

## **How Effective are Individual Lifestyle Changes in Reducing Electricity**

### **Consumption? Measuring the Impact of Earth Hour**

David Solomon\*

University of Chicago

Graduate School of Business

**Abstract:** On March 31st 2007 at 7:30pm, the residents of Sydney, Australia, held Earth Hour, where people were urged to turn off lights and electrical appliances for one hour. According to poll evidence, over 57% of Sydney took part. To estimate the impact of this event, simply measuring the difference between actual consumption and predicted consumption (as media reports did) gives an incorrect inference, because over 67% of the apparent decline was due to factors common throughout the day, not just Earth Hour. Once this is controlled for, electricity consumption during Earth Hour shows a decline of only 2.10%, statistically indistinguishable from zero. Declines as large as those during Earth Hour were common throughout the whole day and within the overall sample, suggesting that cause is omitted variables, not the event itself. These results indicate that policies aimed at encouraging reductions in individual household energy use may be of considerably less benefit than commonly assumed.

\*5807 S. Woodlawn Ave., Chicago IL 60637. Contact at [dsolomon@chicagogsb.edu](mailto:dsolomon@chicagogsb.edu).

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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. The group described the event as ‘Australia’s biggest climate change initiative’, and one that would ‘[S]end a powerful message around the world that we’re serious about reducing global warming and that we care enough to take action’<sup>1</sup>.

A poll by AMR Interactive, reported in newspaper The Sydney Morning Herald, found that 57% of respondents had participated in Earth Hour, which the Herald’s Sunanda Creagh interpreted as ‘more than half of Sydneysiders - as many as 2.2 million - switched off their lights to celebrate Earth Hour on Saturday night...’<sup>2</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.<sup>3</sup> This was described as reducing carbon dioxide by an amount equivalent to ‘taking 48,613 cars off the road for one hour’<sup>2</sup>.

There are several reasons to question this analysis. Firstly, there is the obvious question of the statistical significance of any drop observed. A drop in use that is within the expected level of variation has a very different interpretation than a statistically significant decrease. Secondly, there is the problem of omitted variables – did Earth Hour exhibit lower energy consumption than predicted values because of different daily levels

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<sup>1</sup> <http://wwf.org.au/articles/now-is-the-hour-to-tackle-global-warming/>

<sup>2</sup> <http://www.smh.com.au/articles/2007/04/01/1175366081038.html>

<sup>3</sup> The summary of this, without any regressions attached, is 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)

of some omitted variable? One way to test this is to compare the drop in energy consumption during Earth Hour with the drop in energy consumption during the rest of the day. This provides a test of how much of the lower consumption during Earth Hour may be due to other factors that day, since there is no evidence that businesses and households decided to switch off their lights and appliances for the whole day. The third criticism, raised by commentator Andrew Landeryou, is that consumers may have simply brought forward electricity consumption that they would have otherwise had during Earth Hour, causing increases in electricity use beforehand<sup>4</sup>. A similar argument can be made for delayed consumption occurring after Earth Hour finishes.

Using intraday data on 8 years of New South Wales electricity consumption, I find that there is little evidence that Earth Hour caused a statistically significant decrease in electricity consumption, and that the popularly reported figures appear to greatly exaggerate the effect of the exercise. 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. With the full specification of control variables, a Dummy Variable for Earth Hour shows a reduction in electricity use of only 6.33%, or 531-545MW/h. Once the factors specific to the whole day of March 31<sup>st</sup> are removed via the inclusion of an Earth Day effect, the Earth Hour effect is statistically indistinguishable from zero, with a point estimate of a drop 2.10%. In other words, over 67% of the estimated Earth Hour effect is actually due to factors common throughout the entire day, rather than just people switching off electrical devices during the hour in question.

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<sup>4</sup> <http://andrewlanderyou.blogspot.com/2007/04/total-scam-earth-hours-contribution-to.html>

In terms of intertemporal consumption smoothing, there is not evidence of statistically significant increases consumption before or after Earth Hour, although there is some limited directional evidence in favor of higher consumption between 6:30pm and 7:30pm.

To further demonstrate the problems of attributing any residual between predicted and actual values to an Earth Hour effect, I examine how common drops of an Earth Hour size are. The decreases during Earth Hour were not even unusual for that day - equivalently large percentage declines were observed as early as 5am and persisted throughout the day, inconsistent with a simple explanation of the drop being due to people turning off their appliances at 7:30pm. Earth Hour sized differences between predicted and actual consumption are also very common within the sample. Over 27.5% of days in the sample have two consecutive periods with consumption more than 6.36% below predicted values (the larger of the two Earth Hour period drops). In other words, Earth Hour sized drops actually happen roughly every four days, without attracting the slightest attention, making it very problematic to interpret the difference between predicted and actual values as necessarily being due to the event itself.

In terms of reducing electricity consumption, Earth Hour was, statistically speaking, a failure. These results suggest that policies that emphasize small lifestyle changes in order to reduce electricity consumption may be of considerably less impact than commonly assumed – it is difficult, for instance, to be optimistic about the effect of energy efficient light bulbs, when turning off the lights altogether has only a trivial impact on overall electricity use.

## **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 less) frequency. Summary Statistics and correlations of the non-categorical variables are presented in Table I.

[Insert Table I here]

## **3. 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 Wolf (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 Wolf (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), *EarthDay* is a Dummy Variable that equals 1 on March 31st 2007 and zero otherwise, *EarthHour*, *PreEarthHour* and *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.

Depending on the specification, 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. This is almost certainly a more realistic specification, and closer to the Kellogg and Wolf (2007) specifications. The reduced version, without these interaction terms, is included mainly to allay potential concerns about the full specification over-fitting the model, as the number of control variables is reduced from 1256 to 81.

[Insert Table II here]

The results of these regressions are presented in Table II. Columns 1 and 2 examine the effect of *EarthHour* variable without day fixed effects (with and without interaction controls, respectively). In column 1, when the interaction variables are not included in the regression, *EarthHour* is statistically significant. The coefficient is  $-0.111$ , with a t-statistic of  $-2.35$ , significant at a 5% level. The point estimate for *EarthHour* corresponds to a decrease in electricity consumption of 10.5% relative to what it would otherwise have, equal to 946MW/h from 7:30-8pm and 925 MW/h from 8-8:30pm. However when interaction terms are included in column 2, the coefficient and t-statistic are reduced to  $-0.065$  and  $-1.90$  respectively, significant at a 10% level. The point estimate now corresponds to a drop of 6.33%, equal to 545MW/h from 7:30-8pm and 531 MW/h from 8-8:30pm.

Columns 3 and 4 examine the average drop during the whole day of March 31<sup>st</sup>. In columns 3 and 4, *EarthDay* shows a statistically significant coefficient in both specifications, of  $-0.047$  (t-statistic of  $-4.82$ , percentage drop of 4.60%) and  $-0.046$  (t-statistic of  $-6.43$ , percentage drop of 4.66%).

Columns 5 and 6 examine the effect of *EarthHour* once a day fixed effect is controlled for. They show that in both specifications, once the *EarthDay* fixed effect is controlled for, the *EarthHour* effect is greatly reduced, and loses any remaining significant explanatory power. In column 5, without interaction terms, the *EarthHour* coefficient is  $-0.068$  (t-statistic of  $-1.40$ , percentage decrease of 6.55%), and in column 6

when interaction terms are included, -0.021 (with a t-statistic of  $-0.60$ , percentage decrease of 2.10%).

These results show quite strongly that once reasonable controls are included, there is no significant drop in electricity use during Earth Hour –when a fixed effect is included for the whole day, 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 39.0% or 67.6%, depending on specification. The pattern of the coefficients is not encouraging for Earth Hour supporters either – if there really were a large drop during that period, controlling for more variables would reduce the error on the estimate of the other data points and make the Earth Hour drop more significant. Including more controls, with the addition of the interaction terms, instead reduces the effect significantly, suggesting that much of the apparent drop is actually due to a failure to control for other factors. Taking more realistic control reference points rather than simply a Day fixed effect makes the estimated *EarthHour* effect even smaller.<sup>5</sup>

Columns 7 and 8 examine the question of whether electricity consumption was larger before and after Earth Hour. The coefficients on *PreEarthHour* and *PostEarthHour* are insignificant in all cases, indicating that there was not a significant increase in consumption before or after due to substitution effects. On the other hand, the magnitude of these changes is of the same order as the *EarthHour* effect in this specification – *EarthHour*, *PreEarthHour* and *PostEarthHour* show coefficients of -0.071, -0.023 and -0.049 (column 7 with no interactions, corresponding to percentage

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<sup>5</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), and are virtually identical if the weather\*time of day interactions are removed (leaving 927 independent variables).

changes of  $-6.84\%$ ,  $-2.26\%$  and  $-4.75\%$ ) and  $-0.021$ ,  $0.010$  and  $-0.010$  (column 8 with interactions, corresponding to percentage changes of  $-2.10\%$ ,  $0.99\%$  and  $-0.98\%$ ).

The interpretation of these results 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.

#### **4. 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 II, 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 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. 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 the Andrew Landeryou story, the only points in Figure 2 that look unusual are 6:30pm and 7pm, where actual use was closer to predicted values.

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.

## **5. Conclusion**

It is difficult to detect in the data any reliable evidence that the Earth Hour event actually caused any statistically significant decline in New South Wales electricity consumption, despite apparently having over 2.2 million residents of Sydney turning off lights and other appliances. While it is possible that the statistically significant drop during the whole day was due to residents becoming motivated by the idea of Earth Hour to turn off electrical appliances at other times of day, this is a problematic explanation. Not only did the decline begin as early as 5am, but also on a more mundane level, there is simply no evidence that half of Sydney decided to sit in the dark for the entire day of March 31<sup>st</sup> 2007. Instead, the relative frequency of gaps between predicted and actual values of electricity consumption suggests that to do as media reports did and simply attributing the entire gap to Earth Hour is extremely problematic. The fact that gaps of an equivalent size occur roughly every four days in the sample suggests strongly that omitted variables may be driving such gaps, rather than necessarily Earth Hour.

It is nevertheless possible that Earth Hour may have had a significant effect in a more localized area than New South Wales. The Energy Australia estimates were based on Sydney CBD only, and so may not be directly comparable. It is also possible that different control variables and specifications may produce slightly different results,

although the addition or subtraction of a very large number of additional interaction variables made Earth Hour effect less apparent, not more, suggesting that misspecification is not driving the results.

These results also speak to the practicality of various attempts to reduce Greenhouse gas emissions. Many environmental commentators urge individuals to make small sacrifices to their lifestyle to reduce energy use, with the implicit idea that such actions are able to significantly reduce Greenhouse gas emissions<sup>6</sup>. Taking the point estimate of the *EarthHour* Dummy variable in the full specification after controlling for *EarthDay* fixed effects, the estimated impact of half of Sydney apparently sitting in darkness using no appliances was to reduce statewide electricity use by around 2.1%. By contrast, some currently debated policies that seek to reduce Australian greenhouse gas emissions by 60% by the year 2050. The Earth Hour experiment suggests quite strongly that small changes in individual lifestyle are unlikely to have a significant effect in achieving such goals.

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<sup>6</sup> See for instance, Al Gore's documentary 'An Inconvenient Truth', discussed at <http://www.climatecrisis.net/>

## References

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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

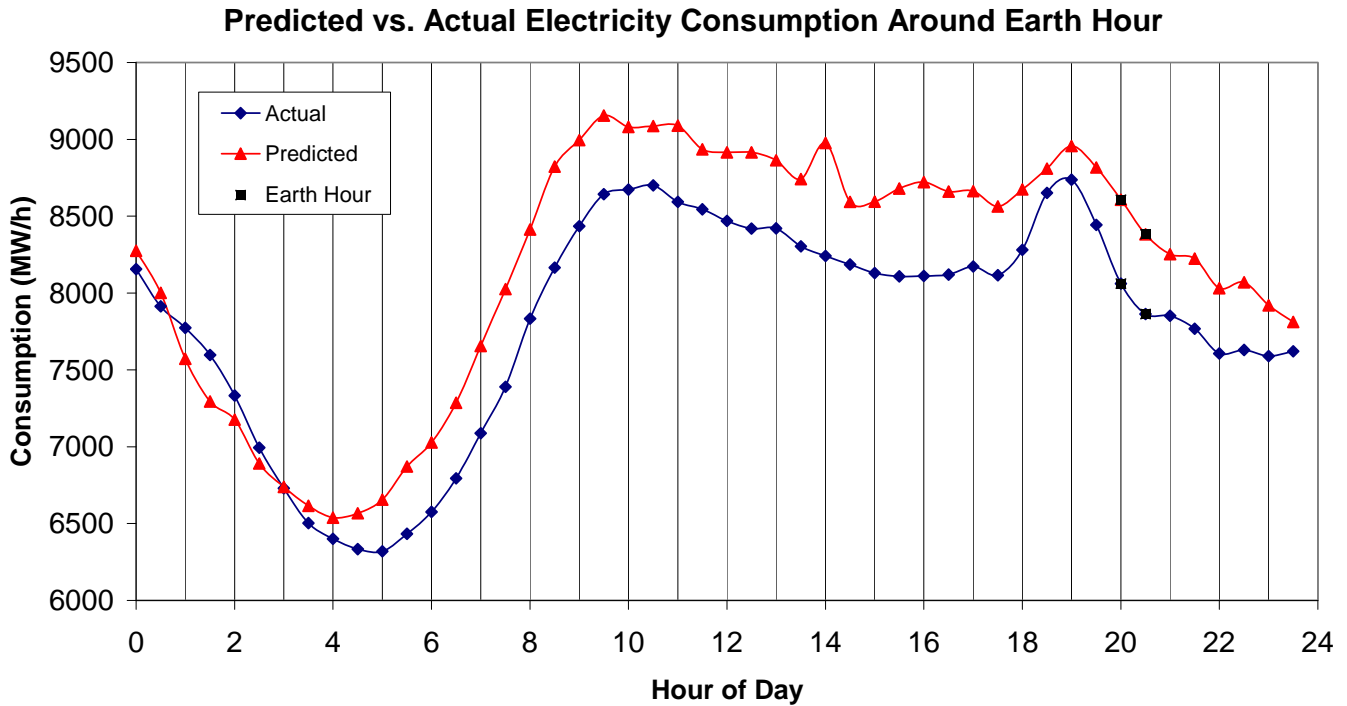
This Table presents summary statistics and correlations for the log of New South Wales electricity consumption (in MW/h), electricity retail price (in Australian \$/MW/h) Sydney Airport Temperature (in degrees Fahrenheit), and wind speed (in knots). The data are from January 1, 1999 to April 1, 2007, 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 - Regressions of Electricity Demand on Earth Hour Variables**

Independent Variable is ln(NSW Electricity Consumption in MW/h)									
<b>Intercept</b>	<b>8.947 ***</b>	<b>8.936 ***</b>	<b>8.948 ***</b>	<b>8.937 ***</b>	<b>8.948 ***</b>	<b>8.937 ***</b>	<b>8.948 ***</b>	<b>8.937 ***</b>	<b>8.937 ***</b>
	(0.002)	(0.006)	(0.002)	(0.006)	(0.002)	(0.006)	(0.002)	(0.006)	(0.006)
<b>Earth Hour Dummy</b>	<b>-0.111 **</b>	<b>-0.065 *</b>			<b>-0.068</b>	<b>-0.021</b>	<b>-0.071</b>	<b>-0.021</b>	
	(0.047)	(0.035)			(0.048)	(0.035)	(0.048)	(0.035)	
<b>Earth Day (24 hours) Dummy</b>			<b>-0.047 ***</b>	<b>-0.046 ***</b>	<b>-0.044 ***</b>	<b>-0.045 ***</b>	<b>-0.041 ***</b>	<b>-0.045 ***</b>	
			(0.010)	(0.007)	(0.010)	(0.007)	(0.010)	(0.008)	
<b>(Earth Hour-1) Dummy</b>							<b>-0.023</b>	<b>0.010</b>	
							(0.048)	(0.035)	
<b>(Earth Hour + 1) Dummy</b>							<b>-0.049</b>	<b>-0.010</b>	
							(0.048)	(0.035)	
<b>Controls</b>									
<b>(Time, Day, Month, Year, DL Saving)</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
<b>Price</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
<b>(Weather)</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
<b>Interactions</b>									
<b>(Day, Month, DL Saving)*Time</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>
<b>(Weather)*Time</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>
<b>Total # Independent Variables</b>	<b>81</b>	<b>1256</b>	<b>81</b>	<b>1256</b>	<b>81</b>	<b>1256</b>	<b>81</b>	<b>1256</b>	<b>1256</b>
<b>R2</b>	<b>0.8412</b>	<b>0.9170</b>	<b>0.8412</b>	<b>0.9171</b>	<b>0.8412</b>	<b>0.9171</b>	<b>0.8412</b>	<b>0.9171</b>	<b>0.9171</b>
<b>N</b>	<b>140604</b>	<b>140604</b>	<b>140604</b>	<b>140604</b>	<b>140604</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. 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 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.

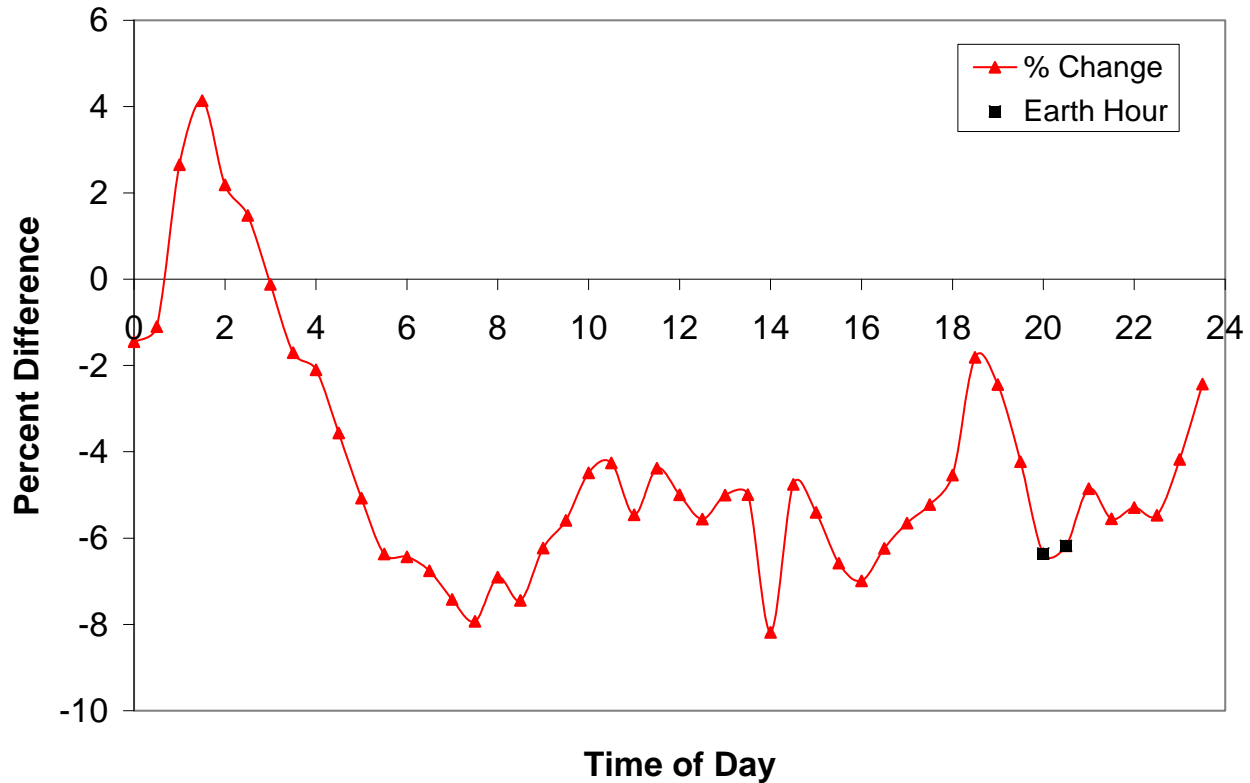
Figure 1



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:  $\ln(Consumption_t) = \alpha + \beta_1 Controls + \varepsilon_t$ . 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. 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:  $\ln(\text{Consumption}_t) = \alpha + \beta_1 \text{Controls} + \varepsilon_t$ . 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.