

Research in Experimental Economics
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Experiments on Energy, the Environment, and Sustainability

R. Mark Isaac
Douglas A. Norton
Editors

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EXPERIMENTS ON ENERGY, THE ENVIRONMENT, AND SUSTAINABILITY

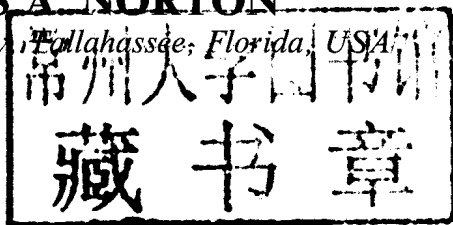
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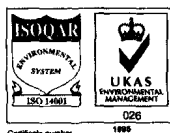
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INTRODUCTION

R. Mark Isaac and Douglas A. Norton

ABSTRACT

Purpose – This chapter is the introductory chapter for the volume.

Approach – We begin with “A Fable for Our Time” and discuss the role that laboratory experimental social science research can play in policy issues regarding energy, the environment, and sustainability. We follow this general discussion with a chapter-by-chapter summary of the volume.

PREFACE: A FABLE FOR OUR TIME (AND TWO TRUE STORIES)

Tallahassee, Florida is in many ways a typical, progressive American university/state capital city. It voted overwhelmingly for Al Gore, John Kerry, and Barack Obama. And in the recent past, it engaged in a spirited debate on a proposal to loosen city ordinances that restrict the ability of the municipal electric utility to generate electricity from coal.

During the coal debate, the possibility of so-called “alternative energy” generation was widely discussed. So, it seemed only natural that in January 2007 the local newspaper, the *Tallahassee Democrat*, praised the decision of the City Council and Florida State University to work together with a private corporation to build an alternative energy, biomass electric generation facility at an industrial park. The newspaper said that the plant “fit the bill neatly”

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as the type of action the community endorsed during the coal debate, with a view toward “‘green’ energy” alternatives to coal. The editorial was replete with references to the Kyoto Protocol, reductions in global warming, and “thinking globally and acting locally.”

In October 2008, the state Department of Environmental Protection announced that it intended to issue a permit for the plant. It might seem surprising, therefore, that having received the approval of the city, one of the city’s two universities, and the state of Florida, that only three months later, in January 2009, the private company involved in the plant, BG&E, pulled out. In shutting down the project, the company issued an angry letter in which BG&E President S. Glenn Farris attacked Tallahassee’s civic leadership, specifically calling the behavior of a County Commissioner “disgraceful” ... “demagoguery, fear mongering, and race bating.” The commissioner in question in turn called the demise of the facility a “victory” for Tallahassee.

If the biomass facility had passed such obvious political and legal hurdles as the city council vote, the cooperation of the university, and the DEP permitting process, what had happened? What had happened was that the biomass proposal had split the city of Tallahassee, and (most remarkably) the local environmental community, over the issue of environmental protection. On one side, represented by the *Democrat’s* initial editorial, were those who saw the plant as providing environmental benefits from a carbon-emissions perspective. On the other side were neighbors of the proposed facility (and their representatives) who saw the plant as little more than an “incinerator” emitting a “toxic plume” near their homes. The story of the ultimate success of the opponents of the plant was not in winning any legislative or regulatory victories in the formal process for siting power facilities. Instead, the opponents organized for action outside these narrow channels. In addition to making their opposition well known through local political channels, they petitioned (unsuccessfully) for the federal Environmental Protection Agency to withhold federal funds from the state DEP. They lobbied (successfully) for the empanelling of a county grand jury to investigate the agreements behind the biomass plant.

The tenor and the intensity of the debate can be seen, in part, from the headlines on editorials and opinion pieces in the *Democrat*: “Clean Deal” and “If Not Biomass, What?” on the one hand, and “Biomass Plant May Kill More Black Babies” on the other. Apparently, there was one thing upon which both sides could agree. One resident in the neighborhood of the plant said, “I don’t have a problem with them, I just have a problem with them being right there.” And, as the executive editor of the *Democrat* said, “No, I wouldn’t like a power plant of any type in my neighborhood either.

But these plants are going to have to go somewhere – and soon – to save the planet and reduce our reliance on foreign oil.”¹

Meanwhile, in December 2009, ADAGE biopower corporation announced plans for a similar biomass plant in the city of Gretna, a high unemployment, low income, rural community on the edge of the Tallahassee metropolitan area. At first glance, it appeared that some of the obstacles that overturned the Tallahassee plant might be avoided with the ADAGE plant. Gretna is in Gadsden County which has a large minority population that is well represented on local and county political bodies. Indeed, the roll-out of the plant included the endorsement of Gretna Mayor Reed Willis, Gadsden County Commission Chairman Eugene Lamb, and Florida State Representative Alan Williams, all African-Americans. According to the *Havana Herald* (Havana, Florida is a neighboring town) “Williams praised the Gretna Council, City Attorney Harold Knowles and City Manager Antonio Jefferson for bringing ‘green jobs’ to Gretna. ‘We like projects like this.’” The plant would operate on wood chips, and lumber was already a local industry in the heavily forested part of North Florida. Groundbreaking was scheduled for mid-year of 2010.

After less than two months, a visit to the *Havana Herald* indicated a changed situation. The *Herald* was hosting a “Pro-Con” debate on the plant, between a representative of ADAGE and James Malloy, a nearby resident identified as a representative of “Concerned Citizens of Gadsden County.” Malloy said, “Unlike the people in the county who stand to financially benefit from this Biomass Incinerator, your doctor will tell you the truth.... I challenge ADAGE and the proponents of the Biomass Incinerator to deliver a practicing board certified medical professional with a valid medical license and 36 months worth of bank statements showing no large deposits to guarantee that this facility will be as good for our health as they would like us all to believe.” Mr. Malloy’s organization provided the expertise of Dr. William Sammons. Research on the web shows that a Dr. William Sammons is associated with EcoLaw Massachusetts, which has a long-standing national position opposed to biomass projects. On their web site, an October 20, 2009 letter from Dr. Sammons and attorney Margaret Sheehan to U.S. Senators Amy Klobaucher and Lamar Alexander urged the U.S. Senate to make changes in pending public works legislation that they claim gave preferential treatment to biomass facilities. On January 27, 2010, Sheehan and Malloy issued a press release on a web site identified as “Don’t Burn Gretna” in which they announced that a coalition of 48 citizen and environmental groups “launched a nationwide campaign to end federal financing for biomass incinerators being called ‘green energy.’” Opponents

highlighted the location of the facility as “adjacent” to a public school. After about three months of the debate (according to 850 Business Magazine), the city of Gretna called for a six-month period to study the issue before final approval. ADAGE then cancelled its plans for the facility.²

INTRODUCTION

In our modern environmental fable about Tallahassee, it becomes clear that the success or failure of important decisions with the next generation of energy and environmental issues will not be decided on physical sciences or engineering alone. Rather, the human element will be central in facilitating or opposing new technologies. People will weigh the costs and benefits to them and their neighbors of new policies and facilities and then decide whether or not to act or voice their opinions and concerns. This suggests that social scientists, economists, political scientists, psychologists, and sociologists, should have important roles in these debates.

For example, Mancur Olson, in his classic work, *The Logic of Collective Action* (1965), modeled how groups organize for the collective action needed to support or oppose an alternative energy facility. One feature of such facilities is that their benefits may be spread across a large number of people, while the costs may be concentrated on a much smaller community. This is the essence of the so-called NIMBY (“Not in My Back Yard”) problem.³ Social scientists are able to make predictions about what policies or institutions make organization for or against NIMBY projects more or less successful, where “success” can be defined according to a number of different criteria.⁴ Likewise, other social scientists may have a formal explanation as to why the opposition to the Gretna facility relied so much on a national network of opponents of biomass across the United States.⁵

In fact, social scientists frequently provide models and analyses with implications for energy and environmental policy. But here, as elsewhere in the social sciences, laboratory experimental methods have proven a valuable research tool that complements theoretical and field-data analysis. The advantage of laboratory research is straightforward: the ability to reduce uncertainty associated with policy analysis.

Numerous permutations and combinations of environmental policies are submitted to state and local governments as well as the national stage. Yet, we have an imperfect picture of the kinds of outcomes produced by these policy changes and the new equilibria that will emerge in different institutions.

Political economist Frederic Bastiat speaks to the problem of counterfactuals in *What is Seen and What is Not Seen* (1995),

[Mankind] has to learn this lesson from two very different masters – experience and foresight. Experience teaches effectually, but brutally. It makes us acquainted with all the effects of an action, by causing us to feel them; and we cannot fail to finish by knowing that fire burns, if we have burned ourselves. For this rough teacher, I should like, if possible, to substitute a more gentle one. I mean Foresight. For this purpose I shall examine the consequences of certain economical phenomena, by placing in opposition to each other those which are seen, and those which are not seen.

We can never perfectly observe how changes in policy will change outcomes until we have experienced such outcomes. On the other hand, the fact that economists have regaled the policy community with nightmares of unintended consequences makes a strong case for foresight. Sometimes this foresight can be obtained from a rudimentary understanding of economic theory or the development of new theory, but, frequently, questions about policies are empirical in nature. Therefore, if we wish to avoid that brutal but effectual teacher called experience we must set forth a method for peering into the counterfactuals.

Experimental economics is specially equipped for this task because complex economic problems can often be distilled into some essential features. The control afforded from the simplified environment allows the experimenter to carefully manipulate the incentives faced by human decision-makers. The data generated from the experimental process allows the economist to glimpse into this counterfactual world when other available methods would not.

With respect to experimental research and issues in the environment some of the largest traditional literatures deal with methods for managing the commons, with contingent valuation, and with emissions permit markets. Contingent valuation and emissions markets are vital tools for valuing nonmarket environmental goods or exporting market incentives to price public bads. In fact, the last time the *Research in Experimental Economics* series published a volume on environmental experiments was *Volume 7: Emissions Permit Experiments*. The 1999 publication was timely because it emerged during a time when the sulfur dioxide permit markets were being developed. That volume in conjunction with other research revealed something every economist and policy-maker knows: the devil is in the details. From those experiments on market power, permit property rights, and different trading institutions, we know the legal rules and economic context of the game produce very different outcomes.

To add one more example, if we consider our fable from Tallahassee one could easily foresee experimentalists recreating the essential features of these

NIMBY processes in the laboratory. Then, the experimentalist could manipulate committee procedures in that experimental environment and analyze how those different procedures influence outcomes.

In this volume of *Research in Experimental Economics*, we carry forward the experimental methodology and aspire to paint a broad picture of how experiments can provide foresight into environmental policy. In addition to chapters on permit trading markets, this volume explores such topics as urban sprawl, eco-tourism, firm-level production decisions, and rule compliance. Chapters 2–7 were submitted for consideration and reviewed by external referees. We believe they add to growing experimental literatures as policy-makers continue seeking guidance and justification for what kinds of outcomes are produced by different sets of rules. We invited Professor David Cartes, the director of the Florida State University Institute for Energy Systems, Economics, and Sustainability to give us his views, as an environmental engineer, of social science research in these areas.

Chapter 2: Our first two chapters provide the closest links to Volume 7 of *Research in Experimental Economics (Emissions Permit Experiments)*. Volume 7 was published in the wake of the policy debates surrounding the U.S. emissions markets in sulfate emissions which followed amendments to the Clean Air Act. Today, emissions markets (or their equivalents in common property resource problems) encompass a variety of environmental control issues. Most notable have been proposals for market-based control programs for carbon emissions. In Chapter 2, Burtraw, Goeree, Holt, Myers, Palmer, and Shobe investigate the critical relationship between the centralized (typically government-sponsored) auctions for such permits and the concurrent, often more decentralized ongoing secondary and futures markets. The centralized markets play an important role in providing price information that can be incorporated into the secondary markets. The authors evaluate the ability of several different types of auction markets to provide in an efficient manner this price discovery information when there is a large, unanticipated change in the demand for permits.

Chapter 3: Botelho, Fernandes, and Pinto also examine issues of the design of the centralized auctions for emissions permits, addressing the important policy issue of the design of the process for initial allocation of the permits. The two most common systems involve either prior allocation (often called “grandfathering”) or direct auctioning. In comparing grandfathering versus direct auctions, an innovative feature of this research is that the rules and parameters are chosen to mimic the European Union’s “ETS” (Emissions Trading System) for greenhouse gas emissions.

Chapter 4: Many experimental papers involving emissions permit markets censor the action space for decision-makers with respect to pollution; put another way, these experiments presume perfect compliance with rules. However, in naturally occurring settings firms can pollute more than their permit allows. Cason and Raymond extend a preexisting experimental economics and accounting literature by investigating compliance in an emissions permit market. Consistent with previous experiments they find that increasing the probability of punishment for violators increases compliance. But, Cason and Raymond also provide the nonintuitive result that framing the experiment in an environmental context reduces compliance.

Chapter 5: Each firm requires some technology for the production of goods or services in the marketplace; however, in the naturally occurring economy the pollution propensities of those technologies will be heterogeneous. Pevnitskaya and Ryvkin investigate how firms make production decisions when they have more- or less-polluting technologies. Their analysis reveals some key insights for policy-makers. First, they confirm an intuitive and well-researched finding that learning quickens when losses are higher. That is, if people are able to feel the immediate costs of pollution they curb their production decisions. From that result, Pevnitskaya and Ryvkin comment that rules that encourage or enforce less production would be helpful. Second, if legal rules encouraging or enforcing less pollution do not exist firms could attempt to set informal norms for lower production.

Chapter 6: Other firm activities beyond compliance and production decisions impact the environment. Swope, Wielgus, Schmitt, and Cadigan (SWSC) call attention to a well-advertised but not well-understood problem of land acquisition. The success of acquiring the necessary parcels for developing land hinges upon transaction costs and the strategic problem of holding out to be the last seller. To the extent that transaction costs and strategic bargaining problems reduce successful acquisitions, businesses will develop land in new and different locations. This has direct implications for urban sprawl and land fragmentation. SWSC investigate how the details and rules of bargaining such as time horizon, sequential bargaining, and contingent contracts influence the success of land acquisition. They find significant differences across bargaining rules with contingent contracts reducing bargaining failure while other rules such as sequential bargaining and longer time horizons exacerbate bargaining failures and costs.

Chapter 7: Many environmental experiments are oriented toward government action, but, Lopez, Blanco, and Coleman utilize eco-tourism in Majorca, Spain to conduct a field experiment on the joint action of government and

voluntary processes. Because the large amounts of eco-tourism in Majorca caused environmental degradation there was a need for improved conservation. Political unpopularity made taxation of local residents to cover these damages infeasible. Lopez, Blanco, and Coleman investigate how different levels of taxation on tourists and a one-to-one matching mechanism on charitable contributions influence the overall funds raised for conservation. They find that higher taxes reduce charitable giving, but, not one hundred percent. This implies that the largest funds were raised when the taxes and voluntary gifts were combined.

Chapter 8: In two previous volumes of *Research in Experimental Economics*, we have invited scholars from outside the academic community to provide their thoughts on experimental research in the volume's topical area. In some cases, our contributors were not themselves experimental economists. In this volume, we have followed that precedent with an even broader invitation. Many of our colleagues in the Institute for Energy Systems, Economics, and Sustainability (IESES) are noneconomists. While the value of studying the scope and performance of political and economic institutions is well understood by them, that understanding may not be shared by everyone in the scientific and engineering community. David Cartes, an associate professor of mechanical engineering, a member of the Center for Advanced Power Systems, and the director of IESES, writes as an engineer about the importance of social science research in areas of energy and sustainability. After reviewing the future of improvements to the electric power grid, transportation, and land use for alternative energy, he concludes "At this time, our society needs exceptional energy policy as much or more than it needs direct technology investment."

In closing, we would like to thank David Cartes not only for contributing a chapter to this volume but also for his pioneering work in bringing about the IESES program at Florida State. Without IESES funding, we would never have been in a position to produce this volume. In addition, we would like to thank the many referees who contributed, without compensation, to the production of the volume. Finally, the professional staff at Emerald Publishing have been exceedingly helpful in our tasks as editors of this series.

NOTES

1. The narrative for the story of the biomass plant is documented in a number of articles, editorials, and opinion pieces in the Tallahassee *Democrat*. In the Appendix, we provide a listing of the citations we quote and reference for this section.

2. In the Appendix, we also provide the citations for the narrative of the Gretna plant.

3. Wind, geothermal, and solar projects have experienced NIMBY opposition.

4. One such criterion may be for the absolute success rate of such proposals. A different criterion might be for the frequency in which the success rate lines up with unobservable costs and benefits. A third criterion might propose that, whatever the outcome, it be made with a minimal amount of rivalrous expenditure of time and effort on both sides.

5. This is indeed the subject of research we are conducting with our colleague Svetlana Pevnitskaya, who is also a coauthor of Chapter 5. A shorter version of the “Fable for Our Time” appeared as an introduction to a conference version of our joint work (Isaac, Norton, & Pevnitskaya, 2010).

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APPENDIX

The sources for the events in the introductory fable for our time regarding the Tallahassee biomass plant are stories, editorials, and opinion pieces from the Tallahassee *Democrat*, and were accessed from the *Democrat's* archive at www.tdo.com (payment and registration required). The following sources were quoted or cited:

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2. “DEP to Permit Biomass,” Bruce Ritchie, October 28, 2008.
3. “Biomass Debate Coming to a Boil,” Bruce Ritchie, November 19, 2008. “Incinerators.” “Plume of toxins.”
4. “Biomass Plant May Kill More Black Babies,” opinion piece, Edward Holifield, November 20, 2008.

5. "If Not Biomass, What?" signed editorial, Bob Gabordi (Executive Editor), December 2, 2008. "I wouldn't want a power plant of any type in my neighborhood, either. But ... "
6. "NAACP Challenges Biomass Site," Bill Cotterell, December 6, 2008. Request for EPA to withhold funds from Florida DEP.
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2. "Pro-Con," *Havana Herald*, February 25, 2010.
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PRICE DISCOVERY IN EMISSIONS PERMIT AUCTIONS

Dallas Burtraw, Jacob Goeree, Charles Holt,
Erica Myers, Karen Palmer and William Shobe

ABSTRACT

Objective – This chapter examines the performance of the market to discover efficient equilibrium under alternative auction designs.

Background – Auctions are increasingly being used to allocate emissions allowances (“permits”) for cap and trade and common-pool resource management programs. These auctions create thick markets that can provide important information about changes in current market conditions.

Methodology – This chapter uses experimental methods to examine the extent to which the predicted increase in the Walrasian price due to a shift in willingness to pay (perhaps due to a shift in costs of pollution abatement) is reflected in observed sales prices under alternative auction formats.

Results – Price tracking is comparably good for uniform-price sealed-bid auctions and for multi-round clock auctions, with or without end-of-round information about excess demand. More price inertia is observed for “pay as bid” (discriminatory) auctions, especially for a continuous discriminatory format in which bids could be changed at will, in part because “sniping” in the final moments blocked the full effect of the demand shock.

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