RESEARCH ARTICLE

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State-Based Effects on Ideology: An Empirical Study of the Relationship of Political Polarization with State Energy Production Share, Per Capita Consumption and Population Density

Arthur J O'Connor

Wall Street IT and Risk Management Consultant, Doctoral Candidate,
Lubin School of Business, Pace University, New York, USA.

Correspondence: arthurjoconnor@gmail.com

Abstract

This empirical study explores state-based, socio-economic dimensions of political polarization. The study theorizes that, given their surroundings, residents of energy-producing states may be more sympathetic to the energy industry – and/or have different perceptions on the durability or quality of their immediate natural ecological environment or the cost/benefit of fossil fuel dependency – than residents in more densely populated states. The study provides new insights into the personal incentives and cognitive biases underlying political environmentalism, and shows emerging evidence of the mitigating effects of broad-based national initiatives to promote renewable energy.

Keywords: Political polarization; environmentalism; greenhouse gas emissions; sustainability.

1. Introduction

Over the past 25 years, America's "culture wars" – or ideological divides on moral, religious and cultural issues such as abortion, gay marriage, gun control and the size and role of government – voters have become increasingly polarized along political party lines [1], bringing about bitter partnership and paralyzing gridlock at all levels of the government.

The empirical study explores state-based environmental effects on voter polarization, building off an earlier study on the effect of political polarization on spatial differences in the amount and ways industrial pollutants are released in "red" (the Republican candidate receiving the majority of votes) versus "blue" (the Democratic candidate receiving the majority of votes) states in Presidential elections [2].

The research study theorizes that, despite the political, economic, demographic, social and cultural heterogeneity of states – and while acknowledging that America's "culture war" ideological divisions manifest themselves at a more granular neighborhood, community or county level than at the state level (the "red"/"blue" states dichotomy created by the winner-take-all electoral system employed for Presidential elections by 48 of the 50 U.S. with the losing party consistently winning a sizable percentage [3]) geographically – state-based effects still influence voter adoption outlook and ideology.

2. Theory and Conceptual Model

2.1. Theory model

The empirical study theorizes that where one lives influences what one believes. This theory is consistent with the previous studies that show a prevailing political orientation of the state where a voter lives influences attitudes, ideological outlooks and behaviors [4].

The study assumes that, due to increasing political polarization – with more consistent liberal views prevailing among Democrats and more conservative views prevailing among Republicans [1] – the percentage voting Republican and Democrat by state has become a reliable indicator of the ideological division over global climate change and national energy policy.

The study theorizes that, given to their socio-economic and natural environmental surroundings, residents of energy-producing states may be more sympathetic to the energy industry and/or have different perceptions to the durability or quality of the natural environment than residents in more densely populated states. The greater relative proximity to energy producers and/or extractors suggests that residents of energy-producing states may have a stronger personal socio-economic relationships, affinities or associations with these employers and thus be more supportive to the industry status quo and vote Republican. These voters live in more sparsely populated states, consume more energy per capita, 92% of which still comes from traditional energy sources [5].

Conversely, voters in more densely populated states that produce less energy have less personal stake in the energy industry status quo, and are thus more open to environmental initiatives for change and vote Democratic. These voters may perceive the natural environment as more damaged and fragile than do residents of more sparsely populated areas, and may also have different perceptions about the relative abundance or scarcity as well as economic viability or social benefit of America's continued dependency on fossil fuels as its primary source of energy.

2.2. Conceptual model

The first set of hypotheses explore state-based local environmental effects on ideology and behavior. In this view, political orientation by state is viewed as a function of local effects – per capita energy consumption, direct greenhouse gas emissions and percent national energy generation – which create disparities in beliefs and outlooks regarding the threat or reality of climate change/global warming, and the need to develop renewable or sustainable sources of energy.
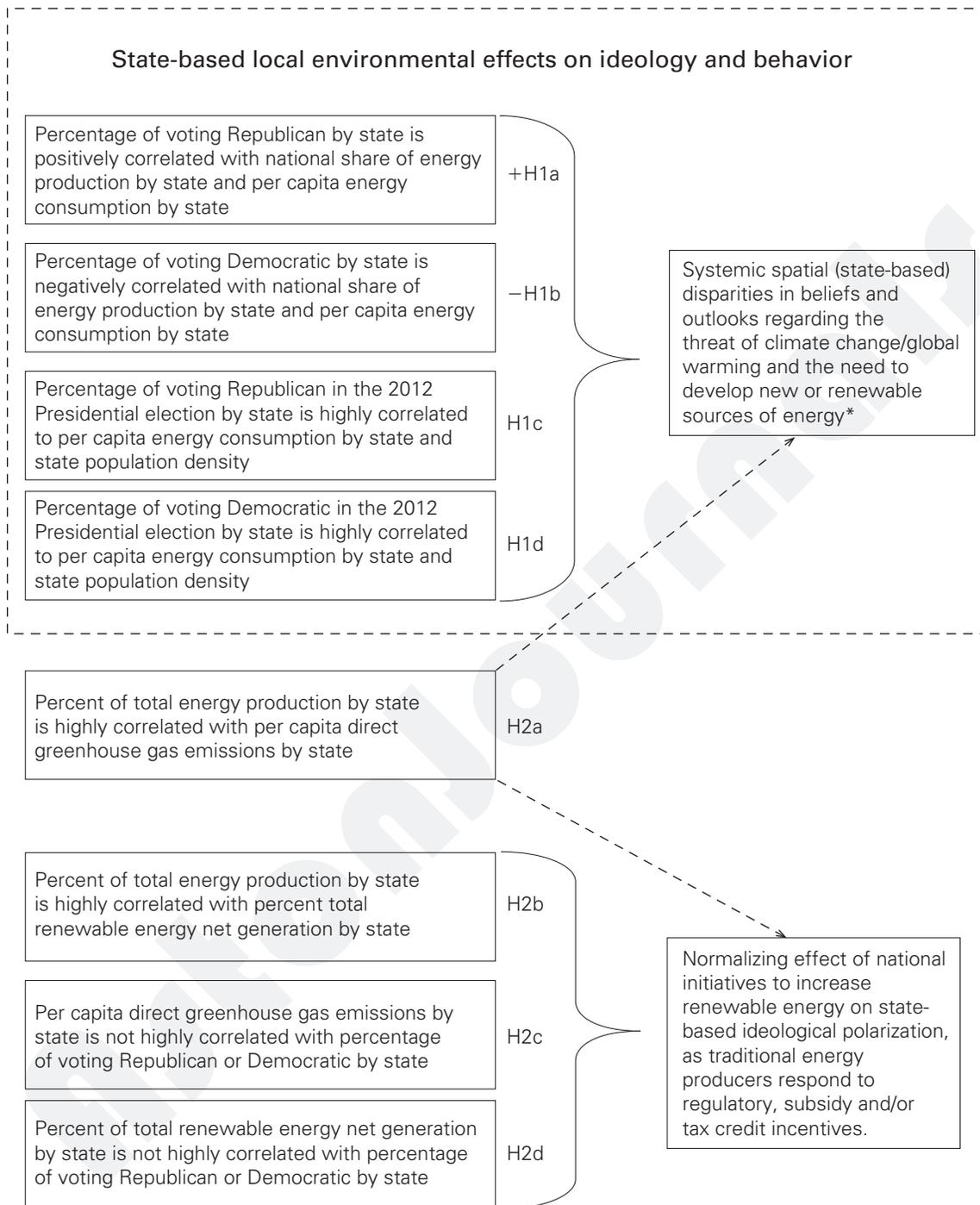
In the conceptual model, H1a proposes that percentage of voting Republican in the 2012 Presidential election by state is positively correlated with national share of energy production and per capita energy consumption by state. Conversely, H1b proposes that percentage of voting Democratic in the 2012 Presidential election by state is negatively correlated with national share of energy production and per capita energy consumption by state, as shown in Figure 1.

H1c and H1d apply an additional variable (population per square mile) to capture state-based population density effects on these relationships. H1c proposes that percentage of voting Republican in the 2012 Presidential election by state is highly correlated to per capita energy consumption by state and state population density. Conversely, H1d proposes that percentage of voting Democratic in the 2012 Presidential election by state is highly correlated to per capita energy consumption by state and state population density.

The second set of hypotheses propound that while percent of total energy production by state remains highly correlated with per capita greenhouse gas emissions by state (as per H2a), national initiatives to encourage renewable energy sources are disrupting and confounding these state-based effects of ideological polarization, as traditional energy producers and individuals nationwide respond to broad-based regulatory, subsidy and/or tax credit incentives.

Conversely, H2b proposes the percent of total energy production by state is highly correlated with percent of total renewable energy net generation by state, as rational utility maximizing conventional energy producers increase alterative energy production in response to regulatory

Figure 1: Theory and conceptual model.

State-based local environmental effects on ideology and behavior

Percentage of voting Republican by state is positively correlated with national share of energy production by state and per capita energy consumption by state	+H1a
Percentage of voting Democratic by state is negatively correlated with national share of energy production by state and per capita energy consumption by state	−H1b
Percentage of voting Republican in the 2012 Presidential election by state is highly correlated to per capita energy consumption by state and state population density	H1c
Percentage of voting Democratic in the 2012 Presidential election by state is highly correlated to per capita energy consumption by state and state population density	H1d

Systemic spatial (state-based) disparities in beliefs and outlooks regarding the threat of climate change/global warming and the need to develop new or renewable sources of energy*

Percent of total energy production by state is highly correlated with per capita direct greenhouse gas emissions by state	H2a

Percent of total energy production by state is highly correlated with percent total renewable energy net generation by state	H2b
Per capita direct greenhouse gas emissions by state is not highly correlated with percentage of voting Republican or Democratic by state	H2c
Percent of total renewable energy net generation by state is not highly correlated with percentage of voting Republican or Democratic by state	H2d

Normalizing effect of national initiatives to increase renewable energy on state-based ideological polarization, as traditional energy producers respond to regulatory, subsidy and/or tax credit incentives.

*Due to increased political polarization – with more consistently liberal views among Democrats and conservative views among Republicans [1] – percentage of voting Republican/Democrat by state has become a reliable indicator of the ideological divide about global climate change and national energy policy.

requirements, subsidies, and/or tax credits. Examples of such tax credits for businesses include the advanced energy investment credit, renewable electricity production credit, alternative fuel pump tax credit and wind generation credit. Examples of such tax credits for individuals include the

residential energy property credit, residential energy-efficient improvements credit and the plug-in electric vehicles credit.

Moreover, in contrast to the first set of the hypotheses, the H2c and H2d propose that the correlation between state-based total net renewable energy generation, as well as per capita greenhouse gas emissions by state, are not highly correlated with percentage of voting a Republican or a Democratic by state.

2.3. Reflections on energy 20/20
What are the conservative ideological viewpoints that are created by spatial proximity and/or associated with energy production/extraction industries and/or population density effects?

Perhaps one of the best and most recent examples of the current sub-culture of denial regarding the threat of global climate change and soundness of America's continued energy dependency upon fossil fuels is Energy 20/20 [6], is a report sponsored by Senator Lisa Murkowski from the Republican stronghold and energy-producing state of Alaska.

Described as "a blueprint for discussion" [6] to make energy abundant, affordable, clean, diverse, and secure, the report makes scores of recommendations for government to remove regulatory restrictions, and subsidize the private sector to aggressively increase oil and gas production in North America over the next decade. According to the report, the scarcity of oil and/or impending depletion of fossil fuel resources are myths. It argues that America sits on massive reserves of natural gas as well as crude oil, whose extraction are now made economically feasible through new technologies such as hydraulic fracturing (or "fracking").

In this worldview, environmental concerns are misplaced: "Rivers no longer catch fire because of the waste dumped into them. Our skies are blue, less often clouded by particulate matter or haze. Emissions from power plants have declined considerably, and vehicle efficiency has been increasing since 2005. The air in America is dramatically cleaner than it was 30 years ago…" [6].

As for the monumental issue of global climate change, the long-term effects on the nation's coastlines, arable land and water supply are dismissed as unfounded extrapolations of inconclusive evidence of a phenomenon that the scientific community has yet to confirm as real: "It is understandable that theories differ on what may happen in the future. The complexity of this problem is underscored by the fact that we haven't even reached a consensus on what has already happened, which greatly complicates attempts to predict the likely impacts of climate change" [6].

3. Literature Review and Hypotheses
According to the Pew Research Center [1], while the overall mix of values has been relatively stable among the American public, these beliefs have been increasingly divided along partisan lines, with more consistently liberal views among Democrats and conservative views among Republicans – across a wide range of beliefs and cultural issues. Interestingly, the study found that nearly all of the increase since 1987 took place over the past 10 years – a time that also saw increased income polarization in America [7]. In 1987, when Pew began its survey based on value-oriented questions, the average disparity by party affiliation was 10% and by 2012, the partisan gap had nearly doubled to 18 points.

3.1. The relationship of political party affiliation and ideology with environment concerns and behaviors
An analysis of three cross-sectional public opinion polls of Americans conducted by the Gallup Organization at 10-year intervals (in 1990, 2000 and 2010) showed that political party affiliation had become an increasingly important determinant of environmental concern [8]. Guber [8] found that global climate change, or the need to reduce greenhouse gas emissions, was found to be a particularly polarizing issue.

McCright and Dunlap [9] examined the relationship between political polarization and attitudes towards climate change from 10 national Gallup Polls of the general public between 2001 and 2010, found significant ideological and partisan polarization on the issue of climate change occurring over the past decade. The results showed that Democrats and liberals were more likely to report personal concerns about global warming than were Republicans and conservatives [9].

Energy consumptions patterns have been found to be different between environmentally conscious "green" versus "brown" consumers [10]. In their private choices as consumers, green party registered voters in a California community were more likely to commute by public transit, purchase hybrid vehicles and consume less gasoline than non-environmentalists [10]. Individual ideology and values play an influential role in forming opinions on energy issues such as oil exploration and expansion of nuclear power [11].

Academic research in the area of environmental politics has long established ideological differences between Republicans and Democrats [12, 13]. Granzin and Olsen [14] discovered that personal values were more predictive of environment and energy conservation behaviors such as donating items for reuse, recycling newspapers and walking instead of driving, than demographic, media usage patterns, information sources or knowledge.

Based on the analysis of the results of a general population survey, Samdahl and Robertson [15] found liberal ideology as a strong predictor of support for environmental regulation in their longitudinal analysis of rate making and state electricity deregulation policy-making of the politics of state electricity. Ka and Teske [16] found state legislative ideology as a central factor in decision regarding issues of redistribution of energy resources. Costa and Kahn [17] discovered that Democratic households respond favorably and strongly to reminders to lower their home electricity usage, with higher consumption of renewable sources and donations to environmental causes, whereas Republican households do not respond favorably and sometimes react counter to these reminders or "nudges."

By analysis of voting patterns in "red" versus "blue" states, Gelman *et al.* [4] uncovered differences in voter behaviors, and proposed that while income influences what people believe and how they think, income matters more in "red" states than in "blue" ones. They concluded that context, or the state where a voter lives, plays a key role in influencing attitudes and behaviors.

The first and primary set of hypotheses proposes state-based relationships among ideology, personal socio-economic relationships, population density and energy consumption habits.

H1a: Percentage of voting Republican in the 2012 Presidential election by state is positively correlated with national share of energy production by state and per capita energy consumption by state.

H1b: Percentage of voting Democratic in the 2012 Presidential election by state is negatively correlated with national share of energy production by state and per capita energy consumption by state.

H1c: Percentage of voting Republican in the 2012 Presidential election by state is highly correlated to per capita energy consumption by state and state population density.

H1d: Percentage of voting Democratic in the 2012 Presidential election by state is highly correlated to per capita energy consumption by state and state population density.

In contrast, Buttel and Flinn [18, 19] found no correlation between political party affiliation or ideology with environmental attitudes or behavior. In their statewide survey of Wisconsin residents, Buttel and Flinn [18] found strong correlations of liberalism and environmentalism, especially among college-educated respondents, but found no significant differences in levels of environmental concerns between Republicans and Democrats. Likewise, in their study on the effect of political party affiliation and political ideology with awareness of environmental problems and support for environmental initiatives, Buttel and Flinn [19] found that neither political party identification nor political ideology had a substantial effect on awareness of environmental problems or support

for environmental reform, although they noted that liberal ideology was highly correlated with support for environmental reform, particularly among the middle class.

However, both of these studies date back to the late 1970's, prior to that polarizing alignment of ideology with political party affiliation over the past 25 years, which has intensified over the past 10 years [1].

3.2. The economics and behaviors of reducing or abandoning the use or production of conventional energy sources in exchange for regulatory imposed or subsidized alternate energy sources

Cragg and Kahn found that ideologically and/or politically more conservative and lower income areas have higher per capita carbon emissions than do liberal, wealthier areas, whose elected representatives have a much lower probability to vote in support of legislation to lower carbon emissions [20]. They observed that costs of compliance with carbon reduction standards would differ greatly state to state, placing a greater burden on high-carbon (predominantly Republican) states in the Midwest than on low-carbon environmental-friendly (predominantly Democratic) states such as California, and such projected costs are likely to affect congressional voting patterns [20].

Sovacool's study [21] of the cultural barriers to renewable energy and energy efficiency in the U.S. found empirical evidence that deeply held values related to consumption, abundance, trust, control and freedom shape American attitudes towards energy. Sovacool [21] concluded that many people oppose renewable energy projects such has solar panels and wind farms due to their perceptions and misunderstanding of the needs for such initiatives from 181 interviews conducted by 82 organizations from 2005 to 2008.

The second set of hypotheses explore national initiatives to increase renewable energy sources are disrupting and confounding the state-based effects of ideological polarization, essentially uncoupling the high correlation between energy production and greenhouse gas emission amounts by state with voting patterns by state.

H2a: Percent of total energy production by state is highly correlated with per capita direct greenhouse gas emissions by state

H2b: Percent of total energy production by state is highly correlated with percent of total renewable energy net generation by state

H2c: Per capita direct greenhouse gas emissions by state is not highly correlated with percentage of voting Republican or Democratic by state

H2d: Percent of total renewable energy net generation by state is not highly correlated with percentage of voting Republican or Democratic by state

The percent of total energy production by state, as the second set of hypotheses propose, is highly correlated with per capita greenhouse gas emissions by state (as per H2a). However, H2b proposes that total energy production by state is also highly correlated with total renewable energy net generation by state, as organizations and individuals respond to national incentives to reduce production of conventional energy sources in exchange for regulation imposed-subsidized-alternate energy sources. Moreover, the correlations between per capita greenhouse gas emissions by state and total renewable energy net generation by state are not highly correlated with percentage of voting Republican or Democratic by state (H2c and H2d).

4. Methodology and Data Sources

In the tests for the first and primary hypotheses, Pearson product movement correlations in a two-tailed test at the 0.01 and 0.05 significant levels will be conducted to measure the linear association of state percentages of voting Republican and Democrat with national share of energy production by state and per capita energy consumption by state. Also, linear regressions will be performed,

expressing state percentages of voting Republican and Democrat as a function of per capita energy consumption by state and by population density.

In the tests for the second hypotheses, Pearson product movement correlations in a two-tailed test at the 0.01 and 0.05 significant levels will be conducted to measure the linear association of state national share of energy production with per capita volume of direct emissions of green-house gas by state, percent of total renewable energy net generation by state and percentage of voting Republican or Democratic by state.

State share of national energy production and per capita consumption rates (by million British thermal unit or Btu's) for 2012 were sourced from the U.S. Energy Information Administration. State voting percentage results from the 2012 U.S. Presidential election was sourced from the Public Disclosure Division, Office of Communications, Federal Election Commission. Population per square mile data by state for 2011 came from the Statistical Abstract from the U.S. Census Bureau.

Volume of direct greenhouse gas emissions by state (units of metric tons of carbon diox-ide equivalent) were sourced from the Environmental Protection Agency's (EPA), Greenhouse Gas (GHG) Reporting Program for 2011, from the approximately 8,000 facilities that directly emit GHG's and report data to EPA. Per capita amounts by state were calculated by multiplying total amounts by state with 2012 population percentages by state, which were sourced from the U.S. Census Bureau.

5. Results

In a two-tailed test, H1a at the 0.01 statistical significance level, the Pearson product movement correlations showed statistically significant (or a 99.99% probability of the effect being true, versus random variation or chance) positive linear correlation of state percentages of voting Republican in the 2012 Presidential election with 2012 per capita energy consumption. Similar correlation strength in 2012 per capita energy consumption by state and 2012 national share energy production by state was observed. The linear correlation between state percentages of voting Republican in the 2012 Presidential election with 2012 national share energy production by state in a two-tailed test at the 0.05 statistical significance level showed statistical significance (or a 99.95% probability of the effect being true, versus random variation or chance), as shown in Table 1.

Table 1: Test results of H1a.

Two-tailed Pearson correlation significance (N)	Correlations		
	Romney, 2012 (%)	Total energy production, 2012 (U.S. share)	Total energy consumption per capita, 2012 (million Btu)
Romney, 2012 (%)	1	.314*	.412**
		.025	.003
	51	51	51
Total energy production, 2012 (U.S. share)	.314*	1	.514**
	.025		.000
	51	51	51
Total energy consumption per capita, 2012 (million Btu)	.412**	.514**	1
	.003	.000	
	51	51	51

*Correlation is significant at the 0.05 level (two-tailed).
**Correlation is significant at the 0.01 level (two-tailed).

Similarly, in a two-tailed test of H1b at the 0.01 statistical significance level, the Pearson product movement correlations showed statistically significant (or a 99.99% probability of the effect being true, versus random variation or chance) negative linear correlation of state percentages of voting Democratic in the 2012 Presidential election with 2012 per capita energy consumption, as shown in Table 2.

Table 2: Test results of H1b.

Two-tailed Pearson correlation significance (N)	Correlations		
	Obama, 2012 (%)	Total energy production, 2012 (U.S. share)	Total energy consumption per capita, 2012 (million Btu)
Obama, 2012 (%)	1	−.317*	−.411**
		.024	.003
	51	51	51
Total energy production, 2012 (U.S. share)	−.317*	1	.514**
	.024		.000
	51	51	51
Total energy consumption per capita, 2012 (million Btu)	−.411**	.514**	1
	.003	.000	
	51	51	51

*Correlation is significant at the 0.05 level (two-tailed).

**Correlation is significant at the 0.01 level (two-tailed).

The results for the test of regressing percentages of voting Republican (H1c) and Democrat (H1d) with per capita energy consumption by state and state population density (population per square mile) were found to be statistically significant, with an R^2 value of .454, or 45.4% of the variance in the dependent variable predicted by the independent variables for H1c, and an R^2 value of .457, or 45.7% of the variance in the dependent variable predicted by the independent variables for H1d, as shown in Tables 3 and 4.

Table 3: Test results of H1c.

Model	Model summary			
	R	R^2	Adjusted R^2	Standard error
1	.674[a]	.454	.432	.0885416

[a]Predictors: Constant, population density, 2010 (population per square mile), total energy consumption per capita, 2012 (million Btu).

Model		ANOVA[b]				
		Sum of squares	Differential frequency	Mean square	F	Significance
1	Regression	.313	2	.157	19.977	.000[a]
	Residual	.376	48	.008		
	Total	.690	50			

[a]Predictors: Constant, population density, 2010 (population per square mile), total energy consumption per capita, 2012 (million Btu).

[b]Dependent variable: Romney, 2012 (%).

Model		Coefficients[a]				
		Unstandardized coefficients		Standardized coefficients		
		B	Standard error	Beta	t	Significance
1	Constant	.421	.030		13.911	.000
	Total energy consumption per capita, 2012 (million Btu)	.000	.000	.345	3.205	.002
	Population density, 2010 (population per square mile)	−4.583E−5	.000	−.537	−5.001	.000

[a]Dependent variable: Romney, 2012 (%).

Table 4: Test results of H1d.

Model	Model summary			
	R	**R²**	**Adjusted R²**	**Standard error**
1	.676[a]	.457	.434	0.888140

[a]Predictors: Constant, population density, 2010 (population per square mile), total energy consumption per capita, 2012 (million Btu).

Model		**ANOVA[b]**				
		Sum of squares	**Differential frequency**	**Mean square**	**F**	**Significance**
1	Regression	.319	2	.159	20.201	.000[a]
	Residual	.379	48	.008		
	Total	.697	50			

[a]Predictors: Constant, population density, 2010 (population per square mile), total energy consumption per capita, 2012 (million Btu).
[b]Dependent variable: Obama, 2012 (%).

Model		**Coefficients[a]**				
		Unstandardized coefficients		**Standardized coefficients**		
		B	**Standard error**	**Beta**	**t**	**Significance**
1	Constant	.559	.030		18.405	.000
	Total energy consumption per capita, 2012 (million Btu)	.000	.000	−.343	−3.202	.002
	Population density, 2010 (population per square mile)	4.636E–5	.000	.541	5.043	.000

[a]Dependent variable: Obama, 2012 (%).

The results of the second set of hypotheses provide empirical evidence that broad-based national initiatives to encourage renewable energy sources are disrupting and confounding the state-based effects of ideological polarization. In a two-tailed test of H2a at the 0.01 statistical significance level, the Pearson product movement correlations showed statistically significant (or a 99.99% probability of the effect being true, versus random variation or chance) positive linear correlation of 2012 national share energy production by state with per capita greenhouse gas emissions by state, as shown in Table 5.

Table 5: Test results of H2a.

Two-tailed Pearson correlation significance (N)	Correlations	
	Per capita GHG, 2011	**Total energy production, 2012 (U.S. share)**
Per capita GHG, 2011	1	.649**
		.000
	51	51
Total energy production, 2012 (U.S. share)	.649**	1
	.000	
	51	51

**Correlation is significant at the 0.01 level (two-tailed).

However, in a two-tailed test of H2b at the 0.01 level for statistical significance, the Pearson product movement correlations showed statistically significant (or a 99.99% probability of the effect being true, versus random variation or chance) positive linear correlation of 2012 national share energy production by state with 2010 total renewable energy net generation by state, as shown in Table 6.

Table 6: Test results of H2b.

Two-tailed Pearson correlation significance (N)	Correlations	
	Percent of total energy production, 2010	**Total renewable energy net generation, 2010**
Percent of total energy production, 2010	1	.509**
		.000
	51	51
Total renewable energy net generation, 2010	.509**	1
	.000	
	51	51

**Correlation is significant at the 0.01 level (two-tailed).

Moreover, while percentage voting Republican by state was found to be positively correlated with volume of direct greenhouse gas emissions by state (units of metric tons of carbon dioxide equivalent), there were no statistically significant linear correlations found between state percentages of voting Republican in the 2012 and Presidential election with 2011 per capita greenhouse gas emissions by state, as shown in Table 7.

Table 7: Test results of H2c.

Two-tailed Pearson correlation significance (N)	Correlations		
	Per capita GHG, 2011	**Obama, 2012 (%)**	**Romney, 2012 (%)**
Per capita GHG, 2011	1	−.227	.242
		.110	.088
	51	51	51
Obama, 2012 (%)	−.227	1	−.997**
	.110		.000
	51	51	51
Romney, 2012 (%)	.242	−.997**	1
	.088	.000	
	51	51	51

**Correlation is significant at the 0.01 level (two-tailed).

Also no statistically significant linear correlations found between total renewable energy net generation by state and state percentages of voting Republican in the 2012 Presidential election, as shown in Table 8.

Table 8: Test results of H2d.

Two-tailed Pearson correlation significance (N)	Correlations		
	Total renewable energy net generation, 2010	Romney, 2012 (%)	Obama, 2012 (%)
Total renewable energy net generation, 2010	1	.134	−.109
		.347	.448
	51	51	51
Romney, 2012 (%)	.134	1	−.997**
	.347		.000
	51	51	51
Obama, 2012 (%)	−.109	−.997**	1
	.448	.000	
	51	51	51

**Correlation is significant at the 0.01 level (two-tailed).

6. Conclusion

The results of H1a and H1b reveal how state-based Democratic and Republican voting patterns – due to increased political polarization along ideological lines – become powerful predictors of differences in levels of per capita energy consumption and greenhouse gas emissions by state due to increased political and ideological polarization. The results for the test of H1c and H1d, which include population density effects, are consistent with the demographic profiles of Republicans (predominantly white, middle-income, suburban and rural conservatives) and Democrats (more non-white, urban liberals comprised of both the high and low extremes of income and educational levels).

The results of the first set of hypotheses suggest that political polarization threatens to paralyze government and regulatory initiatives or prevent national consensus-building to overhaul energy policies to break America's traditional and historic dependence on cheap and abundant fossil fuels. In his examination of the different types of governments and their relative success rates in adopting clean energy, Matthews [22] found that Nordic countries, whose governance model features close ties between public and private sectors, are more capable in transitioning to clean fuels than pluralist democracies such as the U.S.

The results of the second set of hypotheses provide some emerging and encouraging news. While the results for H2a show that state share of national energy production is still highly correlated with per capita greenhouse gas emissions by state, the net generation by state of renewal energy, while currently representing only 8% of total energy consumption, is nonetheless highly correlated with share of total energy production by state. These results suggests that, while energy-producing and consuming "red" states may not be reducing or abandoning the use of conventional energy sources, they are nonetheless responding to regulatory imposed or government subsidized incentives to develop alternate energy sources. These results provide emerging evidence that national initiatives are beginning to overcome the Republican party's sub-culture of denial regarding the reality of climate change and the critical need to embrace sustainability.

6.1. Limitations

The study has many limitations. Inherent in the Republican/Democrat or "red"/"blue" states dichotomy are general assumptions of unit homogeneity and conditional independence of values for energy industry sympathies versus environmental concerns. It was well established that the "red" and "blue" states construct is a product of the winner-take-all electoral system employed for Presidential elections by 48 of the 50 U.S. states (Maine and Nebraska provide for splitting electoral votes) and the District of Columbia [3]. Studies have found that the losing party gets a sizable vote in

elections [3], and that shades of purple, reflecting mixtures of outlooks spread more or less evenly across the nation, is a more accurate metaphor for our nation's political geography [3].

In the statistical tests, the study made classic assumptions or pre-conditions for correlations and regressions: the linearity of the relationship among the variables, constant variance of the errors and normality of the error distribution. Other notable limitations were the lack of a test for a direction of effect (i.e., whether incentives or behavior drive ideology or vice versa), and the risk of endogeneity or feedback relationship between the independent and dependent variables. The study used a limited number of variables to explain behaviors associated with many complex and countless other factors. Lastly, it must be noted that the statistical test results, while providing some degree of empirical support for the study's hypotheses, reveal nothing conclusive about what these effects are just that they are most likely real.

6.2. Implications for future research

However inconclusive the results this research study may be, given its many limitations, the implications of the research are many. The study introduces a new dimension to understanding the state-based effects of local proximity to the energy industry and population density effects on ideological adoption and voter political polarization. The results provide new insights into the personal economic incentives and motivations associated with America's traditional dependence on fossil fuels. The most significant implications, however, may be that of test results for H2, which suggest that broad-based, national initiatives to encourage renewable energy generation are mitigating the state-based effects on political polarization. Wider and/or more detailed studies, with more robust or precise variables to reflect different types of business models and organizational behaviors, are needed to better understand these dynamics and potential effects.

Competing Interests
None declared.

References

[1] Pew Research Center, 2012. Partisan Polarization Surges in Bush, Obama Years Trends in American Values: 1987–2012. Washington, DC: Paw Research Center for the People and the Press, Released: 4 June 2012, pp. 1–168 [online] Retrieved March 3, 2013. http://www.peoplepress.org/2012/06/04/section-1-understanding-the-partisan-divide-over-american-values/

[2] O'Connor AJ, 2012. Political polarization and environmental inequality: a pilot study of pollution release amounts and practices in 'Red' versus 'Blue' states. Interdisciplinary Environmental Review, 13(4): 308–322.

[3] Rose PF, 2012. We Are All Purple: The Destructive Lie of Red and Blue States. Patheos Press. Retrieved March 3, 2013. http://www.patheos.com/blogs/philfoxrose/2012/11/we-are-all-purple-the-destructive-lie-of-red-states-and-blue-states/

[4] Gelman A, Shor B, Bafumi J, Park D, 2007. Rich state, poor state, red state, blue state: what's the matter with connecticut? Quarterly Journal of Political Science, 2(4): 345–367. ISSN 1554-0626; DOI: 10.1561/100.00006026.

[5] U.S. Energy Information Administration, Annual Energy Review Consumption Statistics. Released September 27, 2012. U.S. Energy Information Administration, Monthly Energy Review Table 1.3 Primary Energy Consumption Estimates by Source, 1949–2011 (Quadrillion Btu).

[6] Energy 20/20: A Vision for America's Energy Future, U.S. Senator Lisa Murkowski Releases Energy Blueprint. February 4, 2013.

[7] Pew Research Center, 2012. The Rise of Residential Segregation by Income. Fry R, Taylor P (Eds.), Released: August 1, 2012, pp. 1–25.

[8] Guber DL, 2010. A Cooling Climate for Change? Party Polarization and the Politics of Global Warming. American Behavioral Scientist January 2013, 57: 93–115. First Published on October 23, 2012. DOI: 10.1177/0002764212463361.

[9] McCright AM, Dunlap RE, 2011. The Politicization of Climate Change and Polarization in the American Public's Views of Global Warming, 2001–2010. The Sociological Quarterly, 52(2): 155–194.

[10] Kahn ME, 2007. Do greens drive hummers or hybrids? environmental ideology as a determinant of consumer choice and the aggregate ecological footprint. Journal of Environmental Economics and Management, 54(2): 129–145.

[11] Smith ERAN, 2002. Energy, the Environment, and Public Opinion. Rowman, Littlefield (Eds.)., 2002 – Technology & Engineering, 251 pages.

[12] Calvert JW, 1989. Party politics and environmental policy. In: Lester JP (Ed.), Environmental Politics and Policy, 158–78.

[13] Dunlap RE, 2008. The new environmental paradigm scale: from marginality to worldwide use. The Journal of Environmental Education, 40(1): 3–18.

[14] Granzin KL, Olsen JE, 1991. Characterizing participants in activities protecting the environment: A focus on donating, recycling, and conservation behaviors. Journal of Public Policy & Marketing, 10(2): 1–27. Environmental Problems and Marketing (Fall, 1991), Published by: American Marketing Association. Article Stable URL: http://www.jstor.org/stable/30000233.

[15] Samdahl DM, Robertson R, 1989. Social determinants of environmental concern: specification and test of the model. Environment and Behavior January, 21(1): 57–81. DOI: 10.1177/0013916589211004.

[16] Ka S, Teske P, 2002. Ideology and professionalism electricity regulation and deregulation over time in the American states. American Politics Research, 30(3): 323–343.

[17] Costa DL, Kahn ME, 2010. Energy conservation "nudges" and environmentalist ideology: evidence from a randomized residential electricity field experiment. NBER Working Paper No. 15939. Issued in April 2010.

[18] Buttel FH, Flinn WL, 1976. Environmental politics: the structuring of partisan and ideological cleavages in mass environmental attitudes. The Sociological Quarterly, 17(4): 477–490. DOI: 10.1111/j.1533-8525.1976.tb01716.x.

[19] Buttel FM, Flinn WL, 1978. The politics of environmental concern: the impacts of party identification and political ideology on environmental attitudes. Environment and Behavior, 10(1): 17–36.

[20] Cragg MI, Kahn ME, 2009. Carbon geography: the political economy of congressional support for legislation intended to mitigate greenhouse gas production. NBER Working Paper No. 14963.

[21] Sovacool BK, 2009. The cultural barriers to renewable energy and energy efficiency in the United States. Technology in Society, 31(4): 365–373.

[22] Matthews MM, 2005. Cleaning up their acts: shifts of environment and energy policies in pluralist and corporatist states. Policy Studies Journal, 29(3): 478–498. DOI: 10.1111/j.1541-0072.2001.tb02105.x.