

## **How Effective are Individual Lifestyle Changes in Reducing Electricity Consumption? - Measuring the Impact of Earth Hour**

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**Abstract:** This paper examines a unique natural experiment where Sydney residents turned off lights and electrical appliances for one hour. While polls reported 57% of Sydney participated, statewide electricity use declined by 2.10%, statistically indistinguishable from zero. This indicates that discretionary household electricity use like lighting forms only a small component of total electricity consumption, and policies targeting such use may be of limited impact. Using poll data on participation and previous estimates of household electricity consumption, evidence indicates that respondents overstated their involvement by around 36%. This is consistent with consumers feeling pressure to overstate their preferences for environmental goods.

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## 1. Introduction

On March 31<sup>st</sup> 2007 at 7:30pm, the residents of Sydney, Australia, held an Earth Hour, where people were urged to turn off their lights and electrical appliances for one hour. This event was organized by the WWF Australia, an environmental group. A poll by AMR Interactive, reported in newspaper The Sydney Morning Herald<sup>1</sup>, found that 57% of respondents had participated in Earth Hour, corresponding to roughly 2.4 million people. 53 per cent turned off the lights at home, 25 per cent switched off their computer and 17 per cent turned off the television.

This event provides a unique natural experiment to test two questions of importance in economics. First, it allows for a measure of the size and importance of discretionary household electricity consumption, which has implications for the ability of energy-saving policies aimed at households to achieve cuts in electricity use and greenhouse gas emissions.<sup>2</sup> Second, it provides a test of whether individuals overstate their preference for social goods in the presence of interviewer scrutiny, and the reliability of poll evidence in examining preferences for such goods.

In terms of the size of discretionary household electricity use, I find that state-wide electricity use declined by a statistically insignificant 2.10% during Earth Hour, equivalent to a drop of 168-173 MW/h. In economic terms, the voluntary cuts to electricity consumption that Sydney households are willing to bear (even even for an hour) in the name of environmental events produces only a very small decline in New

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<sup>1</sup> <http://www.smh.com.au/articles/2007/04/01/1175366081038.html>

<sup>2</sup> The measured drop in Earth Hour will necessarily not capture household use from items of a less-discretionary nature which were unlikely to be turned off, such as refrigerators, water heaters, pool pumps etc. For estimates of the size of household use of these appliances, see Bartels and Fiebig (2000)

South Wales electricity use. This further suggests that policies targeting discretionary household electricity use may not be of large environmental impact.

Moreover, the estimated electricity declines suggest that poll respondents significantly overstated their level of involvement in the event. Using the results of an AMR Interactive poll of 926 Sydney residents and electricity end-use estimates of lighting and television from Bartels and Fiebig (2000), it is possible to compare actual and predicted declines in electricity use and obtain a measure of whether respondents appeared to have over- or under-stated their level of involvement in the event. I find that the predicted electricity decline during Earth Hour based on Sydney participation was 236 MW/h. The ratio of the actual and predicted electricity declines suggests that respondents overstated their level of participation in the event by around 36%. This indicates that poll results may significantly overstate consumers' true willingness to make sacrifices for environmental issues.

This paper adds to the literature in environmental economics that seeks to estimate of the size and importance of household electricity use. Most of the previous literature on the subject has focused on either smaller scale individual metering data (Bartels and Fiebig (2000)) or structural models of consumption (Narayan and Smith (2005), Larsen and Nesbakken (2004), Saab, Badrb and Nasra (2001), among others). In terms of measuring household consumption, the Earth Hour experiment is unique in that it not only covers a very large number of households, but also allows for reduced form estimates of household consumption, rather than relying on a particular structural model of household use. Most similar to the current paper is Kendrick and Wolff (2007), who estimate the effect of daylight saving on total electricity consumption.

Second, it presents further evidence on the problems of taking consumers stated preferences for social goods as indicating the actual value they place on them. A long literature in this area relates to hypothetical bias, the tendency of people to overstate their preferences for goods when asked hypothetical questions (see for instance List and Shogren (1998) and List (2001)). This paper documents even more basic problem - that in questions of environmental goods, consumers cannot even be relied on to accurately report their own *actions* ex post (rather than their valuations of goods ex ante). In a broader sense, it shows importantly that consumers may feel pressure in surveys to claim to have preferences for environmentalism, even if they privately do not (over and above whether they are being forced to make hypothetical estimates)

There are a number of reasons why consumers might overstate their involvement in such an event. Levitt and List (2007) develop a model where an individual's choice of behavior depends in part upon the moral cost of the action, which is a function of the level of scrutiny the actions receive - people are less likely to undertake morally costly actions when there is more scrutiny. If being perceived to be environmentally unfriendly has moral costs, then respondents who did not take part in Earth Hour may hesitate to reveal this fact when faced with a poll situation. This could result in them either declining to participate in the poll at larger rates than those who were involved<sup>3</sup>, or lying to interviewers about their level of involvement (if these two alternatives are seen as less

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<sup>3</sup> Merkle and Edelman (2000) argue that different response rates do not necessarily affect prediction error, although they do not examine the possibility that refusal may vary systematically across groups, rather than randomly.

morally costly to them than admitting to being environmentally unfriendly). Either way would see the poll results overstating true participation in the event.

Indeed, the polls themselves suggest such overstatement. Although 57% of respondents took part in some level, only 53% turned off lights, notwithstanding that this was the main promotion point of the event. In other words, at least 7% of claimed participation in the event came from people who didn't even turn off any lights, but claimed participation based on switching off some 'other appliance', which may or may not have otherwise even been on in the first place. While this is only suggestive, it is consistent with respondents preferring to classify themselves as participating (or pollsters facing similar pressure), even when they had only limited levels of involvement.

This finding is related to the literature in political science on the accuracy of opinion polls (see Converse and Traugott (1986)), and in particular exit polls in elections, where respondents are asked to report on past actions rather than opinions per se. There is evidence that exit polls may overestimate the support for socially desirable causes (Traugott and Price (1992)), and that this effect is larger for face-to-face interviews than secret ballots (Bishop and Fisher (1995)). As a more positive policy result, the results of this paper would suggest that more accurate measures of preferences can be obtained by using less intrusive questioning techniques, such as handing out anonymous questionnaires rather than conducting face-to-face or phone interviews.

Using intraday data on 8 years of New South Wales electricity consumption, I find that there is limited evidence that Earth Hour caused a statistically significant decrease in electricity consumption. Following Kellogg and Wolff (2007), I estimate electricity use with a baseline regression that controls for year, month, day-of-week and

time-of-day fixed effects, daylight saving, retail electricity price, and weather-related variables, as well as interaction terms. Furthermore, I show that simply taking the difference between actual and predicted consumption (as press accounts purported to do<sup>4</sup>) can produce erroneous inferences based on the presence of omitted variables. While the controls above seem likely to control for much of household use (such as lighting, heating and cooling etc), it is unclear how well they explain industrial electricity usage. This is likely to fluctuate with firm inventory requirements, short term demand, and a variety of other economic variables for which daily and intraday measures are hard to come by, and which may not be captured by time fixed effects.

Consistent with this, while a Dummy Variable for Earth Hour shows a reduction in electricity use of 6.33%, or 551-567MW/h, over 67% of this effect is due to omitted factors common throughout the entire day. When an Earth Day dummy is included as well, the Earth Hour effect is statistically indistinguishable from zero, with a point estimate of a drop 2.10%, or 168-173 MW/h.

While it is possible that some of this Earth Day effect may be coming from consumers switching off appliances earlier in the day in response to the event, I present a variety of evidence that this is unlikely to be a large driver of the difference between the two estimates. Firstly, equivalently large percentage declines as during the 7:30-8:30pm

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<sup>4</sup> The effect of this was reported as being a drop in electricity use in the Central Business District of 10.2%, according to an analysis by Energy Australia, that purported to control for time-of-day, weather, and month effects. Results, without details on the specifications used, are available at [http://www.energy.com.au/energy/ea.nsf/AttachmentsByTitle/070402+Earth+Hour+wrap+up/\\$FILE/070402+Earth+Hour+wrap+up.pdf](http://www.energy.com.au/energy/ea.nsf/AttachmentsByTitle/070402+Earth+Hour+wrap+up/$FILE/070402+Earth+Hour+wrap+up.pdf)

Earth Hour were observed as early as 5am and persisted fairly uniformly throughout the day, indicating that the bulk of the declines were due to variables operating before sunrise. Second, an effect of turning off lights in preparation for the event ought to become more pronounced as Earth Hour approached. In fact, a dummy variable for the 6:30-7:30pm hour shows a weakly positive sign (after controlling for the day effect), suggesting that if anything consumers brought forward electricity demand that they might otherwise have had, thus the drop during the hour itself ought to have been even more pronounced.

Third, a spokesperson for Integral Energy, the company that maintains the electrical network, claimed that “We noticed a steep decline in the first five minutes of Earth Hour, between 7.30 and 7.35pm”<sup>5</sup>, confirming the intuition behind the event that the focus was on consumers turning off lights for that particular hour. Finally, I show that by simply comparing actual and predicted consumption, over 27.5% of days in the sample have two consecutive periods with consumption ‘Earth Hour’ sized gaps more than 6.36% below predicted values (the larger of the two Earth Hour period drops, using the base specification without any dummy variables). This confirms both that it is problematic to simply attribute any gap in consumption to Earth Hour, and that notwithstanding the long list of controls, omitted variables relating to industrial production still need to be accounted for, such as by a day fixed effect. This conclusion is consistent with Kellogg and Wolff (2007), who find a similar need to control for omitted variables when working with data from the same source and a similar list of controls.

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<sup>5</sup> <http://wwf.org.au/news/congratulations-sydney-earth-hour-2007-results/>

The rest of the paper is as follows: section 2 describes the data, section 3 presents estimates of likely changes in electricity use from poll results and Bartels and Fiebig (2000) estimates, section 4 presents regression tests of the electricity drop during Earth Hour, section 5 compares Earth Hour drops with declines during the rest of the day, and section 6 concludes.

## **2. Data**

Data on New South Wales electricity consumption are obtained from <http://www.nemmco.com.au>, at a half hourly frequency between January 1, 1999, and March 31, 2007. These include quantity consumed (in Megawatt hours) and retail price of electricity (in Australian Dollars). Weather data are obtained from the National Climatic Data Center at <http://www.ncdc.noaa.gov>. They give measures from the Sydney Airport station, including temperature (in degrees Fahrenheit), wind speed, classification of level of cloud cover, at an hourly (or shorter) frequency. Summary Statistics and correlations of the non-categorical variables are presented in Table I.

[Insert Table I here]

## **3. Estimated Effects from Bartels and Fiebig (2000)**

To estimate the likely drop in electricity use, it is possible to combine the survey evidence on Earth Hour participation with the Bartels and Fiebig (2000) estimates of residential end-use. The end-use estimates apply to an average working day in August, and so to the extent that they differ from a Saturday in March the estimates will be noisy.

On March 31<sup>st</sup> 2007, sunset in Sydney was at 5:52pm, compared with sunset times from 5:15pm to 5:36pm during August in 1997 (in Bartels and Fiebig (2000)), suggesting that lighting use estimates from 7:30pm to 8:30pm should not differ greatly due to the different seasons. The effect of the different time of year and day of week on computer use and television use is less clear, although these make up a much smaller component of the total estimated effect.

The AMR Interactive Poll found that 53% of respondents turned off lights, 25% turned off a computer, 17% turned off the television, and 25% turned off ‘other appliances’. In estimating electricity use from computers, I assign the likely use the same as for televisions (as Bartels and Fiebig (2000) do not provide a specific computer estimate). I ignore the ‘other appliances’ category, because it is not clear what this corresponds to – it is unlikely that households switched off some more energy-intensive appliances such as refrigerators, freezers, pool pumps, or hot water systems. The level of participation for cooktops, ovens, dryers and dishwashers is less obvious. To the extent that these are not included, the estimates will underreport the likely drop in electricity consumption. Further, while the event was targeted largely at households, to the extent that any businesses took part the true likely drop will again be greater than the numbers here.

Table II presents the results of these estimates. Estimated electricity use is calculated assuming the survey participation data covers only Sydney (population 4.28m according to June 2006 Australian Bureau of Statistics figures, in column 3), or all of New South Wales (population 6.82m according to June 2006 Australian Bureau of Statistics figures, in column 4). The estimated drops are 236 MW/h and 374 MW/h. I take

the lower of the two, which assumes only Sydney residents took part, as a conservative estimate of the likely electricity reduction based on the poll numbers.

[Insert Table II here]

#### 4. Regression Tests of Earth Hour Effects

There are a variety of approaches that can be used to model electricity demand. Narayand and Smyth (2005) use a cointegration approach to estimate annual electricity consumption in Australia, while Saab, Badrb and Nasra (2001) use autoregressive models to estimate monthly electricity consumption in Lebanon. It is not clear that autoregressive models are necessarily appropriate for modeling much higher frequency consumption, where autoregression may be drowned out by within-day cyclical factors. Closest to the current question is the work of Kellogg and Wolff (2007), who use a panel regression framework to estimate the effects of daylight saving on half-hourly data from Australian electricity consumption. The structure and choice of variables used here is based on Kellogg and Wolff (2007). To test whether Earth Hour caused a significant drop in electricity use, I use a regression framework. I estimate the equation:

$$\ln(\text{Consumption}_t) = \alpha + \beta_1 \text{EarthDay}_t + \beta_2 \text{EarthHour}_t + \beta_3 \text{PreEarthHour}_t + \beta_4 \text{PostEarthHour}_t + \beta_5 \text{Controls} + \varepsilon_t$$

where  $\ln(\text{Consumption})$  is the natural log of New South Wales electricity consumption in MW/h (for that half-hour period),  $\text{EarthDay}$  is a Dummy Variable that equals 1 on March 31st 2007 and zero otherwise,  $\text{EarthHour}$ ,  $\text{PreEarthHour}$  and  $\text{PostEarthHour}$  are

Dummy Variables that equal 1 for demand from 7:30pm-8:30 pm, 6:30pm-7:30pm, and 8:30pm-9:30pm respectively on March 31 2007, and zero otherwise. *Controls* includes a large number of variables that affect electricity consumption. Dummy Variables are included for year, month, day of the week, time of day (per half hour, for a total of 47 variables), and whether Daylight Savings is occurring. Additional controls are included for the retail price of electricity in Australian Dollars, and the most recently available Sydney Airport weather observations: the quadratic temperature (that is,  $(T-65)^2$ , where T is the temperature in degrees Fahrenheit), wind speed, and Dummy variables for the level of cloud cover. Additional controls are included for the interaction of the half-hour time dummy variables with daylight saving, day of the week, month, and the weather variables. The interaction terms thus allow these variables to have different effects at different times of the day, rather than forcing them to be constant.

[Insert Table III here]

The results of these regressions are presented in Table III. Column 1 examines the effect of *EarthHour* variable without day fixed effects. *EarthHour* is statistically significant. The coefficient is  $-0.065$ , with a t-statistic of  $-1.90$ , significant at a 10% level. The point estimate for *EarthHour* corresponds to a decrease in electricity consumption of 6.33% relative to what it would otherwise have been, equal to 551MW/h from 7:30-8pm and 567 MW/h from 8-8:30pm<sup>6</sup>.

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<sup>6</sup> Percentage changes in consumption are obtained by converting predicted log consumption to predicted consumption by taking an exponent, and then taking the percentage changes. This is equivalent to  $\exp(\beta)-1$ ,

Column 2 examines the average drop during the whole day of March 31<sup>st</sup>. *EarthDay* shows a statistically significant coefficient in both specifications, of  $-0.046$  (t-statistic of  $-6.43$ , percentage drop of 4.66%).

Column 3 examines the effect of *EarthHour* once a day fixed effect is controlled for. Once the *EarthDay* fixed effect is controlled for, the *EarthHour* effect is greatly reduced, and loses any remaining significant explanatory power. The *EarthHour* coefficient is  $-0.021$  (t-statistic of  $-0.60$ , percentage decrease of 2.10%, decreases of 173 MW/h and 168 MW/h).

These results show quite strongly that the Earth Hour effect is of only weak statistical significance, and even this is sensitive to the inclusion of a fixed effect for the whole day, whereupon the drop in electricity use during Earth Hour is statistically indistinguishable from zero. Controlling for the day fixed effect reduces the estimated *EarthHour* effect by 67.6%.<sup>7</sup>

Column 4 examines the question of whether electricity consumption was larger before and after Earth Hour, and indicates that there was not a significant increase in consumption before or after due to substitution effects. The coefficients on *PreEarthHour* and *PostEarthHour* are insignificant in all cases. The magnitude of these changes is of

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where  $\beta$  is the *EarthHour* coefficient in Table III. To convert percentage declines to MW/h declines, the percentages above are multiplied by the predicted value of log consumption from the same regression if the *EarthHour* variable were equal to zero during the hour in question.

<sup>7</sup> The *EarthHour* coefficients and significance are even weaker if the *EarthDay* coefficient is substituted with a Dummy that equals 1 on March 31<sup>st</sup> after 6:00am (if the effects were due to people's waking activity), or for a Dummy that equals 1 between 5:30pm and 10:00pm (to compare Earth Hour with the immediate surrounding times).

the similar size as the *EarthHour* effect in this specification : *EarthHour*, *PreEarthHour* and *PostEarthHour* show coefficients of  $-0.021$ ,  $0.010$  and  $-0.010$  (column 4, corresponding to percentage changes of  $-2.10\%$ ,  $0.99\%$  and  $-0.98\%$ ).

The interpretation of the results in Table III is that the lower consumption during Earth Hour was driven primarily by factors common to the entire day, rather than people actually turning off their lights during the main period of the event. Since the estimates are for statewide electricity consumption, if it is assumed that only Sydney residents took part, then the estimated drop measured in MW/h will be correct, but it will represent a larger proportion of Sydney electricity use (relative to New South Wales). On the assumption that only Sydney residents took part (62.9% of the New South Wales population) and that total electricity use is spread evenly per capita, this would amount to a Sydney-wide reduction of 3.34% of total electricity use under the column 3 specification.<sup>8</sup> If it is assumed that that all of New South Wales took part, then 2.10% represents the entire decline as a percentage of electricity use (over the relevant area).

Moreover, the omitted variable controlled EarthHour / EarthDay specification produces estimates of the Earth Hour effect that are smaller than the estimated effects from Table II. The poll-use estimate of 234 MW/h estimate based on Sydney participation represents a 36-40% overstatement of true participation levels based on the 168-173 MW/h decline. This is consistent with Earth Hour non-participants either lying to pollsters about their involvement, or refusing to participate in the poll at a higher rate than Earth Hour participants.

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<sup>8</sup> Based on Australian Bureau of Statistics 2006 Population estimates,

## 5. Predicted and Actual Electricity Use Around Earth Hour

To show further that the apparent electricity decline during Earth Hour was in fact mainly an effect over the whole day, Figures 1 and 2 present visual evidence that the declines during Earth Hour were not unusual even within the day of March 31<sup>st</sup>, 2007. Figure 1 plots actual electricity consumption versus the consumption predicted from regressions of consumption on just the Control variables (including the interaction variables).

[Insert Figure 1 here]

Consistent with Table III, the gap between predicted and actual electricity consumption is large throughout the whole day, but is not especially large during the two data points corresponding to Earth Hour. In other words, the claimed size of the drop due to Earth Hour is not visible in the data. In order to better see the size of the decline during the day, Figure 2 plots the difference between predicted and actual consumption as a percentage of the predicted value.

[Insert Figure 2 here]

Based on the raw residuals from the base regression (rather than the estimated effect of the Dummy variable, as was calculated earlier), the drop in electricity

consumption during Earth Hour was 6.36% (547 MW/h) lower than expected from 7:30-8pm, and 6.18% (518MW/h) lower than expected from 8-8:30pm. On the other hand, equivalently large percentage declines were observed virtually throughout the day, starting as early as 5am, as seen in Figure 2. For drops this early, it suggests that the variables causing the day-long decline were present even before sunrise. It is stretching credibility to claim that changes in electricity use this early in the morning were due to consumers reacting to Earth Hour at this point in the day, and consequently the entire day of March 31<sup>st</sup> looks unusual, not just Earth Hour. In fact, directionally consistent with intertemporal substitution, the only points in Figure 2 that look unusual are 6-6:30pm and 6:30-7pm, where actual use was closer to predicted values. This pattern makes it difficult to attribute the early decline during the day to consumers switching off appliances early in the day as part of Earth Hour, as it would require them to have turned off appliances early, turned them back *on* from 6-7pm, and turned them off again at 7:30pm.

The second question is whether the declines from predicted values during Earth Hour are unusual in terms of the whole sample. Ranking all periods in terms of percentage declines from predicted values, the 7:30-8pm period was ranked only in the 86.17th percentile of largest unexpected declines (that is, just inside the top 14% of biggest unexpected declines), while the 8-8:30pm period was ranked 86.86<sup>th</sup> percentile of unexpected declines. Another way to test the significance of the results is to find out how many days in the sample observed two consecutive periods with unexpected declines greater than 6.36% (the higher of the percentage declines between the two Earth Hour periods). There were a total of 831 days with two consecutive periods having unexpected declines of more than 6.36%, out of a total of 3011 days. In other words, slightly more

than 27.5% of days in the sample have Earth Hour sized differences between predicted and actual electricity consumption, making it highly problematic to simply attribute the difference between predicted and actual consumption during Earth Hour as being due to the event itself, and indicating that some method (such as a day fixed effect) is needed to control for omitted variables.

## **5. Conclusion**

The Earth Hour natural experiment presents a number of lessons for economics, and in particular environmental economics. While it is unclear whether the aim of the event was to actually reduce electricity significantly or simply raise awareness, the reductions in electricity use nonetheless provide a valuable measure of the size of discretionary household electricity use. The estimated drop in consumption is sensitive to whether a day effect is included to control for possible omitted variables, but all measures suggest that discretionary household electricity use is only an economically small component of total electricity use. While I argue that the most reliable measure is of a decrease in statewide electricity use of 2.10%, even excluding the day control produces an estimated effect of only 6.33%.

At a basic level, this indicates that the vast majority of electricity use comes from either industrial use, or household use that is more difficult to change in the short term. This is consistent with Bartels and Fiebig (2000), who find that the largest components of annual household electricity use are water heaters (2666-3885 kW/h depending on type), refrigerators (993kW/h for households with only a single refrigerator), freezers (648

kW/h) and pool pumps (1311 kW/h), as opposed to light use (560 kW/h). Given that the large focus of Earth Hour was on switching off the lights, the modest decrease in electricity use reflects the fact that environmental policies targeting household light use are unlikely to have a large effect. Indeed, the estimates in Bartels and Fiebig (2000) would have suggested that Earth Hour would almost certainly have had a larger effect on electricity use had it been billed as a ‘turn off your pool pump for an hour’ event, or a ‘take a cold shower for the day’ festival.

This large-scale natural experiment thus suggests that policies aimed at reducing electricity use may be better targeted at areas other than residential light use. Notwithstanding that changes here are easy to make, the aggregate effect of any change is likely to be small. Turning off the lights altogether provides an upper bound for the likely effect of energy efficient light bulbs, for instance.

Furthermore, the 36% discrepancy between estimated electricity reductions and likely values implied by poll measures mean that caution must be taken in inferring consumers preferences for environmental goods from poll results. The current findings suggest that consumers feel pressure to overstate their preferences for environmentalism when surveyed by pollsters. This is particularly troubling in this context, because the question involved was not one of complex valuations of goods, but merely to truthfully report ex post levels of involvement. Data limitations on poll responses mean that it is not possible to distinguish between explanations involving non-participants either selectively refusing to take part in the poll or simply overstating their level of involvement.

In either case, theoretical arguments in Levitt and List (2007) and previous empirical results from the political science literature (Bishop and Fisher (1995)) indicate

that this problem could be reduced by designing surveys that subject respondents to less scrutiny. This could involve (as in Bishop and Fisher (1995)) anonymous questionnaires that are placed in sealed boxes upon completion, rather than phone interviews with an interviewer. Nonetheless, the results in this paper present further evidence in favor of the desirability of using market-based, revealed preference estimates of consumers' environmental preferences, rather than the stated preference measures implied by polls and surveys.

Indeed, the Earth Hour experiment suggests that consumers feel pressure to overstate their preferences for environmental causes relative to which costly actions they are actually willing to undertake, and that making changes to light and appliance use will likely result in only small changes to total electricity consumption. Neither of twould likely be heartening to the event's or

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**Table I - Summary Statistics and Correlations**

<b>Panel A - Summary Statistics</b>						
	<b>Mean</b>	<b>Std Dev</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>	<b>N</b>
<b>In(Consumption)</b>	9.00	0.17	9.02	8.44	9.49	140604
<b>Price</b>	34.26	179.29	23.04	1.47	9909.03	140604
<b>Temperature</b>	65.26	8.99	66	39	113	140298
<b>Wind Speed</b>	12.00	6.27	10	0	53	140492

<b>Panel B - Correlations</b>				
	<b>In(Consumption)</b>	<b>Temperature</b>	<b>Price</b>	<b>Wind Speed</b>
<b>In(Consumption)</b>	1	0.091	0.126	0.178
<b>Temperature</b>	0.091	1	0.071	0.195
<b>Price</b>	0.126	0.071	1	0.038
<b>Wind Speed</b>	0.178	0.195	0.038	1

This Table presents summary statistics and correlations for the log of New South Wales electricity consumption (in MW/h), electricity retail price (in Australian \$/MW/h) Sydney Airport Temperature (in degrees Fahrenheit), and wind speed (in knots). The data are from January 1, 1999 to April 1, 2007, with consumption and price available at a half-hourly frequency, and temperature at an hourly (or less) frequency, with each consumption matched to the most recent temperature.

**Table II - Estimated Drop in Electricity Consumption from End-Use Estimates**

<b>Source</b>	<b>Participation (Sydney)</b>	<b>Estimated Bartels &amp; Fiebig (2000) Use per Household 7:30-8:30pm (Watts)</b>	<b>Estimated Earth Hour Electricity Drop (Sydney, MW/h)</b>	<b>Estimated Earth Hour Electricity Drop (NSW, MW/h)</b>
Lights	53%	300	208.1	331.6
Television	17%	50	11.1	17.7
Computer	25%	50	16.4	26.1
<b>Total</b>	<b>57%</b>	<b>400</b>	<b>235.6</b>	<b>375.4</b>

This Table presents estimates of the likely effect of Earth Hour on New South Wales electricity use. Participation data come from a poll by AMR Interactive. Estimates of household end-use come from Bartels and Fiebig (2000) for the period 7:30pm-8:30pm, with the 'Computer' category being approximated by television electricity use. The column 'Sydney' is calculated based on participation by Sydney residents (4.28 million), while the 'NSW' column uses participation by all of New South Wales (6.82 million). The Bartels and Fiebig (2000) mean estimate of 3.27 people per household is used to covert population figures to household figures.

**Table III - Regressions of Electricity Demand on Earth Hour Variables**

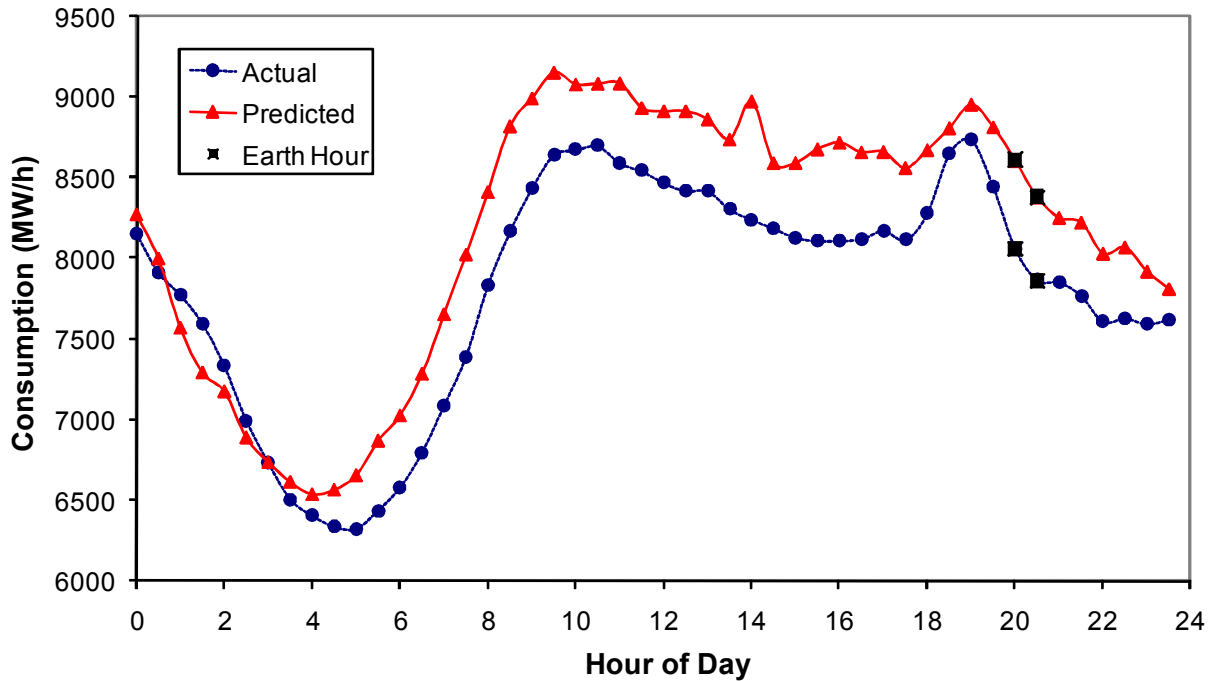
Independent Variable is ln(NSW Electricity Consumption in MW/h)

<b>Intercept</b>	<b>8.936</b> ***	<b>8.937</b> ***	<b>8.937</b> ***	<b>8.937</b> ***
	(0.006)	(0.006)	(0.006)	(0.006)
<b>Earth Hour Dummy</b>	<b>-0.065</b> *		<b>-0.021</b>	<b>-0.021</b>
	(0.035)		(0.035)	(0.035)
<b>Earth Day (24 hours) Dummy</b>		<b>-0.046</b> ***	<b>-0.045</b> ***	<b>-0.045</b> ***
		(0.007)	(0.007)	(0.008)
<b>(Earth Hour-1) Dummy</b>				<b>0.010</b>
				(0.035)
<b>(Earth Hour + 1) Dummy</b>				<b>-0.010</b>
				(0.035)
<b>Controls</b>				
<b>(Time, Day, Month, Year, DL Saving, Price, Weather)</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
<b>Interactions</b>				
<b>(Day, Month, DL Saving, Weather)*Time</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
<b>Total # Control Variables</b>	<b>1256</b>	<b>1256</b>	<b>1256</b>	<b>1256</b>
<b>R2</b>	<b>0.9170</b>	<b>0.9171</b>	<b>0.9171</b>	<b>0.9171</b>
<b>N</b>	<b>140604</b>	<b>140604</b>	<b>140604</b>	<b>140604</b>

This Table presents the results of regressions of New South Wales electricity consumption on a large number of controls and variables to measure the effect of Earth Hour, March 31<sup>st</sup> 2007 from 7:30pm-8:30pm. The dependent variable is the log of New South Wales electricity consumption (in MW/h). Independent variables are dummy variables that equal 1 during the specified period and zero otherwise. 'Earth Hour Dummy' covers observations between 7:30pm and 8:30pm on March 31<sup>st</sup> 2007, 'Earth Day (24 Hours) Dummy' covers all observations on March 31<sup>st</sup> 2007, '(Earth Hour-1) Dummy' covers all observations between 6:30pm and 7:30pm on March 31<sup>st</sup> 2007, and '(Earth Hour+1) Dummy' covers all observations between 8:30pm and 9:30pm on March 31<sup>st</sup> 2007. A large number of additional controls are included in the regression. Fixed effects are included for time of day (in half hour periods), day of the week, month, year, whether daylight saving was currently occurring, as well as controls for electricity retail price (in Australian dollars), Quadratic Temperature (that is,  $(T-65)^2$ , where T is the Sydney Airport Temperature in degrees Fahrenheit) Cloud cover, and wind speed. Interactions are included for the half-hour time dummy variables with Day of the Week, Month, the Daylight Saving Dummy, and all the weather variables. The data are taken at a half-hourly frequency from January 1, 1999 to April 1, 2007, top value is the coefficient, and the bottom value in parentheses is the standard error associated with that coefficient. \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively from a t-statistic.

Figure 1

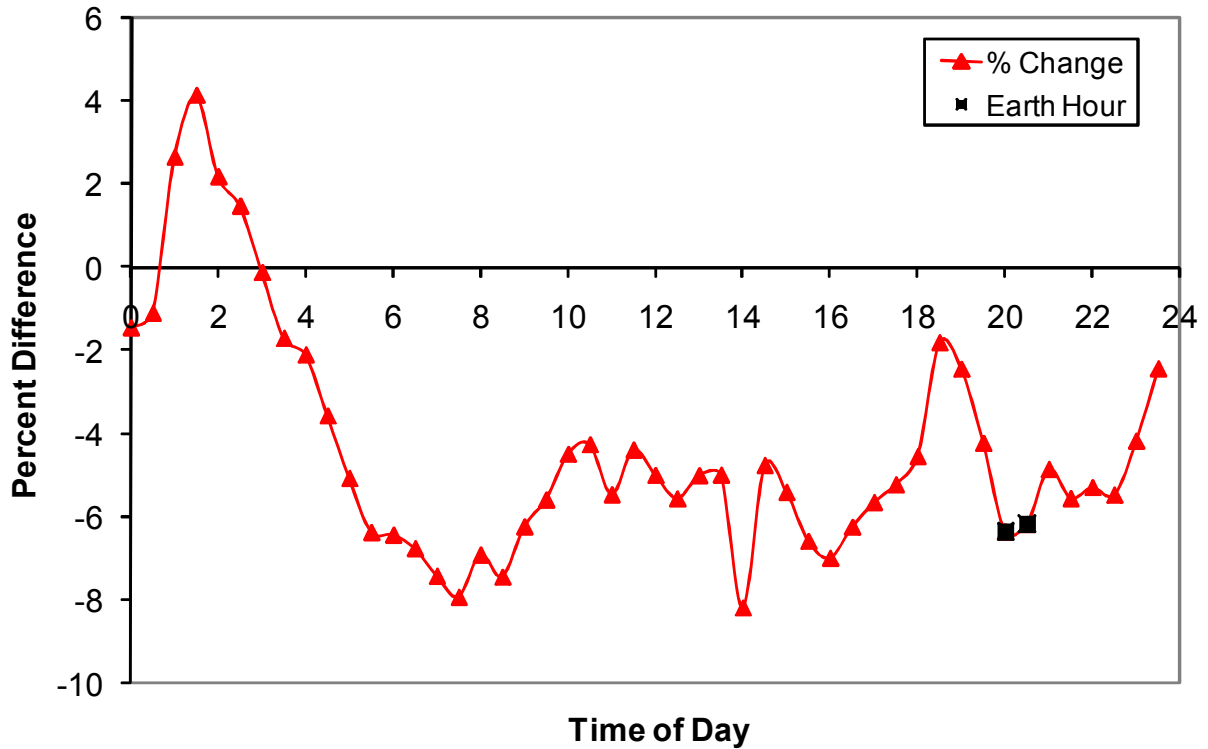
Predicted vs. Actual Electricity Consumption Around Earth Hour



This figure presents predicted and actual values of New South Wales electricity consumption (in MW/h) around Earth Hour, on March 31<sup>st</sup> 2007 from 7:30pm-8:30pm. Predicted values are estimated from the equation:  $\ln(\text{Consumption}_i) = \alpha + \beta_1 \text{Controls} + \varepsilon_i$ . Fixed effects are included for time of day (in half hour periods), day of the week, month, year, whether daylight saving was currently occurring, as well as controls for electricity retail price (in Australian dollars), Quadratic Temperature (that is,  $(T-65)^2$ , where T is the Sydney Airport Temperature in degrees Fahrenheit) Cloud cover, and wind speed. Additional controls are included for interactions of the half-hour time dummy variables with Day of the Week, Month, the Daylight Saving Dummy, and all the weather variables. The y-axis is Electricity consumption in MW/h. The x-axis is the hour of the day, measured in 24-hour time. The red line is predicted consumption, the blue line is actual consumption, and points in black correspond to those during Earth Hour.

Figure 2

### Percentage Difference Between Actual and Predicted Electricity Consumption Around Earth Hour



This figure presents the difference between predicted and actual values (as a percentage of predicted values) of New South Wales electricity consumption around Earth Hour, on March 31<sup>st</sup> 2007 from 7:30pm-8:30pm. Predicted values are estimated from the equation:  $\ln(Consumption_t) = \alpha + \beta_1 Controls + \varepsilon_t$ . Fixed effects are included for time of day (in half hour periods), day of the week, month, year, whether daylight saving was currently occurring, as well as controls for electricity retail price (in Australian dollars), Quadratic Temperature (that is,  $(T-65)^2$ , where T is the Sydney Airport Temperature in degrees Fahrenheit) Cloud cover, and wind speed. Depending on specification, additional controls are included for interactions of the half-hour time dummy variables with Day of the Week, Month, the Daylight Saving Dummy, and all the weather variables.. The y-axis is percentage change in electricity consumption, in percent. The x-axis is the hour of the day, measured in 24-hour time.