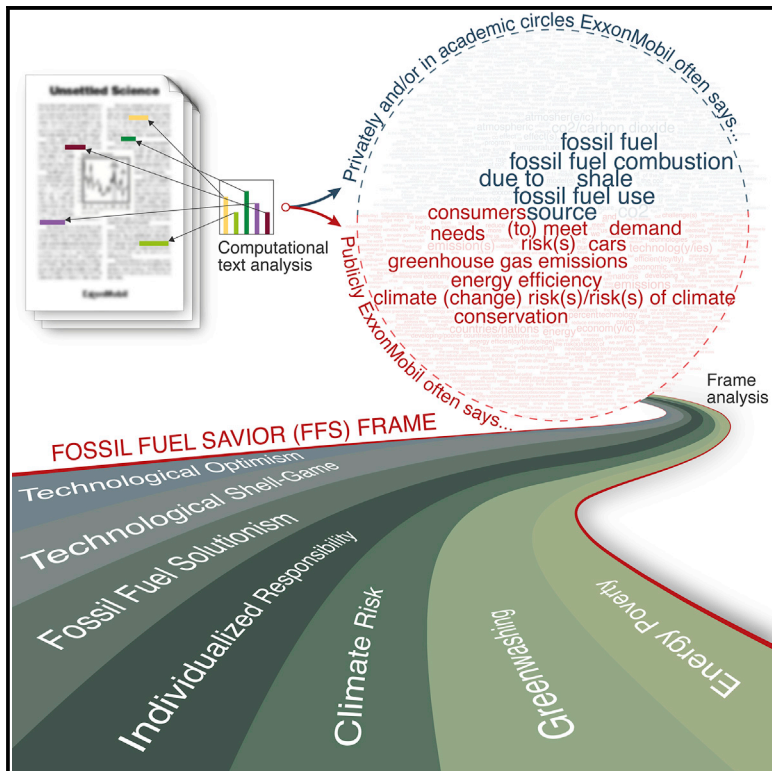


# Rhetoric and frame analysis of ExxonMobil's climate change communications

## Graphical abstract



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## In brief

This is the first computational assessment of how ExxonMobil has used language to subtly yet systematically frame public discourse about climate change. We show that ExxonMobil uses rhetoric mimicking the tobacco industry to downplay the reality and seriousness of climate change, to present fossil fuel dominance as reasonable and inevitable, and to shift responsibility for climate change away from itself and onto consumers. Our work is relevant to lawsuits, policy proposals, and grassroots activism seeking to hold fossil fuel companies accountable for deceptive marketing.

## Highlights

- ExxonMobil's public climate change messaging mimics tobacco industry propaganda
- Rhetoric of climate “risk” downplays the reality and seriousness of climate change
- Rhetoric of consumer “demand” (versus fossil fuel supply) individualizes responsibility
- Fossil Fuel Savior frame uses “risk” and “demand” to justify fossil fuels, blame customers



## Article

# Rhetoric and frame analysis of ExxonMobil's climate change communications

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**SCIENCE FOR SOCIETY** A dominant public narrative about climate change is that “we are all to blame.” Another is that society must inevitably rely on fossil fuels for the foreseeable future. How did these become conventional wisdom? We show that one source of these arguments is fossil fuel industry propaganda. ExxonMobil advertisements worked to shift responsibility for global warming away from the fossil fuel industry and onto consumers. They also said that climate change was a “risk,” rather than a reality, that renewable energy is unreliable, and that the fossil fuel industry offered meaningful leadership on climate change. We show that much of this rhetoric is similar to that used by the tobacco industry. Our research suggests warning signs that the fossil fuel industry is using the subtle micro-politics of language to downplay its role in the climate crisis and to continue to undermine climate litigation, regulation, and activism.

## SUMMARY

This paper investigates how ExxonMobil uses rhetoric and framing to shape public discourse on climate change. We present an algorithmic corpus comparison and machine-learning topic model of 180 ExxonMobil climate change communications, including peer-reviewed publications, internal company documents, and advertorials in *The New York Times*. We also investigate advertorials using inductive frame analysis. We find that the company has publicly overemphasized some terms and topics while avoiding others. Most notably, they have used rhetoric of climate “risk” and consumer energy “demand” to construct a “Fossil Fuel Savior” (FFS) frame that downplays the reality and seriousness of climate change, normalizes fossil fuel lock-in, and individualizes responsibility. These patterns mimic the tobacco industry’s documented strategy of shifting responsibility away from corporations—which knowingly sold a deadly product while denying its harms—and onto consumers. This historical parallel foreshadows the fossil fuel industry’s use of demand-as-blame arguments to oppose litigation, regulation, and activism.

## INTRODUCTION

In previous work, we have shown that Exxon, Mobil, and ExxonMobil Corp misled the public about anthropogenic global warming (AGW) by contributing to climate science through academic and internal research, while promoting doubt about it in advertorials and other propaganda.<sup>1–3</sup> (We refer to Exxon Corporation as Exxon, Mobil Oil Corporation as Mobil, ExxonMobil Corporation as ExxonMobil Corp, and generically refer to all three as Exxon-Mobil.) We have also observed that, starting in the mid-2000s, ExxonMobil’s statements of explicit doubt about climate science and its implications (for example, that “there does not appear to be a consensus among scientists about the effect of fossil fuel use on climate”<sup>4</sup>) gave way to implicit acknowledgments couched in ambiguous statements about climate “risk” (such as discussion of lower-carbon fuels for “addressing the risks

posed by rising greenhouse gas emissions,”<sup>5</sup> without mention of AGW). This invites research as to how, beyond outright disinformation, ExxonMobil may have employed rhetoric and framing to construct misleading public narratives about AGW. Here, we take up this question.

“Framing” is a term of art in communications science that refers to how an issue is portrayed and understood.<sup>6–9</sup> Frames construct meaning by selecting “some aspects of a perceived reality” and making them “more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation.”<sup>10</sup> (Here and throughout, we strictly refer to “emphasis frames” rather than “equivalency frames.”)<sup>11</sup> Analyzing which frames are present and absent in public discourse helps to reveal how actors have tried to shape policy debates by setting agendas and legitimating certain participants



and responses, while discouraging or precluding others.<sup>12–15</sup> Framing of responsibility, for example, can determine whether society calls upon individuals, industry, or government to take action.<sup>16</sup>

One of the fossil fuel industry's primary AGW frames has been scientific uncertainty.<sup>17</sup> Researchers have documented in detail industry's over-emphasis of uncertainty to deny climate science and delay action.<sup>1,2,17–25</sup> Subtler forms of rhetoric and framing, which dominate today's AGW discourse, are only just beginning to receive similar attention.<sup>7,26–29</sup> Fossil fuel interests have spent billions of dollars on AGW public affairs, yet their role in perpetuating these narratives is underexplored.<sup>30,31</sup>

In this paper, we analyze how ExxonMobil has publicly constructed AGW frames by selectively emphasizing some terms and topics while avoiding others. Our analysis compares the terms and topics between ExxonMobil's different AGW communications, including peer-reviewed publications, internal documents, and paid, editorial-style advertisements—known as advertorials—published on the Op-Ed page of *The New York Times* (NYT). We also identify frames in the latter. These well-defined, longitudinal corpora are conducive to a rigorous case study of fossil fuel industry messaging on AGW.

Our study offers the first computational assessment of how ExxonMobil has used language to frame public discourse about AGW. By bringing to bear the mixed-methods of computational linguistics and inductive frame analysis, our results add to (1) analyses of ExxonMobil's public affairs practices,<sup>32–44</sup> (2) qualitative accounts of the company's AGW communications,<sup>23,45–49</sup> and (3) the application of discourse and (algorithmic) content analysis to AGW communications by ExxonMobil and the wider climate countermovement.<sup>1,2,17–19,26,27,29,50–57</sup> A “distant”—that is, quantitative, statistical, and macroscopic—reading of ExxonMobil's AGW communications offers three practical advantages.<sup>58</sup> First, it complements the qualitative and/or manual methodologies previously applied to the AGW communications of ExxonMobil and other fossil fuel interests, and corroborates our prior work, which used manual coding to demonstrate systematic discrepancies between ExxonMobil's private and public AGW communications.<sup>1,2</sup> Second, automated methods of textual analysis allow detection of broad, sometimes subtle, patterns of language that would otherwise be unattainable. Third, by using existing corpora to establish the application of computational techniques to the analysis of AGW discourse, we help demonstrate the efficacy of these approaches, which researchers will be able to use to analyze the large numbers of documents that lawsuits against fossil fuel companies are anticipated to generate.

Our analysis is the first computational study illustrating how the fossil fuel industry has encouraged and embodied AGW narratives fixated on individual responsibility. Our findings corroborate the insights of qualitative discourse analyses about the role of fossil fuel interests, and add to what Kent<sup>59</sup> has called an “under-theorised” understanding “of why contemporary interest focuses on individual responsibility for climate change.”<sup>26,51</sup> In so doing, this work helps to decrypt the fossil fuel industry's playbook of climate delay framings, illuminating how sense-making schema conveyed by subtle yet systematic deployments of language may have “penetrated public

discourse to become naturalized as common sense or unfortunate realities.”<sup>13,26</sup> Although misleading frames that deceive the public may be defended on First Amendment grounds, the history of tobacco litigation shows that a misleading framework may also be held in some circumstances to be part of a pattern of fraudulent activities. Our work may, therefore, be relevant to ongoing lawsuits against ExxonMobil alleging “deceptive marketing” and “greenwashing,” as well as to calls for policymakers to ban fossil fuel industry advertisements or require that they come with tobacco-style warning labels.<sup>60–65</sup> Our research also adds to an expanding scholarly and journalistic AGW literature—spanning emissions accounting and extreme weather attribution,<sup>66,67</sup> supply-side policy analysis,<sup>68–70</sup> decarbonization theory,<sup>71,72</sup> the history of climate denial, lobbying, and propaganda by fossil fuel interests;<sup>73–83</sup> ethical philosophy;<sup>84,85</sup> and climate litigation<sup>86,87</sup>—challenging the zeitgeist of individualized responsibility. Finally, this study contributes to broader literatures on discourse and content analysis;<sup>88–91</sup> corporate issue management and advocacy marketing;<sup>56,92–96</sup> and the cross-pollination of corporate strategies of public affairs, litigation, and deceit.<sup>13,86,97–100</sup>

We adopt a mixed-method, computational approach to rhetorical frame analysis of 180 ExxonMobil documents previously compiled for manual content analysis<sup>1,2</sup>: 32 internal company documents (1977–2002; from ExxonMobil Corp,<sup>101</sup> *InsideClimate News*,<sup>102</sup> and Climate Investigations Center),<sup>103</sup> 72 peer-reviewed publications (1982–2014; from ExxonMobil Corp),<sup>104</sup> and 76 advertorials in the NYT expressing any positions on AGW (real and human caused, serious, or solvable) (1972–2009; from PolluterWatch and ProQuest).<sup>105,106</sup> To our knowledge, these constitute all publicly available internal and peer-reviewed ExxonMobil documents concerning AGW, including those made available by the company. They also include all discovered ExxonMobil advertorials in the NYT taking any positions on AGW. These corpora thus offer bound sets reflecting ExxonMobil's internal, academic, and public AGW communications, respectively.

Following text pre-processing and vectorization into document-term matrices, we first use frequency score (FS) and Dunning log-likelihood (LL) ratio corpus comparison algorithms to identify statistically distinctive keywords (“divergent terms”) that help locate rhetorical frames.<sup>107–110</sup> The FS indicates how often a given term appears in corpus A versus corpus B (accounting for corpus sizes), and ranges from 0 (only in corpus A) to 1 (only in corpus B). The LL ratio ( $G^2$ ) indicates the statistical significance of the relative frequencies of a given term between corpora A and B, and ranges from large and negative (term is disproportionately common in corpus A) to large and positive (disproportionately common in corpus B). Second, we complement this approach with latent Dirichlet allocation (LDA) topic modeling to identify statistically distinctive, thematically connected texts and vocabularies (“divergent topics”), which are commonly equated to either frames or frame elements.<sup>111–115</sup> Third, we integrate these quantitative tools into an inductive, qualitative approach to constructing frames as “frame packages” in advertorials.<sup>17,116–118</sup> In the **discussion**, we examine the congruence of our findings with the tobacco industry's rhetorical strategies in public relations and litigation.<sup>13,109,119,120</sup>

**Table 1. Rhetorical tropes and taboos: Highly divergent terms in (left) ExxonMobil Corp advertorials versus (right) Mobil advertorials, by LL ratio ( $G^2$ ) and FS**

	ExxonMobil Corp advertorials often say:				Mobil advertorials often say:				
	ExxonMobil Corp	Mobil	$G^2$	FS	ExxonMobil Corp	Mobil	$G^2$	FS	
*energy*	279	99	110.51	0.76	*nations*	4	79	-74.90	0.05
challenge(s)	52	4	54.33	0.94	plan	0	21	-26.84	0.00
(to) meet	51	14	26.70	0.80	senate	0	16	-20.45	0.00
demand	32	8	18.22	0.82	treaty	0	14	-17.89	0.00
use	60	27	16.78	0.71	in kyoto	0	13	-16.61	0.00
needs	27	9	11.53	0.77	the us [United States]	18	51	-12.99	0.28
*risk(s)*	46	3	50.30	0.94	*co2/carbon dioxide*	33	105	-31.90	0.26
climate (change) risk(s)/risk(s) of climate	26	0	39.02	1.00	emission(s)	97	197	-24.48	0.35
longterm	37	3	38.05	0.93	greenhouse gases	8	39	-18.96	0.19
*research*	75	21	38.53	0.80	effect	1	18	-16.67	0.06
gcep [Global Climate and Energy Project]	17	0	25.51	1.00	global warming	2	21	-16.25	0.10
technologies	55	18	24.00	0.77	evs [electric vehicles]	0	12	-15.34	0.00
solar	24	3	21.02	0.90					
stanford	14	0	21.01	1.00					
policies	27	5	19.17	0.86					
wind	18	3	13.62	0.87					

Terms that appear to be thematically related have been grouped (asterisked, high-scoring terms identify each group). ExxonMobil Corp advertorials often say terms (“tropes”) with large positive  $G^2$  scores and rarely say terms (“taboos”) with FS scores near 0. Mobil advertorials often say terms with large negative  $G^2$  scores and rarely say terms with FS scores near 1. p values < 0.001 for all  $G^2$  and FS scores.

## RESULTS

In the section entitled “[divergent terms and topics](#),” we compare divergent terms and topics between pairs of document categories. In “[rhetorical frames](#),” we summarize the findings of frame package analysis of advertorials: three dominant frames communicated by 11 constituent discourses. Other sections then focus on two of these complementary discourses, “[discourse of climate risk](#)” and “[discourse of individualized responsibility](#),” and analyze how they work alongside other discourses to construct one specific frame, Fossil Fuel Savior (FFS) (“[FFS frame](#)”).

### Divergent terms and topics

Table 1 presents a selection of highly divergent terms in ExxonMobil Corp advertorials versus Mobil advertorials, as identified by LL and FS. Likewise, Tables 2 and 3 compare highly divergent terms between all advertorials (Mobil plus ExxonMobil Corp) and, respectively, Exxon internal documents (Table 2) and Exxon/ExxonMobil Corp peer-reviewed publications (Table 3). In all three tables, the highest  $|G^2|$ -scoring terms, marked with asterisks, are suggestive of distinctive themes around which we group other relevant terms. These themes closely resemble the divergent topics shown in Table 4, which emerge from LL analysis of our LDA topic model solutions in all advertorials (top half of Table 4) and in combined internal and peer-reviewed documents (bottom half). The top 20 words associated with each topic are listed, together with assigned topic labels.

### Mobil versus ExxonMobil Corp advertorials

We have previously shown that both Mobil and ExxonMobil Corp advertorials often promoted doubt about climate science.<sup>1,2</sup> Terms conveying explicit doubt are therefore common to both corpora, and so do not appear in Table 1 (for examples, see S2.1, [supplemental information](#)). This undercuts ExxonMobil Corp’s suggestion that only Mobil, not ExxonMobil Corp, promoted doubt.<sup>2,3</sup> Both did. Moreover, when Exxon and Mobil merged in 1999, ExxonMobil Corp inherited legal and moral responsibility for both parent companies.

Comparison of advertorials over time can nevertheless be insightful in revealing other rhetorical trends. In this regard, Mobil and ExxonMobil Corp advertorial corpora serve as well-defined longitudinal proxies.

Table 1 shows, for example, that earlier, Mobil advertorials disproportionately contested climate science head-on, discussing emission(s) of CO<sub>2</sub>/carbon dioxide and the global warming effect (terms exhibiting statistically significant divergence are underlined throughout). Mobil advertorials also notably engaged in climate policy debates concerning the role of the US (and Senate) compared with other nations as part of the Kyoto treaty plan. By contrast, ExxonMobil Corp advertorials no longer referred to “global warming”: the term became taboo (FS = 0.10). Relative usage of “climate change” versus “global warming” went from 3-to-1 pre-merger to 34-to-1 post merger. Indeed, ExxonMobil Corp mostly sidestepped detailed discussions about climate science, acknowledging only the long-term risks of climate change before reframing it as a challenge to meet the public’s energy demand and needs. ExxonMobil

**Table 2. Rhetorical tropes and taboos: Highly divergent terms in (left) advertorials versus (right) internal documents, by LL ratio ( $G^2$ ) and FS**

	Advertorials often say:				Internal documents often say:				
	Advertorials	Internal	$G^2$	FS	Advertorials	Internal	$G^2$	FS	
*emission(s)*	294	97	293.80	0.86	*co2/carbon dioxide*	138	1,053	-291.63	0.21
risk(s)	49	7	72.48	0.93	atmosher(e/ic)	36	458	-187.01	0.14
greenhouse gas emissions	42	7	58.90	0.92	fossil fuel	9	144	-66.26	0.11
climate (change) risk(s)/risk(s) of climate	26	0	57.89	1.00	ppm [parts per million]	0	78	-62.12	0.00
climate change	124	103	45.39	0.71	co2 concentration	1	61	-40.57	0.03
dont [don't]	24	2	40.93	0.96	fossil fuel combustion	1	48	-30.69	0.04
know	32	8	37.59	0.89	co2 increase	0	28	-22.30	0.00
longterm	40	17	33.14	0.83	source	6	39	-9.08	0.24
doom(sday/sdayers)/apocalypse/hype/scare	11	0	24.49	1.00	*effect(s)*	27	359	-150.31	0.13
debate	26	12	20.05	0.82	temperature	15	270	-130.89	0.10
(un)know(/n/ing/ledge)	57	66	9.63	0.64	doubling	2	83	-51.60	0.05
*energy*	378	222	227.73	0.78	greenhouse effect	10	119	-46.69	0.15
(to) meet	65	2	128.34	0.99	ocean	15	135	-43.38	0.19
challenge(s)	56	5	94.08	0.96	due to	5	89	-42.94	0.10
energy efficiency	30	1	58.76	0.98	ph [pH]	0	44	-35.04	0.00
electricity	29	1	56.60	0.98	radiation	1	44	-27.68	0.04
consumers	21	0	46.76	1.00	co2 greenhouse	0	33	-26.28	0.00
oil and natural gas	18	0	40.08	1.00	sea	6	65	-23.99	0.16
energy use	23	4	31.75	0.92	global temperature	0	30	-23.89	0.00
demand	40	21	27.24	0.80	2050	0	30	-23.89	0.00
needs	36	22	20.69	0.77	temperature increase	3	50	-23.44	0.11
for generations/foreseeable future/several decades/decades to come/next 25 years	12	3	14.10	0.89	polar	1	28	-15.83	0.07
*countries/nations*	157	17	251.77	0.95	*program*	12	195	-90.37	0.11
developing/poorer countries/world/nations	53	3	97.01	0.97	natuna [Natuna Island, Indonesia]	0	67	-53.36	0.00
kyoto	59	7	92.31	0.95	doe [Department of Energy]	0	38	-30.26	0.00
targets	26	4	37.52	0.93	tanker	1	35	-20.96	0.06
*econom(y/ic)*	148	22	216.08	0.93	*model(s)*	30	309	-110.12	0.17
economic growth/impact	29	2	51.34	0.97	figure	0	112	-89.19	0.00
prosperity	15	0	33.40	1.00	rate	2	122	-81.13	0.03
jobs	13	0	28.95	1.00	data	10	98	-33.68	0.17
prices	12	0	26.72	1.00	vugraph	0	41	-32.65	0.00
cost	33	17	22.92	0.80	scenario	1	42	-26.17	0.05
tax	15	2	22.68	0.94					
living standard(s)/standard(s) of living/quality of life	10	0	22.27	1.00					
*steps*	36	1	71.76	0.99					
reduce emissions	23	0	51.21	1.00					
voluntary	18	0	40.08	1.00					
wise(r)/prudent/reasonable/responsible/sound(er)	39	21	25.87	0.79					
*technology(ies)*	198	40	257.20	0.91					
vehicles	33	0	73.48	1.00					

(Continued on next page)

**Table 2. Continued**

	Advertorials often say:				Internal documents often say:			
	Advertorials	Internal	G <sup>2</sup>	FS	Advertorials	Internal	G <sup>2</sup>	FS
natural gas	48	18	43.87	0.85				
trees	24	2	40.93	0.96				
invest(ing/ment(s))	27	4	39.46	0.93				
gcep [Global Climate and Energy Project]	17	0	37.85	1.00				
evs [electric vehicles]	16	0	35.63	1.00				
gasoline	20	2	32.72	0.95				
innovat(e/ion(s))	17	1	30.93	0.97				
solutions	26	7	29.36	0.88				
renewables	13	0	28.95	1.00				
wind	21	5	25.29	0.90				

Terms that appear to be thematically related have been grouped (asterisked, high-scoring terms identify each group). Advertorials often say terms (“tropes”) with large positive G<sup>2</sup> scores and rarely say terms (“taboos”) with FS scores near 0. Internal documents often say terms with large negative G<sup>2</sup> scores and rarely say terms with FS scores near 1. p values < 0.001 for all G<sup>2</sup> and FS scores.

Corp advertorials emphasized the need for more climate and energy technologies research, such as the company’s sponsorship of the GCEP (Global Climate and Energy Project) at Stanford University. Current solar and wind technologies were presented as inadequate.

#### Advertorials versus internal documents

Comparing divergent terms in all advertorials against those in internal documents, a combination of the above advertorial themes emerges (Tables 2 and 4). Numerous Mobil and Exxon-Mobil Corp advertorials promoted explicit doubt about whether AGW is real and human caused. They emphasized debate and focused on what scientists “do and don’t know” [Climate science uncertainty] (topic labels from Table 4 are indicated in bracketed italics throughout). This eventually gave way to rhetoric about potential long-term risks of AGW (after several years of overlap in ~2000–2005 and 2007), juxtaposed against the challenge to meet demand [Energy/emissions challenge]. The energy use and needs of consumers, such as electricity and oil and natural gas, are presented as necessitating greater energy efficiency and new technologies [Energy/emissions challenge; Vehicles]. The public is told about how ExxonMobil Corp is partnering with GCEP at Stanford to develop solutions such as more efficient gasoline vehicles and “clean...natural gas” [Vehicles; Energy technologies]. ExxonMobil Corp touts its efforts to plant trees, but renewables such as wind and electric vehicles/EVs are given short shrift [Conservation; Energy technologies]. Algorithmic analysis also documents Mobil’s public rhetoric on the Kyoto Protocol: targets that exempt developing countries threaten American jobs, prosperity, and economic growth; instead, governments and industry should pursue market-based, voluntary steps to reduce emissions [Climate policy].

Compared with Mobil advertorials, which promoted debate about climate science, and ExxonMobil Corp advertorials, which did the same or ignored it, Exxon’s internal conversations focused on it. Internal documents are notable for their detailed articulation of the causes and consequences of AGW. The source of the observed CO<sub>2</sub> increase in the atmosphere was

fossil fuel combustion [AGW science/projections]. Effects of the resulting greenhouse effect would include a global temperature increase. Internal discussions adopted a rigor absent from the company’s public communications, including reference to climate models, scenarios, and rates of change [Climate modeling]. One scenario they examined—the doubling of atmospheric CO<sub>2</sub> concentration by 2050—threatened melting of the polar icecaps, a decrease in ocean pH, and rising sea levels [AGW science/projections]. ExxonMobil advertorials disputed or remained silent about not just this early knowledge of climate science and its implications but also Exxon’s “CO<sub>2</sub> program” that helped acquire and apply that knowledge [AGW science/projections]. Internal memos report that this program included measuring CO<sub>2</sub> with a tanker, monitoring DOE (US Department of Energy) climate science, and evaluating the CO<sub>2</sub> emissions from their natural gas project in Natuna, Indonesia [Climate research programs].

#### Advertorials versus peer-reviewed publications

Table 3 compares divergent terms in all advertorials against those in peer-reviewed publications. Advertorials are distinguished by the same rhetorical themes as in “advertorials versus internal documents”; indeed, the contrast against academic articles is more pronounced. Independently and collectively, Mobil and ExxonMobil Corp advertorials offset the risks of manmade climate change by also promoting debate about complex science [Climate science uncertainty]. Advertorials are again seen to frame AGW as a challenge to meet the needs of consumers for more energy from fossil fuels, while seeking to allay concerns by publicizing the promise of advanced technology innovation (including cogeneration) [Energy/emissions challenge; Energy technologies]. In comparison with peer-reviewed papers, advertorials stand out for their emphasis of corporate environmental programs to reduce emissions through energy efficiency and conservation [Conservation].

While advertorials talk about the scientific process—research, science, and the extent of scientists’ knowledge are disproportionately discussed—peer-reviewed publications

**Table 3. Rhetorical tropes and taboos: Highly divergent terms in (left) advertorials versus (right) peer-reviewed documents, by LL ratio (G<sup>2</sup>) and FS**

	Advertorials often say:				Peer-reviewed documents often say:				
	Advertorials	Peer reviewed	G <sup>2</sup>	FS	Advertorials	Peer reviewed	G <sup>2</sup>	FS	
*energy*	378	1,777	500.41	0.82	et al	0	4,001	-372.50	0.00
(to) meet	65	98	191.64	0.93	model	5	3,000	-236.23	0.03
challenge(s)	56	100	151.75	0.92	figure	0	1,475	-137.32	0.00
needs	36	71	92.45	0.91	table	1	909	-75.18	0.02
more energy	21	12	87.65	0.97	rate	2	823	-60.90	0.05
consumers	21	33	60.70	0.93	estimates	5	978	-59.17	0.10
energy use	23	83	39.00	0.85	observed	1	715	-57.60	0.03
energy efficiency	30	152	36.65	0.81	scenario	1	562	-43.84	0.04
for generations/foreseeable future/several decades/decades to come/next 25 years	12	28	27.91	0.90	noise	0	311	-28.95	0.00
fossil fuels	24	149	22.89	0.77	projections	0	273	-25.42	0.00
gasoline	20	117	20.61	0.78	ipcc [Intergovernmental Panel on Climate Change]	4	505	-25.00	0.14
demand	40	422	14.35	0.67	error	1	317	-22.17	0.06
*research*	96	209	232.87	0.91	*co2*	69	5,161	-172.61	0.22
science	61	74	198.02	0.95	ocean	15	2,412	-134.77	0.12
scientists	39	25	157.74	0.97	transport	0	825	-76.81	0.00
dont [don't]	24	0	148.34	1.00	carbon cycle	0	462	-43.01	0.00
greenhouse gas emissions	42	60	126.97	0.94	ghg [greenhouse gas]	0	446	-41.52	0.00
carbon dioxide	69	227	126.15	0.86	ppm [parts per million]	0	397	-36.96	0.00
know	32	25	121.96	0.96	atmospheric co2	1	480	-36.52	0.04
climate (change) risk(s)/risk(s) of climate	26	10	119.09	0.98	ch4	0	272	-25.32	0.00
debate	26	30	86.15	0.95	gt [gigaton]	0	243	-22.62	0.00
manmade	15	2	80.58	0.99	*temperature*	15	1,836	-89.31	0.15
climate change	124	1,122	63.41	0.70	anthropogenic	0	609	-56.70	0.00
(un)know(/n/ing/ledge)	57	330	59.52	0.78	effect(s)	27	1,727	-48.70	0.25
risk(s)	49	261	56.56	0.80	due to	5	731	-39.08	0.13
longterm	40	282	31.82	0.75	radiative forcing	0	338	-31.47	0.00
gap(s)	11	39	18.93	0.86	climate sensitivity	0	219	-20.39	0.00
better science/understanding	6	10	16.85	0.93	temperature change	0	198	-18.43	0.00
complex	14	120	7.97	0.71	*mitigation*	4	880	-55.49	0.09
*technolog(y/ies)*	198	1,016	238.49	0.80	injection	0	443	-41.24	0.00
gcep [Global Climate and Energy Project]	17	1	97.44	1.00	ccs [carbon capture and storage]	0	374	-34.82	0.00
promise	20	12	82.39	0.97	dissolution	0	270	-25.14	0.00
evs [electric vehicles]	16	11	63.42	0.97	alkalinity	0	260	-24.21	0.00
trees	24	48	61.15	0.91	caco3	0	251	-23.37	0.00
cars	24	59	54.00	0.90	budget	0	180	-16.76	0.00
solutions	26	78	51.00	0.87	cement	1	237	-15.31	0.08
nuclear	26	82	49.12	0.87					
renewables	13	18	39.86	0.94					
wind	21	82	33.25	0.84					
cogeneration	12	26	29.19	0.91					
innovat(e/ion(s))	17	93	19.02	0.79					
invest(ing/ment(s))	27	243	13.96	0.70					

(Continued on next page)

**Table 3. Continued**

	Advertorials often say:				Peer-reviewed documents often say:			
	Advertorials	Peer reviewed	G <sup>2</sup>	FS	Advertorials	Peer reviewed	G <sup>2</sup>	FS
*steps*	36	36	126.05	0.95				
programs	28	14	120.90	0.98				
reduce emissions	23	25	78.03	0.95				
wise(r)/prudent/reasonable/ responsible/sound(er)	39	119	75.54	0.87				
environmental	56	384	46.45	0.75				
conservation	15	66	21.23	0.83				
*nations*	83	110	259.48	0.94				
kyoto	59	182	113.35	0.87				
governments	36	62	99.41	0.92				
senate	16	0	98.89	1.00				
developing/poorer countries/ world/nations	53	196	88.01	0.85				
*econom(y/ic)*	148	714	190.67	0.81				
prosperity	15	1	85.32	1.00				
economic growth/impact	29	74	63.68	0.89				
living standard(s)/standard(s) of living/quality of life	10	0	61.81	1.00				
voluntary	18	32	48.89	0.92				
jobs	13	11	48.27	0.96				

Terms that appear to be thematically related have been grouped (asterisked, high-scoring terms identify each group). Advertorials often say terms (“tropes”) with large positive G<sup>2</sup> scores and rarely say terms (“taboos”) with FS scores near 0. Peer-reviewed documents often say terms with large negative G<sup>2</sup> scores and rarely say terms with FS scores near 1. p values < 0.001 for all G<sup>2</sup> and FS scores.

actually engage in it. As expected, academic articles—even more so than internal documents—are distinguished by their articulation of AGW science. Observed atmospheric CO<sub>2</sub> concentrations are reported in ppm (parts per million), anthropogenic temperature change due to radiative forcing by GHG (greenhouse gases) such as CO<sub>2</sub> and CH<sub>4</sub> is acknowledged, and AGW model projections are run for different scenarios based on climate sensitivity [AGW science/projections]. The academic language of estimates and noise and references to the IPCC (Intergovernmental Panel on Climate Change) are commonplace [Climate modeling]. While advertorials offer unfocused representations of technologies such as renewables, nuclear, and EVs as variously promising, hypothetical, or insufficient, Exxon/ExxonMobil Corp supported peer-reviewed studies that squarely centered AGW mitigation around approaches consistent with continued reliance on fossil fuels: CCS (carbon capture and storage); and the injection of CO<sub>2</sub> into oceans through dissolution of minerals such as CaCO<sub>3</sub> to increase alkalinity [CO<sub>2</sub> disposal/storage; Carbon cycles]. As a recent literature review observed, the “use of enhanced ocean alkalinity for C storage was first proposed by [chief Exxon climate scientist Haroon] Khesghi.”<sup>122</sup>

Like internal documents, peer-reviewed publications attribute GHG emissions and/or AGW to fossil fuels significantly more often than advertorials (p < 0.01–0.03). Common terms include fossil fuel emissions, fossil fuel CO<sub>2</sub>, and fossil fuel combustion [AGW science/projections] (see Table 5).

### Rhetorical frames

Frame package analysis leads us to identify three dominant frames in ExxonMobil’s advertorials, which we name (1) Scientific Uncertainty, (2) Socioeconomic Threat, and (3) Fossil Fuel Savior (FFS) (for details, see S4, supplemental information). The Scientific Uncertainty frame presents AGW as unproven and advocates additional climate science research. The Socioeconomic Threat frame argues that binding climate policies (such as the Kyoto Protocol) are alarmist and threaten prosperity, urging voluntary measures instead. The FFS frame describes AGW as the inevitable (and implicitly acceptable) risk of meeting consumer energy demand with fossil fuels for the foreseeable future, and presents technological innovation as the long-term solution.

These frames are constructed of reasoning and framing devices variously communicated by the 11 discourses listed in Figure 1. Figure 1 is a Venn diagram representing the chain of logic (i.e., reasoning devices) of each frame as defined by Entman:<sup>10</sup> problem, cause, moral evaluation, and solution (as indicated, these reasoning devices are the logical bases challenged by denials that AGW is real, human caused, serious, and solvable, respectively).<sup>10</sup> Discourses are manifest in one or more framing devices (e.g., lexical choices, catchphrases, depictions), and their positions in Figure 1 depict their contributions to the reasoning devices of each frame (definitions and examples of each frame’s reasoning and framing devices are provided in S4 and S5, supplemental information). For example, discourses of Technological



**Table 4. Topical tropes: Highly divergent topics in (top) advertorials versus (bottom) internal and peer-reviewed documents, by LL ratio ( $G^2$ ) of topics identified by LDA topic modeling**

Category	Topic labels	$G^2$	Top terms
Advertorials	energy/emissions challenge	10,271.93	*energy, *technolog(y/ies), *emission(s), *efficien(t/ty/cy), *world, *global, <u>fuel(s)</u> , *improv(e/es/ed/ing/ements), *develop(ing), *environment(/al/ally), *econom(y/ic), *need(s), *challenge(s), *percent, *demand, *risk(s), *gas, *reduce, *invest(ing/ment/ments), <u>future</u> , [*meet, *longterm]
	climate policy	6,045.82	*countries/nations, *kyoto, *emission(s), *econom(y/ic), *protocol, *targets, *gases, *agree(ment)/consensus, *industrialized, *administration, <u>reduction</u> , *participat(e/tion/ing), *senate, *plan, <u>measures</u> , *governments, *developed, *develop(ing), *public, *treaty [*jobs/*employment, <u>cost(/s/ly/liar/liest)</u> , *bind(ing), <u>lifestyle(s)</u> , *voluntary]
	vehicles	1,992.81	*vehicles, *evs/electric vehicles, <u>vehicle</u> , *gasoline, *cars, <u>diesel</u> , *citizenship, *math, <u>corporate</u> , *engine, *performance, *road, *engines, *social, car, *science, *education, <u>balancing</u> , dieselpowered, spills
	energy technologies	1,627.41	<u>nuclear</u> , *power, solar/photovoltaic(s), *oil, *renewable(s), <u>trillion</u> , <u>natural</u> , cell, brooklyn, reserves, <u>barrels</u> , turbine, *wind, generate, *gas, petroleum, fine, hydropower, inexhaustible, vote [ <u>offshore</u> , onshore, ethanol, biofuels]
	conservation	304.39	*tree(s), forest(s), *plant(/ing), *helped, buildings, lands, sequestration, star, *protect(/ion/ing), acres, eco(logical/system), enhance, conservancy, epas [EPA's], habitat, planted, threat, *conservation, agricultural, carefully [diversity, eagle, indigenous, preservation, restoring, wildlife]
	climate science uncertainty	201.47	<u>climate</u> , <u>change</u> , <u>research</u> , <u>scientific</u> , <u>science</u> , <u>human</u> , uncertain(ty/ties), ( <u>un</u> )*know(/n/ing/ledge), national, *scientists, <u>earths</u> , predict, *debate, underst(and/anding/ood), variability, weather, <u>impacts</u> , <u>consequences</u> , ability, <u>development</u> [ <u>program(s)</u> , *policy, compl(ex/exity/icated), *universit(y/ies)]
Internal and peer reviewed	AGW science/projections	-4,554.30	*co2/carbon dioxide, atmospher(e/ic), *effect(s), <u>fossil</u> , *temperature, fuel(s), *concentration, <u>increase</u> , *concentrations, carbon, *rate, global, *ocean, *ppm, <u>average</u> , level, *due, *oceans, combust(ion)/burn(ing), *biosphere [*scenarios, impact]
	climate modeling	-3,897.21	*model(s), <u>results</u> , <u>forc(e/ed/ing)</u> , climate, *data, *estimates, <u>response</u> , <u>variability</u> , *temperature, *shown, *flux, <u>anthropogenic</u> , <u>range</u> , *projections, emission(s), <u>detection</u> , <u>parameter</u> , *estimated, <u>studies</u> , <u>based</u>
	CO <sub>2</sub> disposal/storage	-2,668.42	*co2/carbon dioxide, *ph [pH], *figure, <u>time</u> , *seawater, *depth, <u>km</u> , *vertical, <u>retention</u> , *model(s), seafloor, <u>sparger</u> , <u>degassing</u> , diffusive, <u>natuna</u> , <u>release</u> , flow, *mixed, *surface, <u>fraction</u> [*injection]
	mitigation assessments	-1,917.80	*transport, <u>mitigation</u> , price, cost(/s/ly/liar/liest), <u>biomass</u> , <u>waste</u> , *al [et al.], infrastructure, china, <u>usa</u> , wastewater, reduction, potentially, forestry, losses, sector, availability, capture, <u>direct</u> , sectors
	climate research programs	-1,259.86	<u>dr</u> [Dr.], <u>program(s)</u> , <u>exxon</u> , <u>tanker</u> , <u>ere</u> [Exxon Research and Engineering Company], <u>phase</u> , federal, fund(/ed/ing), plan, division, <u>weinberg</u> [Harold Weinberg], additional, mass, academy, interface, underway, wines, organization, <u>shaw</u> [Henry Shaw], engineering [ <u>committee</u> , funds, scoping]
	carbon cycles	-1,215.66	*al [et al.], *ocean, <u>deep</u> , carbon, broecker [Wallace Broecker], upwelling, bbsr [Bermuda Biological Station for Research], <u>stocks</u> , <u>uptake</u> , <u>land</u> , <u>gt</u> [gigaton], vegetation, bermuda, landuse, <u>cycles</u> , jain [Atul Jain], station, transient, <u>biospheric</u> , <u>column</u> [dissolved, *water, <u>inventory</u> ]
	oil and gas production	-1,034.26	*ccs [carbon capture and storage], hs [HS], gas, acid, <u>cement</u> , n2 [N <sub>2</sub> ], processing, date, <u>natuna</u> [Natuna Island, Indonesia], park, project, earliest, eor [enhanced oil recovery], field, oil, mw [megawatt], recovery, describes, liquid, substantial [pipeline]

For each emergent topic, a topic label and its corresponding top 20 terms are listed (additional informative terms are in brackets at the end of each list). Top 20 terms are ordered according to the relevance metric proposed by Sievert and Shirley,<sup>121</sup> which accounts for both per-term ( $w$ )-per-topic ( $k$ ) probabilities ( $\varphi_{w,k}$ ) and the marginal probability of each term in the corpus ( $\rho_w$ ). We indicate divergent terms, as identified earlier by  $G^2$  and FS, between advertorials versus (italics) internal documents, (underlining) peer-reviewed publications, and (asterisks) internal and peer-reviewed documents.  $p$  values < 0.001 for all  $G^2$  and FS scores.

Shell Game, which, as Schneider et al.<sup>27</sup> define them, use “misdirection that relies on strategic ambiguity about the feasibility, costs, and successful implementation of technologies,” serve to downplay the need for public and political concern by trivializing the seriousness and solvability of AGW. Technological Shell

Game discourse is therefore placed in the overlapping areas of Moral evaluation (“Serious”) and Solutions (“Solvable”) in Figure 1.

The frame of Scientific Uncertainty—and its underlying taxonomy of explicit doubt about climate science and its

**Table 5. Rhetoric of individualized responsibility: Highly divergent terms in (top) advertorials and (bottom) internal and/or peer-reviewed documents, by LL ratio ( $G^2$ ) and FS**

	Advertorials	Internal	Peer reviewed	$G^2$ (Int./P.r.)	FS (Int./P.r.)	Example
Advertorials often say:						
(to) meet	65	2	98	128.34/191.64	0.99/0.93	" <u>To meet</u> this demand, while addressing the risks posed by rising greenhouse gas emissions, we'll need to call upon broad mix of energy sources." <sup>5</sup>
vehicles	33	0	240	73.48/25.02	1/0.74	"[T]he cars and trucks we drive aren't just <u>vehicles</u> , they're opportunities to solve the world's energy and environmental challenges." <sup>123</sup>
greenhouse gas emissions	42	7	60	58.9/126.97	0.92/0.94	"We're supporting research and technology efforts, curtailing our own <u>greenhouse gas emissions</u> and helping customers scale back their emissions of carbon dioxide." <sup>124</sup>
energy efficiency	30	1	152	58.76/36.65	0.98/0.81	"We have invested \$1.5 billion since 2004 in activities to increase <u>energy efficiency</u> and reduce greenhouse gas emissions. We are on track to improve energy efficiency in our worldwide refining and chemical operations." <sup>125,126</sup>
cars	24	0	59	53.44/54	1/0.9	"By enabling <u>cars</u> and trucks to travel farther on a gallon of fuel, drivers not only spend less money per mile, they also emit less carbon dioxide (CO <sub>2</sub> ) per mile." <sup>127</sup>
reduce emissions	23	0	25	51.21/78.03	1/0.95	"During the fact-finding period, governments should encourage and promote voluntary actions by industry and citizens that <u>reduce emissions</u> and use energy wisely. Governments can do much to raise public awareness of the importance of energy conservation." <sup>128</sup>
consumers	21	0	33	46.76/60.7	1/0.93	"We also are developing new vehicle technologies that can help <u>consumers</u> use energy more efficiently." <sup>125,126</sup>
world	91	64	338	43.45/150.55	0.74/0.85	"By 2030, experts predict that the <u>world</u> will require about 60 percent more energy than in 2000 .... As a result, greenhouse gas emissions are predicted to increase too." <sup>129</sup>
developing countries	27	3	162	43/26.94	0.95/0.78	Through 2030, " <u>developing countries</u> ... will rely on relatively carbon-intensive fuels like coal to meet their needs." <sup>5</sup>
transportation	23	2	121	38.87/26.93	0.96/0.8	"Ongoing advances in vehicle and fuel technology will be critical to meeting global demand for <u>transportation</u> fuels. They will also help address the risk posed by rising greenhouse-gas emissions." <sup>123</sup>
energy use	23	4	83	31.75/39	0.92/0.85	"Central to any future policy should be the understanding that man-made greenhouse gas emissions arise from essential <u>energy use</u> in the everyday activities of people, governments and businesses." <sup>130</sup>
people	30	11	61	27.87/75.73	0.85/0.91	"Thus, we're pleased to extend our support of ... American Forests ... whose 'Global Releaf 2000' program is mobilizing <u>people</u> around the world to plant and care for trees." <sup>131</sup>
demand	40	21	422	27.24/14.35	0.8/0.67	"[I]n the electric power sector, growing <u>demand</u> will boost CO <sub>2</sub> emissions." <sup>132</sup>

(Continued on next page)

Table 5. Continued

	Advertorials	Internal	Peer reviewed	G <sup>2</sup> (Int./P.r.)	FS (Int./P.r.)	Example
needs	36	22	71	20.69/92.45	0.77/0.91	"[F]ossil fuels must be relied upon to meet society's immediate and near-term <u>needs</u> ." <sup>133</sup>
conservation	15	5	66	14.89/21.23	0.86/0.83	"Prudent measures such as <u>conservation</u> and investment in energy-efficient technology make sense, but embarking on regulatory [climate/energy] policies that may prove wasteful or counterproductive does not." <sup>134</sup>
energy demand	15	14	59	4.38**/23.59	0.69**/0.84	"[I]ncreasing prosperity in the developing world [is] the main driver of greater <u>energy demand</u> (and consequently rising CO <sub>2</sub> emissions) over the coming decades." <sup>135</sup>
Internal and/or peer-reviewed documents often say:						
fossil fuel	9	144	359	-66.26/-4.48**	0.11/0.34***	"Release of this amount of CO <sub>2</sub> to the atmosphere raises concern with respect to its effect on the CO <sub>2</sub> greenhouse problem. Global <u>fossil fuel</u> emissions of CO <sub>2</sub> currently amount to about 1.8 × 10 <sup>10</sup> metric tons per year." <sup>136</sup> "Arrhenius put forth the idea that CO <sub>2</sub> from <u>fossil fuel</u> burning could ... warm the Earth. ... fossil fuel greenhouse warming ... fossil fuel greenhouse effect ..." <sup>137</sup>
natuna	0	67	NA	-53.36/NA	0/NA	"This would make <u>Natuna</u> the world's largest point source emitter of CO <sub>2</sub> and raises concern for the possible incremental impact of <u>Natuna</u> on the CO <sub>2</sub> greenhouse problem." <sup>136</sup>
due to	5	89	731	-42.94/-39.08	0.1/0.13	"The CO <sub>2</sub> concentration in the atmosphere has increased .... The most widely held theory is that: the increase is <u>due to</u> fossil fuel combustion." <sup>138</sup> "About three-quarters of the anthropogenic emissions of CO <sub>2</sub> to the atmosphere during the past 20 years is <u>due to</u> fossil fuel burning." <sup>139</sup>
fossil fuel combustion	1	48	NA	-30.69/NA	0.04/NA	"[T]here is the potential for our [climate] research to attract the attention of the popular news media because of the connection between Exxon's major business and the role of <u>fossil fuel combustion</u> in contributing to the increase of atmospheric CO <sub>2</sub> ." <sup>140</sup>
shale	1	41	NA	-25.43/NA	0.05/NA	"The quantity of CO <sub>2</sub> emitted by various fuels is shown in Table 1 .... They show the high CO <sub>2</sub> /energy ratio for coal and shale ... ["Shale oil"] is not predicted to be a major future energy source due to ... rather large amounts of CO <sub>2</sub> emitted per unit energy generated (see Table 1)." <sup>138</sup>
ccs	0	NA	374	NA/-34.82	NA/0	" <u>CCS</u> includes applying technologies that capture the CO <sub>2</sub> whether generated by combustion of carbon-based fuels or by the separation of CO <sub>2</sub> from natural gas with a high CO <sub>2</sub> concentration." <sup>141</sup>
source	6	39	322	-9.08*/-7.16**	0.24*/0.28**	"[F]ossil fuel combustion is the only readily identifiable <u>source</u> [of CO <sub>2</sub> ] which is (1) growing at the same rate, (2) large enough to account for the observed increases ..." <sup>142</sup>

(Continued on next page)

**Table 5. Continued**

	Advertorials	Internal	Peer reviewed	G <sup>2</sup> (Int./P.r.)	FS (Int./P.r.)	Example
fossil fuel use	0	13	NA	-10.35*/NA	0**/NA	Table 1 presents "coal combustion" and "natural gas combustion" as the "source[s]" of CO <sub>2</sub> , CH <sub>4</sub> , and SO <sub>2</sub> <sup>143</sup>
fossil fuel CO <sub>2</sub>	0	NA	64	NA/-5.96**	NA/0***	"[F]or scenarios with higher fossil fuel use (hence, higher carbon dioxide emissions ..." <sup>139</sup>
fossil fuel emissions	0	NA	54	NA/-5.03**	NA/0***	"This long tail on the fossil fuel CO <sub>2</sub> forcing of climate may well be more significant to the future glacial/interglacial timescale evolution of Earth's climate." <sup>144</sup> "We use our Integrated Science Model to ... estimate the time variation fossil fuel emissions of CO <sub>2</sub> ... required to match the [IPCC] concentration stabilization scenarios." <sup>145</sup>

Divergent terms in advertorials are identified by frame package analysis as framing devices of individualized responsibility discourse. Example quotations illustrate how advertorials use divergent terms to disproportionately present: (1) consumer demand for energy as the cause of—and culpable for—fossil fuel use, greenhouse gas emissions, and/or AGW; and (2) individual/demand-side actions as accountable for mitigating AGW. By contrast, divergent terms in internal and/or peer-reviewed documents often articulate the causality and culpability of fossil fuel combustion. p values < 0.001 for all G<sup>2</sup> and FS scores except: \* <0.005; \*\* <0.05; \*\*\* ≥ 0.05. NA, not available.

implications—has previously received detailed scrutiny and is here discussed further only in S4.1, [supplemental information](#).<sup>1,2,17–24</sup> By contrast, frames of Socioeconomic Threat and FFS—and the subtler discourses of delay that underpin them—are underexplored.<sup>17,26–28</sup> For further discussion of the Socioeconomic Threat frame, see S4.2, [supplemental information](#). In the remainder of this paper, we focus on the role of two specific, complementary discourses, Climate Risk and Individualized Responsibility, in constructing the FFS frame. As [Figure 1](#) suggests, these discourses serve as rhetorical gateways connecting the problem and cause of the FFS frame to its moral evaluation and solution.

### Discourse of climate risk

We have previously noted that, accompanying the emergence in the mid-2000s of implicit acknowledgments by some ExxonMobil Corp advertorials that AGW is real and human caused, there appeared to be a rhetorical framework focused on risk.<sup>2</sup> Algorithmic analyses here demonstrate that this was part of a wider trend in which, following the merger of Exxon and Mobil at the end of 1999, "risk" was incorporated into advertorials communicating explicit doubt. Specifically, LL and FS results in [Table 1](#) show that "risk(s)" is among the terms that most statistically distinguish Mobil advertorials from ExxonMobil Corp advertorials. Within all advertorials published prior to the merger and expressing any positions on AGW (as real and human caused, serious, or solvable), "risk(s)" appears three times, only once in reference to the risk(s) of AGW or greenhouse gases. By contrast, from 2000 onwards, such "risk(s)" are cited 46 times: an average of once per advertorial; 10 times higher than an average NYT article.<sup>146</sup> Permutations include "risk," "risks," "potential risks," "long-term risk," "long-term risks," "legitimate long-term risk," "legitimate long-term risks," and "potential long-term risks."

In 2000, for instance, ExxonMobil Corp's first post-merger advertorial in our corpus promoted "scientific uncertainty" that

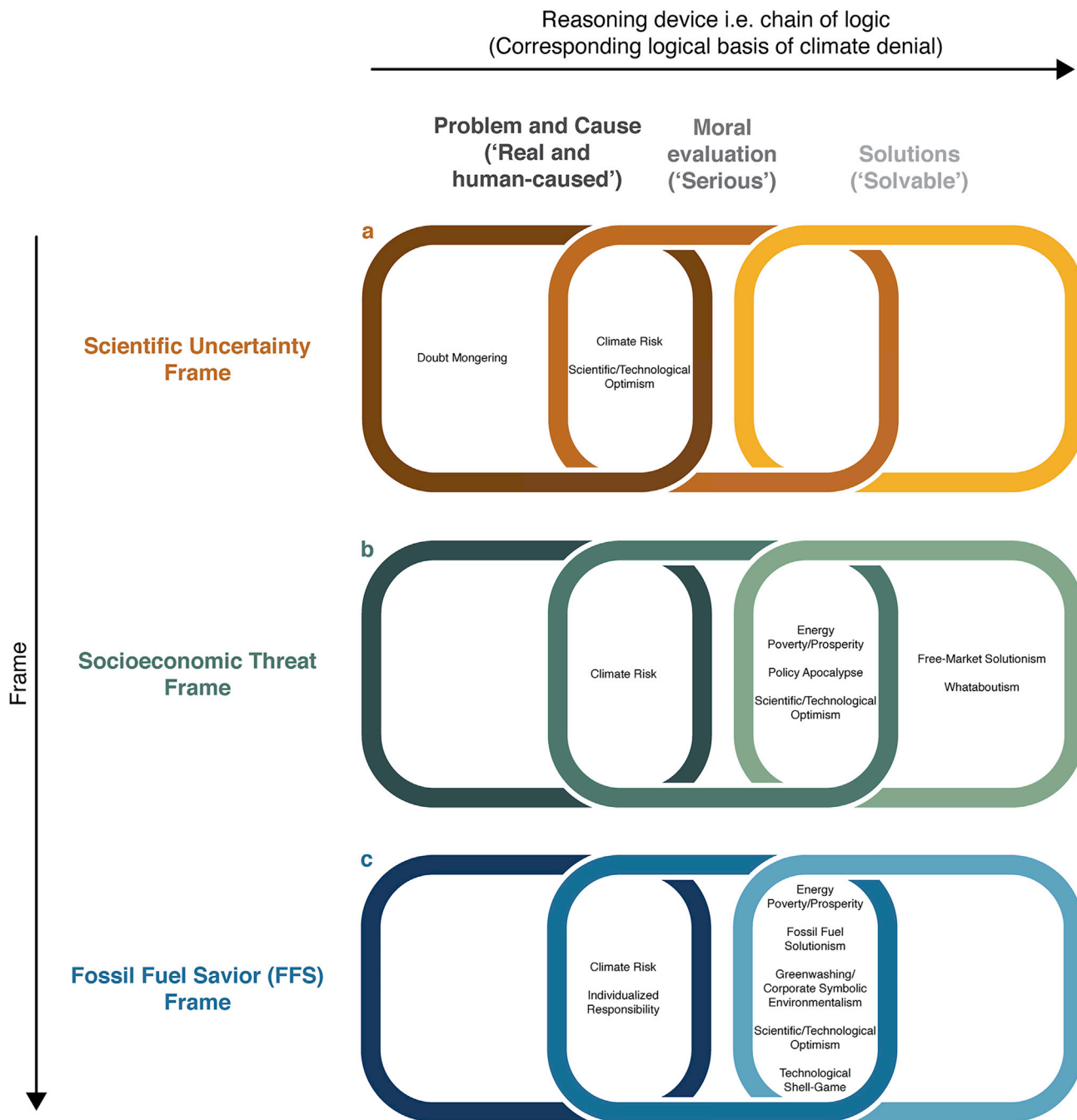
AGW is real, human caused, serious, and solvable, acknowledging only that it "may pose a legitimate long-term risk, and that more needs to be learned about it."<sup>147</sup> By the time the company took out its last advertorial expressing a position on AGW in 2009, its tune had changed but "risk" rhetoric remained. The advertorial was entitled, "Tackling climate risks with technology," followed by the subtitle, "Support for oil and natural gas innovation can reduce emissions."<sup>148</sup>

The function of "risk" rhetoric in moderating the conveyed status of AGW or greenhouse gases is unambiguous. First, "risks" is among the top terms characterizing the LDA-generated topic of *Energy/Emissions Challenge*, which is the primary topic that introduces readers to AGW (and compares it with energy demand; see "discourse of individualized responsibility") ([Table 4](#)). Second, "climate (change) risk(s)/risk(s) of climate" is, like "risk(s)" itself, a statistically distinctive term of ExxonMobil Corp advertorials versus Mobil advertorials, internal documents, and peer-reviewed publications ([Tables 1, 2, and 3](#)). Indeed, automated collocation analysis reveals that the highest scoring collocate of "climate change" and "global warming" in ExxonMobil Corp advertorials is "risk(s)." By contrast, in Mobil advertorials, it is "science" (followed by "gases" and "debate") ([Table S18](#)).

### Discourse of individualized responsibility

[Table 5](#) (top half) collates terms that are (1) identified by frame package analysis as framing devices communicating Individualized Responsibility in advertorials, and (2) highly divergent between all advertorials and internal and/or peer-reviewed documents according to LL and FS analyses. Two patterns emerge.

First, we observe that advertorials disproportionately employ terms that present consumer demand for energy (rather than corporate supply of oil, coal, and gas) as the cause of fossil fuel production, greenhouse gas emissions, and/or AGW. A characteristic example of this "(energy) demand" rhetoric is a 2008 ExxonMobil Corp advertorial stating: "By 2030, global



**Figure 1. Typology of discourses of climate denial and delay**

Using frame package analysis, we identify three dominant frames in ExxonMobil’s advertorials: (a, top) Scientific Uncertainty; (b, middle) Socioeconomic Threat; and (c, bottom) Fossil Fuel Savior (FFS). For each frame, a Venn diagram is presented corresponding to the reasoning devices (i.e., chains of logic) defined by Entman:<sup>10</sup> (left) problem and cause; (middle) moral evaluation; and (right) solution (as indicated, these reasoning devices are the logical bases challenged by denials that AGW is real, human caused, serious, and solvable, respectively). Each reasoning device is communicated by one or more of the 11 discourses of climate denial and delay listed within each chain of logic. Although not shown, these discourses are manifest in one or more framing devices (e.g., lexical choices, catchphrases, depictions), as identified in S4, [supplemental information](#). As an example, discourses of Technological Shell Game, which, as Schneider et al.<sup>27</sup> define them, use “misdirection that relies on strategic ambiguity about the feasibility, costs, and successful implementation of technologies,” serve to downplay the need for public and political concern by trivializing the seriousness and solvability of AGW. Technological Shell Game discourse is therefore placed in the overlapping areas of Moral evaluation (“Serious”) and Solutions (“Solvable”) in the diagram. For definitions and examples of all reasoning devices, framing devices, and discourses, see S4 and S5, [supplemental information](#).

energy demand will be about 30 percent higher than it is today ... oil and natural gas will be called upon to meet ... the world's energy requirements."<sup>149</sup> Another, in 2007, says that "increasing prosperity in the developing world [will be] the main driver of greater energy demand (and consequently rising CO<sub>2</sub> emissions)."<sup>135</sup> A 1999 Mobil advertorial is even blunter: "[G]rowing demand will boost CO<sub>2</sub> emissions."<sup>132</sup> In other words, they present growing energy demand as inevitable, and imply that it can only be met with fossil fuels.

Synonyms for "(energy) demand" include "needs" ("fossil fuels must be relied upon to meet society's immediate and near-term needs") and "energy use" ("man-made greenhouse gas emissions arise from essential energy use in the everyday activities of people, governments and businesses"). Fossil fuels are either presented as passively responding "to meet this demand" of consumers, developing countries, and the world; or they are left out of the equation entirely: "[A]s populations and economies have grown, energy use has increased, and so have greenhouse gas emissions."<sup>150</sup>

Second, we observe that, to the extent that advertorials admit the need for AGW mitigation, they disproportionately introduce terms conveying individual and/or demand-side actions as the appropriate response. Even while promoting explicit doubt about the reality of AGW, advertorials focus on downstream energy efficiency and greenhouse gas emissions, rather than upstream supply of fossil fuels, as the appropriate target of mitigation efforts. "During the [climate science] fact-finding period," a 1997 advertorial states, "governments should encourage and promote voluntary actions by industry and citizens that reduce emissions and use energy wisely. Governments can do much to raise public awareness of the importance of energy conservation."<sup>128</sup> Twelve years later, advertorials continued to equate the "global environmental challenge" with "curbing greenhouse gas emissions," but not with constraining fossil fuel supply.<sup>151</sup> As one 2000 advertorial put it: "Prudent measures such as conservation and investment in energy-efficient technology make sense, but embarking on regulatory [energy] policies that may prove wasteful or counter-productive does not."<sup>134</sup>

Advertorials repeatedly highlighted ways the public could, as one in 1998 put it, "show a little voluntary 'can do.'"<sup>152</sup> A 2008 advertorial suggested that the "cars and trucks we drive aren't just vehicles, they're opportunities to solve the world's energy and environmental challenges."<sup>123</sup> A 2007 advertorial offered readers "simple steps to consider": "Be smart about electricity use"; "Heat and cool your home efficiently"; "Improve your gas mileage"; "Check your home's greenhouse gas emissions" using an online calculator.<sup>153</sup> Mobil and ExxonMobil Corp presented themselves as facilitating, and participating in, such demand-side AGW mitigation. A 1997 advertorial laid the groundwork: "We're supporting research and technology efforts, curtailing our own greenhouse gas emissions and helping customers scale back their emissions of carbon dioxide."<sup>124</sup> In 1999, Mobil announced that "we're pleased to extend our support of ... American Forests ... whose 'Global Releaf 2000' program is mobilizing people around the world to plant and care for trees."<sup>131</sup> This narrative was echoed by advertorials a decade later: "By enabling cars and trucks to travel farther on a gallon of fuel, drivers...emit less carbon dioxide (CO<sub>2</sub>) per mile," said

a 2008 advertorial.<sup>127</sup> "We also are developing new vehicle technologies that can help consumers use energy more efficiently," said two more the following year.<sup>125,126</sup>

By contrast, Exxon and ExxonMobil Corp's internal and/or academic communications recognized AGW and/or greenhouse gases as also an upstream problem caused by fossil fuel supply and burning (see also S2.2, supplemental information). "[Fossil fuel combustion is the only readily identifiable source [of CO<sub>2</sub> consistent with the rate and scale of] observed increases..." observed Exxon scientist James Black<sup>142</sup> in a 1978 presentation to the Exxon Corporation Management Committee. Other internal (1979) and peer-reviewed (2001) documents likewise attributed CO<sub>2</sub> accumulation in the atmosphere as "due to fossil fuel burning" and "fossil fuel combustion."<sup>138,139</sup> A 1984 internal report and a 1994 academic article spoke of "fossil fuel emissions of CO<sub>2</sub>," while a 1998 paper referred to "fossil fuel CO<sub>2</sub> forcing of climate."<sup>136,144,145</sup> A 1982 internal memo went further, acknowledging "the connection between Exxon's major business and the role of fossil fuel combustion in contributing to the increase of atmospheric CO<sub>2</sub>."<sup>140</sup> The 1979 and 1984 internal documents discuss the CO<sub>2</sub> emissions of specific fossil fuel sources such as shale oil and Exxon's natural gas reservoir off Natuna Island in Indonesia.<sup>136,138</sup>

In sum, ExxonMobil's advertorials statistically overuse terms that reduce AGW to a downstream problem caused by consumer energy demand, to be solved primarily by energy efficiency to reduce greenhouse gas emissions. In contrast, their private and academic documents disproportionately recognize that AGW is an upstream problem caused by fossil fuel supply.

As we show in S6.2, supplemental information, this statistical dichotomy extends throughout all of ExxonMobil Corp's flagship reports concerning AGW spanning 2002–2019 compared with the firm's internal and academic publications.

### FFS frame

In addition to Climate Risk and Individualized Responsibility, the FFS frame comprises the five other discourses shown in Figure 1 and defined in S5, supplemental information. Together, they establish the frame's chain of logic (i.e., reasoning devices, see Table S4).

First, as shown in the previous two sections, discourses of Climate Risk and Individualized Responsibility present AGW as the inevitable "risk" of meeting consumer energy demand.

In response to this problem definition and causal attribution, discourses of Scientific/Technological Optimism (which gives primacy to scientific or technological breakthroughs as the solutions to AGW) and Greenwashing/Corporate Symbolic Environmentalism (which is when companies make changes for environmental reasons that, in the case of greenwashing, are merely and deliberately symbolic) lend what Plec and Pettenger<sup>52</sup> (2012) call "an aura of scientific and technical authority," which "resigns us to putting our faith in the power of industry, technology, and science" (see also Schneider et al.<sup>26</sup>). "[W]e believe that technology provides the key avenue to solutions that manage long-term risk and preserve prosperity," says the voice of reason presented by a 2002 advertorial entitled "A responsible path forward on climate." "[This] will almost certainly require decades."<sup>154</sup> ExxonMobil asserts its leadership in this challenge with advertorials citing "our industry-leading investments in research and

development,”<sup>149</sup> such as “supporting climate-related research efforts at major universities, including Stanford and MIT.”<sup>155</sup> Visual images such as graphs, charts, and science iconography reinforce this impression.

This technocratic authority helps legitimize accompanying discourses of Fossil Fuel Solutionism and Technological Shell Game, which join the dots between energy demand and continued reliance on fossil fuels. An example of Fossil Fuel Solutionism (which presents fossil fuels and their industry as an essential and inevitable part of the solution to AGW) is a 2007 advertorial that unequivocally depicts the future: “Coal, oil, and natural gas will remain indispensable to meeting total projected energy demand growth” through 2030.<sup>156</sup> “Oil and gas will be essential to meeting demand,” reiterates another in 2008.<sup>5</sup> “Meeting this growing long-term demand requires that we develop all economic sources of energy – oil, natural gas, coal, nuclear and alternatives,” says a third in 2009.<sup>151</sup>

The non-fossil fuel alternatives are then dismissed by Technological Shell Game discourse promoting doubt and confusion about AGW’s technological solvability, such as three advertorials in 2005 depicting, again unequivocally, how “Wind and solar ... meet about 1% of total world demand by 2030.”<sup>157–159</sup> Another, 3 years later, updates the figure to “only 2 percent” (including bio-fuels).<sup>5</sup> ExxonMobil also takes aim at clean energy subsidies and renewable energy’s “highly variable output” and “enormous land-use requirements.”<sup>133,154,160</sup> Meanwhile, the three 2005 advertorials, and another in 2009, falsely promote natural gas as “clean-burning” and “clean,” respectively.<sup>157–159</sup>

In a 2009 advertorial, ExxonMobil acknowledges that there is “a dual challenge” to “provide energy” and “protect the environment” (notably, they say that this challenge concerns energy rather than fossil fuels, and that it applies to “all of us”).<sup>150</sup> But then they tip the scales by pitting concrete, unequivocal benefits (“[Energy] lights our homes. Fuels our transportation. Powers our industries. ... [D]riv[es] our economy and rais[es] living standards”) against amorphous, uncertain costs (the “risks of climate change”). Two 2007 advertorials similarly compare “economic growth and human development” against undefined “risks of climate change.”<sup>161,162</sup>

In cases such as these, discourses of Energy Poverty/Prosperity and Policy Apocalypse (which respectively articulate social justices of energy access and alleged socioeconomic tolls of decarbonization—the latter strictly assigned to the socioeconomic threat frame), contrasted against that of Climate Risk, work to affirm the moral evaluation of the FFS frame that fossil fuel lock-in is righteous and reasonable.

## DISCUSSION

The patterns observed in “results” are similar to those documented in the tobacco industry. In “risk rhetoric facilitates ExxonMobil’s have-it-both-ways position on AGW” and “energy demand rhetoric individualizes AGW responsibility,” we discuss the strategic functions of AGW “risk” rhetoric and individualized responsibility framings, respectively, in comparison with the history of the tobacco industry. “Energy demand rhetoric individualizes AGW responsibility” distinguishes how consumer energy demand is presented in public (“demand as fossil fuel lock-in in public relations”) versus in legal defense (“demand as blame

in litigation”). “Historical contexts, ramifications, and trajectories of ExxonMobil’s communication tactics” explores the historical contexts, ramifications, and trajectories of ExxonMobil’s “risk” rhetoric (“risk”) and individualized responsibility framings (“individualized responsibility”).

### Risk rhetoric facilitates ExxonMobil’s have-it-both-ways position on AGW

Our identification of ExxonMobil’s discursive shift to “risk” rhetoric (see “discourse of climate risk”) is broadly consistent with independent findings. Jaworska<sup>51</sup> observes the emergence of “risk” as one of the most frequent collocations of “climate change” in the late 2000s within the corporate social responsibility reports of the world’s major oil corporations, including ExxonMobil. Grantham and Vieira,<sup>44</sup> examining “welcome letters” from ExxonMobil’s CEO in the company’s Corporate Citizenship Reports, note that “risk” is one of the most influential words coinciding with emphasis on the “planet.” Schlichting<sup>17</sup> concludes that, over the course of the 2000s, industry actors increasingly adopted the framing that “climate change [might be/is] a risk.”

ExxonMobil’s rhetorical pattern of stressing “risk” is consistent with the company’s effort in the mid-2000s, chronicled by journalist Steve Coll,<sup>48</sup> “to reposition ExxonMobil’s arguments about warming to more fully account for consensus scientific opinion, without admitting that any of the corporation’s previous positions had been mistaken, for that might open a door to lawsuits.”

This approach resembles the tobacco industry’s well-documented response to the scientific consensus on the harms of tobacco use, described by historian Allen Brandt<sup>163</sup> as a “shift” in focus from scientific “uncertainty” to “(alleged) risks” of smoking (see also Proctor<sup>164,165</sup>). This scientific hedging strategy was made explicit in a 1996 Reynolds training manual instructing new employees to tell reporters that smoking was “a risk factor” but “not a proven cause.”<sup>165</sup> In 1998, for example, Philip Morris’s CEO Geoffrey Bible conceded a “possible risk” but not a “proven cause,” the distinction being in what historian Robert Proctor<sup>165</sup> calls “a kind of legal having-it-both-ways: an admission strong enough to ward off accusations of having failed to warn, yet weak enough to exculpate from charges of having marketed a deadly product.” This carefully parsed conclusion became the industry’s new official position.<sup>163</sup>

“Risk” facilitates ExxonMobil’s have-it-both-ways position on AGW. It is a “‘good’ candidate to serve various rhetorical purposes,” Jaworska<sup>51</sup> notes, because it “opens up many semantic slots.” Fillmore and Atkins<sup>166</sup> work on the conceptual meaning of risk, for example, shows that “risk” has two dominant sub-frames, “Chance” and “Harm,” and many optional valence description categories. “Chance” is defined as “uncertainty about the future,” such that risk rhetoric (1) implies inherent uncertainty and (2) is subject to temporal discounting heuristics.<sup>167–169</sup> “The essence of risk is not that it is happening, but that it *might* be happening.”<sup>170,171</sup>

“Risk” is never clearly or consistently defined by ExxonMobil. The presence and absence of risk’s various sub-frames introduce so-called strategic ambiguity—and therefore flexibility—in contemporaneous and retrospective interpretations of what ExxonMobil wants us to see as a “risk” rather than a “reality.”<sup>27,172</sup> For instance, does the “Chance” sub-frame of “risk”—and

therefore the implication of uncertainty—apply to whether AGW is happening, human caused, serious, or solvable? Sub-frames of Harm, Actor, Victim, and Valued Object are also rarely articulated: who assumes the risk(s) of AGW: the public, the company, its shareholders, or others? What might be the consequences, and when? In contrast, the “Gain,” “Beneficiary,” and “Motivation” sub-frames of risk taking, manifest in discourse of Policy Apocalypse, are stated explicitly, as discussed in [“demand as fossil fuel lock-in in public relations.”](#)

Like its weaponized rhetorical cousins—such as “uncertainty,” “sound science,” and “more research” and the hedging words “may,” “potential,” etc.—“risk” has the strategic advantage of not necessarily implying intent to deny or delay, because it is coopted from common academic, regulatory, journalistic, and colloquial parlance (S1.4.2, Supran and Oreskes<sup>1</sup>).<sup>15,146,167,173,174</sup> It can be used correctly (for example, to refer to expected *future* damages and stranded fossil fuel assets—a risk that we have previously shown ExxonMobil was publicly silent about) or incorrectly (for example, to describe AGW and past/present climatic changes such as sea level rise as risks rather than realities).<sup>1</sup>

ExxonMobil employs almost identical “risk” language in advertorials promoting explicit doubt about AGW as in those that implicitly acknowledge it. For example, they refer to “the risk of global warming” in 1989 (accompanied by explicit doubt); the “risk(s)” “that climate changes may pose” in 2000 (alongside explicit doubt); and “the risks of climate change” in 2009 (which, in the absence of doubt, is coded as an implicit acknowledgment).<sup>150,175,176</sup> This is not limited to advertorials (for wide-ranging examples, see table 3 of Supran and Oreskes<sup>2</sup>). In ExxonMobil Corp’s 2005 *Corporate Citizenship Report*, for instance, which extensively questions whether AGW is human caused and serious, a member of the public asks: “Why won’t ExxonMobil recognize that climate change is *real* ...?” The company replies: “ExxonMobil recognizes the *risk* of climate change and its *potential* impact” (emphases added).<sup>177</sup> By shifting the conversation from the semantics of reality to the semantics of risk, they inject uncertainty into the AGW narrative, even while superficially appearing not to.

### Energy demand rhetoric individualizes AGW responsibility

Two dimensions of issue responsibility are commonly identified in communications and psychological research: causality and treatment.<sup>16,178</sup> Causality responsibility addresses the source of a problem—who or what causes it. Treatment responsibility identifies who or what has the power to alleviate the problem, and should be held responsible for doing so. Studies of responsibility framing and attribution theory argue that attribution of these responsibilities broadly takes two conflicting forms: individual versus social.<sup>16,179,180</sup> Expressing our findings in [“discourse of individualized responsibility”](#) through this analytical lens, ExxonMobil’s public advertorials are biased toward individualist framings of both causality and treatment responsibilities for AGW as compared with their private and academic representations.

Jaworska<sup>51</sup> has observed similar appeals to energy demand as the driving force behind greenhouse gas emissions in the corporate citizenship reports of ExxonMobil Corp and other fos-

sil fuel companies, noting that they are “an example of differentiation, which shifts the responsibility to other constituencies.” Princen et al.<sup>72</sup> similarly argue that a focus on carbon and greenhouse gases—and away from fossil fuels—is reductionist. “This chemical framing,” they note, “implies that the problem arises after a chemical transformation, after fuels are burned. It effectively absolves of responsibility all those who organize to extract, process, and distribute...So constructed...the burden of harm and responsibility for amelioration falls on governments and consumers rather than extractors.”

“The most effective propaganda,” Parenti<sup>181</sup> contends, “is that which relies on framing rather than on falsehood.” As with the language of risk, a rhetorical power of narratives that individualize responsibility is that they do not require the statement of outright falsehoods. After all, consumer demand is one valid and universally recognized aspect of the AGW problem and its solution, and not all advertorials entirely disregard the role of fossil fuels. On balance, however, the disproportionate public fixation of ExxonMobil, a supplier company, on demand-side causation and accountability (as shown in [“discourse of individualized responsibility”](#)) fulfills the fundamental function of emphasis frames to “call attention to some aspects of reality while obscuring other elements.”<sup>10</sup> It is in this selection process that the individualized responsibility framing device creates a false dichotomy, leading readers toward AGW problem definitions, evaluations, and solutions skewed toward consumer demand and away from industry supply.<sup>11,16,178</sup>

ExxonMobil’s framing is reminiscent of the tobacco industry’s effort “to diminish its own responsibility (and culpability) by casting itself as a kind of neutral innocent, buffeted by the forces of consumer demand.”<sup>165</sup> It is widely recognized that the tobacco industry used, and continues to use, narrative frames of personal responsibility—often marketed as “freedom of choice”—to combat public criticism, influence policy debates, and defend against litigation and regulation.<sup>13,100,119,164,182–184</sup> Friedman et al.<sup>13</sup> recently demonstrated that tobacco companies use “freedom of choice” to imply two distinct concepts: liberty and blame. In their public relations messaging, industry asserts smokers’ rights as individuals who are at liberty to smoke. In the context of litigation, industry asserts that those who choose to smoke are solely to blame for their injuries.

In the following two subsections, we further explore the congruence between ExxonMobil’s public responsibility framing and these tobacco tactics ([“demand as fossil fuel lock-in in public relations”](#); [“demand as fossil fuel lock-in in public relations”](#)). We discuss how this Individualized Responsibility discourse is rationalized and reinforced by the semantic duality of “risk.”

### **Demand as fossil fuel lock-in in public relations**

In [“FFS frame,”](#) we showed that ExxonMobil’s FFS frame insists—typically as self-fulfilling fact rather than opinion—upon society’s inevitable and indefinite reliance on fossil fuels. Rather than asserting that demand is a personal choice and liberty, ExxonMobil’s public “(energy) demand” rhetoric inverts the tobacco industry’s “freedom of choice” messaging. Liberty becomes lock-in.

Within this frame, discourses of Energy Poverty/Prosperity and Policy Apocalypse contrast against that of Climate Risk ([“FFS frame”](#)). The role of “risk” rhetoric here is to downplay the downside, namely AGW, of this alleged dichotomy: fossil



fuels are essential, whereas the potential effects—indeed realities—of AGW are uncertain.<sup>26</sup> Such assertions, St. John III<sup>35</sup> notes, extend Mobil's messaging in its "Observations" columns "about what constitutes reasonable risk." Observations were "pithy, easy-to-read" advertorials that Mobil ran in Sunday newspaper supplements between 1975 and 1980.<sup>35,185</sup> In a 1980 "Observations" column, for example, Mobil lamented that "the country seems to be afflicted with the Chicken Little Syndrome" of "cry[ing] that 'The sky is falling!'"<sup>186</sup> "Hardly a day passes," they said, without "fresh perils" like "harmful rain" or "cancerous sunshine." But a "risk-free society" through government regulation is impossible, the advertorial reasoned, because "everything people do everyday involves a slight measure of risk" (emphasis in original). The company concluded with the warning that to "avoid risk, fight change" may be a short-term solution, "but for the long pull, it's a way to certain stagnation." Tobacco industry apologists made the same arguments, calling it "the menace of daily life."<sup>187</sup>

To the extent that advertorials concede AGW may be a problem, the "risk" angle helps frame AGW as unpredictable, positioning the oil industry "not as a contributor but as a victim" alongside consumers.<sup>51</sup> As a 2009 advertorial put it, "[we'll need] a global approach to managing the risks of climate change. Everyone has a role to play – industry, governments, individuals."<sup>150</sup> This complemented Mobil's broader use of advertorials to rhetorically reframe itself as what Kerr<sup>42</sup> terms a "corporate citizen." "A citizen of many lands" is how Mobil described itself in a 1999 advertorial.<sup>131</sup> "Climate change: we're all in this together," another was titled in 1996.<sup>188</sup> With this narrative of an "empathetic fellow traveler," St. John III<sup>35</sup> argues, "Mobil offers up the reasonable, risk-taking corporate persona who is willing to take the initiative to provide a beneficial product to all Americans...[B]y appealing to Americans' penchant for valorizing the self-starting individual, such a message of energy harvesting as never being 100% safe could well explain how a significant amount of Americans today do not see fossil fuel-induced climate change as a significant risk."<sup>35</sup>

ExxonMobil's advertorials say almost nothing about the seriousness of AGW.<sup>1,2</sup> Nor do they mention the concepts of carbon budgets and stranded fossil fuel assets, which are part of the argument for the fundamental incompatibility of unrestricted fossil fuel supply with climate mitigation.

Overall, the didactic framing of demand as fossil fuel lock-in communicates what Plec and Pettenger<sup>52</sup> describe as "a rhetoric of resignation, naturalizing consumption of resources and teaching us to put our trust in industry solutions to energy problems." Or as Schneider et al.<sup>27</sup> and Cahill<sup>26</sup> put it, quoting the neoliberal bromide: "There is no alternative" to the *status quo*.

### **Demand as blame in litigation**

Although the tobacco industry sells "freedom of choice" as *liberty* in public relations, in litigation they equate it with *blame* toward individuals who exercised their choice to smoke.<sup>13,164,183,184</sup> Climate litigation is nascent, yet the fossil fuel industry has already successfully repackaged demand as *lock-in* to instead impute *blame* on customers for being individually responsible.

In 2018, arguing in defense of five oil companies (including ExxonMobil Corp) against a lawsuit brought by California cities seeking climate damages, Chevron lawyer Theodore Broutrous

Jr. offered his interpretation of the IPCC's latest report: "I think the IPCC does not say it's the production and extraction of oil that is driving these emissions. It's the energy use. It's economic activity that creates demand for energy." "It's the way people are living their lives."<sup>189</sup> The judge's dismissal of the case accepted this framing: "[W]ould it really be fair to now ignore our own responsibility in the use of fossil fuels and place the blame for global warming on those who supplied what we demanded?"<sup>190</sup>

Even if plaintiffs prove their case, fossil fuel companies can invoke "affirmative defenses"—as tobacco companies often have—such as "common knowledge" and "assumption of the risk."<sup>164,183</sup> These respectively argue (1) "that the plaintiff had engaged in an activity [such as smoking] that involved obvious or widely known risks," and (2) "that the plaintiff knew about and voluntarily undertook the risk."<sup>13</sup> As Brandt<sup>163</sup> explains it, "If there was a risk, even though 'unproven,' it nonetheless must be the smoker's risk, since the smoker had been fully informed of the 'controversy.' The industry had secured the best of both worlds."

By way of the FFS frame, ExxonMobil appears to have constructed an ability to do the same. On the one hand, "risk" rhetoric is weak enough to allow the company to maintain a position on climate science that is ambiguous, flexible, and unalarming ("risk rhetoric facilitates ExxonMobil's have-it-both-ways position on AGW"). On the other, it is strong enough—and prominent enough, in NYT advertorials and elsewhere—that ExxonMobil may claim that the public has been well informed about AGW. This duality has been a cornerstone of the tobacco industry's legal position on the "risks" of smoking: "Everyone knew but no one had proof."<sup>163,164</sup> Akin to early, tepidly worded warning labels on cigarette packages, ExxonMobil's advertorials in America's newspaper of record help establish this claim, sometimes explicitly: "*Most people acknowledge* that human-induced climate change is a long-term *risk*," a 2001 advertorial states<sup>13,130</sup> (emphases added). "The *risk* of climate change and its *potential* impacts on society and the ecosystem are *widely recognized*," says another the following year.<sup>191</sup> As Baker<sup>192</sup> has pointed out about the socialization of risk, "a transfer of risk is also a transfer of responsibility .... [R]isk creates responsibility."

The fossil fuel industry's use of demand-as-blame framing is not limited to its legal defenses. As Schneider et al.<sup>27</sup> describe, fossil fuel interests have likewise sought to delegitimize AGW activism, such as the fossil fuel divestment movement, by deploying a rhetorical "hypocrite's trap [that] performs the disciplinary work of individualizing responsibility" (see also Ayling<sup>193</sup>).

### **Historical contexts, ramifications, and trajectories of ExxonMobil's communication tactics**

ExxonMobil's selective use of rhetoric and discourse to frame AGW epitomizes the first "general principle" of effective public affairs according to Herbert Schertz,<sup>185</sup> Mobil Oil's Vice President of Public Affairs (1969–1988) and the pioneer of their advertorials: "Grab the good words – and the good concepts – for yourself."<sup>185</sup> "[B]e sensitive to semantic infiltration, the process whereby language does the dirty work of politics...Be sensitive to these word choices, and be competitive in how you use them. Your objective is to wrap yourself in the good phrases while sticking your opponents with the bad ones."

## Risk

ExxonMobil Corp's systematic introduction of "risk" rhetoric into its doubt-mongering advertorials coincided with the 1999 merger of Exxon and Mobil, suggestive of a strategic shift in public relations.

A second shift, in the mid-2000s, from explicit doubt to implicit acknowledgment confused by "risk" rhetoric, coincides with what one ExxonMobil Corp manager saw as "an effort by [then CEO Rex] Tillerson to carefully reset the corporation's profile on climate positions so that it would be more sustainable and less exposed."<sup>48</sup>

To this day, ExxonMobil Corp's (also Chevron's and ConocoPhillips') refrain on AGW, and the primary basis on which the company is now widely perceived to accept basic climate science, is that it is a "risk."<sup>26,194,195</sup> Across all of ExxonMobil Corp's flagship reports concerning AGW, by far the highest scoring collocate of "climate change" and "global warming" is "risk(s)" (S6.1, [supplemental information](#)). Compared with internal and peer-reviewed documents, terms in flagship reports invoking "risks of climate change" are highly divergent (S6.1). As with advertorials, none say that climate change is real and human caused.

## Individualized responsibility

The findings in the [results](#) section lead us to conclude that ExxonMobil advertorials used frames of individualized responsibility and the rhetoric of "risk" to construct what St. John III<sup>35</sup> calls a "sense-making corporate persona" that appealed to the enduring principles of "rugged individualism" and self-reliance that pervade US culture and ideology.<sup>35,196–201</sup> Their public affairs campaign coincided with solidifying, intertwined notions of distributed risks and individualized responsibility in western public policy debates since the 1970s, which have been driven by the global embrace of neoliberalism and globalization<sup>27,197,202,203</sup> and encouraged by reductive, episodic news framings<sup>16,179</sup> (and which are conceptualized by social theories<sup>59,204,205</sup> such as Beck et al.'s "risk society,"<sup>170,206,207</sup> Douglas et al.'s "risk culture,"<sup>208</sup> and Foucault et al.'s "governmentality").<sup>209,210</sup> ExxonMobil tapped into this trend toward the individualization of social risks, and brought it to bear on AGW.<sup>59,208,211</sup>

ExxonMobil is part of a lineage of industrial producers of harmful commodities that have used personal responsibility framings to disavow themselves.<sup>212–214</sup> Among them: tobacco companies;<sup>13,119,120</sup> the National Association of Manufacturers;<sup>215</sup> plastics producers (including Exxon, Mobil, and ExxonMobil Corp), packaging and beverage manufacturers, and waste companies;<sup>197,216–222</sup> and purveyors of sugar-sweetened beverages and junk food,<sup>98,99,214</sup> leaded products,<sup>223,224</sup> motor vehicles,<sup>94,225</sup> alcohol,<sup>12,226</sup> electronic gambling,<sup>227</sup> and firearms.<sup>228</sup>

Among, in particular, the public AGW communications of major fossil fuel companies, individualized responsibility framings—and the accompanying narrative of fossil fuel lock-in—have become seemingly ubiquitous.<sup>26,51</sup> The very notion of a personal "carbon footprint," for example, was first popularized in 2004–2006 by oil firm BP as part of its \$100+ million per year "beyond petroleum" US media campaign.<sup>229–235</sup> Discourse analysis of this campaign led Doyle<sup>236</sup> to conclude that "BP places responsibility for combatting climate change upon the individual consumer." Smerecnik and Renegar<sup>57</sup> have shown that subsequent BP branding activities similarly "plac[e] participatory emphasis

on consumer conservation behavior as opposed to corporate responsibility." This industry framing continues to dominate today.<sup>26,81</sup> In 2019, for instance, BP launched a new "Know your Carbon Footprint" publicity campaign.<sup>237</sup> In 2020, the CEO of Total said that "Change will not come from changing the source of supply. You have to reduce demand."<sup>238</sup> Until 2020, all major oil and gas companies disregarded or disavowed accountability for all Scope 3 greenhouse gas emissions resulting from the use of their products. ExxonMobil Corp, Chevron, and ConocoPhillips continue to do so.<sup>239</sup>

The result is that fossil fuel industry discourse on AGW appears to have encouraged and embodied what Maniates<sup>197</sup> describes as "an accelerating individualization of responsibility" that "is narrowing, in dangerous ways, our 'environmental imagination'" by "ask [ing] that individuals imagine themselves as consumers first and citizens second."<sup>197,26,27,52,56</sup> This depoliticized "capitalistic agency," Smerecnik and Renegar<sup>57</sup> argue, works to "prohibit fundamental social change that would disrupt the fossil fuel industry."<sup>57,59</sup> Experimental evidence appears to support this conclusion. Palm et al.,<sup>240</sup> for example, observe that messages framed in terms of individual behavior not only "decreased individuals' willingness to take personal actions" but also "decreased willingness to [take collective action such as to] support pro-climate candidates, reduced belief in the accelerated speed of climate change, and decreased trust in climate scientists." Illustrations of how narratives of individualized responsibility have protected fossil fuel interests from climate action are widespread. One is Yale University's 2014 refusal to divest from fossil fuel companies, which was "predicated on the idea that consumption of fossil fuels, not production, is the root of the climate change problem."<sup>241</sup> Another is the Republican Party's 2020 legislative agenda on AGW, whose premise was that "fossil fuels aren't the enemy. It's emissions."<sup>242,243</sup> A third is that the Paris Agreement "is silent on the topic of fossil fuels."<sup>68</sup>

## Summary and conclusion

Available documents show that, during the mid-2000s, ExxonMobil's public AGW communications shifted from explicit doubt (a Scientific Uncertainty frame) to implicit acknowledgment couched in discourses conveying two frames: a Socioeconomic Threat frame, and a Fossil Fuel Savior (FFS) frame. According to the FFS frame:

- (1) Everything about AGW is uncertain: a "risk," as contrasted with a reality.
- (2) Fossil fuel companies are passive suppliers responding to consumer energy demand.
- (3) Continued fossil fuel dominance is (1) inevitable, given the insufficiency of low-carbon technologies; and (2) reasonable and responsible, because fossil fuels lead to profound, explicit benefits and only ambiguous, uncertain climate "risk(s)."
- (4) Customers are to blame for demanding fossil fuels, whose "risk(s)" were common knowledge. Customers knowingly chose to value the benefits of fossil fuels above their risks.

Ignored and obscured by these perspectives are fossil fuel interests' pervasive marketing, disinformation campaigns, and lobbying against climate and clean energy policies, all of which

have served to establish and reinforce infrastructural, institutional, and behavioral carbon lock-ins, thereby undercutting consumer choice and agency.<sup>244,245</sup>

Propaganda tactics of the fossil fuel industry such as these have received less scrutiny than those of their tobacco counterparts. Further attention is needed, because although individualized narratives of risk, responsibility, and the like are less blatant than outright climate science denial, such “discursive grooming” is now pervasive in structuring the agenda of scholars, policymakers, and the public.<sup>59,68,69,197,246</sup>

## EXPERIMENTAL PROCEDURES

### Resource availability

#### Lead contact

Further information and reasonable requests for resources by qualified researchers should be directed to and will be fulfilled by the lead contact, Geoffrey Supran ([gjsupran@fas.harvard.edu](mailto:gjsupran@fas.harvard.edu)).

#### Materials availability

This study did not generate new unique materials.

#### Data and code availability

Raw data (original PDF internal documents, peer-reviewed publications, and advertorials) for this study cannot be reproduced due to copyright restrictions. However, a catalog of all 180 analyzed documents, and links to public archives containing these data, are provided in S7, [supplemental information](#). Additionally, raw searchable .txt versions of all documents, as well as post-processed flattened text and document term matrices, are deposited on Harvard Dataverse: <https://doi.org/10.7910/DVN/XXQUKJ>. The datasets and code generated during this study are provided in the same repository. Access will be granted upon reasonable request by qualified researchers.

### Corpora

For detailed descriptions of how we previously compiled the 180 ExxonMobil documents analyzed in this study, see Supran and Oreskes.<sup>1,2</sup> For a catalog of all 180 documents, and links to their public archives, see S7, [supplemental information](#). In summary, the 32 internal company documents (1977–2002) were collated from public archives provided by ExxonMobil Corp,<sup>101</sup> *InsideClimate News*,<sup>102</sup> and Climate Investigations Center.<sup>103</sup> The 72 peer-reviewed publications (1982–2014) were obtained by identifying all peer-reviewed documents among ExxonMobil Corp’s lists of Contributed Publications, except for three articles discovered independently during our research. All 72 publications were (co-)authored by at least one ExxonMobil employee.<sup>104</sup> The 76 advertorials (1972–2009) expressing any positions on AGW (real and human caused, serious, or solvable) were identified by manual content analysis of 1,448 ExxonMobil advertorials (1924–2013) collated from PolluterWatch and ProQuest archives.<sup>105,106</sup>

### Pre-processing

To enable computational analysis, scanned documents were converted to searchable text files using optical character recognition. Text was stripped of formatting details and punctuation, tokenized, and lowercased (for details, see S1.1, [supplemental information](#)). This yielded internal, peer-reviewed, and advertorial corpora comprising 69,802 words, 716,477 words, and 34,141 words (16,121 in Mobil advertorials and 18,020 in ExxonMobil Corp advertorials), respectively.

For divergent term (topic) analysis, we added (substituted) several synthetic tokens that combine: terms of identical cognate form (e.g., “effect” and “effects” became “effect(s)”; and terms judged by the authors to be near-synonyms (e.g., “co2” and “carbon dioxide” became “co2/carbon dioxide”; “countries” and “nations” became “countries/nations”)—for all synthetic tokens, see `vectorize.R` script.<sup>109,247</sup> Document collections were transformed into document-term matrices comprising all: 1- to 5-grams (unique, contiguous word strings of 1–5 tokens in length) for divergent term analysis; and 1-grams for divergent topic analysis.<sup>248</sup>

### Divergent term analysis (FS and LL ratio)

Internal, peer-reviewed, and advertorial corpora were compared pairwise to identify rhetorical distinctiveness (or divergence) between the terms communicated in each text. (We combine all (Mobil plus ExxonMobil Corp) advertorials before comparing them against internal and peer-reviewed documents from Exxon and Exxon/ExxonMobil Corp, respectively. This simplifies the presentation of results without substantively affecting our findings.) To capture different forms of divergence, we applied two algorithms: FS and Dunning LL ratio ( $G^2$ ) score.<sup>108–110</sup> FS and LL are established, complementary tools for word frequency analysis in computational linguistics and digital humanities.<sup>110,249,250</sup>

The FS indicates how often a given term appears in one corpus versus another. The score ranges from 0 (when only corpus A features the term) to 1 (when only corpus B includes the term). To account for the difference in word counts between corpora, we normalized scores by using relative frequencies. For example, a score of 0.8 means that 80% of all normalized instances of a term appear in corpus B. As Risi and Proctor observe, “FSs are useful for identifying taboos: terms generally avoided by one side or the other.”<sup>109</sup>

FSs produce immediately interpretable results, yet their reliance on multiplicative ratios—versus additive differences—tends to over-represent rare words.<sup>108</sup> To identify subtle patterns that might otherwise escape notice, we also use the LL ( $G^2$ ) statistic proposed by Dunning (1993), which is a parametric analysis that primarily identifies “surprising,” additively over-represented words, while also giving some weight to multiplication.<sup>108,110,251</sup> Large  $[G^2]$  scores indicate terms that have statistically significant relative frequency differences between two corpora. LLs are therefore useful for identifying tropes: terms used disproportionately by one side.

### Divergent topic analysis (LDA)

In the field of automated text summarization, divergent terms identified by LL are referred to as “topic signatures.”<sup>249,252</sup> In order to identify the topics represented by such terms, and to better understand the roles these terms play in framing each topic, we also examine the documents using topic modeling with LDA.<sup>111</sup> LDA is a computational, unsupervised machine-learning algorithm for discovering hidden thematic structure in collections of texts.<sup>253</sup> *A priori* coding schemes are not supplied. Rather, ‘topics’ (clusters of words associated with a single theme) emerge inductively based on patterns of co-occurrence of words in a corpus.

We are specifically interested in identifying the topical distinctiveness (or divergence) between document categories. In the main text, we compare topics between ( $\alpha$ ) all advertorials and ( $\beta$ ) combined internal and peer-reviewed documents.

To do so, we first model the distribution of topics over all document categories, by inputting to LDA an aggregated corpus comprising all advertorials, internal documents, and peer-reviewed publications (for details of LDA model selection, topic validation, and labeling, see section S1.2, [supplemental information](#)). Once topic-word distributions are obtained, we then take an approach analogous to that for finding divergent terms above, noting that just as LL ratios of term frequencies identify divergent terms, LL ratios of topic weights identify divergent topics. We compute LL ratios of topic weights by constructing document-topic matrices for each of sub-corpora  $\alpha$  and  $\beta$ .

Although they are run independently, analyses of divergent terms (by FS and LL) and topics (by LL of LDA) are complementary. The former identifies the distinctive usage of individual n-grams by one corpus versus another. The latter helps contextualize the thematic role that these words together play in communicating and framing topics.

### Frame package analysis

Van Gorp<sup>117</sup> argues that the “strongly abstract nature of frames implies that quantitative research methods should be combined with the interpretative prospects of qualitative methods.” To this end, we use the distinctive terms and topics identified using computational techniques to then inform an inductive, qualitative approach to constructing frames as frame packages in advertorials. Van Gorp<sup>117</sup> defines frame packages as an integrated structure of framing devices (manifest textual elements that function as indicators of a frame) and reasoning devices (logical chains of causal reasoning), and proposes Strauss and Corbin’s<sup>254</sup> three-step coding scheme for identifying frame packages and

assembling them into a so-called “frame matrix.”<sup>6,10,17,116–118,254</sup> We adopt this approach.

### Open coding

The first step is to compile what Van Gorp<sup>116</sup> calls an “inventory of empirical indicators that may contribute to the readers’ interpretation of the text,” comprising feasible framing or reasoning devices identified in each document. We used FS, LL, and LDA to systematize this process of locating frames and detecting how they are shaped by lexical composition (for details, see S1.3, [supplemental information](#)). We further investigated these discursive constructs by performing collocation searches.<sup>51</sup> The logDice statistic was computed to measure collocational association because it permits meaningful comparison of different sized corpora.<sup>255,256</sup>

### Axial coding

The second step is to arrange coded devices along “axes of meaning” by comparing and contrasting open-coding results between documents and then reducing the results to broader meanings or dimensions.<sup>113,116</sup> We do so with reference to an inventory of discourses that we assembled based on a literature review of past studies of AGW communications by fossil fuel interests (see S3, [supplemental information](#)).<sup>116</sup>

### Selective coding

The last step is to enter axial codes into a “frame matrix” that summarizes the framing and reasoning devices of each frame package.<sup>116</sup>

## SUPPLEMENTAL INFORMATION

Supplemental information can be found online at <https://doi.org/10.1016/j.oneear.2021.04.014>.

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## AUTHOR CONTRIBUTIONS

Conceptualization, G.S.; methodology, G.S.; validation, G.S. and N.O.; formal analysis, G.S.; investigation, G.S.; writing – original draft, G.S.; writing – review & editing, G.S. and N.O.; visualization, G.S.; supervision, G.S. and N.O.; funding acquisition, G.S. and N.O.

## DECLARATION OF INTERESTS

The authors have received speaking and writing fees (and N.O. has received book royalties) for communicating their research, which includes but is not limited to the topics addressed in this paper. The authors have no other relevant financial ties and declare no competing interests.

## INCLUSION AND DIVERSITY

While citing references scientifically relevant for this work, we also actively worked to promote gender balance in our reference list.

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