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Pennsylvania Residents' Perceptions and Support for Climate Change Policies

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ABSTRACT

The research aims to examine the extent to which residents of Pennsylvania support three statewide climate change policies and one generic policy for a control policy. A web-based survey assessed policy support and agreement with a range of possible anticipated positive and negative environmental, social, individual economic, and business economic impacts. The Carbon Tax Cut and Renewable Portfolio Standards (RPS) policy were preferred over the Regional Greenhouse Gas Initiative (RGGI). RGGI and the Generic policy were equally supported. Differences in political party identification and policy type created unique patterns: Republicans were more inclined to support the policies than Democrats and Independents. Yet, Republicans had similar preferences to Independents and Democrats for the Carbon Tax Cut policy and significantly less support for the remaining policies. Participants anticipated somewhat to moderate positive impacts, with the most substantial anticipated impacts occurring for environmental impacts. Policy type only impacted anticipated positive individual economic impacts. Participants anticipated more positive individual economic impacts for this policy than the other two policies and the generic policy. Our hypothesis that perceiving favorable environmental, social, individual economic, and business economic impacts would be positively associated with policy support was supported.

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Chapter 1

Introduction

The United States houses only five percent of the global population; however, it emits 28 percent of the world's carbon (*GHG Inventory, n.d.*). In terms of overall carbon emissions in 2019, Pennsylvania ranked fourth highest among the states in the United States (*GHG Inventory, n.d.*). On a global scale, Pennsylvania contributes approximately one percent of the world's greenhouse gas emissions, surpassing over one hundred countries in emissions (*GHG Inventory, n.d.*). Well-designed climate policy reduces carbon emissions on a large scale and at a high speed; however, passing and implementing climate policy is incredibly difficult without understanding public preferences. There is a lack of data regarding Pennsylvanians' public opinions and support for climate policies relevant to the state, which in turn makes it difficult to enact meaningful climate change policies.

On January 17th, 2023, Josh Shapiro took the oath of office to become the 48th governor of Pennsylvania (*Governor-elect Josh Shapiro & Lieutenant Governor-elect Austin Davis announces diverse, experienced transition advisory committees, 2022*). Shapiro assembled an Advisory Committee for Environment and Energy to determine how to tackle one of the most pressing global issues: climate change. This committee aims to expand Pennsylvania's economy and preserve Pennsylvanians' constitutional right to clean air and pure water (*Governor-elect Josh Shapiro & Lieutenant Governor-elect Austin Davis announces diverse, experienced transition advisory committees, 2022*). Given Pennsylvania's dominant role in the fossil fuel industry, passing climate policy is difficult; understanding public perception and support is

essential. The goal of this research is to comprehend better Pennsylvanians' support for three climate policies under consideration in Pennsylvania and the environmental impacts, social impacts, individual economic impacts, and business economic impacts they anticipate from the policies.

The three climate change policies are: Renewable Portfolio Standards (RPS), the Regional Greenhouse Gas Initiative (RGGI), and a Carbon Tax Cut. RPS attempts to lower CO₂ emissions by requiring electric utilities to include a certain percentage of their electricity to come from renewable sources (*Brief state renewable portfolio standards and goals*, n.d.). RGGI sets a cap on the CO₂ electric utilities can produce. Lastly, the Carbon Tax Cut replaces the current Gross Receipts State Tax with a Carbon Tax Cut that is reduced if electric utilities hit certain CO₂ reduction targets (Andrew Bell & Daniel J. Mallinson, 2021). These policies will be discussed in more depth, and the public perceptions of such policies will be considered.

Chapter 2

Background Information

Pennsylvania has a long and robust history of supplying power to the United States, and that continues to the present day. Pennsylvania is the third-largest producer of electricity in the United States and the second-largest net supplier of energy to other states (*U.S. Energy Information Administration - EIA - independent statistics and analysis*, n.d.). The electric power sector is the largest contributor to carbon emissions in Pennsylvania. It accounts for more than a third of the state's total emissions. The World Meteorological Organization and the United Nations Environment Program created The Intergovernmental Panel on Climate Change (IPCC)

in 1988 to determine “scientific, technical, and socio-economic information relevant for the understanding of the risk of human-induced climate change.” Pertaining to the 21st century, the IPCC used the words “virtually certain” in determining the dominant role of burning fossil fuels and carbon dioxide emissions on climate change (Dernbach, 2004). Pennsylvania is the second largest natural gas-producing state and the third largest coal-producing state (*U.S. Energy Information Administration - EIA - independent statistics and analysis*, n.d.).

The Pennsylvanian energy sector has been controlled by coal mining, nuclear power, and in recent years, natural gas. Pennsylvania is expected to provide 40 percent of the United States' natural gas by 2040 (Ladislaw & Hyland, n.d.). Natural gas production was 10 times larger in 2017 than in 2010 in Pennsylvania. The shift from coal mining to natural gas has led to a decline in carbon emissions, but not at a high enough rate of descent to make a meaningful impact on the environment (Ladislaw & Hyland, n.d.). Although natural gas's carbon intensity is lower than coal's carbon intensity, Pennsylvania's rate of natural gas production still contributes to accelerating climate change (Ladislaw & Hyland, n.d.).

The relatively weak climate policies in Pennsylvania are harming Pennsylvania, other states, and other countries. The National Assessment Synthesis team assists the United States government through the US Global Change Research Program to predict how the changing climate will impact different parts of the United States (National Assessment Synthesis Team, *Climate change impacts on the United States*, 2000). Pennsylvania is estimated to warm up by 5.9F by 2050 (National Assessment Synthesis Team, *Climate change impacts on the United States*, 2000). The National Assessment Synthesis team determined the key issues facing the northeast of the United States. Key issues include an increase in weather extremes (increased flooding and heavy precipitation), stresses on estuaries, bays, and wetlands, stresses on urban

areas, recreation shifts, worse air quality, and species change (National Assessment Synthesis Team, Climate change impacts on the United States, 2000). The effects of climate change will continue to worsen if carbon emission levels remain the same. (National Assessment Synthesis Team, Climate change impacts on the United States, 2000).

Chapter 3

Pennsylvania Policies

The United States started tracking six greenhouse gases (carbon dioxide, methane, nitrous oxide hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride oxide) in the early 1990s after the United States signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) (Environmental Protection Agency, 2022). The reporting system is managed and reported annually by the Environmental Protection Agency. Following this report, climate policy became an increasingly popular discussion on a state level. Prior to the 1990s, climate policy was not introduced to reduce carbon emissions.

The Public Utility Regulatory Policy Act (PURA) of 1978 passed as part of the National Energy Act following the energy crisis of the 1970s (*The Public Utility Regulatory Policies Act of 1978*, n.d.). PURA is the only federal law focused on increasing renewable energy usage. This act was implemented by the Federal Energy Regulatory Commission (FERC or Commission) with the goal of promoting cogeneration and increasing energy generation from renewable energy sources (*The Public Utility Regulatory Policies Act of 1978*, n.d.). The legislation helped promote renewable energy projects. PURA introduced legislative value to renewable energy usage, and it helped the wind power industry grow in the electrical sector (Partners, 2016). That

said, PURA received criticism from utility companies citing bill cost increases for customers (*The Public Utility Regulatory Policies Act of 1978*, n.d.). Following PURA, in 1995, the Electricity Generation Customer Choice and Competition Act passed, allowing Pennsylvanians to choose their energy provider (Partners, 2016). Around 99 percent of all electricity is generated by independent power producers (Partners, 2016). Although this bill was introduced to increase customer choice and reduce electricity costs, it also allows Pennsylvanians to choose providers that use more renewable energy. In 2021, wind energy was Pennsylvania's largest source of renewable electricity generation (*U.S. Energy Information Administration - EIA - independent statistics and analysis*, n.d.). PURA has evolved since it was first introduced, and it has led to more recent legislation like Renewable Portfolio Standards (RPS).

Iowa adopted the first mandatory RPS in 1983. This policy aims to increase the use of renewable energy sources for electricity generation (*Brief state renewable portfolio standards and goals*, n.d.). Although RPS was not initially adopted to reduce greenhouse gas emissions, they do have that effect. Overall, this policy has successfully developed renewable energy generation in the United States. About half of the growth in US renewable energy generation since 2000 can be credited to various RPS policies (*Brief state renewable portfolio standards and goals*, n.d.).

Currently, there is no federal RPS, so the policy operates differently in participating states. Thirty-eight of the 50 U.S states and the District of Columbia have some form of RPS. States refer to Renewable Portfolio Standards (RPS) as Clean Energy Standards and Alternative Energy Standards. The following four states include Alternative Energy in their RPS policy title: Iowa, Ohio, Pennsylvania, and West Virginia (*Brief state renewable portfolio standards and goals*, n.d.). Thirty states and two territories include clean energy requirements in their RPS

policies. The difference in the policies is most meaningfully determined by what types of energy sources electric utilities can include in the specified percentage of their sale (*Brief state renewable portfolio standards and goals*, n.d.).

The Office of Energy Efficiency and Renewable Energy defines renewable energy as energy that is “produced from sources like the sun and wind that are naturally replenished and do not run out (*Renewable energy*, n.d.).” Renewable energy generally includes wind, solar, geothermal, biomass, and hydroelectric (*Renewable energy*, n.d.). The Office of Energy Efficiency and Renewable Energy defines nonrenewable energy as energy that “comes from finite sources that could get used up, such as fossil fuels like coal and oil (*Renewable energy*, n.d.).” Clean energy is energy that has zero carbon emissions. As an example, nuclear energy is considered clean energy because it is carbon-free, but it creates waste. Therefore, it is not renewable energy (*Renewable energy*, n.d.). It is more difficult to determine a concrete definition of “alternative energy” than “renewable” or “clean” energy.

Governor Edward G. Rendell passed the Pennsylvanian Alternative Energy Portfolio Standard on November 30, 2004. Although it is difficult to determine a concrete definition of ‘alternative energy,’ the enactment of the Alternative Energy Portfolio Standard outlines the energy sources included in “Alternative Energy Sources.” The Alternative Energy Portfolio Standard requires 18% of electricity utilities sell to come from tier I or tier I I sources by 2020-2021 (*Brief state renewable portfolio standards and goals*, n.d.). The Alternative Energy Standard requires eight percent to come from so-called tier 1: solar photovoltaic, wind power, low-impact hydropower, geothermal energy, biologically derived methane gas, fuel cells, biomass energy, and coal methane. Ten percent must come from tier 11 sources: waste coal, distributed generation systems, demand side management, large-scale hydropower, and

municipal solid waste (Center, n.d.). The portfolio is applicable to investor-owned utility and retail supplier sectors (electric distribution companies and electric generation suppliers).

The Pennsylvania Alternative Energy Portfolio Standard has been criticized because it includes the following six “dirty” energy sources: burning coal; wood; paper mill residue; municipal solid waste; waste methane from landfills; sewage treatment plants; and factory farms (Food and Water Watch, n.d.). Food and Water Watch believes the goals and timeline of Pennsylvania’s Alternative Energy Portfolio are too weak to effectively combat climate change. RPS policies also receive criticism because they force electric utilities to utilize certain technologies instead of setting certain carbon reduction emission goals (Sklar, 2019). As mentioned before, RPS was not introduced with the goal of reducing carbon emissions; it was introduced with the goal of diversifying four types of energy resources electricity companies were using (Sklar, 2019). The Rendell Administration’s goal of diversifying the energy sector can be highlighted through other implemented climate policies.

On July 9, 2008, Governor Edward G. Rendell signed the Pennsylvania Climate Change Act (Act 70 of 2008). The Pennsylvania Climate Change Act demanded the Department of Environmental (DEP) to administer a Climate change advisory committee; set up a voluntary GHG emissions; prepare a Climate Change Impacts Assessments and provide an update once every three years; prepare a climate change action plan and provide an update once every three years; and develop an inventory of GHGs (greenhouse gas) and update this inventory annually (*Climate change*, n.d.). Governor Rendell emphasized increasing jobs through renewable energy (Governor, P. O., 2018). The Pennsylvania Climate Change Act and the Alternative Portfolio Standards are important components of Pennsylvanian climate policy history.

Tom Corbett was elected Governor of Pennsylvania on November 2, 2010 (Pennsylvania, n.d.). Prior to his election, the Climate change advisory committee released the 2009 report showing Pennsylvania contributed one percent of the greenhouse gas emissions for the entire planet (*Climate change*, n.d.). In addition, the report ranked Pennsylvania third highest for carbon dioxide emissions and fourth highest for coal production among the states in the United States (*Climate change*, n.d.). Unlike Governor Rendell, Governor Corbett was less concerned about climate change and Pennsylvania's role in causing climate change. A chair from the state Department of Environmental Protection's Climate Change Advisory Committee, Christina Simeone, stated, "There's real questions about whether the Corbett administration believes that human-induced climate change exists (Cusick, 2013)." Not surprisingly, no significant climate legislation was passed during Governor Corbett's term as Governor.

Following the Corbett administration, Governor Tom Wolf was elected in 2015 (Pennsylvania, n.d.). The Wolf administration emphasized the importance of climate mitigation. Climate mitigation focuses on reducing or removing greenhouse gas emissions from the atmosphere (Press, A., & Rubinkam, 2022). During the Wolf administration and today, the leading proposal in the United States for addressing global climate change is some form of a market-based cap and trade system (Avi-Yonah, R. S., & Uhlmann, D. M., 2009). The first cap and trade system in the United States was implemented in the 1990s to reduce acid rain levels (Avi-Yonah, R. S., & Uhlmann, D. M., 2009). Like the Wolf Administration at the state level, the cap-and-trade system was a focal point of federal legislation during the Obama Administration.

A cap-and-trade system seems to offer something for everyone. Cap and trade systems promise a declining cap on carbon emissions through economic incentives. A cap-and-trade

system is a market-based policy that provides incentives as polluters reduce their carbon emissions. The system provides motivation for industry groups to reduce their carbon emissions through a market called carbon allowances (Avi-Yonah, R. S., & Uhlmann, D. M., 2009). Cap and Trade also tend to align with economists' beliefs because it allows the market to consider externalities as it determines the price of carbon. Politicians appreciate a cap-and-trade system because it allows them to act against climate change without implementing a tax on fossil fuel companies (Avi-Yonah & Uhlmann, 2009).

The Regional Greenhouse Gas Initiative (RGGI) is a cooperative, market-based effort that represents the first cap-and-invest regional initiative implemented in the United States (*RGGI, 2020*). RGGI was created in 2009 and currently has eleven member states: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia. RGGI operates by setting a region-wide carbon dioxide cap electric utilities can produce. Electric utilities can emit more than the cap by purchasing emissions allowances at quarterly auctions (*RGGI, 2020*). The allowances permit electricity generators to emit one metric ton of CO₂ per allowance purchased. The cap reduces over time, requiring more emissions reductions or payments for allowances (*RGGI, 2020*). The money collected from the allowances is then used to invest in various programs throughout the state (*Investments of proceeds, 2020*). Member states decide how they would like to invest proceeds. Still, the investments must fall into one of the five categories: energy efficiency, clean and renewable energy, beneficial electrification, greenhouse gas abatement, and direct bill assistance. In 2020, about 35% of the total money made from RGGI was invested in energy efficiency, and 19% of the money was invested in direct bill assistance (*Investments of proceeds, 2020*). This

procedure highlights the cap and investment components. Carbon emissions are capped, and money is reinvested in state practices that reduce climate change causing emissions.

An interstate policy like RGGI is complicated because political factors make it easier for certain states to join than others. Pennsylvania houses numerous natural resources, and the fossil fuel industry exercises significant political influence. In 2019, Governor Tom Wolf signed an executive order titled *Commonwealth Leadership in Addressing Climate Change through Electric Sector Emissions Reductions* (Cassie Miller, 2022). This order directed the Pennsylvania Department of Environmental Protection to draft a plan for Pennsylvania to enter RGGI. The DEP Environmental quality board approved the ruling in 2021, and Pennsylvania was expected to start participating in RGGI in 2022. However, on July 25, 2022, the Commonwealth Court of Pennsylvania blocked the state from pursuing the efforts to join RGGI (Cassie Miller, 2022).

The Pennsylvania Environmental Rights Amendment, established in the Pennsylvania constitution, is the backbone of the argument to implement a more aggressive climate policy in Pennsylvania, like RGGI. Article 1. Section 27 of the Pennsylvania Constitution states:

The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic, and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustees of these resources, the commonwealth shall conserve and maintain them for the benefit of all the people (Dcnr, 2021).

The Environmental Rights Amendment aided Governor Tom Wolf in his battle against the Republican-dominated General Assembly to join RGGI, but it did not hold up in court. Attorneys for Republican state lawmakers believed it imposed an unconstitutional tax on power plants (NPR, 2022). Republican state lawmakers and other industry groups argued the

Department of Environmental Protection does not have the legal state authority to decide if Pennsylvania joins RGGI (NPR, 2022). Finally, the lawyers argued the DEP did not go through the regulatory process properly because public hearings were held virtually instead of in person. The Pennsylvania Department of Environmental Protection released a modeling report to show what would happen if Pennsylvania joined RGGI. RGGI would slightly increase energy prices, Pennsylvania's carbon emissions would reduce by 26% by 2025, and carbon emissions will emit 80% by 2050 (RGGI, 2020). Although the Wolf administration was avid about joining RGGI, the new governor, Shapiro, has not committed to continuing efforts to join RGGI.

Another popular climate policy option is a carbon tax. Like a cap-and-trade policy, a carbon tax policy focuses on climate mitigation and is another example of a market-based policy (Avi-Yonah & Uhlmann, 2009). Also, like a cap-and-trade system, a carbon tax is often viewed as an effective strategy to limit carbon emissions. Despite being one of the world's biggest CO₂ emitters, the US currently does not have a carbon tax at a federal level. The Environmental Protection Agency proposed the first Carbon Tax proposal in the United States in 1992. In 1999, Congress introduced a bipartisan bill proposing a carbon tax, but it failed to pass (Avi-Yonah, & Uhlmann, 2009). A carbon tax allows the market to account for the societal costs of carbon dioxide emissions and promotes the reduction of on dioxide emissions at a large scale (Avi-Yonah, R.S., & Uhlmann, D.M., 2009). It is often cited as a climate policy that would be easy to implement and enforce. In addition, a carbon tax would also be a quick way to slow down carbon emissions because it could go into effect almost immediately (Avi-Yonah, R.S., & Uhlmann, D.M., 2009). The main concern with a carbon tax is the challenges of enacting any "tax" legislation in the United States. A cap-and-trade system may be easier to implement because it is not labeled as a "tax."

There have also been various regional efforts to pass a carbon tax. For example, Yoram Bauman, Seattle economist and founder of an advocacy group, Carbon WA, designed the first Carbon Tax on pollution to attract support from Conservatives on the right (Lavelle, M., 2020). Nevertheless, the Carbon Tax bill was rejected in a referendum in Washington State. It was a landmark attempt to reduce carbon emissions through a carbon tax (Lavelle, M., 2020). This bill's passing depended heavily on public opinion and perception. Most citizens in Washington state report concern about climate change, but the Carbon Tax bill did not pass (Lavelle, M., 2020).

There is potential for a Climate Action Tax Cut in Pennsylvania. This cut would give electric utilities a strong incentive to reduce emissions while saving taxpayers money. It works by cutting an existing tax on electricity, one that disproportionately burdens low-income households (U.S. Bureau of Labor Statistics, n.d.). The existing tax is the state's 5.9% Gross Receipts Tax on electric utilities (*Gross receipts tax, n.d.*). Although this tax is levied on the utilities, they pass it along to consumers, so it is basically a sales tax on everyday consumers.

The gross receipts tax, upon which Pennsylvania's Gross Receipts Tax is based, became popular in the United States following the Great Depression in the late 1920s and 1930s as state revenues tanked. Some states introduced the tax to create a stable source of revenue with a broad base, low rates, and low administration costs. Yet, the gross receipts tax is often viewed as one of the most economically damaging taxes (*Gross receipts tax, n.d.*). There are seven states alongside Pennsylvania with some form of a gross receipts tax.

A Climate Action Tax Cut would lower the Pennsylvania Gross Receipts Tax for utilities that hit certain carbon targets. This reward for reduction creates financial

incentives that mimic economists' favorite policy— a carbon tax—by using a carrot instead of a stick. According to Bauman: “climate action historically in this country has been in the purview of the Democratic Party (Lavelle, 2020).” Bauman described his climate action tax cut as follows: “This is a budget-friendly, business-friendly, market-friendly, sprocket-book friendly approach. We think that is a model for action in other states and in Washington, D.C (Lavelle, 2020).”

The Climate Action Tax Cut could work by setting up a benchmark equal to the average carbon intensity for utilities in the state in 2021 (*Pennsylvania Electricity Profile 2021*, n.d.). In future years, utilities that are unable to beat that benchmark would pay the Gross Receipts Tax at the current 5.9% rate. In contrast, utilities that lower their emissions below the benchmark would see a proportional reduction in their tax rate. A utility that can cut emissions to, for example, half of the carbon benchmark would see their tax rate cut in half. In the long run, there would be zero tax for utilities with zero emissions. Taxpayers would save up to \$800 million a year, which is a manageable tax cut in the context of long-run economic growth and the state's \$40 billion per year General Fund (*Statistical Supplement for the tax compendium*, n.d.). In the short run, this approach meets Governor-elect Shapiro's goal of not raising energy prices. Utilities can keep doing what they are doing now; at worst, they would continue to pay the existing 5.9% tax. The opportunity for lower taxes creates a strong incentive to reduce emissions. For an average utility, a Climate Action Tax Cut would be like a \$20 carbon tax. For comparison purposes, the RGGI program features the equivalent of a \$13 carbon tax (*Allowance prices and volumes*, n.d.).

Pennsylvania has a long and disjointed history of enacting climate policies. Initially, the state focused on diversifying energy resources to combat climate change, but this strategy shifted throughout the years to climate policy focusing on reducing carbon emissions. Enacting meaningful climate change policies has also been challenging, given Pennsylvania's mixed and somewhat inconsistent values on global warming. In 2021, only 56% of Pennsylvanians believed global warming is caused mostly by human activities (*Yale climate opinion maps, 2021*). However, 76% of Pennsylvanians reported they support funding research into renewable energy sources (*Yale climate opinion maps, 2021*). In addition, 66% of Pennsylvanians support requiring fossil fuel companies to pay a carbon tax (*Yale climate opinion maps 2021*). Pennsylvania voters are reporting an increasing concern about climate causing emissions. For example, in the 2022 midterm election, Pennsylvania voters reported they are more likely to support lawmakers who back limits on methane and carbon emissions (Micek, 2022). Although Pennsylvanians report concern about climate change, it is difficult for citizens to view climate change as an individual issue. Only 44% of Pennsylvanians think climate change will harm them personally (*Yale climate opinion maps, 2021*). Given the varied viewpoints, it is important to explore perceptions of the specific policies under consideration.

Chapter 4

Public Support for Policies

Public opinion plays a prominent role in determining policy change in democratic countries. Politicians and policymakers are often reluctant to implement or support policies if they know there will be strong public opposition. Still, they may be more likely to implement policy if they sense public support (Drews & van den Bergh, 2015). That said, climate policy in the United States is difficult to pass because it is a highly politicized topic. Fortunately, concern about climate change is increasing, and there is public consensus across the United States that steps must be taken to prevent climate change. In 2021, 61% of American adults reported Congress should do more to address global warming (*Yale climate opinion maps, 2021*). Furthermore, 57% of American adults (56% of Pennsylvanian adults) think their state governor should do more to address global warming (*Yale climate opinion maps, 2021*). Although citizens report desire for the federal and state governments to do more about global warming, this does not mean they will support any type of climate policy. Given the increase in concerns, citizens may be thinking more deeply about which climate policy they would support (Geiger et al., 2021; Swim & Geiger, 2022). These findings highlight the need to better understand the public perception of climate policy.

Research suggests individuals' perceptions of the anticipated impacts of climate policies can be subdivided into the following three categories: environmental impacts, economic impacts, and social impacts. There are negative and positive environmental, economic, and social impacts. One example of a positive environmental impact would be the policy reduces a state's contribution to climate change causing emissions. A negative environmental impact would be a

policy that cuts down forests to make way for solar energy panels. An example of a positive social impact would be a climate policy that improves human health. A negative social impact would be the policy destroys communities supported by the fossil fuel industries. Finally, an example of a positive economic impact would be a policy that decreases economic threats to farmers from climate change impacts. A negative economic impact would be the policy increases electricity costs. Research has shown the three impacts are correlated with climate policy support, and people make distinctions between them (Geiger, Swim, & Benson, 2021). People seem to be more supportive of climate policy if they can connect the policy to environmental, economic, and social reform. Various impacts have been summarized by the three pillars of sustainability. “The three-pillar framework proposes that sustainability results from pursuing and balancing three dimensions of sustainability: environmental (i.e., preserving ecosystem resilience and environmental quality), social (i.e., maximizing human health and well-being), and economic (i.e., maintaining production of vital goods and services over the long term; World commission on environment and development)” (Geiger, & Swim, 2021).

Although the three-pillar framework has received criticism, it remains the most widely used framework for defining sustainability (Geiger & Swim, 2021). Overall, individuals are more likely to support climate mitigation if the effect includes social and economic reforms in addition to environmental reforms such as affordable housing and job creation (Bergquist, Mildemberger, & Stokes, 2020). Research shows this connection is even more important for increasing climate policy support among people of color, the group of people most vulnerable to the effects of climate change (Bergquist, Mildemberger, & Stokes, 2020).

For the present research, we divided economic impacts into two groups: individual economic impacts and business-level impacts. There is discussion surrounding whether climate

policy should target individuals or businesses. Magnitude matching research suggests individuals think climate policy targeting larger corporations is more effective than climate policy targeting individuals (Geiger & Swim, 2021). People appear to believe it is easier for businesses to change than individuals (Geiger & Swim, 2021).

Research suggests mitigation policy support is determined through anticipated environmental, social, and economic impacts (Geiger et al., 2021), yet there are meaningful variations in these perceptions. The importance of perceived impact changes depends on where an individual lives. For example, individuals living in urban areas often show greater support for environmental policy. This support might be because they see the effects of air pollution more vividly (Bergquist, Mildenerger, & Stokes, 2020). In addition, regions dependent on carbon-intensive industries, like Pennsylvania, are often less supportive of climate policy regardless of environmental impacts (Bergquist et al., 2020). This lack of support may be because climate policy is viewed as negatively impacting industry jobs.

Other research has compared support for different types of policy. Participants preferred policies designed to change the source of electrical energy over policies intended to reduce energy demand (Geiger et al., 2021). In other words, people prefer transitioning from fossil fuels to renewable energy instead of reducing the overall demand for energy. In addition, participants preferred policies using incentives over disincentives. Yet, the preference for policies using incentives over disincentives was stronger for policies targeting individuals than policies targeting businesses (Swim & Geiger, 2021). The result was that a minority of people supported a policy disincentivizing individual use of electricity through their taxes. Still, most people supported disincentivizing a company's use of fossil fuels through a carbon tax (Swim & Geiger, 2021). It is evident support for climate policy is not random.

Chapter 5

Present Research

The research presents four impact questions:

RQ1) Which of three policies that could be implemented in PA (the RPS, RGGI, a Carbon Tax Cut) do PA residents like best?

RQ2) Does policy support vary by political party?

RQ3) What impacts do people anticipate?

RQ4) Are anticipated impacts related to policy support?

While we anticipate that Democrats would like the policies the most, we do not have a prediction about which policy they prefer. We hypothesized that perceiving favorable environmental, economic, and social impacts will be positively correlated with policy support.

Methods

Sample

A sample of 464 Pennsylvanians participated in our experiment, which was conducted through a web-based survey with participants recruited through Prolific's research platform (<https://www.prolific.co/>). Participants completed the survey created on Qualtrics. Participants who went too fast through the survey (less than one-third the mean completion times of 741 seconds) or were outliers in how long it took to complete the survey (greater than 6260 seconds). These exclusions resulted in a sample size of 364 participants. The study employed the IBM SPSS statistical software (version 21) to perform all statistical analyses.

Procedure

The participants were randomly assigned to read about one of the three policies or a control condition. The purpose of the control condition is whether specific policy descriptions improve or decrease support of general support for a policy. First, participants self-identified their political party identification with 18% identifying as Republican, 53% as Democrats, 24% as Independent, and 1% as not interested in politics or identifying with a different party because of the low frequency, and they may be unique from the other three categories. In analyses with political identity, we excluded participants who were not interested in politics or identified with a different party. Next, respondents were asked to what extent they understood the policy on a 100-point scale from “not at all” to “completely.” Average understanding was moderate ($M = 59.18$, $SD = 29.59$). A one-way ANOVA indicated no difference in understanding across the three policies and the generic. All the other questions used a seven-point scale from ‘strongly disagree’ to ‘strongly agree.’ Participants were asked about general policy support and political action. Finally, participants rated their agreement concerning statements about environmental impacts, social impacts, individual economic impacts, and business economic impacts for the policy they read.

Policy Descriptions

The following texts were presented to participants. Each text was approximately the same length, composed of 141 to 145 words and eight sentences. The descriptions were as follows:

Carbon Tax Cut:

Electric utilities generate electricity or distribute electricity to businesses and residents who pay for the electricity. Pennsylvania electricity comes mostly from coal (25%), natural gas (27%), and nuclear Power (43%). Burning coal and natural gas to produce electricity creates CO₂, which is a climate change/greenhouse gas causing emissions.

Currently, the Gross Receipts State Tax charges electric utilities 5.9% on their sales. Although the utilities pay the tax, they may pass their costs to residents and businesses who purchase electricity.

The proposed Carbon Action Tax Cut would change the Gross Receipts State tax by reducing the amount of taxes utilities pay if they hit CO2 reduction targets. That is, their taxes are less if they decrease their CO2. Their reduced costs may reduce the amount they charge to residents and businesses who choose to purchase their electricity from the utilities that lower their emissions.

Regional Greenhouse Gas Initiative (RGGI)

Electric utilities generate electricity or distribute electricity to businesses and residents who pay for the electricity. Pennsylvania electricity comes mostly from coal (25%), natural gas (27%), and nuclear Power (43%). Burning coal and natural gas to produce electricity creates CO2, which is a climate change/greenhouse gas causing emissions.

The Regional Greenhouse Gas Initiative (RGGI) sets caps on the CO2 that utilities can produce. Electric utilities can emit more than the cap by purchasing emissions allowances at auctions. The cap reduces over time, requiring more emission reduction or payments for allowances.

If they buy allowances rather than reduce emissions, they may pass the cost to residents and businesses who choose to purchase electricity from utilities that had to pay for the allowances. Money from purchased allowances supports energy efficiency, bill assistance, clean and renewable energy, clean transportation, and replacing fossil fuels with electricity.

Renewable Portfolio Standards (RPS)

Electric utilities generate electricity or distribute electricity to businesses and residents who pay for the electricity. Pennsylvania electricity comes mostly from coal (25%), natural gas (27%), and nuclear Power (43%). Burning coal and natural gas to produce electricity creates CO₂, which is a climate change/greenhouse gas causing emissions.

The Renewable Portfolio Standard (RPS) sets requirements that affect electric utilities. The RPS requires electric utilities to include a certain percentage of their electricity to come from renewable sources such as wind, solar, biomass, and geothermal.

This requirement reduces the amount of electricity generated from fossil fuels. Thus, the amount of CO₂ that these companies create is reduced. However, if utilities had to pay additional to meet the RPS, that cost may be passed along to businesses and residents who choose to purchase electricity from utilities that had to pay that cost.

Generic Policy

Electric utilities generate electricity or distribute electricity to businesses and residents who pay for the electricity. Pennsylvania electricity comes mostly from coal (25%), natural gas (27%), and nuclear Power (43%). Burning coal and natural gas to produce electricity creates CO₂, which is a climate change/greenhouse gas causing emissions.

The State of Pennsylvania is looking over its current climate change policies and considering renewing or passing a new Pennsylvania Climate Change Policy. The policy would most likely impact Pennsylvania electric utilities. The policy would reduce the amount of CO₂ the electric utilities produce.

There are many different types of climate change policies that the state of Pennsylvania could adopt. Here we would like you to consider the general idea of a Pennsylvania Climate

Change Policy climate that has not been specified but would be implemented in the state of Pennsylvania.

Measures

Policy support and political action

Participants indicated their agreement with three questions concerning policy support and three questions concerning political action. Statements were randomly presented within the two sets of statements. After recoding the reverse coded items and averaging responses for each measure, participants were more likely to indicate support for the policies ($M=1.12$, $SD=1.46$) than be willing to take political action ($M=.66$, $SD=1.40$), $t(363)=12.16$, $p<.001$. Yet both measures strongly correlated with each other, $r(363)=.87$. Therefore, we averaged the two measures together to form one measure of policy support. The Statements were as follows:

Policy Support.

1. I support this policy.
2. I like this policy.
3. I am NOT in favor of this policy (reverse coded)

Political Action.

1. I would support a political candidate who supported this policy.
2. I would donate money to a candidate supporting this policy.
3. I would call my representative to tell them to reject this policy.
4. I would sign a petition in support of this policy.

Anticipated Impacts

Participants were asked about their agreement with four sets of possible policy impacts: environmental impacts, social impacts, individual economic impacts, and business economic impacts. There were six statements in each section. Statements within the four sets were randomly presented. Three of the statements indicated a positive impact, and three indicated a negative impact. After recoding the negative statements, responses were averaged to create a measure for each of the four types of anticipated impacts. Below are the statements for each type of impact:

Environmental impacts.

1. Reduces Pennsylvania's contribution to climate change causing emissions.
2. Reduces the threat of climate change on ecosystems (e.g., water systems that affect water quality and availability, places where animals live).
3. Reduces threats of more intense natural disasters (e.g., flooding, heat wave, drought, wildfires).
4. Hurts wild animals (reverse coded).
5. Requires cutting down forests to make way for solar energy panels (reverse coded).
6. Increases pollution from making and disposing of batteries needed to store electricity (reverse coded).

Social impacts.

1. Improves human health (e.g., decrease severity of Asthma and other respiratory illnesses, heat stress and related deaths, spread of disease from disease causing insects not dying in winter).

2. Improves people's ability to engage in outdoor recreation opportunities reliant on stable weather patterns (winter activities, fishing, etc.).
3. Reduces the health harms to people with low incomes living near fossil fuel companies.
4. Expands the government's over-control of people's lives (reverse coded).
5. Destroys communities supported by fossil fuel industries (reverse coded).
6. Takes away money that could have been spent to address social problems faced in Pennsylvania (reverse coded).

Individual Economic Impacts.

1. Creates skilled trades and manufacturing jobs in Pennsylvania.
2. Decreases economic threats to farmers from climate change impacts (e.g., flooding, drought, heat stress on animals).
3. Saves money for the average Pennsylvanian (e.g., decreases electricity and health costs).
4. Increases PA residence electricity costs (reverse coded).
5. Creates unemployment for those working in fossil fuel energy (reverse coded).
6. Increases prices of food and other goods (reverse coded).

Business Economic Impacts.

1. Grows PA businesses that create renewable energy.
2. Increases profitable business investment in energy efficient technologies.
3. Improves PA businesses' ability to compete with China's growing energy economy.
4. Inappropriately interferes with the free market (reverse coded).
5. Increases Pennsylvania companies' expenses (reverse coded).
6. Hurts Pennsylvania coal and natural gas companies (reverse coded).

Results

RQ1: Which of three policies that could be implemented in PA (the RPS, RGGI, a Carbon Tax Cut) do PA residents like best?

A one-way ANOVA compared support for each of the four policies. Figure 1 shows participants somewhat to moderately supported each policy type. However, they preferred some policies over others, $F(3,364) = 2.80, p = .04$. Pairwise comparisons showed that participants support the Carbon Tax Cut ($M = 1.29, SD = 1.37$) significantly more than they support RGGI ($M = .81, SD = 1.60$), $p = .02$. Additionally, RPS ($M = 1.36, SD = 1.33$) is supported significantly more than RGGI ($M = .81, SD = 1.60$), $p = .01$. There were no other significant differences in support for the Carbon Tax Cut, RPS, and the Generic policy and the Generic policy did not differ from any of the policies $p's > .05$.

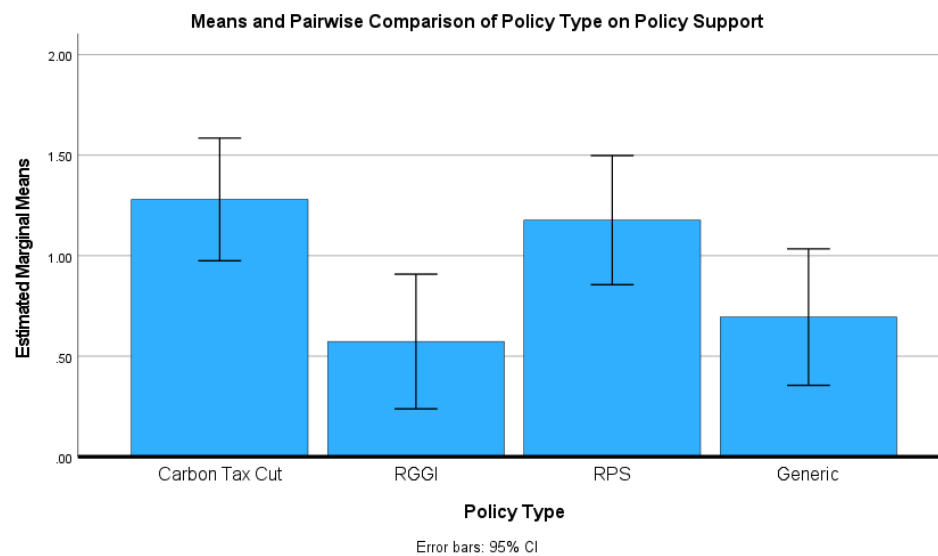


Figure 1. Means and Pairwise Comparison of Policy Type on Policy Support

RQ2: Does policy support vary by political party?

A 4(type of policy) x 3(political identity) ANOVA revealed a significant main effect of political identification on policy support $F(2, 348) = 15.86, p < .001$ (see Figure 2). Democrats ($M = 1.26, SD = 1.09$) support policies significantly more than Independents ($M = .69, SD = 1.43$), $p = .006$, and Republicans ($M = .19, SD = .17$), $p < .001$. In addition, independents support policies significantly more than Republicans $p = .026$.

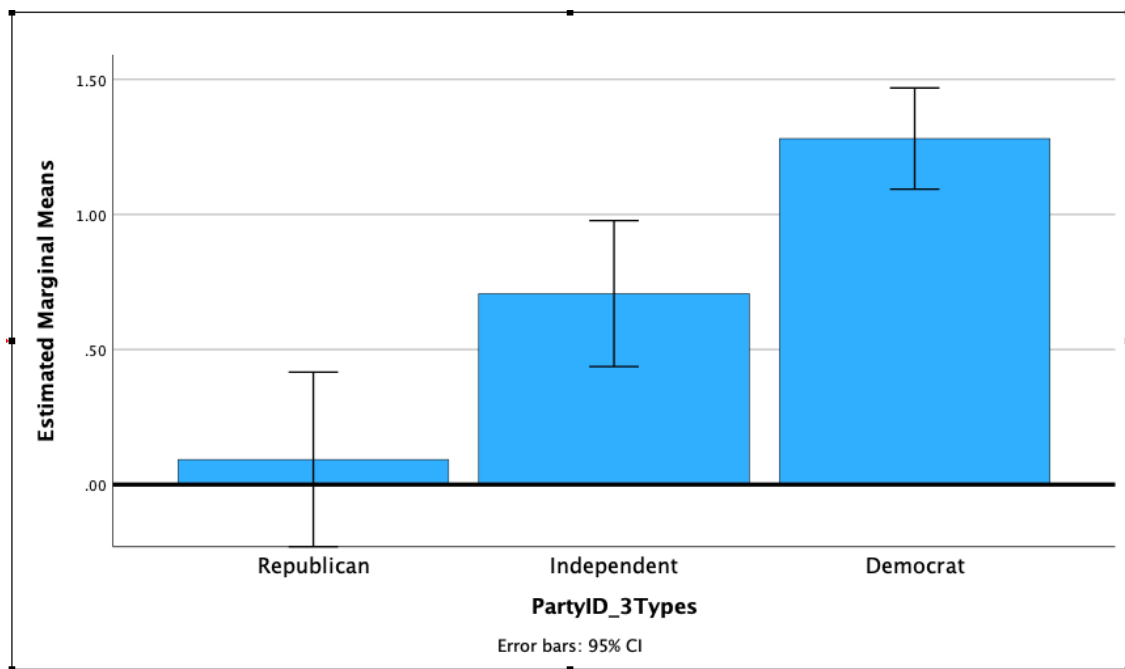


Figure 2. Means of Party Identification on Policy Support

In addition, there was a significant interaction effect of political identification and policy type on policy support, $F(6, 336) = 2.69, p = .02$. This suggests that participants' support of policy depends on which policy they are looking at alongside their political party identification. This 4 x 2 ANOVA also illustrated an interaction between policy type and party type (see Figure 3). Republicans preferred the Carbon Tax Cut ($M = 1.14, SD = 1.21$) than RGGI ($M = -.43, SD = 2.04$), $p = .001$, and the Generic policy ($M = -.56, SD = 2.05$), $p = .002$. For Independents and Democrats, there is no significant difference between support for the policies $p > .05$.

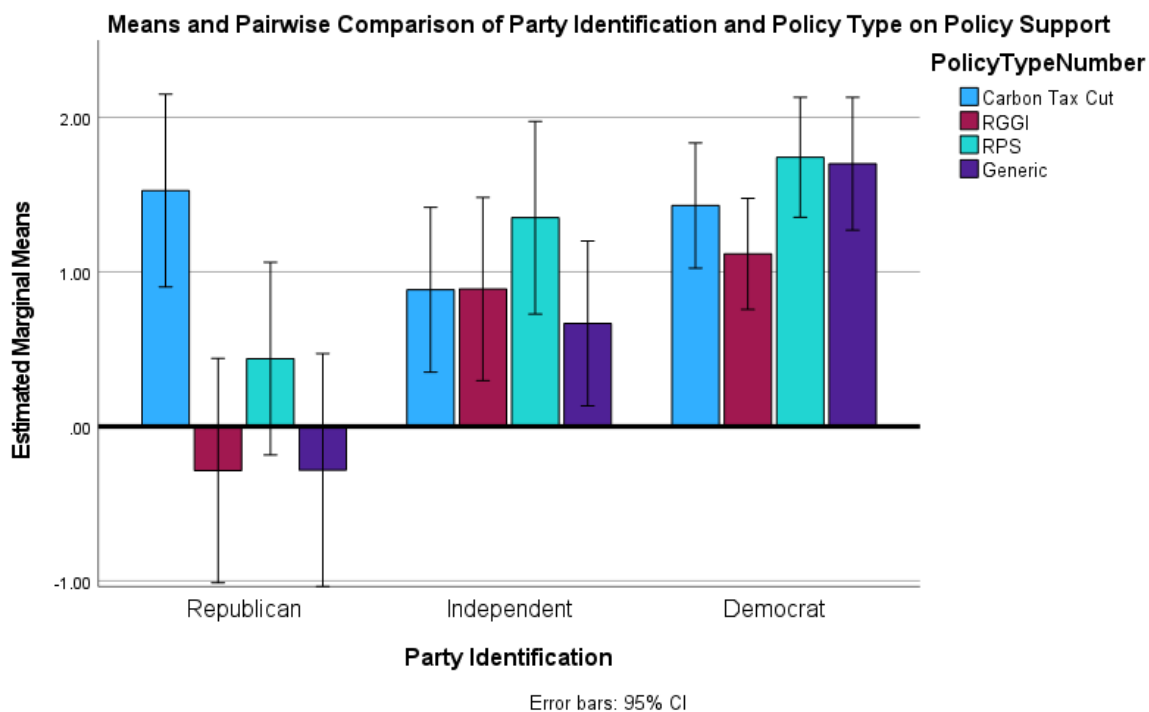


Figure 3. Means and Pairwise Comparison of Party Identification and Policy Type on Policy Support

RQ3: What impacts do people anticipate?

Participants anticipated positive impacts for all four types of impacts. Yet, a 4(type of impact) x4(type of policy) mixed ANOVA with repeated measures on types of impacts revealed there was a significant difference among the four types of impacts, $F(9,355) = 4.132$, $p < .001$. Figure 4 shows participants thought policies were significantly more likely to anticipate positive environmental impacts ($M = .95$, $SD = 1.03$) than social impacts ($M = .84$, $SD = 1.15$) $p = .013$, individual economic impacts ($M = .24$, $SD = 1.11$), $p < .001$, and business impacts ($M = .55$, $SD = .99$), $p < .001$. Participants thought policies were significantly more likely to have positive social impacts ($M = .84$, $SD = 1.15$) than individual economic impacts ($M = .24$, $SD = 1.11$) or business economic impacts ($M = .55$, $SD = .99$), p 's $< .001$. Participants thought policies were significantly

more likely to have positive business economic impacts ($M = .55$, $SD = .99$), $p < .001$, than individual economic impacts ($M = .24$, $SD = 1.11$).

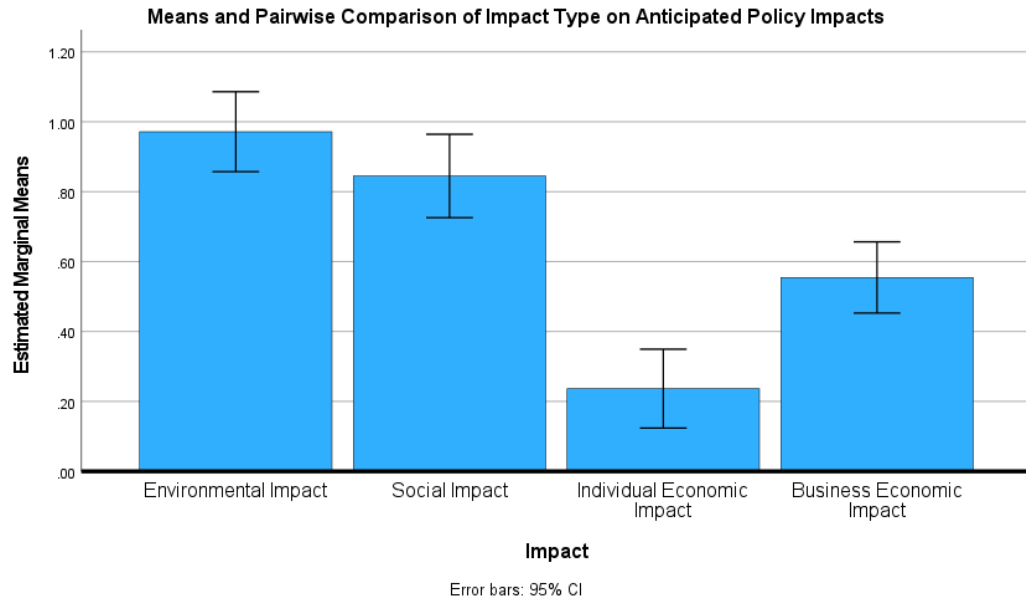


Figure 4. Means and Pairwise Comparison of Impact Type on Anticipated Policy Impacts

An additional analysis adding political identity to the ANOVA revealed indicated that Democrats anticipated more positive impacts ($M = .98$, $SD = .79$) than Independents ($M = .43$, $SD = .90$), who anticipated more positive impact than Republicans ($M = -.02$, $SD = 1.23$), with Republicans being neutral on their assessment of impacts, $F(2, 342) = 35.00$, $p < .001$. There was no interaction between type of impact and political identity, $p = .06$, and among type of impact, type of policy, and political identity, $p = .26$.

Anticipated impact varied among policies, especially the individual economic impacts, $F(9, 1080) = 4.13$, $p < .001$ (see Figure 5). The results indicate that there are no differences in anticipated impacts for the positive environmental impacts, social impacts, and business impacts, $p > .12$. Differences emerge for the individual economic impacts, $F(3, 360) = 5.32$, $p = .001$.

Participants anticipated more positive individual economic impacts for the Carbon Tax Cut ($M = .59, SD = .98$) than RGGI ($M = .02, SD = 1.14$), $p = .002$, and the Generic policy ($M = .07, SD = 1.28$), $p = .01$. Anticipated positive individual economic impacts for RPS ($M = .27, SD = .95$) did not differ statistically from the Carbon Tax Cut, RGGI, or the Generic policy.

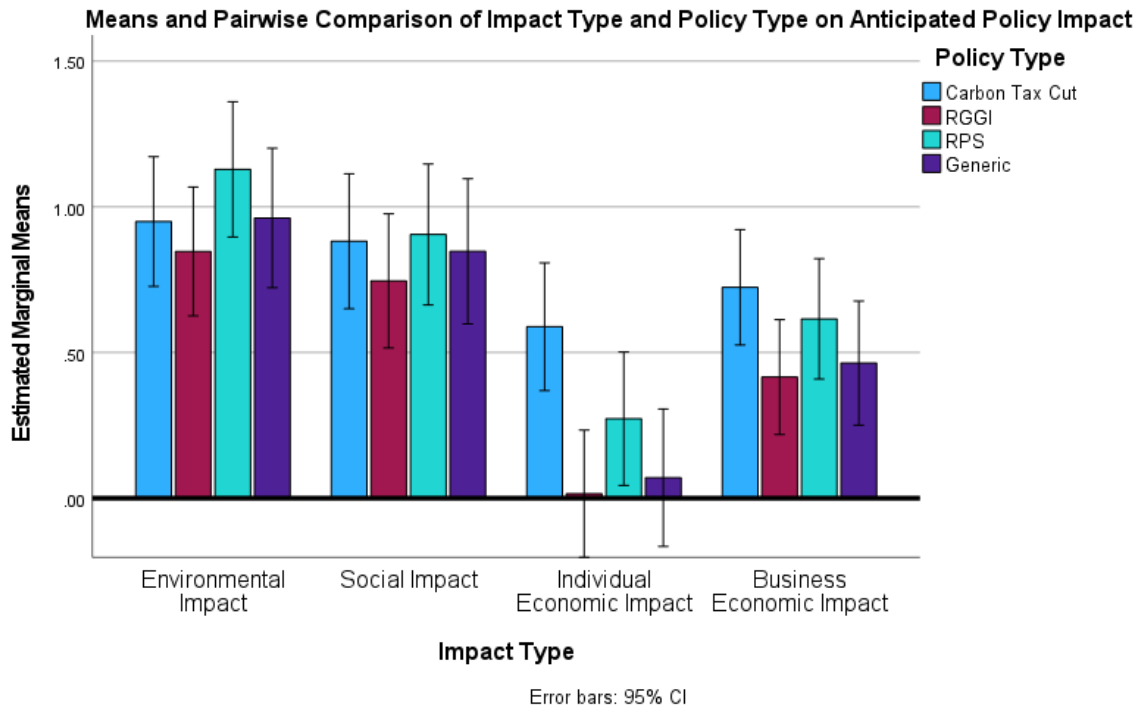


Figure 5. Means and Pairwise Comparison of Impact Type and Policy Type on Anticipated Policy Impact

RQ4: Are anticipated impacts related to policy support?

The more positive environmental impacts, social impacts, individual economic impacts, and business economic impacts, the more participants supported the policy. Environmental impacts, $r = .62, p < .001$, social impacts, $r = .73, p < .001$, individual impacts $r = .71, p < .001$, and business economic impacts, $r = .70, p < .001$, are positively correlated with policy support.

Chapter 6

Discussion and Conclusion

By considering public opinions, this research provides useful information on the viability of enacting Pennsylvania climate policy options. Averaged across political party identification, participants significantly preferred the Carbon Tax Cut over the Regional Greenhouse Gas Initiative (RGGI). Moreover, the policy supported equally across party lines was the Carbon Tax Cut policy. While Republicans, relative to Independents and Democrats, were least supportive of climate change policies in general, Republicans liked the Carbon Tax Cut policy more than RGGI, the Renewable Portfolio Standard, and the Generic policy. In contrast, Independents' and Democrats' support did not differ across the policy type. These results indicate that the Carbon Tax Cut policy could be a good option for future climate policy in Pennsylvania because it appeals to Democrats, Republicans, and Independents.

As expected, participants were more supportive of policies they perceived as having more positive environmental, social, individual economic, and business economic impacts. More positive personal benefits for the Carbon Tax Cut policy may be why participants, particularly Republicans, liked this policy the best. These two findings are important information for future policy makers. They highlight the importance of connecting and communicating all four types of climate policy impacts. Moreover, it is particularly important to communicate individual economic impacts because it appears to drive preferences for the Carbon Tax Cut for Republicans. It is possible that communicating positive individual economic impacts and countering the negative individual economic impacts of the other policies could result in Republicans being more receptive to them.

Some of the limitations of the research include the length of the policy descriptions and laws in Pennsylvania. The policy descriptions were short, participants, on average, moderately understood the policies (see Method section), and some respondents said in open-ended comments they would understand the policies better if they had more information or graphic visuals. Furthermore, Pennsylvania does not have public referendums, so the impact of public opinion on policy support will be indirect through political actions. Thus, in Pennsylvania, the impact of people's opinions on policy descriptions is not as direct as in other states that have referendums. This lack of referendums could make it difficult to garner support because average agreement with political action statements was lower than those for the policy support (see Method section).

Pennsylvania energy policies have evolved from diversifying energy sources to include more renewable energy to a focus on reducing climate change causing emissions. Most discussions to date have involved joining RGGI and a supportive Renewable Portfolio Standard. The present research suggests the public prefers a Carbon Tax Cut when implemented via reducing the graduated tax. The results, and other research (Swim & Geiger, 2022), suggest support for the Carbon Tax Cut is preferred because it is the only policy that uses incentives to motivate change, and those incentives will benefit individuals economically. The Pennsylvania Advisory Committee for Environment and Energy should advise Governor Shapiro to also consider the Carbon Tax Cut policy because it may be more politically advantageous. This policy could put Pennsylvania on a better track to combat its contribution to climate change.

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