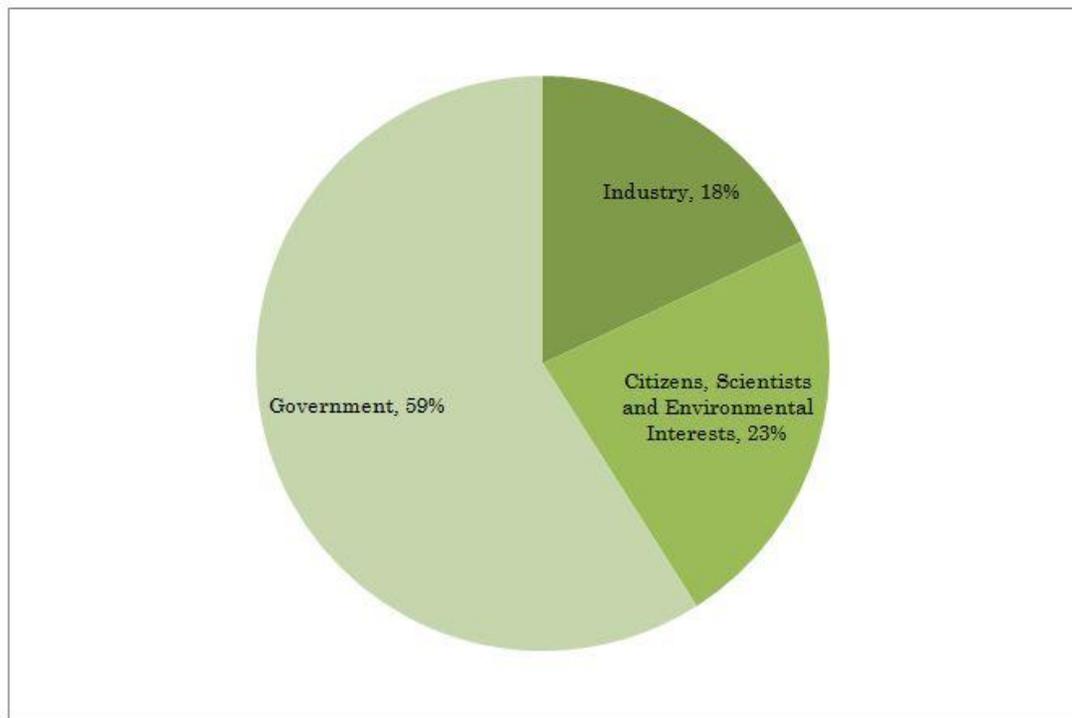
**Table 3-1. Distribution of Article Topics**

Article Focus	Percent of total (N=1471)
Public policy related to vehicle emissions	51%
Vehicle emissions testing	17%
Technology/innovations	17%
Air pollution/public health	11%
Greenhouse gas emissions	4%

### 3.2 Sources

Government and industry sources dominated the coverage.

**Figure 3-2. Percent of Citations to Sources (n=840)**



Source: Newspaper Articles data-base.

Source use remained relatively constant across each year of the study. Government officials were the dominant source used by journalists throughout the entire period, ranging from a low of 44 percent of all citations in 2003 to a high of 69 percent in 2008 (see Table 3-1).

**Table 3-1-A. Percent Source Citations within News Articles by Article Year (n=840).**

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Citizen, Scientist and Environmental	22%	23%	22%	40%	25%	17%	15%	12%	35%
Government	60%	65%	45%	44%	66%	67%	69%	68%	44%
Industry & Business	18%	12%	33%	16%	9%	16%	17%	21%	21%
n	149	86	103	91	100	76	48	112	75

Citizens, scientists and environmental interest groups appeared in 65 percent of the articles about air quality and pollution but in only 23 percent of the articles about emission testing. Similarly, citizens, scientists and environmental interest groups received 44 percent of the citations within the air quality and pollution themed articles and 13 percent of the citations in articles about vehicle emissions testing (see Table 2). A Kruskal-Wallis pairwise comparison showed that the number and proportion of these sources used in air pollution and climate change stories was significantly greater than in emissions testing articles ( $p < .05$ ) and policy articles ( $p < .05$ ). In other words citizen, scientists and environmental interests groups tended to have a greater number of citations and a greater proportion of all citations within a news article when it discussed air quality and pollution.

Auto industry officials and other business organizations appeared the least in news articles about air quality and pollution (23 percent) and the most in news articles about technology and innovation (72 percent). Industry's prominence in the technology and innovation articles is also indicated by the percent of citations displayed within this theme area (36 percent). A pairwise comparison found that industry sources had a greater number and proportion of citations in technology articles compared to air pollution and climate articles ( $p < .001$ ) and policy articles ( $p < .05$ ). The number of industry sources was significantly greater in emissions testing articles than in technology articles ( $p < .05$ ).

The dominant role of government sources is indicated by their appearance in 90 percent of all the news articles and 97 percent of the policy articles. Government officials were responsible for 66 percent of all citations in policy-themed articles and 68 percent of citations in emissions testing-themed articles. The number of government sources and the proportion of government citations in policy articles was significantly greater than technology-themed articles ( $p < .001$ ). Policy-themed articles also had a significantly greater proportion of government sources than emission testing articles ( $p < .001$ ).

**Table 2-2-B. Percent Citations within each News Article by Article Theme (n=840)**

	Air quality /Pollution/ Climate	Emissions testing	Technology and innovation	Policy	All Articles
Citizen, Scientist and Environmental Interest Groups	44%	13%	27%	18%	23%
Government	49%	68%	37%	66%	58%
Industry & Business	7%	19%	36%	17%	18%
n	157	135	149	465	840

### 3.3 Frames

The technology frame outnumbered the alternative frame in every year of the study. Sources raised alternatives to private automobile use as a solution to motor vehicle emissions only 19 times in the 180 articles in the sample. In contrast, sources promoted technology 295 times, a

margin of about 15:1. The dominance of the technology frame is also seen when looking at the relationship between the display of these two solution frames and the subject of the article. While alternatives appeared in stories related to public policy and air pollution/public health, they only appeared twice in technology themed articles and were completely absent from stories about vehicle emissions testing.

**Table 3-3-A. Percent of Articles by Theme Displaying either the Alternatives or Technology Solution Frame**

Article theme	Percent of Articles	Percent of Articles with the technology solution frame	Percent of Articles with the alternatives solution frame
Public policy	49%	40%	4%
Technology/innovations	16%	15%	1%
Vehicle emissions testing	18%	9%	0%
Air pollution/public health	15%	6%	3%
Climate Change	2%	2%	0%
Total number	180	130	16

The prominence of technology is also seen by looking at the co-occurrence of new sources with the frames they promoted in the news articles. While scientists, environmentalists and government officials display alternatives more frequently than business interests, technology is still the dominant frame within their statements.

**Table 3-3-B. Policy Framing by News Source**

Policy Solution	Independent Scientists	Government	Industry (Auto and Others)	Environmental Interest	Citizens
Alternatives	0%	8%	2%	5%	18%
Technology Solutions	100%	92%	98%	95%	82%
Total Number	14	214	54	64	11

## 4. Discussion

News articles that discussed air pollution, climate change or other health or environmental issues contained a greater diversity of sources, with a greater share of citations from citizens, scientists and environmental interest groups. Theories of news production can provide an explanation. Journalists depend on a steady source of reliable, credible information [37,46, 47, 48]. News sources also actively and strategically provide ‘information subsidies’ to journalists [46].

The American Lung Association, a national public health organization, was frequently cited as a source in air pollution themed articles in the context of their annual “State of the Air” report that ranks states by their air quality. The auto industry was cited in technology and innovation articles in the context of routine press releases to announce recent vehicle emission-reducing technology innovations. This is consistent with previous research that shows that business news sources are associated with economic topics and routine channels of news <sup>[49]</sup>.

This study also reinforces the hypothesis that U.S. policy discourse is systematically biased towards the technological fix as a solution to vehicle emissions and broader social and environmental issues. We found that most new sources cited in the media coverage defined tailpipe emissions as a technical issue and promoted technological fixes as solutions. News sources in the media promoted technology 94 percent of the time, outnumbering displays of alternatives 15:1. In a personal interview, the Chairman of CARB explained that “technology solutions are always favored, both because they can be implemented on a mass basis with less administrative costs to the system and because they seem to be easier for elected officials or people who work in a political environment to do because you don’t have to interact so much with real people with all their individual quirks and difficulties...” (Mary D. Nichols, Chairman, California Air Resources Board, August 19, 2010).

Policymakers are drawn to solutions that they can understand and measure and that can be implemented without political consequences <sup>[17]</sup>. The technology frame attributes responsibility to bureaucratic and industry interests and enables policymakers to bypass the politically risky discourse of addressing citizen behavior.

The values and ideas embedded in the frames analyzed in this study bear resemblance to the dominant social paradigm of a belief in technological optimism <sup>[50]</sup>. In the AP coverage the values linked to the dominant social paradigm appear to underlie the logic of the technological fix in the policy debate. For example, California’s former Governor Gray Davis, in expressing support for technology forcing regulations, said “... we can have the choice of the auto or truck we want, and still do a better job with the cleaning up (of) the environment around us” <sup>[51]</sup>. Rather than challenge this paradigm, policy makers transformed the issue into a technical problem to be addressed by technical experts.

## 5. Conclusion and Further Research

This study adds to research investigating news source diversity in domestic policy by showing that source diversity shifts when journalists focus on different thematic elements of an issue. Citizens, scientists and environmental groups tend to have greater opportunities to build the media agenda in the context of air pollution and climate change topics. An important point that can be drawn out from this result is that the dominance of government sources in this study can, to some extent, be explained by a thematic focus by journalists on public policy and vehicle emission testing programs.

Regardless, the policy discourse is heavily weighted towards technical solutions and the technological approach is almost never questioned in the policy discourse. Dryzek notes that the embeddedness of a paradigm creates barriers for proponents of alternative paradigms to establish a forum for debate <sup>[50,52]</sup>. This could help explain the dominance of the technological fix in the vehicle emission policy discourse and how little credence is given to proposals to shift away from automobility. Researchers that are interested in technology and its relationship to policy should further examine the relationship between the dominant social paradigm and its influence over the acceptance and use of the technological fix in policy discourse.



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