The impact of climate change and air pollution information on support for CO_2 emissions regulations

Brian Sergi, Inês Azevedo, and Alex Davis
Department of Engineering & Public Policy, Carnegie Mellon University

Research question

How does information on the climate change and air pollution consequences of generating electricity affect how people think about tradeoffs in energy policies?

Introduction

Recent research has focused on quantifying the environmental, health, and climate change costs and benefits associated with changes in the U.S. power sector [1-2]. Less work has been done, however, on whether the public understands these different costs and benefits, and whether providing information about them would change support towards policies for reducing emissions from the power sector [3-4]. As the need to address climate change increases, understanding more about what information motivates people to support emissions reductions and how they value energy tradeoffs will be critical elements of advancing future climate policy.

Some previous work has begun to explore how individuals consider tradeoffs across different options for generating electricity [3,5] or the importance of health-related information in motivating changes to behavior or preferences related to energy [3,6]. This research builds on previous work by using a discrete choice survey with randomized experimental controls to test the effect of providing different information.

Methods – Survey design

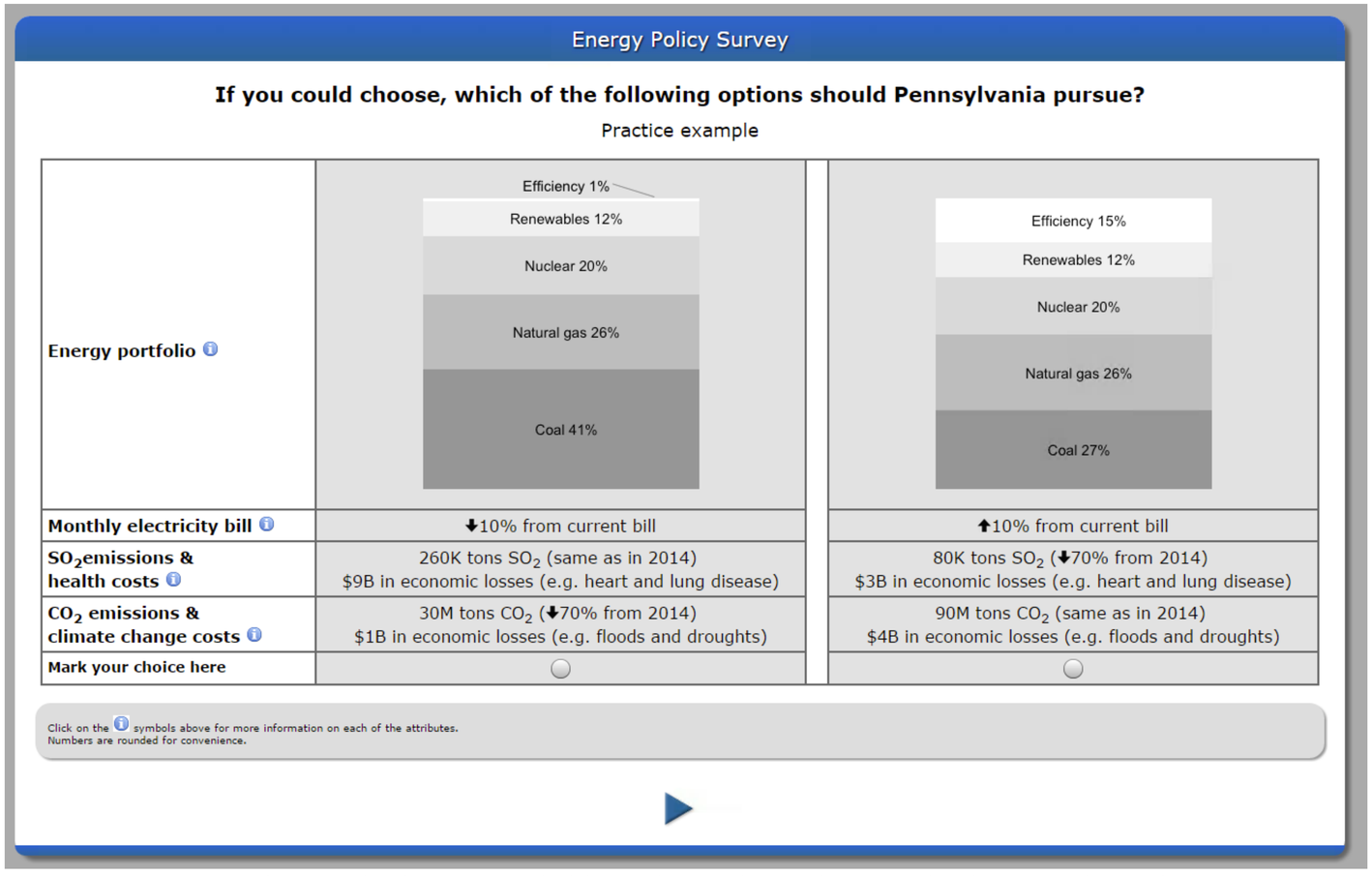
To test our research question, we will create and distribute a survey that asks people to make tradeoff-based choices between two energy strategies. This *discrete choice* structure is based on methods developed in marketing research and conjoint analysis [7] and has been used recently in research at Carnegie Mellon in the context of preferences for electric vehicles and light bulbs [8-9].

In this experiment, individuals will choose between energy strategies that are described by different combinations of the following attributes:

1) the portfolio of electricity generation technologies and extent of energy efficiency deployment
2) CO_2 emissions and the associated climate impacts
3) SO_2 emissions and the associated health impacts
4) economic cost, as a monthly electricity bill.

An example of the screens that individuals will see in the survey is given in the figure to the right. Respondents will face 10-15 of these types of choices.

In addition, follow-up questions will be used to gain an understanding of individuals' mental models for electricity generation and to collect demographics.



Example of the type of choice screens that individuals will see. This screen includes all 4 attributes (experimental Group E).

Methods – Experimental design

In order to test our research question, we will vary the attribute information shown to respondents across different experimental groups. The information shown to the different groups will be as follows:

A. Only energy portfolio (control group)
B. Energy portfolio + monthly electric bill
C. Energy portfolio + monthly electric bill + CO_2 emissions & climate impacts
D. Energy portfolio + monthly electric bill + SO_2 emissions & health impacts
E. All four attributes shown

We are currently pre-testing the survey to ensure that respondents understand the task and the information provided. After pre-testing, we will conduct a 50-person pilot test on Amazon Mechanical Turk (mTurk) in order to assess how much data we will need to collect to estimate any results. After pilot-testing we will distribute the survey to a large sample, again using Amazon mTurk. A supplementary local sample of Pittsburgh residents will also be collected, utilizing the Carnegie Mellon social science research truck for recruitment.

Methods – Analysis

Respondents' choices will analyzed using the following general utility model:

$$(1)\quad U_{G,i,j} = \sum \beta_{1,G,i} X_{MIX,j} + \beta_{G,2} X_{PRICE,j} + \beta_{3,G} X_{CLIMATE,j} + \beta_{4,G} X_{HEALTH,j} + \varepsilon_{G,i,j}$$

i = individual i
j = the alternative seen by the individual
G = the experimental group of the individual
ε = any unobserved factors

This model will be analyzed using both multinomial logit and mixed logit so as to allow for potential heterogeneity across individuals. After estimating these coefficients, the willingness-to-pay (WTP) for different energy portfolios will be compared across the experimental groups, as calculated by:

$$(2)\ \text{WTP} = \beta_{1\,(\text{MIX})} / \beta_{2\,(\text{PRICE})}$$

The models will also be analyzed with information on respondents' state residence to assess for regional variations in preferences, on their own understanding and perception of energy technologies, and against demographic information.

Anticipated results

We anticipate that each experimental group will have different WTP for each of the energy mix portfolios, and that the change in WTP will be greater for groups seeing health information relative to those seeing only climate impacts (reflecting omitted variable bias). We also expect that individuals in Group E will have a greater WTP for SO2 reductions than for CO2. Finally, we expect to see differences in WTP levels depending on the individuals' geographic location and knowledge, and we think individuals in states with greater air pollution will have higher WTP for emissions reductions.

These results would have important implications for the communication of emissions reductions policies, and would suggest value in re-framing the climate debate around the health consequences of electricity generation.

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Further information

For more information, contact Brian Sergi at bsergi@andrew.cmu.edu.

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